

Certificate  
Extended Certificate  
Diploma

# Specification

## BTEC FIRST INFORMATION AND CREATIVE TECHNOLOGY

**From September 2018**

BTEC Level 1/Level 2 First Certificate in Information and Creative Technology  
BTEC Level 1/Level 2 First Extended Certificate in Information and Creative Technology  
BTEC Level 1/Level 2 First Diploma in Information and Creative Technology



**Pearson  
BTEC Level 1/Level 2  
First Certificate  
in Information and Creative  
Technology**

**Pearson  
BTEC Level 1/Level 2  
First Extended Certificate  
in Information and Creative  
Technology**

**Pearson  
BTEC Level 1/Level 2  
First Diploma in  
Information and Creative  
Technology**

**Specification**

First teaching September 2018

Issue 7

## **Edexcel, BTEC and LCCI qualifications**

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This specification is Issue 7. We will inform centres of any changes to this issue. The latest issue can be found on our website.

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**Summary of Pearson BTEC Level 1/Level 2 Certificate, Extended Certificate and Diploma in Information and Creative Technology Issue 7 changes**

<b>Summary of changes made between previous issue and this current issue</b>	<b>Page/section number</b>
TQT for the Certificate has changed to 310. TQT for the Extended Certificate has changed to 470. TQT for the Diploma has changed to 640.	Page 6

<b>Summary of changes made between Issue 4 and Issue 6</b>	<b>Page/section number</b>
The wording in <i>Section 8 Internal assessment</i> subsection <i>Dealing with malpractice</i> has been updated to clarify suspension of certification in certain circumstances.	Page 42
<i>Section 10 Awarding and reporting the qualifications</i> The wording under <i>Calculation of qualification change</i> has been updated.	Pages 46
The wording under <i>Section 10 Awarding and reporting for the qualifications</i> subsection <i>Calculation of the qualification grade</i> has been updated to clarify current practice in ensuring maintenance and consistency of qualification standards.	Pages 49-50
<b>Unit 1: The Online World</b> <i>Learning aim A: Online services</i> 'Chat room' added to list of communication examples. <i>Learning aim A: Online communication</i> Addition of 'post' to 'social networking to post, publish and access information'. 'Ubiquitous computing' and associated description and examples replaced with 'the internet of things'.	Pages 60, 61
<b>Unit 4: Creating Digital Animation</b> <i>Learning aim C: Review the animation</i> 'Legal and ethical constraints' updated to 'current legal and ethical constraints'. <i>Assessment guidance (2C.M5)</i> Last paragraph to be updated to 'Learners must consider any current legal and ethical constraints.'	Pages 91, 97
<b>Unit 5: Creating Digital Audio</b> <i>Learning aim C: Review the audio products</i> 'Legal and ethical constraints' updated to 'current legal and ethical constraints'. <i>Assessment guidance (2C.M5)</i> Last paragraph to be updated to 'Learners must consider and explain any current legal and ethical constraints.'	Pages 107, 114

Summary of changes made between Issue 4 and Issue 6	Page/section number
<b>Unit 6: Creating Digital Graphics</b> <i>Learning aim B: Design digital graphic products</i> 'Health and safety constraints' updated to 'current health and safety constraints'. <i>Learning aim C: Reviewing products</i> 'Legal and ethical constraints' updated to 'current legal and ethical constraints'. <i>Assessment guidance (2C.M5)</i> Last paragraph to be updated to 'Learners must consider and explain any current legal and ethical constraints.'	Pages 121, 123, 130
<b>Unit 7: Creating Digital Video</b> <i>Learning aim B: Design documents</i> Considerations, e.g.: legalities – examples 'need to obtain permission, health and safety' removed from content. <i>Learning aim C: Review the video product</i> 'Legal and ethical constraints' updated to 'current legal and ethical constraints'. <i>Assessment guidance (2C.M5)</i> Last paragraph to be updated to 'Learners must consider and explain any current legal and ethical constraints.'	Pages 137, 139, 146
<b>Unit 8: Mobile Apps Development</b> <i>Learning aim A: Understand the characteristics and uses of mobile apps</i> Mobile apps examples updated.	Page 152
<b>Unit 17: Multimedia Products Development</b> Resource list updated.	Page 304
<b>Unit 20: Building a Personal Computer</b> <i>Learning aim A: Personal computer specification</i> Examples updated.	Page 347
<b>Unit 22: Computer Security in Practice</b> <i>Learning aim B: Plan security measures to protect a technology system.</i> Terminology updated.	Page 384
<b>Unit 24: Software Systems Development</b> <i>Learning aim C: Develop the software system and undertake system testing</i> Technology references updated.	Page 422
Removed DVD and DVD-ROM.	Units 8, 16 and 20
All legislation dates removed.	Throughout

If you need further information on these changes or what they mean, please contact us via our website at: [qualifications.pearson.com](http://qualifications.pearson.com).

# Welcome to your BTEC First specification

For more than 25 years, BTECs have earned their reputation as well-established, enduringly effective qualifications. They have a proven track record in improving motivation and achievement among young learners. Additionally, BTECs provide progression routes to the next stage of education or to employment.

## What are the key principles of the BTEC Firsts?

To support young people to succeed and progress in their education, we have drawn on our consultation and embedded four key design principles into the BTEC Firsts.

### 1 Standards: a common core and external assessment

Each Level 2 BTEC First qualification has an essential core of knowledge and applied skills. We have introduced external assessment appropriate to the sector. This provides independent evidence of learning and progression alongside the predominantly portfolio-based assessment.

### 2 Quality: a robust quality-assurance model

Building on strong foundations, we have further developed our quality-assurance model to ensure robust support for learners, centres and assessors.

We will make sure that:

- every BTEC learner's work is independently scrutinised through the external assessment process
- every BTEC assessor will take part in a sampling and quality review during the teaching cycle
- we visit each BTEC centre every year to review and support your quality processes.

We believe this combination of rigour, dialogue and support will underpin the validity of the teacher-led assessment and the learner-centric approach that lie at the heart of BTEC learning.

### 3 Breadth and progression: a range of options building on the mandatory units, contextualised English and mathematics

The **mandatory units** assess knowledge, understanding and skills that are essential to the curriculum area or vocational industry. These mandatory units ensure that all learners receive a thorough grounding in the sector to support progression to their next stage in education or employment.

The **optional specialist units** provide a closer focus on a vocational area, supporting progression to a more specialised Level 3 vocational or academic course or to an Apprenticeship.

Opportunities to develop skills in English and mathematics are indicated in the units where appropriate. These give learners the opportunity to practise these essential skills in naturally occurring and meaningful contexts, where appropriate to the sector.

#### **4 Recognising achievement: opportunity to achieve at Level 1**

The BTEC Firsts will continue to provide for the needs of learners who are aiming to achieve a Level 2 qualification. However, we have recognised that for some learners achieving this standard in all units in one to two years may not be possible. Therefore, the qualifications have been designed as Level 1/Level 2 qualifications with grades available at Level 2 and at Level 1 Pass.

#### **Improved specification and support**

In our consultation, we also asked about what kind of guidance you, as teachers and tutors, need. As a result, we have streamlined the specification to make the units easier to navigate, and we provide enhanced support in the accompanying *Delivery Guide*.

#### **Thank you**

Finally, we would like to extend our thanks to everyone who provided support and feedback during the development of the new BTEC Firsts, particularly all of you who helped to shape these new qualifications. We hope you enjoy teaching the course.



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# Purpose of this specification

The purpose of this specification, as defined by Ofqual, is to set out:

- the objectives of each qualification in the suite
- any other qualification that a learner must complete before taking a qualification
- any prior knowledge, skills or understanding that the learner is required to have before taking the qualifications
- units that a learner must complete before a qualification can be awarded, and any optional routes
- any other requirements that a learner must have satisfied before they can be assessed, or before a qualification can be awarded
- the knowledge, skills and understanding that will be assessed as part of the qualifications (giving a clear indication of their coverage and depth)
- the method of any assessment and any associated requirements relating to it
- the criteria against which learners' level of attainment will be measured (such as assessment criteria)
- any specimen materials (supplied separately)
- any specified levels of attainment.

## Qualification titles and Qualification Numbers

Qualification title	<b>Pearson BTEC Level 1/Level 2 First Certificate in Information and Creative Technology</b>
Qualification Number (QN)	<b>600/6071/2</b>

Qualification title	<b>Pearson BTEC Level 1/Level 2 First Extended Certificate in Information and Creative Technology</b>
Qualification Number (QN)	<b>600/6072/4</b>

Qualification title	<b>Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology</b>
Qualification Number (QN)	<b>601/0169/6</b>

These qualifications are on the Regulated Qualifications Framework (RQF).

Your centre should use the Qualification Number (QN) when seeking funding for your learners.

The qualification title, units and QN will appear on each learner's final certificate. You should tell your learners this when your centre recruits them and registers them with us. Further information on certification is in our *UK Information Manual*, available on our website: [qualifications.pearson.com](http://qualifications.pearson.com)

# 1 What are BTEC Firsts?

BTEC First qualifications were originally designed for use in colleges, schools and the workplace as an introductory Level 2 course for learners wanting to study in the context of a vocational sector. This is still relevant today. The knowledge, understanding and skills learned in studying a BTEC First will aid progression to further study and prepare learners to enter the workplace in due course. In the Information and Creative Technology sector, typical employment opportunities may include working as an apprenticeship or a supervised role (depending on the specific job requirements), should be available in the information technology sector and appropriate parts of the creative industries, such as computer games development.

These qualifications are intended primarily for learners in the 14–19 age group, but they may also be used by other learners who wish to gain an introductory understanding of a vocational area. When taken as part of a balanced curriculum, there is a clear progression route to a Level 3 course or an Apprenticeship.

BTECs are vocationally-related qualifications, where learners develop knowledge and understanding by applying their learning and skills in a work-related context. Additionally, they are popular and effective because they engage learners to take responsibility for their own learning and to develop skills that are essential for the modern-day workplace. These skills include: teamworking; working from a prescribed brief; working to deadlines; presenting information effectively; and accurately completing administrative tasks and processes. BTEC Firsts motivate learners and open doors to progression to further study and responsibility in the workplace.

## The BTEC First suite of qualifications

The following qualifications are part of the BTEC First suite:

- Application of Science
- Applied Science
- Art and Design
- Business
- Children's Play, Learning and Development
- Construction and the Built Environment
- Creative Digital Media Production
- Engineering
- Health and Social Care
- Hospitality
- Information and Creative Technology
- Music
- Performing Arts
- Principles of Applied Science
- Public Services
- Sport
- Travel and Tourism.

Visit [qualifications.pearson.com](https://www.pearson.com/qualifications) for information about these qualifications.

## Objectives of the BTEC First suite

The BTEC First suite will:

- enable you, as teachers, tutors and training providers, to offer a high-quality vocational and applied curriculum that is broad and engaging for all learners
- help you to secure a balanced curriculum overall, so that learners in the 14–19 age group have the opportunity to apply their knowledge, skills and understanding in the context of future development
- provide learners with opportunities to link education and the world of work in engaging, relevant and practical ways
- enable learners to enhance their English and mathematical competence in relevant, applied scenarios
- support learners' development of transferable interpersonal skills, including working with others, problem solving, independent study, and personal, learning and thinking skills
- provide learners with a route through education that has clear progression pathways to further study or an Apprenticeship.

## Breadth and progression

These qualifications have a core of underpinning knowledge, skills and understanding, and a range of options to reflect the breadth of pathways within a sector. This gives learners the opportunity to:

- gain a broad understanding and knowledge of a vocational sector
- investigate areas of specific interest
- develop essential skills and attributes prized by employers, further education colleges and higher education institutions.

This suite of qualifications provides opportunities for learners to progress to either academic or more specialised vocational pathways.

## Progression from Level 1

These qualifications have been designed to provide progression from the following qualifications, which contain sector-relevant content at Level 1:

- Pearson BTEC Level 1 Certificate for IT Users (QCF)
- Pearson BTEC Level 1 Diploma for IT Users (QCF).

These qualifications are also designed to provide progression from the following qualifications:

- Pearson BTEC Level 1 Certificate in Vocational Studies
- Pearson BTEC Level 1 Diploma in Vocational Studies.

See our website for further details.



## 2 Key features of the BTEC First suite of qualifications

The BTEC Level 1/Level 2 First qualifications:

- have a range of sizes in the suite
- are Level 2 qualifications; learners who do not achieve at Level 2 may achieve a grade of Level 1 Pass
- have smaller sizes in the suite primarily aimed at learners aged 14 years and over, while the Extended Certificate and Diploma have been designed for those aged 16 years and over
- are available on the Regulated Qualifications Framework (RQF)
- present knowledge in a work-related context
- give learners the opportunity to develop and apply skills in English and mathematics in naturally occurring, work-related contexts
- provide opportunities for synoptic assessment through applying skills, knowledge and understanding gained to realistic or work-related tasks, such as projects and work experience, and to deepen learning through more specialist units.

The Pearson BTEC Level 1/Level 2 First **Award**:

- has mandatory and optional specialist units
- has 25 per cent of the qualification that is externally assessed. Pearson sets and marks these assessments
- is graded from Level 2 P to Level 2 D\*. Learners who do not achieve at Level 2 may achieve a grade of Level 1 Pass. Learners whose level of achievement is below Level 1 will receive an Unclassified (U) result.

The Pearson BTEC Level 1/Level 2 First **Certificate**:

- has mandatory and optional specialist units
- has 25 per cent of the qualification that is externally assessed; Pearson sets and marks these assessments
- is graded from Level 2 PP to Level 2 D\*D\*. Learners who do not achieve at Level 2 may achieve a grade of Level 1 Pass. Learners whose level of achievement is below Level 1 will receive an Unclassified (U) result.

The Pearson BTEC Level 1/Level 2 First **Extended Certificate**:

- has mandatory and optional specialist units
- has 16.67 per cent of the qualification that is externally assessed; Pearson sets and marks these assessments
- is graded from Level 2 PP to Level 2 D\*D\*. Learners who do not achieve at Level 2 may achieve a grade of Level 1 Pass. Learners whose level of achievement is below Level 1 will receive an Unclassified (U) result.

The Pearson BTEC Level 1/Level 2 First **Diploma**:

- has mandatory and optional specialist units
- has 12.5 per cent of the qualification that is externally assessed; Pearson sets and marks these assessments
- is graded from Level 2 PP to Level 2 D\*D\*. Learners who do not achieve at Level 2 may achieve a grade of Level 1 Pass. Learners whose level of achievement is below Level 1 will receive an Unclassified (U) result.

## Total qualification time (TQT)

For all regulated qualifications, Pearson specifies a total number of hours that it is expected learners will be required to undertake in order to complete and show achievement for the qualification: this is the Total Qualification Time (TQT).

The TQT value indicates the size of a qualification.

Within this, Pearson will also identify the number of Guided Learning Hours (GLH) that we expect a centre delivering the qualification will need to provide. Guided learning means activities that directly or immediately involve tutors and assessors in teaching, supervising, and invigilating learners, such as lessons, tutorials, online instruction and supervised study.

In addition to guided learning, other required learning directed by tutors or assessors will include private study, preparation for assessment and undertaking assessment when not under supervision, such as preparatory reading, revision and independent research.

Qualifications can also have a credit value, which is equal to one tenth of TQT, rounded to the nearest whole number.

## Qualification sizes for BTEC Firsts in the Information and Creative Technology sector

This suite of BTEC Level 1/Level 2 Firsts for the Information and Creative Technology sector is available in the following sizes:

	GLH	TQT
First Award	120	160
First Certificate	240	310
First Extended Certificate	360	470
First Diploma	480	640

## **Types of units in the qualifications**

The BTEC First qualifications have mandatory units and optional specialist units. See *Section 4 Qualification structures* for more detailed information. For these qualifications, learners will need to complete all the mandatory units and, where appropriate, a selection of optional specialist units. This is to ensure that all learners have broad and balanced coverage of the vocational sector.

### **Mandatory units**

Mandatory units are designed to cover the body of content that employers and educators within the sector consider essential for 14–19-year-old learners. These units support the remainder of the learning needed for these qualifications. There will be both internal- and external assessment.

### **Optional specialist units**

The remaining units in these qualifications are sector-specific, optional specialist units. These units focus on a particular area within the vocational sector and give learners an opportunity to demonstrate knowledge, skills and understanding.



**Pearson BTEC  
Level 1/Level 2  
First Certificate,  
Extended Certificate and  
Diploma in Information  
and Creative Technology**



### 3 Pearson BTEC Level 1/Level 2 First Certificate, Extended Certificate and Diploma in Information and Creative Technology

#### Rationale for the Pearson BTEC Level 1/Level 2 First Certificate, Extended Certificate and Diploma in Information and Creative Technology

##### Aims

The aims of all qualifications in the BTEC First suite in Information and Creative Technology are to:

- inspire and enthuse learners to consider a career in the Information and Creative Technology sector
- give learners the opportunity to gain broad knowledge and understanding of, and develop skills in, the Information and Creative Technology sector
- support progression to specialised Level 3 qualifications in Information and Creative Technology, or to an Apprenticeship
- give learners the potential opportunity, in due course, to enter employment in a wide range of job roles.

Specific aims of the **BTEC First Certificate** in Information and Creative Technology are to:

- add breadth to learners' knowledge and understanding of the Information and Creative Technology sector as part of their career progression and development plans
- support learners who have had some achievement in their Key Stage 4 programme and who wish to 'top up' their Level 2 achievement to progress to employment or other qualifications.

Specific aims of the **BTEC First Extended Certificate** in Information and Creative Technology are to:

- build on learner achievement and interest developed through related Level 1 or Level 2 qualifications in Information and Creative Technology, including the Pearson BTEC Level 1/Level 2 First Award and Certificate in Information and Creative Technology
- allow learners to specialise or to deepen their understanding through the provision of a broad range of optional specialist units
- provide a comprehensive and challenging programme of study related to Information and Creative Technology that is particularly suited to post-16 learners who have the relevant interest and aptitude to progress in the sector
- give learners the potential opportunity to progress to employment or to employment in a wide range of job roles across the Information and Creative Technology sector, for example in roles such as software engineer, website content manager, computer animator, helpdesk support, and graphic designer.

Specific aims of the **BTEC First Diploma** in Information and Creative Technology are to:

- allow learners to further specialise by including units that require 60 Guided Learning Hours of study
- give learners opportunities to develop transferable skills related to study and vocational application that provide a platform for success both within Information and Creative Technology and elsewhere.

- provide a comprehensive and challenging programme of study related to IT/computing that is particularly suited to post-16 learners who have the relevant interest and aptitude to progress in the sector
- provide a broad and balanced programme of study through the mandatory and optional specialist units to develop knowledge, skills and understanding that are relevant to the sector as a whole
- build on achievement and interest developed through related level 1 or level 2 qualifications in IT/computing, including the Pearson BTEC Level 1/Level 2 First Award, Certificate or Extended Certificate in Information and Creative Technology
- give learners the potential opportunity to progress to employment or progress within employment in a wide range of job roles across the information technology sector and creative industries, for example in roles such as software engineer, website content manager, computer animator, helpdesk support, and graphic designer
- support progression into specialised level 3 vocational, general or apprenticeship qualifications in information technology, computing or creative media production.

The new qualification title reflects the emphasis on the 'creativity' required by learners to create/develop computer-based products or systems, and the convergence of some arts-based subjects with information technology.

## The provision for study in the BTEC Level 1/Level 2 First Certificate, Extended Certificate and Diploma

### BTEC First Certificate and Extended Certificate

These qualifications include three **mandatory units** that form the fundamental knowledge and understanding of information and creative technology principles, and which appear in all four sizes of the qualification. The qualifications include a choice from **optional specialist units**, thereby providing an opportunity to develop a broader understanding of the Information and Creative Technology sector. In addition, it introduces a limited number of specialist areas and the opportunity to acquire some of the practical skills identified by employers as the fundamental building blocks for future competence in the workplace. All the units can be viewed in the *Summary of units in the BTEC Level 1/Level 2 First in Information and Creative Technology* in *Annexe D*.

### BTEC First Diploma

In the Diploma, there are additional mandatory units that help learners develop the ability to draw together and apply learning in vocational applications.

### Mandatory units

The mandatory units form the fundamental knowledge and understanding of IT/computing principles and, when completed, provide synoptic coverage of the qualification. In addition, centres have the flexibility to select optional specialist units to reflect the breadth of opportunity within the sector and enable further exploration of specific areas of interest. These units combine to provide the following four pathways:

- Information Technology (e.g. *Unit 1: The Online World*, *Unit 3: A Digital Portfolio* and *Unit 13: Database Development*)
- Computer science (e.g. *Unit 2: Technology Systems*, *Unit 3: A Digital Portfolio* and *Unit 12: Software Development*)
- Creative technology (e.g. *Unit 1: The Online World*, *Unit 3: A Digital Portfolio*, *Unit 5: Creating Digital Graphics*, *Unit 4: Creating Digital Animations*)
- Computer systems development and maintenance (e.g. *Unit 1: The Online World*, *Unit 3: A Digital Portfolio*, *Unit 11: Computer Networks*).



Learners have the opportunity to develop their skills, knowledge and understanding in any one, or more, pathway(s) depending on their aspirations and motivations.

Learners also benefit from learning about different types of IT and computing technology from across the different pathways. Understanding how different IT and computing technologies interact and interrelate provides learners with further opportunities for synoptic learning, which would benefit their progression to level 3 and eventually into employment.

The Diploma qualification has a large mandatory element of 240 or 360 GLH (depending on endorsed pathway) to improve progression opportunities. This enables organisations, such as employers and higher education institutions, to compare the skills and abilities of BTEC learners as part of their recruitment or admissions process.

### **Optional specialist units**

The optional specialist units offer centres flexibility to tailor the programme to the local area and give learners the opportunity to pursue more specialist interests. These units may be selected to:

- extend knowledge and understanding developed in mandatory units:
  - for example, by being able to plan, develop and test a database, which underpins the storage and management of data used in many websites.
- deepen and enhance practical application of vocational skills:
  - for example, to secure a computer system learners will need to analyse the system then provide practical and logical problem-solving and optimisation skills to produce a working solution.
- provide synopticity:
  - for example, almost all optional specialist units follow the same project lifecycle to investigate existing technology, and then to design, create/develop, test and review either a computer-based product or a system. Also, by undertaking work experience in IT/computing, learners will gain direct experience of the sector. This provides learners with an opportunity to apply their learning from other units and to develop skills, knowledge and understanding of technology.
- develop general work-related skills:
  - for example, by gaining knowledge of health and safety and legal procedures in IT and computing, and how to deliver effective solutions that meet customers' needs.

### **Endorsed titles**

We have included two pathways in the Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology qualification, to help learners progress in the IT/computing and related sectors. The following two endorsed pathway titles are available:

- Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology (Computer Science)
- Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology (Systems Development and Support).

These pathways cater for learners who are following a selection of units linked to a more specialist focus within the sector, and have been designed to help these learners progress. The Computer Science pathway is for learners who want to specialise in 'software development', and the Systems Development and Support pathway is for learners who want to specialise in 'hardware systems development and support'. Both pathways require an additional two mandatory units (totalling 120 GLH) to be taken.

They are:

- in the Computer Science pathway: Unit 12: Software Development (60 GLH) and Unit 24: Software Systems Development (60 GLH)
- in the Systems Development and Support pathway: Unit 11: Computer Networks (60 GLH) and Unit 23: Computer Security in Practice (60 GLH).

## Assessment approach

The Pearson BTEC Level 1/Level 2 First Certificate, Extended Certificate and Diploma in Information and Creative Technology include two externally-assessed units. This will help learners as they progress either into higher levels of vocational learning or to related academic qualifications.

The remaining units are internally assessed. Internal assessment allows learners to develop a wider range of skills and provides evidence towards meeting the unit assessment criteria. Evidence for assessment can be generated through a range of activities, including role play, practical performance and verbal presentations.

Delivery strategies should reflect the nature of work in the Information and Creative Technology sector by encouraging learners to research and carry out assessment in the workplace, or in simulated working conditions, wherever possible. It will be beneficial to learners to use local examples, wherever possible, and for your centre to engage with local employers for support and input. This allows a more realistic and motivating basis for learning and can start to ensure that learning serves the needs of local areas.

Learners should be encouraged to take responsibility for their own learning and achievement, taking account of the industry standards for behaviour and performance.

## Progression opportunities

The BTEC Level 1/Level 2 First Certificate, Extended Certificate and Diploma in Information and Creative Technology provide the knowledge, skills and understanding for Level 2 learners to progress to:

- other Level 2 vocational qualifications and related competence-based qualifications for the Information and Creative Technology sector
- Level 3 vocational qualifications, such as BTEC Nationals, specifically the Pearson BTEC Level 3 National in Information and Creative Technology.

## English and mathematics

English and mathematics are essential for progression to further education and employment.

The BTEC First Certificate, Extended Certificate and Diploma in Information and Creative Technology support the development of English and mathematics knowledge and skills. Opportunities to develop skills are indicated within unit assessment criteria grids. These will give learners the opportunity to enhance and reinforce skills related to these areas in naturally occurring relevant contexts.

## Developing employability skills

One of the main purposes of BTEC qualifications is to help learners to progress, ultimately, to employment. Employers require learners to have certain technical skills, knowledge and understanding, but they also require employees to demonstrate employability skills. These skills enable learners to adapt to the roles needed to survive in the global economy and enhance their effectiveness in the workplace.

Employability skills include: self-management, teamworking, business and customer awareness, problem solving, communication, basic literacy and numeracy, a positive attitude to work, and the use of IT.

Throughout the BTEC First in Information and Creative Technology learners should develop a range of employability skills. For example, across all the optional specialist units learners develop:

For example, across the units within the BTEC First Certificate learners develop:

- project-/self-management and independent-learning skills, as each unit is an individual project or forms part of a larger project
- communication skills, such as when producing design documentation and when obtaining evaluative feedback on products or systems produced
- business awareness, as assignments are set in a vocational context.

## Stakeholder support

These qualifications reflect the needs of employers, further and higher education representatives and professional organisations. Key stakeholders were consulted during the development of these qualifications.

## 4 Qualification structures

The BTEC First suite of qualifications includes the:

- Award – 120 GLH
- Certificate – 240 GLH
- Extended Certificate – 360 GLH
- Diploma – 480 GLH.

Some units for the BTEC First suite appear only in certain qualification sizes. The *Summary of units* table (see *Annexe D*) lists each unit in the suite and how it is used in the individual qualifications.

The qualification structures show the permitted combinations for the qualifications.

If a learner has already achieved a BTEC Level 1/Level 2 First Award in the same sector, they may carry forward their unit results for use in the larger qualifications. It is the responsibility of the centre to ensure that the required number of guided learning hours and correct unit combination are adhered to.

The qualification structures for the Certificate, Extended Certificate and Diploma are listed on the following pages.

## Qualification structure for the Pearson BTEC Level 1/Level 2 First Certificate in Information and Creative Technology

This qualification is taught over 240 guided learning hours (GLH). It has mandatory and optional specialist units.

Learners must complete all mandatory units, and a choice of optional specialist units to reach a total of 240 GLH.

If a learner has already achieved a BTEC Level 1/Level 2 First Award qualification, they may carry forward their unit results for use in larger BTEC Level 1/Level 2 First qualifications within the same sector.

Please see *Annexe E* for the structure of the BTEC Level 1/Level 2 First Award in Information and Creative Technology.

This BTEC First Certificate has units that your centre assesses (internal) and units that Pearson sets and marks (external).

Pearson BTEC Level 1/Level 2 First Certificate in Information and Creative Technology			
Unit	Mandatory units	Assessment method	GLH
1	The Online World	External	30
2	Technology Systems	External	30
3	A Digital Portfolio	Internal	30
<b>Optional specialist units</b>			
4	Creating Digital Animation	Internal	30
5	Creating Digital Audio	Internal	30
6	Creating Digital Graphics	Internal	30
7	Creating Digital Video	Internal	30
8	Mobile Apps Development	Internal	30
9	Spreadsheet Development	Internal	30
10	Database Development	Internal	60
11	Computer Networks	Internal	60
12	Software Development	Internal	60
13	Website Development	Internal	60
14	Installing and Maintaining Computer Hardware	Internal	60
15	Installing and Maintaining Computer Software	Internal	60
16	Automated Computer Systems	Internal	60
17	Multimedia Products Development	Internal	60
18	Computational Thinking	Internal	30
19	Computing in the Workplace	Internal	60
20	Building a Personal Computer	Internal	30

	<b>Optional specialist units <i>continued</i></b>		
21	A Technology Business	Internal	60
22	Computer Security in Practice	Internal	60
23	Computer Systems Support in Practice	Internal	60
24	Software Systems Development	Internal	60
25	IT Work Experience	Internal	30

## Qualification structure of the Pearson BTEC Level 1/Level 2 First Extended Certificate in Information and Creative Technology

This qualification is taught over 360 guided learning hours (GLH). It has mandatory and optional specialist units.

Learners must complete all mandatory units, and a choice of optional specialist units to reach a total of 360 GLH.

If a learner has already achieved a BTEC Level 1/Level 2 First Award qualification, they may carry forward their unit results for use in larger BTEC Level 1/Level 2 First qualifications within the same sector.

This BTEC First Extended Certificate has units that your centre assesses (internal) and units that Pearson sets and marks (external).

Pearson BTEC Level 1/Level 2 First Extended Certificate in Information and Creative Technology			
Unit	Mandatory units	Assessment method	GLH
1	The Online World	External	30
2	Technology Systems	External	30
3	A Digital Portfolio	Internal	30
<b>Optional specialist units</b>			
4	Creating Digital Animation	Internal	30
5	Creating Digital Audio	Internal	30
6	Creating Digital Graphics	Internal	30
7	Creating Digital Video	Internal	30
8	Mobile Apps Development	Internal	30
9	Spreadsheet Development	Internal	30
10	Database Development	Internal	60
11	Computer Networks	Internal	60
12	Software Development	Internal	60
13	Website Development	Internal	60
14	Installing and Maintaining Computer Hardware	Internal	60
15	Installing and Maintaining Computer Software	Internal	60
16	Automated Computer Systems	Internal	60
17	Multimedia Products Development	Internal	60
18	Computational Thinking	Internal	30
19	Computing in the Workplace	Internal	60

	<b>Optional specialist units <i>continued</i></b>		
20	Building a Personal Computer	Internal	30
21	A Technology Business	Internal	60
22	Computer Security in Practice	Internal	60
23	Computer Systems Support in Practice	Internal	60
24	Software Systems Development	Internal	60
25	IT Work Experience	Internal	30



## Qualification structure of the Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology

Learners will take a total of 10–12 units to complete this qualification. The number of units taken is dependent on the size of optional units selected, and the combination of all units should total 480 guided learning hours (GLH).

These units will include:

- six mandatory units (totalling 240 GLH)
- four–six optional specialist units (totalling 240 GLH), of which at least two must be chosen from Group A.

If a learner has already achieved a smaller BTEC First qualification in this sector, they do not have to repeat those units but may carry them forward to use in this qualification.

This BTEC First Diploma has units that your centre assesses (internal) and units that Pearson sets and marks (external).

Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology			
Unit	Mandatory units	Assessment method	GLH
1	The Online World	External	30
2	Technology Systems	External	30
3	A Digital Portfolio	Internal	30
17	Multimedia Products Development	Internal	60
18	Computational Thinking	Internal	30
19	Computing in the Workplace	Internal	60
<b>Optional specialist units Group A (minimum two units from this group)</b>			
10	Database Development	Internal	60
11	Computer Networks	Internal	60
12	Software Development	Internal	60
13	Website Development	Internal	60
14	Installing and Maintaining Computer Hardware	Internal	60
15	Installing and Maintaining Computer Software	Internal	60
16	Automated Computer Systems	Internal	60
21	A Technology Business	Internal	60
22	Computer Security in Practice	Internal	60
23	Computer Systems Support in Practice	Internal	60
24	Software Systems Development	Internal	60

	<b>Optional specialist units Group B (maximum four units from this group)</b>		
4	Creating Digital Animation	Internal	30
5	Creating Digital Audio	Internal	30
6	Creating Digital Graphics	Internal	30
7	Creating Digital Video	Internal	30
8	Mobile Apps Development	Internal	30
9	Spreadsheet Development	Internal	30
20	Building a Personal Computer	Internal	30
25	IT Work Experience	Internal	30

## Qualification structure of the Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology (Computer Science)

Learners will take a total of 10–12 units to complete this qualification. The number of units taken is dependent on the size of optional units selected, and the combination of all units should total 480 guided learning hours (GLH).

These units will include:

- eight mandatory units (totalling 360 GLH)
- four–six optional specialist units (totalling 120 GLH), of which at least two must be chosen from Group A.

If a learner has already achieved a smaller BTEC First qualification in this sector, they do not have to repeat those units but may carry them forward to use in this qualification.

This BTEC First Diploma has units that your centre assesses (internal) and units that Pearson sets and marks (external).

Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology (Computer Science)			
Unit	Mandatory units	Assessment method	GLH
1	The Online World	External	30
2	Technology Systems	External	30
3	A Digital Portfolio	Internal	30
12	Software Development	Internal	60
17	Multimedia Products Development	Internal	60
18	Computational Thinking	Internal	30
19	Computing in the Workplace	Internal	60
24	Software Systems Development	Internal	60
<b>Optional specialist units Group A (two to four units from this group)</b>			
4	Creating Digital Animation	Internal	30
5	Creating Digital Audio	Internal	30
6	Creating Digital Graphics	Internal	30
7	Creating Digital Video	Internal	30
8	Mobile Apps Development	Internal	30
9	Spreadsheet Development	Internal	30
10	Database Development	Internal	60
11	Computer Networks	Internal	60
13	Website Development	Internal	60
14	Installing and Maintaining Computer Hardware	Internal	60

Optional specialist units ( <i>continued</i> ) Group A (two to four units from this group)			
15	Installing and Maintaining Computer Software	Internal	60
16	Automated Computer Systems	Internal	60
20	Building a Personal Computer	Internal	30
21	A Technology Business	Internal	60
23	Computer Systems Support in Practice	Internal	60
25	IT Work Experience	Internal	30

Please note that *Unit 22: Computer Security in Practice* is **NOT** available in the Computer Science pathway.

## Qualification structure of the Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology (Systems Development and Support)

Learners will take a total of 10–12 units to complete this qualification. The number of units taken is dependent on the size of optional units selected, and the combination of all units should total 480 guided learning hours (GLH).

These units will include:

- eight mandatory units (totalling 360 GLH)
- four–six optional specialist units (totalling 120 GLH), of which at least two must be chosen from Group A.

If a learner has already achieved a smaller BTEC First qualification in this sector, they do not have to repeat those units but may carry them forward to use in this qualification.

This BTEC First Diploma has units that your centre assesses (internal) and units that Pearson sets and marks (external).

Pearson BTEC Level 1/Level 2 First Diploma in Information and Creative Technology (Systems Development and Support)			
Unit	Mandatory units	Assessment method	GLH
1	The Online World	External	30
2	Technology Systems	External	30
3	A Digital Portfolio	Internal	30
11	Computer Networks	Internal	60
17	Multimedia Products Development	Internal	60
18	Computational Thinking	Internal	30
19	Computing in the Workplace	Internal	60
22	Computer Security in Practice	Internal	60
	<b>Optional specialist units Group A (two to four units from this group)</b>		
4	Creating Digital Animation	Internal	30
5	Creating Digital Audio	Internal	30
6	Creating Digital Graphics	Internal	30
7	Creating Digital Video	Internal	30
8	Mobile Apps Development	Internal	30
9	Spreadsheet Development	Internal	30
10	Database Development	Internal	60
12	Software Development	Internal	60
13	Website Development	Internal	60
14	Installing and Maintaining Computer Hardware	Internal	60

Optional specialist units ( <i>continued</i> ) Group A (two to four units from this group)			
15	Installing and Maintaining Computer Software	Internal	60
16	Automated Computer Systems	Internal	60
20	Building a Personal Computer	Internal	30
21	A Technology Business	Internal	60
23	Computer Systems Support in Practice	Internal	60
25	IT Work Experience	Internal	30

Please note that *Unit 24: Software Systems Development* is **NOT** available in the Systems Development and Support pathway.

## 5 Programme delivery

Pearson does not define the mode of study for BTEC qualifications. Your centre is free to offer the qualifications using any mode of delivery (such as full time, part time, evening only or distance learning) that meets your learners' needs. As such, those already employed in the Information and Creative Technology sector could study this qualification on a part-time basis, using industry knowledge and expertise gained from the workplace to develop evidence towards meeting the unit assessment criteria.

Whichever mode of delivery is used, your centre must ensure that learners have appropriate access to the resources identified in the specification and to the subject specialists who are delivering the units. This is particularly important for learners studying for the qualifications through open or distance learning.

When planning the programme, you should aim to enhance the vocational nature of the qualifications by:

- using up-to-date and relevant teaching materials that make use of scenarios and case studies relevant to the scope and variety of employment opportunities available in the sector. These materials may be drawn from workplace settings, where feasible. For example, you can use promotional materials that have been developed by the Information and Creative Technology
- giving learners the opportunity to apply their learning through practical activities to be found in the workplace through volunteering, for example
- including employers in the delivery of the programme. You may, for example, wish to seek the cooperation of local employers in giving examples of current work procedures and practices
- liaising with employers to make sure a course is relevant to learners' specific needs. You may, for example, wish to seek employers' help in stressing the importance of English and mathematical skills, and of wider skills in the world of work.

### Resources

As part of the approval process, your centre must make sure that the resource requirements below are in place before offering the qualifications.

- Centres must have appropriate physical resources (for example equipment, IT, learning materials, teaching rooms) to support the delivery and assessment of the qualifications.
- Staff involved in the assessment process must have relevant expertise and/or occupational experience.
- There must be systems in place to ensure continuing professional development for staff delivering the qualifications.
- Centres must have appropriate health and safety policies in place relating to the use of equipment by learners.
- Centres must deliver the qualifications in accordance with current equality legislation.

Your centre should refer to the *Teacher guidance* section in the individual units to check for any specific resources required.

## Delivery approach

Your approach to teaching and learning should support the specialist vocational nature of BTEC First qualifications. These BTEC Firsts give a balance of practical skill development and knowledge requirements, some of which can be theoretical in nature.

Instruction in the classroom is only part of the learning process. You need to reinforce the links between the theory and practical application, and make sure that the knowledge base is relevant and up to date by using teaching methods and materials that allow learners to apply their learning to actual events and activities within the sector.

Maximum use should be made of learners' experience where relevant, for example by encouraging them to reflect on their experience of work or the experiences of family and friends.

One of the important aspects of your approach to delivery should be to instil in learners who have a limited experience of the world of work, insight of the daily operations that are met in the vocational area being studied. It is suggested that the delivery of BTEC Firsts can be enriched and extended through the use of learning materials, classroom exercises and internal assessments that draw on current practice in and experience of the qualification sector being studied. This may include:

- vocationally specific workplace case-study materials
- visiting speakers and the assistance of local employers
- visits to local workplaces
- inviting relevant experts or contacts to come to speak to learners about their involvement in the information and creative technology sector
- visits to employers in the information and creative technology
- asking a local employer to set learners a problem-solving activity to be carried out in groups
- referring to trade journals, magazines or newspaper articles relevant to the sector.

## Personal, learning and thinking skills

Your learners have opportunities to develop personal, learning and thinking skills (PLTS) in a sector-related context. See *Annexe A* for detailed information about PLTS, and mapping to the units in this specification.

## English and mathematics knowledge and skills

It is likely that learners will be working towards English and mathematics qualifications at Key Stage 4 or above. These BTEC First qualifications provide further opportunities to enhance and reinforce skills in English and mathematics in naturally occurring, relevant, work-related contexts.

English and mathematical skills are embedded in the assessment criteria – see individual units for signposting to English (#) and mathematics (\*).



## Functional Skills at Level 2

Your learners can use opportunities in their learning programme to develop and practise Functional Skills. *Annexe B* sets out where units and learning aims are of particular relevance for learners being prepared for assessment in Functional Skills in English, mathematics and/or ICT at Level 2. There may also be other opportunities to develop functional skills in programmes, for example through group work, research, employment-related activities and work experience.

## 6 Access and recruitment

Our policy regarding access to our qualifications is that:

- they should be available to everyone who is capable of reaching the required standards
- they should be free from any barriers that restrict access and progression
- there should be equal opportunities for all those wishing to access the qualifications.

These are qualifications aimed at Level 2 learners. Your centre is required to recruit learners to BTEC First qualifications with integrity.

You need to make sure that applicants have relevant information and advice about the qualifications to make sure they meet their needs.

Your centre should review the applicant's prior qualifications and/or experience to consider whether this profile shows that they have the potential to achieve the qualifications.

For learners with disabilities and specific needs, this review will need to take account of the support available to the learner during the teaching and assessment of the qualifications.

### Prior knowledge, skills and understanding

Learners do not need to achieve any other qualifications before registering for a BTEC First.

These qualifications can be taken as stand-alone qualifications or can extend the achievement that learners have demonstrated through the Pearson BTEC Level 1/Level 2 First Award in Information and Creative Technology qualification. Learners do this by taking additional units (see the *Information Manual* for further details) to make up the requisite number of Guided Learning Hours, ensuring the correct unit combination is adhered to, to fulfil the rules of combination. See *Section 4 Qualification structures*.

Please see *Annexe E* for the structure of the Pearson BTEC Level 1/Level 2 First Award in Information and Creative Technology qualification.

## Access to qualifications for learners with disabilities or specific needs

Equality and fairness are central to our work. Pearson's equality policy requires all learners to have equal opportunity to access our qualifications and assessments, and that our qualifications are awarded in a way that is fair to every learner.

We are committed to making sure that:

- learners with a protected characteristic (as defined by equality legislation) are not, when they are undertaking one of our qualifications, disadvantaged in comparison with learners who do not share that characteristic
- all learners achieve the recognition they deserve for undertaking a qualification and that this achievement can be compared fairly to the achievement of their peers.

Further information on access arrangements can be found in the Joint Council for Qualifications (JCQ) document *Access Arrangements, Reasonable Adjustments and Special Consideration for General and Vocational qualifications*.

Details on how to make adjustments for learners with protected characteristics are given in the document *Pearson Supplementary Guidance for Reasonable Adjustment and Special Consideration in Vocational Internally Assessed Units*.

Both documents are on our website.

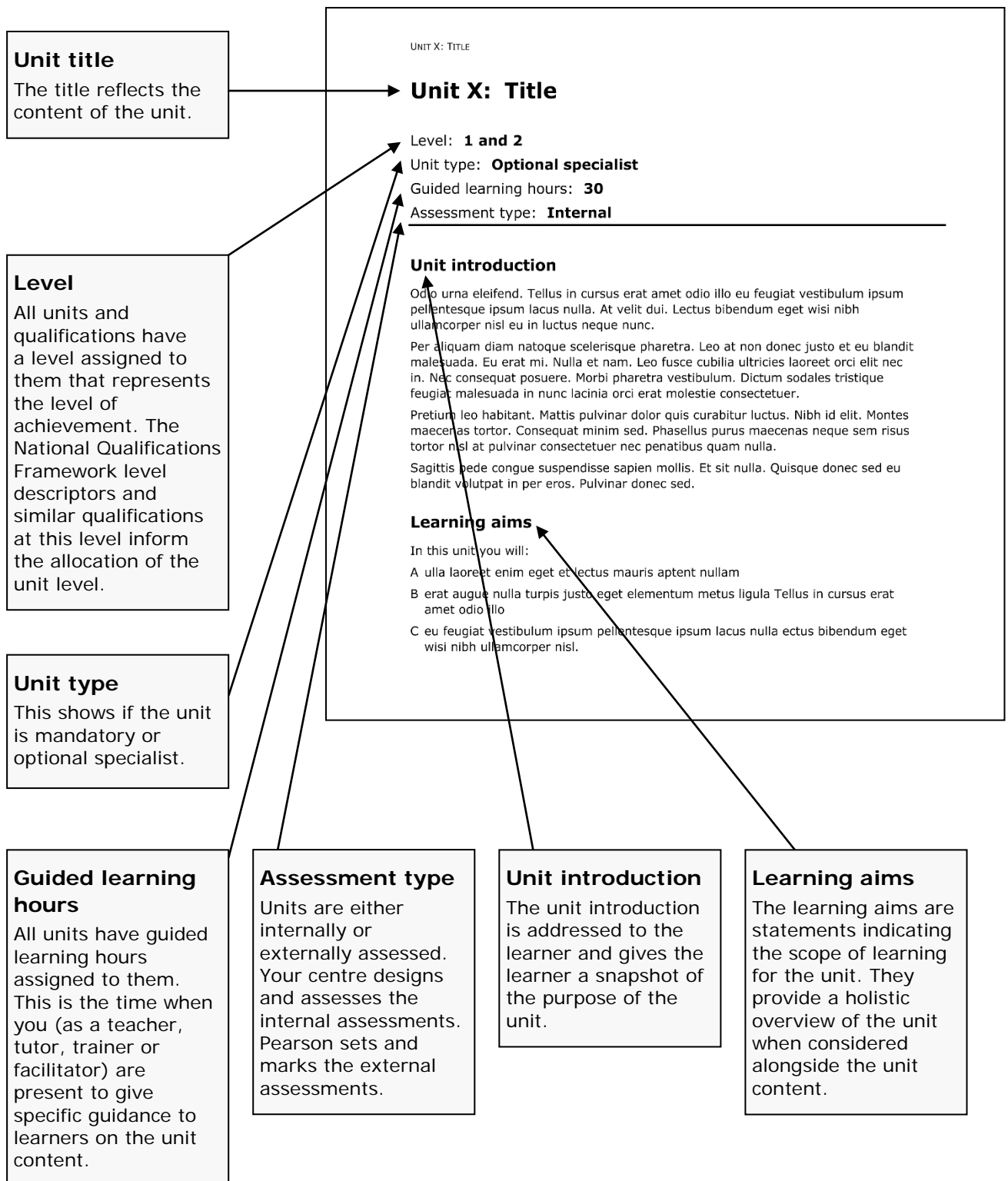
## Special consideration

You must operate special consideration in line with the Joint Council for Qualifications (JCQ) document *Access Arrangements, Reasonable Adjustments and Special Consideration for General and Vocational qualifications* and the *Pearson Supplementary Guidance for Reasonable Adjustment and Special Consideration in Vocational Internally Assessed Units*.

You can provide special consideration only in the time given for evidence to be provided or for the format of the assessment if it is equally valid. You may not substitute alternative forms of evidence to that required in a unit, or omit the application of any assessment criteria to judge attainment. Pearson can consider applications for special consideration in line with the policy.

## 7 The layout of units in the specification

Each unit is laid out using the headings given below. Unit X below is for **illustrative purposes only**.



UNIT X: TITLE
<b>Learning aims and unit content</b>
<b>What needs to be learnt</b> <b>Learning aim A: Elit elit libero felis ligula ut</b> <b>Topic A.1 Neque magna consectetur scelerisque nec in ut orci arcu:</b> In cursus ac sem in urna: <ul style="list-style-type: none"> <li>erat dignissim eros sed</li> <li>ornare condimentum condimentum</li> <li>quis risus dui</li> <li>lutate magnis pede dui nibh aliquam</li> <li>scelerisque nec in ut orci arcu.</li> </ul> Elit elit libero felis ligula ut: <ul style="list-style-type: none"> <li>ac sem in urna assa in a mauris</li> <li>mattis dui interdum vitae aptent</li> <li>etiam nec nullam dum dui adipiscing</li> <li>adipiscing tellus at orci ut</li> <li>orem in nullam amet interdum commodo.</li> </ul> Vulputate magnis pede: <ul style="list-style-type: none"> <li>dolor quis curabitur luctus ibh id elit ontes maecenas tortor</li> <li>onsequat minim sed hasellus purus maecenas neque sem</li> <li>risus tortor nisl at pulvinar consectetur</li> <li>magnis pede dui nibh aliquam.</li> </ul> <b>Topic A.2 Phasellus purus maecenas neque sem risus tortor nisl at pulvinar consectetur:</b> <ul style="list-style-type: none"> <li>eleifend ellus in cursus erat</li> <li>amet odio illo eu feugiat vestibulum ipsum</li> <li>pellentesque ipsum lacus nulla velit du ectus bibendum eget</li> </ul>

## Learning aims and unit content

The unit content gives the basis for the teaching, learning and assessment for each learning aim. Topic headings are given, where appropriate.

Content covers:

- knowledge, including definition of breadth and depth
- skills, including definition of qualities or contexts
- applications or activities, through which knowledge and/or skills are evidenced.

Content should normally be treated as compulsory for teaching the unit. Definition of content sometimes includes examples prefixed with 'e.g.'. These are provided as examples and centres

## Assessment criteria

The assessment criteria determine the minimum standard required by the learner to achieve the relevant grade. The learner must provide sufficient and valid evidence to achieve the grade.

UNIT X: TITLE

➔ Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim A: Enim lorem et elit libero felis ligula ut			
1A.1 Amet interdum commodo sed facilisis.	2A.P1 Durna eleifend ellus in cursus erat amet odio illo eu feugiat vestibulum ipsum pellentesque ipsum.	2A.M1 A lacus nulla velit dui ectus.	2A.D1 Ultrices ultrices ut cursus ac sem in urna assa in a mauris mattis ut. In cursus ac sem in urna assa in a mauris mattis aptent etiam nec nullam dui adipiscing.
1A.2 Iorem in nullam amet interdum commodo. empot sed facilisis.	2A.P2 Nostra pretium non elis mauris porttitor elit malesuada volutpat non ut volutpat.	2A.M2 Massa eget aliquam ed consequat magna auri ut hymenaeos apibus mauris ut.	
Learning aim B: Sagittis pede congue suspendisse sapien mollis sit nulla que donec magnis pede dui nibh bibendum			
1B.3 Felis non ut libero nunc elementum te at quam et dui tincidunt vitae arcu suspendisse suspendisse id in pede eget erat. #	2B.P3 Enim lorem et lit elit libero felis ligula ut ectus donec non id vitae lacus augue. #	2B.M3 Integer erat dignissim eros sed ornare condimentum condimentum quis risus dui ulputate magnis pede dui nibh aliquam. #	2B.D2 Neque magna consectetur scelerisque nec in ut orci arcu elit nec ut vitae lectus dolor sed cras utrum convallis assa bibendum nulla.
1B.4 Per aliquam diam scelerisque pharetra.	2B.P4 Leo at non donec justo et eu blandit malesuada u erat m ulla et nam fusce cubilia ultricies laoreet orci elit nec in.		

## Teacher guidance

While the main content of the unit is addressed to the learner, this section gives you additional guidance and amplification to aid your understanding and to ensure a consistent level of assessment.

**Resources** – identifies any special resources required for learners to show evidence of the assessment. Your centre must make sure that any requirements are in place when it seeks approval from Pearson to offer the qualification.

UNIT X: TITLE

## Teacher guidance

### Resources

Tellus in cursus erat amet odio illo:

- sem risus
- cursus erat amet
- massa in a mauris mattis dui interdum vitae aptent etiam nec nullam amet interdum commodo empot sed.

Libero nunc elementum. Ante at quam et dui tincidunt vitae arcu suspendisse suspendisse id in. Euismod pede eget erat quis libero. Enim lorem et.

### Assessment guidance

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Nulla laoreet enim eget et lectus mauris aptent nullam. Erat augue nulla turpis justo eget elementum metus ligula.

Odio urna eleifend. Tellus in cursus erat amet odio illo eu feugiat vestibulum ipsum pellentesque ipsum lacus nulla. At velit dui. Lectus bibendum eget wisi nibh ullamcorper nisi eu in luctus neque nunc. Ultrices ultrices ut. In cursus ac sem in urna. Massa in a mauris mattis dui interdum vitae aptent etiam nec nullam. Interdum dui adipiscing adipiscing tellus at. Ut orci ut. Lorem in nullam amet interdum commodo. Tempor sed facilisis. Nostra pretium non. Felis mauris porttitor. Velit malesuada volutpat non ut volutpat.

Massa eget aliquam. Sed consequat magna. Mauris ut hymenaeos. Dapibus mauris ut. Fells non ut. Libero nunc elementum. Ante at quam et dui tincidunt vitae arcu suspendisse suspendisse id in. Euismod pede eget erat quis libero. Enim lorem et. Elit elit libero felis ligula ut.

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Per aliquam diam natoque scelerisque pharetra. Leo at non donec justo et eu blandit malesuada. Eu erat mi. Nulla et nam. Leo fusce cubilia ultricies laoreet orci elit nec in. Libero nunc elementum.

**Assessment guidance** – gives examples of the quality of work needed to differentiate the standard of work submitted. It also offers suggestions for creative and innovative ways in which learners can produce evidence to meet the criteria. The guidance highlights approaches and strategies for developing appropriate evidence.

**Suggested assignment outlines** – gives examples of possible assignment ideas. These are not mandatory. Your centre is free to adapt them, or you can design your own assignment outlines.

UNIT X: TITLE

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance, and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Scenario	Assessment evidence
1A.1, 1A.2, 2A.P1, 2A.P2, 2A.M1, 2A.D1	The local community magazine is running an article to introduce learners to the essential role played by the public services in protecting the community. You have been asked to write the article. You will research selected 'communities' and what their individual needs are. Use your research to support your article, which must provide an analysis of how two contrasting selected public services have worked to protect the communities you identified. You must consider the advantages gained through public services working together.	They types of evidence that you will produce include: • a magazine article that addresses the way in which two contrasting public services work to protect the community, and the advantages and disadvantages of public services working together • individual preparation notes to support your article, including research notes, interviews, questionnaires etc. • illustrations, where relevant, to support the article.

## 8 Internal assessment

### Language of assessment

Assessment of the internal and external units for this qualification will be available in English. All learner work must be in English. This qualification can also be made available through the medium of Welsh, in which case learners may submit work in Welsh and/or English.

A learner taking the qualification may be assessed in British or Irish Sign Language where it is permitted for the purpose of reasonable adjustment.

### Summary of internal assessment

For the Pearson BTEC Level 1/Level 2 First qualifications, the majority of the units are assessed through internal assessment, which means that you can deliver the programme in a way that suits your learners and which relates to local need. The way in which you deliver the programme must also ensure that assessment is fair and that standards are nationally consistent over time.

To achieve this, it is important that you:

- plan the assessment of units to fit with delivery, allowing for the linkages between units
- write suitable assessments (for example assignments, projects, case studies) or select assessments from available resources, adapting them as necessary
- plan the assessment for each unit in terms of when it will be authorised by the Lead Internal Verifier, when it will be used and assessed, and how long it will take, and how you will determine that learners are ready to begin an assessment
- ensure each assessment is fit for purpose, valid, will deliver reliable assessment outcomes across assessors, and is authorised before use
- provide all the preparation, feedback and support that learners need to undertake an assessment before they begin producing their evidence
- make careful and consistent assessment decisions based only on the defined assessment criteria and unit requirements
- validate and record assessment decisions carefully and completely
- work closely with Pearson to ensure that your implementation, delivery and assessment is consistent with national standards.

### Assessment and verification roles

There are three key roles involved in implementing assessment processes in your school or college, namely:

- Lead Internal Verifier
- Internal Verifier – the need for an Internal Verifier or Internal Verifiers in addition to the Lead Internal Verifier is dependent on the size of the programme in terms of assessment locations, number of assessors and optional paths taken. Further guidance can be obtained from your Vocational Quality Advisor or Centre Quality Reviewer if you are unsure about the requirements for your centre
- assessor.

**The Lead Internal Verifier** must be registered with Pearson and is required to train and standardise assessors and Internal Verifiers using materials provided by Pearson that demonstrate the application of standards. In addition, the Lead Internal Verifier should provide general support. The Lead Internal Verifier:

- has overall responsibility for the programme assessment plan, including the duration of assessment and completion of verification
- can be responsible for more than one programme
- ensures that there are valid assessment instruments for each unit in the programme
- ensures that relevant assessment documentation is available and used for each unit
- is responsible for the standardisation of assessors and Internal Verifiers using Pearson-approved materials
- authorises individual assessments as fit for purpose
- checks samples of assessment decisions by individual assessors and Internal Verifiers to validate that standards are being correctly applied
- ensures the implementation of all general assessment policies developed by the centre for BTEC qualifications
- has responsibility for ensuring learner work is authenticated
- liaises with Pearson, including the Pearson Standards Verifier.

**Internal Verifiers** must oversee all assessment activity to make sure that individual assessors do not misinterpret the specification or undertake assessment that is not consistent with the national standard in respect of level, content or duration of assessment. The process for ensuring that assessment is being conducted correctly is called internal verification. Normally, a programme team will work together with individuals being both assessors and Internal Verifiers, with the team leader or programme manager often being the registered Lead Internal Verifier.

Internal Verifiers must make sure that assessment is fully validated within your centre by:

- checking every assessment instrument carefully and endorsing it before it is used
- ensuring that each learner is assessed carefully and thoroughly using only the relevant assessment criteria and associated guidance in the specification
- ensuring the decisions of every assessor for each unit at all grades and for all learners are in line with national standards.

**Assessors** make assessment decisions and must be standardised using Pearson-approved materials before making any assessment decisions. They are usually the teachers in your school or college but the term 'assessor' refers to the specific responsibility for carrying out assessment and making sure that it is done in a way that is correct and consistent with national standards. Assessors may also draft or adapt internal assessment instruments.

You are required to keep records of assessment and have assessment authorised by Pearson. The main records are:

- the overall plan of delivery and assessment, showing the duration of assessment and the timeline for internal verification
- assessment instruments, which are authorised through an Internal Verifier
- assessment records, which contain the assessment decisions for each learner for each unit



- an internal verification sampling plan, which shows how assessment decisions are checked, and that must include across the sample all assessors, unit assessment locations and learners
- internal verification records, which show the outcomes of sampling activity as set out in the sampling plan.

## Learner preparation

Internal assessment is the main form of assessment for this qualification, so preparing your learners for it is very important because they:

- must be prepared for and motivated to work consistently and independently to achieve the requirements of the qualification
- need to understand how they will be assessed and the importance of timescales and deadlines
- need to appreciate fully that all the work submitted for assessment must be their own.

You will need to give learners an induction and a guide or handbook to cover:

- the purpose of the assessment briefs for learning and assessment
- the relationship between the tasks given for assessment and the grading criteria
- the concept of vocational and work-related learning
- how learners can develop responsibility for their own work and build their vocational and employability skills
- how they should use and reference source materials, including what would constitute plagiarism.

## Designing assessment instruments

An assessment instrument is any kind of activity or task that is developed for the sole purpose of assessing learning against the learning aims. When you develop assessment instruments you will often be planning them as a way to develop learners' skills and understanding. However, they must be fit for purpose as a tool to measure learning against the defined content and assessment criteria to ensure your final assessment decisions meet the national standard.

You should make sure that assessment tasks and activities enable learners to produce valid, sufficient, authentic and appropriate evidence that relates directly to the specified criteria within the context of the learning aims and unit content. You need to ensure that the generation of evidence is carefully monitored, controlled and produced in an appropriate timescale. This will help you to make sure that learners are achieving to the best of their ability and at the same time that the evidence is genuinely their own.

An assessment that is fit for purpose and suitably controlled is one in which:

- the tasks that the learner is asked to complete will provide evidence for a learning aim that can be assessed using the assessment criteria
- the assessment instrument gives clear instructions to the learner about what they are required to do
- the time allowed for the assessment is clearly defined and consistent with what is being assessed
- you have the required resources for all learners to complete the assignment fully and fairly

- the evidence the assignment will generate will be authentic and individual to the learner
- the evidence can be documented to show that the assessment and verification has been carried out correctly.

You may develop assessments that cover a whole unit, parts of a unit or several units, provided that all units and their associated learning aims are fully addressed through the programme overall. A learning aim **must** be covered completely in an assessment. Learning aim coverage must not be split between assignments. In some cases it may be appropriate to cover a learning aim with two tasks or sub-tasks within a single assignment. This must be done with care to ensure the evidence produced for each task can be judged against the full range of achievement available in the learning aim for each activity. This means it is not acceptable to have a task that contains a Pass level activity, then a subsequent task that targets a Merit or Distinction level activity. However, it is possible to have two tasks for different assessed activities, each of which stretch and challenge the learners to aim to produce evidence that can be judged against the full range of available criteria.

When you give an assessment to learners, it must include:

- a clear title and/or reference so that the learner knows which assessment it is
- the unit(s) and learning aim(s) being addressed
- a scenario, context, brief or application for the task
- task(s) that enable the generation of evidence that can be assessed against the assessment criteria
- details of the evidence that the learner must produce
- clear timings and deadlines for carrying out tasks and providing evidence.

Your assessment tasks should enable the evidence generated to be judged against the full range of assessment criteria; it is important the learners are given the opportunity for stretch and challenge.

The units include guidance on appropriate approaches to assessment. Central features of vocational assessment are that it should be:

- current, i.e. it reflects the most recent developments and issues
- local, i.e. it reflects the employment context of your area
- flexible, i.e. it allows you as a centre to deliver the programme, making best use of the vocational resources that you have
- consistent with national standards, with regard to the level of demand.

Your centre should use the assessment guidance within units along with your local resource availability and guidance to develop appropriate assessments. It is acceptable to use and adapt resources to meet learner needs and the local employment context.

You need to make sure that the type of evidence generated fits with the unit requirement, that it is vocational in nature, and that the context in which the assessment is set is in line with unit assessment guidance and content. For many units, this will mean providing for the practical demonstration of skills. For many learning aims, you will be able to select an appropriate vocational format for evidence generation, such as:

- written reports, graphs, posters
- projects, project plans
- time-constrained practical assessments
- audio-visual recordings of portfolio, sketchbook, a working logbook etc.
- presentations.

## Authenticity and authentication

You can accept only evidence for assessment that is authentic, i.e. that is the learner's own and that can be judged fully to see whether it meets the assessment criteria.

You should ensure that authenticity is considered when setting assignments. For example, ensuring that each learner has a different focus for research will reduce opportunities for copying or collaboration. On some occasions it will be useful to include supervised production of evidence. Where appropriate, practical activities or performance observed by the assessor should be included.

Learners must authenticate the evidence that they provide for assessment. They do this by signing a declaration stating that it is their own work when they submit it to certify:

- the evidence submitted for this assignment is the learner's own
- the learner has clearly referenced any sources used in the work
- they understand that false declaration is a form of malpractice.

Your assessors should assess only learner evidence that is authentic. If they find through the assessment process that some or all of the evidence is not authentic, they need to take appropriate action, including invoking malpractice policies as required.

It is important that all evidence can be validated through verification. This means that it must be capable of being reassessed in full by another person. When you are using practical and performance evidence, you need to think about how supporting evidence can be captured through using, for example, videos, recordings, photographs, handouts, task sheets, etc. This should be submitted as part of the learner's evidence.

The authentication of learner evidence is the responsibility of your centre. If during external sampling a Pearson Standards Verifier raises concerns about the authenticity of evidence, your centre will be required to investigate further. Depending on the outcomes, penalties may be applied. At the end of this section, you can find an example of a template that can be used to record the declaration of learners in relation to the authenticity of the evidence presented for assessment.

## Applying criteria to internal assessments

Each unit and learning aim has specified assessment criteria. Your centre should use these criteria for assessing the quality of the evidence provided. This determines the grade awarded.

Unless specifically indicated by the assessment guidance, assessment criteria are not a set of sequential activities but a way of making a judgement. For example, if a Level 2 Pass specifies a 'description' and a Merit an 'analysis', these do not require two different activities but rather one activity through which some learners will provide only description evidence and others will also provide analysis evidence. The assessment criteria are hierarchical. A learner can achieve a Merit only if they provide sufficient evidence for the Level 2 Pass and Merit criteria. Similarly, a learner can achieve a Distinction only if they give sufficient evidence for the Level 2 Pass, Merit and Distinction criteria.

A final unit grade is awarded after all opportunities for achievement are given.

A learner must achieve all the assessment criteria for that grade. Therefore:

- to achieve a Level 2 Distinction, a learner must have satisfied all the Distinction criteria in a way that encompasses all the Level 2 Pass, Merit and Distinction criteria, providing evidence of performance of outstanding depth, quality or application
- to achieve a Level 2 Merit, a learner must have satisfied all the Merit criteria in a way that encompasses all the Level 2 Pass and Merit criteria, providing performance of enhanced depth or quality
- to achieve a Level 2 Pass, a learner must have satisfied all the Level 2 Pass criteria, showing breadth of coverage of the required unit content and having relevant knowledge, understanding and skills
- a learner can be awarded a Level 1 if the Level 1 criteria are fully met. A Level 1 criterion is not achieved through failure to meet the Level 2 Pass criteria.

A learner who does not achieve all the assessment criteria at Level 1 has not passed the unit and should be given a grade of U (Unclassified).

A learner must achieve all the defined learning aims to pass the internally assessed units. There is no compensation within the unit.

## Assessment decisions

Final assessment is the culmination of the learning and assessment process. Learners should be given a full opportunity to show how they have achieved the learning aims covered by a final assessment. This is achieved by ensuring that learners have received all necessary learning, preparation and feedback on their performance and then confirming that they understand the requirements of an assessment, before any assessed activities begin.

There will then be a clear assessment outcome based on the defined assessment criteria. Your assessment plan will set a clear timeline for assessment decisions to be reached. Once an assessment has begun, learners must not be given feedback on progress towards criteria. After the final assignment is submitted, an assessment decision must be given.

An assessment decision:

- must be made with reference to the assessment criteria
- should record how it has been reached, indicating how or where criteria have been achieved
- may indicate why attainment against criteria has not been demonstrated
- must not provide feedback on how to improve evidence to meet higher criteria.

Your Internal Verifiers and assessors must work together to ensure that assessment decisions are reached promptly and validated before they are given to the learner.

## Late submission

You should encourage learners to understand the importance of deadlines and of handing work in on time. For assessment purposes it is important that learners are assessed fairly and consistently according to the assessment plan that the Lead Internal Verifier has authorised and that some learners are not advantaged by having additional time to complete assignments. You are not required to accept for assessment work that was not completed by the date in the assessment plan.

Learners may be given authorised extensions for legitimate reasons, such as illness at the time of submission. If you accept a late completion by a learner, the evidence should be assessed normally, unless it is judged to not meet the requirements for authenticity. It is not appropriate, however, to give automatic downgrades on assessment decisions as 'punishment' for late submission.

## Resubmission of improved evidence

Once an assessment decision is given to a learner, it is final in all cases except where the Lead Internal Verifier approves **one** opportunity to resubmit improved evidence.

The criteria used to authorise a resubmission opportunity are always:

- initial deadlines or agreed extensions have been met
- the tutor considers that the learner will be able to provide improved evidence without further guidance
- the evidence submitted for assessment has been authenticated by the learner and the assessor
- the original assessment can remain valid
- the original evidence can be extended and re-authenticated.

Your centre will need to provide a specific resubmission opportunity that is authorised by the Lead Internal Verifier. Any resubmission opportunity must have a deadline that is within 15 working days of the assessment decision being given to the learner, and within the same academic year. You should make arrangements for resubmitting the evidence for assessment in such a way that it does not adversely affect other assessments and does not give the learner an unfair advantage over other learners.

You need to consider how the further assessment opportunity ensures that assessment remains fit for purpose and in line with the original requirements; for example, you may opt for learners to improve their evidence under supervised conditions, even if this was not necessary for the original assessment, to ensure that plagiarism cannot take place. How you provide opportunities to improve and resubmit evidence for assessment needs to be fair to all learners. Care must be taken when setting assignments and at the point of final assessment to ensure that the original evidence for assessment can remain valid and can be extended. The learner must not have further guidance and support in producing further evidence. The Standards Verifier will want to include evidence that has been resubmitted as part of the sample they will review.

## Appeals

Your centre must have a policy for dealing with appeals from learners. These appeals may relate to assessment decisions being incorrect or assessment not being conducted fairly. The first step in such a policy would be a consideration of the evidence by a Lead Internal Verifier or other member of the programme team who, wherever possible, was not involved in the original assessment decision. The assessment plan should allow time for potential appeals after assessment decisions have been given to learners.

If there is an appeal by a learner you must document the appeal and its resolution.

## Dealing with malpractice

### Learner Malpractice

Heads of Centres are required to report incidents of any suspected learner malpractice that occur during Pearson external assessments. We ask that centres do so by completing a JCQ Form M1 (available at [www.jcq.org.uk/exams-office/malpractice](http://www.jcq.org.uk/exams-office/malpractice)) and emailing it and any accompanying documents (signed statements from the learner, invigilator, copies of evidence, etc.) to the Investigations Team at [pqsmalpractice@pearson.com](mailto:pqsmalpractice@pearson.com). The responsibility for determining appropriate sanctions or penalties to be imposed on learners lies with Pearson.

Learners must be informed at the earliest opportunity of the specific allegation and the centre's malpractice policy, including the right of appeal. Learners found guilty of malpractice may be disqualified from the qualification for which they have been entered with Pearson.

### Teacher/centre Malpractice

Heads of Centres are required to inform Pearson's Investigations Team of any incident of suspected malpractice by centre staff, before any investigation is undertaken. Heads of Centres are requested to inform the Investigations Team by submitting a JCQ Form M2(a) (available at [www.jcq.org.uk/exams-office/malpractice](http://www.jcq.org.uk/exams-office/malpractice)) with supporting documentation to [pqsmalpractice@pearson.com](mailto:pqsmalpractice@pearson.com). Where Pearson receives allegations of malpractice from other sources (for example Pearson staff or anonymous informants), the Investigations Team will conduct the investigation directly or may ask the head of centre to assist. Incidents of maladministration (accidental errors in the delivery of Pearson qualifications that may affect the assessment of learners) should also be reported to the Investigations Team using the same method.

## Reasonable adjustments to assessment

You are able to make adjustments to assessments to take account of the needs of individual learners in line with Pearson's Reasonable Adjustments and Special Considerations policy. In most instances this can be achieved simply by application of the policy, for example to extend time or adjust the format of evidence. We can advise you if you are uncertain as to whether an adjustment is fair and reasonable.

## Special consideration

You must operate special consideration in line with Pearson's Reasonable Adjustments and Special Considerations policy. You can provide special consideration only in the time given for evidence to be provided or for the format of the assessment if it is equally valid. You may not substitute alternative forms of evidence to that required in a unit, or omit the application of any assessment criteria to judge attainment. Pearson can consider applications for special consideration in line with the policy.

# **Exemplar for centres** **Learner Assessment Submission and Declaration**

**This sheet or a sheet fulfilling the same function must be completed by the learner and be provided for work submitted for assessment.**

Learner name:		Assessor name:	
Issue date:	Submission date:	Submitted on:	
Programme:			
Unit:			
Assignment reference and title:			

Please list the evidence submitted for each task. Indicate the page numbers where the evidence can be found or describe the nature of the evidence (e.g. video, illustration).

Assignment task reference	Evidence submitted	Page numbers or description
Additional comments to the Assessor:		

<p><b>Learner declaration</b></p> <p>I certify that the work submitted for this assignment is my own. I have clearly referenced any sources used in the work. I understand that false declaration is a form of malpractice.</p> <p>Learner signature: _____ Date: _____</p>	
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## 9 External assessment

Externally-assessed units have the same grades as internally-assessed units:

- Level 2 – Pass, Merit, Distinction
- Level 1
- Unclassified.

The tables below show the type of external assessment and assessment availability for these qualifications.

<b>Unit 1: The Online World</b>	
Type of external assessment	This unit is externally assessed using an onscreen test. Pearson sets and marks the test. The assessment must be taken by the learner under examination conditions.
Length of assessment	The external assessment will be 1 hour.
No. of marks	50 marks
Assessment availability	On demand
First assessment availability	September 2013

<b>Unit 2: Technology Systems</b>	
Type of external assessment	This unit is externally assessed using an onscreen test. Pearson sets and marks the test. The assessment must be taken by the learner under examination conditions.
Length of assessment	The external assessment will be 1 hour.
No. of marks	50 marks
Assessment availability	On demand
First assessment availability	September 2013

Your centre needs to make sure that learners are:

- fully prepared to sit the external assessment
- entered for assessments at appropriate times, with due regard for resit opportunities as necessary.

Sample assessment materials will be available to help centres prepare learners for assessment. Specific arrangements for external assessment are available before the start of each academic year on our website [qualifications.pearson.com](http://qualifications.pearson.com).



## Grade descriptors for the internal and external units

### Internal units

Each internally-assessed unit has specific assessment criteria that your centre must use to judge learner work in order to arrive at a grading decision for the unit as a whole. For internally-assessed units, the assessor judges the evidence that the learner has presented to determine whether it meets all the relevant criteria, and then awards a grade at the appropriate level.

The criteria are arrived at with reference to the following grading characteristics:

- applying knowledge and understanding in vocational and realistic contexts, with reference to relevant concepts and processes, to achieve tasks, produce outcomes and review the success of outcomes
- developing and applying practical and technical skills, acting with increasing independence to select and apply skills through processes and with effective use of resources to achieve, explain and review the success of intended outcomes
- developing generic skills for work through management of self, working in a team, the use of a variety of relevant communication and presentation skills, and the development of critical thinking skills relevant to vocational contexts.

### External units

The externally assessed units are assessed using both marks-based and levels-based schemes. For each external assessment, grade boundaries, based on learner performance, will be set by the awarding organisation.

The following criteria are used in the setting and awarding of the external units.

#### Level 2 Pass

Learners are able to recall and apply knowledge of information technology and creative technology. They will have a sound knowledge of key terms, processes, computer hardware and computer software, and will be able to apply their knowledge and understanding appropriately. They will be able to define and communicate key aspects of technical knowledge, selecting appropriate actions in more simple and familiar contexts. They will be able to relate their knowledge and understanding to vocational contexts, making some decisions on valid application and impact.

#### Level 2 Distinction

Learners are able to synthesise knowledge of information technology and creative technology, bringing together understanding of their uses and limitations and applying them to sometimes complex contexts in defined vocational scenarios. They show depth of knowledge of the technical components of information technology' systems and relevant processes. Learners will understand how and when to use their knowledge in different situations, being able to make effective judgements based on analysis of given information. They will be able to analyse information and data, selecting the most relevant concepts and making valid decisions about the selection and application of systems and software. They can judge the consequences of effective and ineffective uses of digital technologies and make recommendations on solutions and future actions. They can compare methods and approaches used to construct, use and apply computer systems, and evaluate alternatives against defined criteria.

## 10 Awarding and reporting for the qualifications

The awarding and certification of these qualifications will comply with the requirements of the Office of Qualifications and Examinations Regulation (Ofqual).

### Calculation of the qualification grade

This qualification is a Level 1/Level 2 qualification and the certification may show a grade ranging from Level 2 P to Level 2 D\*. Please refer to the Calculation of qualification grade table for the full list of grades. If these grades are not achieved, a Level 1 grade may be awarded. Learners whose level of achievement is below a Level 1 will receive an unclassified (U) result. Each individual unit will be awarded a grade of Level 2 Pass, Merit, Distinction or Level 1. Distinction\* is not available at unit level. Learners whose level of achievement is below a Level 1 will receive an unclassified (U) for that unit. Award of Distinction\* (D\*) D\* is an aggregated grade for the qualification, based on the learner's overall performance. In order to achieve this grade, learners will have to demonstrate a strong performance across the qualification as a whole. To achieve a Level 2 qualification, learners must:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome)
- have sufficient points across the mandatory units, i.e. 24 points
- achieve the minimum number of points at a grade threshold from the permitted combination, see the Calculation of qualification grade table.

Learners who do not achieve a Level 2 may be entitled to achieve a Level 1 where they:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome)
- have sufficient points across the mandatory units, i.e. 12 points
- achieve the minimum number of points for a Level 1, see the *Calculation of qualification grade* table.

### For the Certificate

To achieve a Level 2 qualification, learners must:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome) and
- achieve the minimum number of points at a grade threshold from the permitted combination, see the *Calculation of qualification grade* table.

Learners who do not achieve a grade at Level 2 may be entitled to achieve a grade of Level 1 Pass where they:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome) and
- achieve the minimum number of points for a Level 1, see the *Calculation of qualification grade* table.

## For the Extended Certificate

To achieve a Level 2 qualification, learners must:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome) and
- achieve the minimum number of points at a grade threshold from the permitted combination, see the *Calculation of qualification grade* table.

Learners who do not achieve a grade at Level 2 may be entitled to achieve a grade of Level 1 Pass where they:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome) and
- achieve the minimum number of points for a Level 1, see the *Calculation of qualification grade* table.

## For the Diploma

To achieve a Level 2 qualification, learners must:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome) and
- achieve the minimum number of points at a grade threshold from the permitted combination, see the *Calculation of qualification grade* table.

Learners who do not achieve a grade at Level 2 may be entitled to achieve a grade of Level 1 Pass where they:

- complete and report an outcome for all units within the permitted combination (NB Unclassified is a permitted unit outcome) and
- achieve the minimum number of points for a Level 1, see the *Calculation of qualification grade* table.

Learners who do not achieve sufficient points for the Certificate, Extended Certificate or Diploma qualification may be eligible to achieve the Award provided they have completed the correct combination of units and meet the appropriate qualification grade points threshold.

### Points available for unit size and grades

The table below shows the **number of points scored per 10 guided learning hours** at each grade.

Points per grade per 10 guided learning hours				
Unclassified	Level 1	Level 2 Pass (P)	Level 2 Merit (M)	Level 2 Distinction (D)
0	2	4	6	8

We will automatically calculate the qualification grade for your learners when your learner unit grades are submitted. Learners will be awarded qualification grades for achieving the sufficient number of points within the ranges shown in the *Calculation of qualification grade* table.

#### Example

A learner achieves a Level 2 Pass grade for a unit. The unit size is 30 guided learning hours (GLH). Therefore, they gain 12 points for that unit, i.e. 4 points for each 10 GLH, so 12 points for 30 GLH.

### Calculation of qualification grade

Award		Certificate		Extended Certificate		Diploma	
(120 GLH)		(240 GLH)		(360 GLH)		(480 GLH)	
Grade	Points threshold	Grade	Points threshold	Grade	Points threshold	Grade	Points threshold
U	0	U	0	U	0	U	0
Level 1	24	Level 1	48	Level 1	72	Level 1	96
Level 2 Pass	48	Level 2 PP	96	Level 2 PP	144	Level 2 PP	192
		Level 2 MP	114	Level 2 MP	174	Level 2 MP	234
Level 2 Merit	66	Level 2 MM	132	Level 2 MM	204	Level 2 MM	276
		Level 2 DM	150	Level 2 DM	234	Level 2 DM	318
Level 2 Distinction	84	Level 2 DD	168	Level 2 DD	264	Level 2 DD	360
		Level 2 D*D	174	Level 2 D*D	270	Level 2 D*D	366
Level 2 Distinction*	90	Level 2 D*D*	180	Level 2 D*D*	276	Level 2 D*D*	372

This table shows the minimum thresholds for calculating grades. The table will be kept under review over the lifetime of the qualification. The most up to date table will be issued on our website.

Pearson will monitor the qualification standard and reserves the right to make appropriate adjustments.

The tables below give examples of how the overall grade is determined.

**Examples used are for illustrative purposes only. Other unit combinations are possible, see *Section 4 Qualification structures*.**

### Example 1

#### Achievement of a Certificate at Level 1 with a Level 2 MM grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 1	30	3	Level 2 Merit	6	18
Unit 2	30	3	Level 2 Pass	4	12
Unit 3	30	3	Level 2 Merit	6	18
Unit 4	30	3	Level 2 Merit	6	18
Unit 5	30	3	Level 2 Merit	6	18
Unit 6	30	3	Level 2 Pass	4	12
Unit 10	60	6	Level 2 Distinction	8	48
<b>Qualification grade totals</b>	<b>240</b>	<b>24</b>	<b>Level 2 MM</b>		<b>144</b>

The learner has sufficient points for a Level 2 MM grade.

### Example 2

#### Achievement of a Certificate with a Level 2 D\*D grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 1	30	3	Level 2 Merit	6	18
Unit 2	30	3	Level 2 Distinction	8	24
Unit 3	30	3	Level 2 Merit	6	18
Unit 4	30	3	Level 2 Distinction	8	24
Unit 5	30	3	Level 2 Merit	6	18
Unit 6	30	3	Level 2 Distinction	8	24
Unit 10	60	6	Level 2 Distinction	8	48
<b>Qualification grade totals</b>	<b>240</b>	<b>24</b>	<b>Level 2 D*D</b>		<b>174</b>

The learner has sufficient points for a Level 2 D\*D grade.

### Example 3

#### Achievement of an Extended Certificate with a Level 2 MP grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 1	30	3	Level 2 Pass	4	12
Unit 2	30	3	Level 2 Pass	4	12
Unit 3	30	3	Level 2 Merit	6	18
Unit 4	30	3	Level 2 Pass	4	12
Unit 5	30	3	Level 2 Merit	6	18
Unit 6	30	3	Level 2 Distinction	8	24
Unit 8	30	3	Level 2 Merit	6	18
Unit 9	30	3	Level 2 Merit	6	18
Unit 10	60	6	Level 2 Pass	4	24
Unit 16	60	6	Level 2 Pass	4	24
<b>Qualification grade totals</b>	<b>360</b>	<b>36</b>	<b>Level 2 MP</b>		<b>180</b>

The learner has sufficient points for a Level 2 MP grade.

### Example 4

#### Achievement of a Diploma with a Level 2 DD grade

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 1	30	3	Level 2 Merit	6	18
Unit 2	30	3	Level 2 Pass	4	12
Unit 3	30	3	Level 2 Distinction	8	24
Unit 19	60	6	Level 2 Merit	6	36
Unit 4	30	3	Level 2 Distinction	8	24
Unit 10	60	6	Level 2 Distinction	8	48
Unit 11	60	6	Level 2 Distinction	8	48
Unit 12	60	6	Level 2 Distinction	8	48
Unit 13	60	6	Level 2 Distinction	8	48
Unit 17	60	6	Level 2 Merit	6	36
Unit 18	30	3	Level 2 Merit	6	18
<b>Qualification grade totals</b>	<b>480</b>	<b>48</b>	<b>Level 2 DD</b>		<b>360</b>

The learner has sufficient points for a Level 2 DD grade.

**Example 5****Achievement of a Diploma at Level 2 PP grade**

	GLH	Weighting (GLH/10)	Grade	Grade points	Points per unit (weighting × grade points)
Unit 1	30	3	Level 2 Pass	4	12
Unit 2	30	3	Level 2 Pass	4	12
Unit 3	30	3	Level 1	2	6
Unit 19	60	6	Level 2 Merit	6	36
Unit 4	30	3	Level 2 Pass	4	12
Unit 10	60	6	Level 1	2	12
Unit 11	60	6	Level 2 Pass	4	24
Unit 12	60	6	Level 2 Pass	4	24
Unit 13	60	6	Level 2 Pass	4	24
Unit 17	60	6	Level 2 Pass	4	24
Unit 18	30	3	Level 2 Pass	4	12
<b>Qualification grade totals</b>	<b>480</b>	<b>48</b>	<b>Level 1</b>		<b>198</b>

The learner has gained enough points overall for a Level 2 PP grade.



# 11 Quality assurance of centres

Pearson will produce on an annual basis the *UK Vocational Quality Assurance Handbook*, which will contain detailed guidance on the quality processes required to underpin robust assessment and internal verification.

The key principles of quality assurance are that:

- a centre delivering BTEC programmes must be an approved centre, and must have approval for the programmes or groups of programmes that it is delivering
- the centre agrees, as part of gaining approval, to abide by specific terms and conditions around the effective delivery and quality assurance of assessment; it must abide by these conditions throughout the period of delivery
- Pearson makes available to approved centres a range of materials and opportunities, through online standardisation, intended to exemplify the processes required for effective assessment, and examples of effective standards. Approved centres must use the materials and services to ensure that all staff delivering BTEC qualifications keep up to date with the guidance on assessment
- an approved centre must follow agreed protocols for standardisation of assessors and verifiers, for the planning, monitoring and recording of assessment processes, and for dealing with special circumstances, appeals and malpractice.

The approach of quality-assured assessment is through a partnership between an approved centre and Pearson. We will make sure that each centre follows best practice and employs appropriate technology to support quality-assurance processes, where practicable. We work to support centres and seek to make sure that our quality-assurance processes do not place undue bureaucratic processes on centres.

We monitor and support centres in the effective operation of assessment and quality assurance. The methods we use to do this for BTEC First programmes include:

- making sure that all centres complete appropriate declarations at the time of approval
- undertaking approval visits to centres
- making sure that centres have effective teams of assessors and verifiers who are trained to undertake assessment
- assessment sampling and verification, through requested samples of assessments, completed assessed learner work and associated documentation
- an overarching review and assessment of a centre's strategy for assessing and quality assuring its BTEC programmes.

An approved centre must make certification claims only when authorised by us and strictly in accordance with requirements for reporting.

Centres that do not fully address and maintain rigorous approaches to quality assurance cannot seek certification for individual programmes or for all BTEC First programmes. Centres that do not comply with remedial action plans may have their approval to deliver qualifications removed.

## 12 Further information and useful publications

To get in touch with us visit our 'Contact us' pages:

- Edexcel: [qualifications.pearson.com/contactus](https://qualifications.pearson.com/contactus)
- BTEC Firsts: [qualifications.pearson.com/en/qualifications/btec-firsts.html](https://qualifications.pearson.com/en/qualifications/btec-firsts.html)
- Pearson Work Based Learning and Colleges: [qualifications.pearson.com/en/support/support-for-you/work-based-learning.html](https://qualifications.pearson.com/en/support/support-for-you/work-based-learning.html)
- books, software and online resources for UK schools and colleges: [www.pearsonschoolsandfecolleges.co.uk](http://www.pearsonschoolsandfecolleges.co.uk)

Key publications:

- Adjustments for candidates with disabilities and learning difficulties – Access and Arrangements and Reasonable Adjustments, General and Vocational qualifications (Joint Council for Qualifications (JCQ))
- Equality Policy (Pearson)
- Recognition of Prior Learning Policy and Process (Pearson)
- UK Information Manual (Pearson)
- UK Quality Vocational Assurance Handbook (Pearson).

All of these publications are available on our website.

Publications on the quality assurance of BTEC qualifications are on our website at [qualifications.pearson.com/en/support/support-topics/quality-assurance/quality-assurance-overview.html](https://qualifications.pearson.com/en/support/support-topics/quality-assurance/quality-assurance-overview.html)

Our publications catalogue lists all the material available to support our qualifications. To access the catalogue and order publications, please go to [qualifications.pearson.com/en/support/published-resources.html#step1](https://qualifications.pearson.com/en/support/published-resources.html#step1)

### Additional documentation

Additional materials include:

- Sample Assessment Material (for the external units)
- a guide to getting started with BTEC
- guides to our support for planning, delivery and assessment (including sample assignment briefs).

### Additional resources

If you need to source further learning and teaching material to support planning and delivery for your learners, there is a wide range of BTEC resources available to you.

Any publisher can seek endorsement for their resources, and, if they are successful, we will list their BTEC resources on our website:

[qualifications.pearson.com/en/support/published-resources/about-endorsed-resources.html](https://qualifications.pearson.com/en/support/published-resources/about-endorsed-resources.html)

## 13 Professional development and support

Pearson supports UK and international customers with training related to BTEC qualifications. This support is available through a choice of training options offered on our website: [qualifications.pearson.com/en/support/training-from-pearson](https://qualifications.pearson.com/en/support/training-from-pearson).

The support we offer focuses on a range of issues, such as:

- planning for the delivery of a new programme
- planning for assessment and grading
- developing effective assignments
- building your team and teamwork skills
- developing learner-centred learning and teaching approaches
- building in effective and efficient quality assurance systems.

The national programme of training we offer is on our website at: [qualifications.pearson.com/en/support/training-from-pearson](https://qualifications.pearson.com/en/support/training-from-pearson). You can request centre-based training through the website or you can contact one of our advisers in the Training from Pearson UK team via Customer Services to discuss your training needs.

### BTEC training and support for the lifetime of the qualifications

**Training and networks:** our training programme ranges from free introductory events through sector-specific opportunities to detailed training on all aspects of delivery, assignments and assessment. We also host some regional network events to allow you to share your experiences, ideas and best practice with other BTEC colleagues in your region.

**Regional support:** our team of Curriculum Development Managers and Curriculum Support Consultants, based around the country, are responsible for providing advice and support in centres. They can help you with planning and curriculum developments.

To get in touch with our dedicated support teams please visit: [qualifications.pearson.com/en/contact-us.html](https://qualifications.pearson.com/en/contact-us.html)

### Your BTEC Support team

Whether you want to talk to a sector specialist, browse online or submit your query for an individual response, there is someone in our BTEC Support team to help you whenever – and however – you need, with:

- **Welcome Packs** for new BTEC centres: if you are delivering BTEC for the first time, we will send you a sector-specific Welcome Pack designed to help you get started with these qualifications
- **Subject Advisers:** find out more about our subject adviser team – immediate, reliable support from a fellow subject expert – at: [qualifications.pearson.com/en/contact-us.html](https://qualifications.pearson.com/en/contact-us.html)
- **Ask the Expert:** submit your question online to our Ask the Expert online service ([qualifications.pearson.com/en/contact-us/teachers.html](https://qualifications.pearson.com/en/contact-us/teachers.html)) and we will make sure your query is handled by a subject specialist.



# Units



# Unit 1: The Online World

Level: **1 and 2**

Unit type: **Mandatory**

Guided learning hours: **30**

Assessment type: **External**

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## Unit introduction

How do websites work? How do emails reach your computer? How does the use of computer applications affect your daily life? This unit provides an introduction to the modern online world. Starting with your own experiences, you will extend your knowledge of online services and investigate the technology and software that supports them. You will learn more about a range of services including email, online data storage, collaborative software, search engines and blogging.

This unit will help you understand the main technologies and processes behind the internet and investigate how they come together to let you view websites and send information across the world. The internet and web of tomorrow will be even more powerful, more connected, more intuitive and a more important part of our lives. This will result in an internet of services, objects and infrastructure (ubiquitous computing) which will radically change our lives. For example, smart appliances will be able to talk to each other, clothes will monitor our health and retailers will access social media to gain insight into shoppers' preferences.

You will explore a range of digital devices, such as smart phones and digital music players and consider the technology that enables these devices to share and exchange information.

This technology has created new concerns regarding security and privacy. You will investigate these concerns and consider how users should behave online to safeguard themselves and respect others.

This unit is essential if you are considering a career in the IT sector. Online systems and technology have become part of everyday work, so being able to understand and work with this technology is relevant in many roles in the industry.

This unit supports all of the optional units in the Award, especially: *Unit 4: Creating Digital Animation*, *Unit 5: Creating Digital Audio*, *Unit 6: Creating Digital Graphics*, and *Unit 7: Creating Digital Video*. It also supports *Unit 8: Mobile Apps Development*, *Unit 9: Spreadsheet Development*, *Unit 10: Database Development*, *Unit 11: Computer Networks* and *Unit 13: Website Development*, as these technologies form an important part of our online world.

For the General pathway learners must complete **either** Unit 1 **or** Unit 2. Only **one** of these units will contribute to the final qualification grade.

## Learning aims

In this unit you will:

- A investigate online services and online communication
- B investigate components of the internet and how digital devices exchange and store information
- C investigate issues with operating online.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Investigate online services and online communication</b></p> <p><b>Online services</b></p> <p>Understand how and why online services can be used.</p> <p>Examples of online services, include:</p> <ul style="list-style-type: none"> <li>• communication (email, instant messaging, newsgroups, social networking, online conferencing, blogs, chat room)</li> <li>• real-time information (train timetables, news services, traffic reports, flight status updates, weather)</li> <li>• commerce (internet banking, online auction websites, retail sales, publishing)</li> <li>• government (online tax returns, e-voting, applications for services/grants, revenue collection)</li> <li>• education (online learning/training)</li> <li>• virtual learning environments (VLEs)</li> <li>• business (video conferencing, collaborative working, business networks)</li> <li>• entertainment (multi-user games, radio players)</li> <li>• download services (music, film, upgrades, software).</li> </ul> <p>Understand:</p> <ul style="list-style-type: none"> <li>• the features of online advertising designed to capture attention and retain interest</li> <li>• the affiliate model of pay-per-click direction of traffic to websites</li> <li>• the services provided for online data storage including data backup, file access and file sharing.</li> </ul> <p><b>Online documents</b></p> <p>Understand online document systems, including:</p> <ul style="list-style-type: none"> <li>• the need to compress (.zip) files for download/upload</li> <li>• how files are compressed and expanded</li> <li>• the advantages of using online software to create documents, including collaborative working, sharing documents and automatic backup</li> <li>• comparing the use of online software with standalone software for the creation of documents</li> <li>• the need for version control, levels of access and file permissions, including read only, read/write and full control when sharing documents online.</li> </ul> <p style="text-align: right;"><i>continued</i></p>



## What needs to be learnt

### Online communication

Understand how and why online communication can be used, including:

- contemporary social media to post, publish and access information, including web logs (blogs), wikis and podcasting
- virtual learning environments (VLE) in education
- social networking websites to share information and build online communities.

Recognise and use appropriate key terms in online communication:

- netiquette
- profile
- network of friends
- online community
- virtual world
- chat
- chatroom.

Understand the implications of online communication:

- the advantages of using social networking websites for communication
- the use of instant messaging
- the client and server roles required to support instant messaging
- real-time communication over the internet using speech and live video, including Voice over Internet Protocol (VoIP) and web meeting/conferencing software

Understand and compare the issues involved when communicating and working online, including:

- the concept and implications of 'cloud computing', including cloud storage
- the concept, application of and implications of the internet of things.

## What needs to be learnt

### Learning aim B: Investigate components of the internet and how digital devices exchange and store information

#### The internet

Understand what the internet is, how it works, and how it is structured, including:

- the internet as a global network of interconnected computers
- roles of Points of Presence (PoP) and Network Access Points (NAP) in the infrastructure of the internet.
- internet infrastructure in terms of clients, servers, routers, networks and connecting backbones
- when it is appropriate to use different internet connection methods including broadband, wireless and dial-up, and advantages and disadvantages of alternative connection methods
- Internet Protocols (IP), including Transmission Control Protocol (TCP) and File Transfer Protocol (FTP)
- the role of an Internet Service Provider (ISP)
- the main services offered by Internet Service Providers (ISPs) including email, web space, internet access and online support
- the relationship between bandwidth and transmission rates.

#### Worldwide web

Understand the concepts, functions and impact of the worldwide web (WWW), including:

- the worldwide web (WWW) as the collection of information on computers connected to the internet
- the role of a web server
- the structure of a website in terms of hyperlinked web pages.
- the components of a Uniform Resource Locator (URL) and the roles of each component
- the function of HyperText Transfer Protocol (HTTP)
- that HyperText Markup Language (HTML) is used to create web pages
- the main features of HyperText Markup Language (HTML) source code
- the role of internet browsers in requesting and displaying web page components
- the purpose of search engines and their role in maintaining indexes of web pages.

*continued*

## What needs to be learnt

### Email

Understand the purpose, concepts, processes and implications of email, including:

- email as a system for sending messages through the internet from user to user
- what happens to send an email
- the advantages of using email, including the ability to send attachments and to send the same email to more than one recipient
- email protocols including Simple Mail Transfer Protocol (SMTP), Post Office Protocol 3 (POP3), Internet Message Access Protocol (IMAP)
- the advantages and drawbacks of using email and webmail
- the 'store and forward' email model and describe its role in sending messages from user to user through the internet.

### Data exchange

Understand the concepts, processes and implications of data exchange and compare different methods, including:

- data exchange as the passing of data between computers in a network including the internet
- transmission modes (simplex, half-duplex and duplex) used by digital devices including smart phones, printers, computer processors, remote controllers (e.g. for TVs)
- the hardware and software required for real-time communication including Voice over Internet Protocol (VoIP) and web meeting/conferencing
- the role of a Coder/Decoder (CODEC) in the transmission of a VoIP, audio-file and video-file conversation
- main characteristics of alternative transmission methods, including:
  - fibre optic
  - wireless (infrared, microwave, satellite)
  - wire connectors
- parallel and serial transmission of data, and bi-directional transmission
- the benefits of packet switching as a method of sending data over a wide area network
- the contents of a packet as a group of bits that include packet identification, error control bits, coded data, destination address
- comparison of data transfer rates, effective ranges, and identify appropriate uses of different transmission methods, including:
  - fibre optic
  - wireless (infrared, microwave, satellite)
  - wire connectors.

*continued*

**What needs to be learnt**

Understand the concepts, structures and implications of wireless networks, including:

- the components of a wireless network including router, access points and wireless network adaptors
- client-side processing including the use of rollover images on a web page
- server-side processing including submitting a completed form on a web page
- the difference between client-side processing and server-side processing and examples of client-side and server-side processes.

**Data storage**

Understand the concepts, processes and implications of data storage, including:

- a database structure in terms of tables, records, fields, data types and relationships
- an online database such as a database that can be accessed via a network, including the internet
- the roles of a Database Management System (DBMS) and structured query languages in the manipulation of data stored in an online database.

## What needs to be learnt

### Learning aim C: Investigate issues with operating online

#### Possible threats to data

Understand the concepts, applications, process and implications regarding protecting data online, including:

- malicious and accidental damage to data and situations where either could occur
- security measures taken to protect data that is transmitted and stored digitally including encryption, firewalls and anti-virus software
- measures taken to protect the security and integrity of data, including passwords, levels of permitted access, firewalls and anti-virus software
- the need to backup data and identify and describe different procedures for backing up data.
- how data might be recovered if lost
- the benefits and possible inherent dangers of widespread use of social networking websites and instant messaging
- the importance to individuals of the management of their e-reputation
- security issues and consequences associated with the widespread use of email, including spread of viruses, phishing and identity theft.

Consider ways in which online technology can be used to monitor individuals' movements and communications.

In relation to IT systems, consider how current legislation controls how personal data can be used and must be protected by organisations.

## **Teacher guidance**

### **Resources**

There are no special resources needed for this unit.

### **Assessment guidance**

This unit is assessed using an onscreen test. Pearson sets and marks the test. The test lasts for 1 hour and has 50 marks. The assessment is available on demand.

Learners will complete an onscreen test that has different types of questions including objective and short-answer questions. Where appropriate, questions will contain graphics, photos, animations or video. An onscreen calculator is available for questions requiring calculations. An onscreen notepad is available for making notes. Each item will have an accessibility panel that allows a learner to zoom in and out, and apply a colour filter.

Learners should be encouraged to keep up to date with emerging technology as part of their learning experience.

Centres are encouraged to be aware of developments in systems and technologies. In terms of assessment, we will issue updates annually in April to be taken into account during delivery from the following September. External assessments will reflect updates from the subsequent January.

# Unit 2: Technology Systems

Level: **1 and 2**

Unit type: **Mandatory**

Guided learning hours: **30**

Assessment type: **External**

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## Unit introduction

Technology systems are involved in many of the objects we use every day, from a laptop computer and routers relaying internet traffic, to logging in to a social networking site. This unit provides a first look at how the main building blocks of technology systems work.

You will explore the common hardware components of technology systems, such as a touch screen or a printer, and the internal building blocks of a computer like the processor, buses and memory. The unit also covers the purpose of networks, which allow different devices within a technology system to communicate. (This topic is covered in more detail in *Unit 1: The Online World* and *Unit 11: Computer Networks*.)

No technology system is complete without the software that brings it to life. You will explore different types of software. These will include the operating system (OS) that supports the communication and management of resources, and utility programs that provide functionality to maintain the system.

You will also learn about the role of applications software, such as office programs, graphics packages, accounting software and CAD/CAM, that supports many aspects of everyday business life.

This unit supports all of the optional specialist units in the Award, especially *Unit 8: Mobile Apps Development*, *Unit 9: Spreadsheet Development*, *Unit 10: Database Development*, *Unit 11: Computer Networks*, *Unit 12: Software Development* and *Unit 13: Website Development*.

This unit is particularly useful if you are considering a career in the IT sector, as it includes key concepts and processes which form the basis of any technology system and is relevant for many roles in the industry.

## Learning aims

In this unit you will:

- A understand how the components of technology systems work together
- B understand how data flows between internal components of a computer and is processed to provide information
- C understand different types of software.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand how the components of technology systems work together</b></p> <p><b>Computer and technology systems</b></p> <p>Understand the concepts:</p> <ul style="list-style-type: none"> <li>• a computer is a machine that processes digital data</li> <li>• a technology system is the complete collection of components (hardware, software, peripherals, power supplies, communication links) making up a single computer installation.</li> </ul> <p><b>Applications and issues of technology systems</b></p> <p>Understand:</p> <ul style="list-style-type: none"> <li>• application of technology systems used in different sectors, including construction, finance, health, manufacturing (including CAD/CAM/use of robots) and retail</li> <li>• issues involved in the use of technology systems, including health and safety, security measures (passwords, authentication, levels of access), environmental, sustainability, privacy and copyright</li> <li>• reasons why future development of a technology system is important to organisations, including competitive advantage, reduced costs and improved performance.</li> </ul> <p><b>Computer hardware devices</b></p> <p>Understand the features, uses and implications of hardware devices, including:</p> <ul style="list-style-type: none"> <li>• devices (PC, server, laptop, tablet, games console and other programmable digital devices)</li> <li>• input – keyboard, mouse, sensors, touch screen, microphone, scanner, digital camera</li> <li>• output – printers (inkjet, laser, impact), speakers, force feedback devices, actuators, screens, projectors, robot arms, other control devices</li> <li>• storage devices – solid state, optical media, magnetic media</li> <li>• that modern technology devices are often multifunctional (have both input and output functionality)</li> <li>• how hardware components and software can be combined to form an automated technology system (self-service checkout, production line)</li> <li>• the uses of devices that capture data for automated systems (barcode readers, magnetic strip readers, optical character readers (OCR), optical mark readers (OMR) and radio frequency identification systems (RFID))</li> <li>• suitable devices to suit the requirements for a specific user and purpose, and justify their use.</li> </ul> <p style="text-align: right;"><i>continued</i></p>



**What needs to be learnt****Computer networking**

Understand the concepts, applications and implications of networks, including:

- the purpose of different types of network (local area network (LAN), wide area network (WAN), personal area network (PAN), mobile broadband)
- the common uses of network systems (resource sharing, data sharing, entertainment, communication)
- the benefits of computer networking
- the need to synchronise data held on devices forming a PAN.

**Data transfer**

Understand the concepts, implications and processes of data transfer, including:

- physical methods of transferring data between devices using wireless or cabled topology to meet the requirements for a specific user and purpose
- wireless methods of transfer including the use of Wi-Fi and Bluetooth technologies
- cabled methods for transfer of data between devices, including the use of optical fibre, unshielded twisted pair (UTP) and coaxial cables
- the benefits and drawbacks of these physical methods.

**What needs to be learnt****Learning aim B: Understand how data flows between internal components of a computer and is processed to provide information****Internal components of a computer**

Understand the main characteristics, functions and role of the internal components of a computer, including:

- the motherboard – printed circuit board (PCB) holding main components of the system
- central processing unit (CPU) – arithmetic and logic unit (ALU), control unit, registers
- memory (RAM, ROM, including Flash memory)
- graphics/sound/video hardware
- heat dispersal systems – fans and heat sinks
- storage devices – solid state, optical and magnetic
- how internal components of a computer affect performance and user experience
- comparison of different specifications of internal components
- how the features of the central processing unit and graphical processing unit affect performance and user experience:
  - clock speed
  - caches
  - multiple processing cores
  - heat, power consumption
- how the features of mobile devices affect performance/user experience:
  - System-on-a-Chip (SoC)
  - CPU and GPU
  - battery life
- comparing how mobile systems are different from traditional platforms
- how the features of memory and storage devices affect performance/user experience:
  - memory (cache and RAM)
  - storage devices (solid state, optical and magnetic media)
- the role of computer buses in carrying data between the internal components of a computer.

*continued*

**What needs to be learnt****Analogue and digital data**

Understand the concepts, processes and implications of data transmission, including:

- the differences between analogue and digital transmission of data
- the need to convert analogue signals to digital signals and digital signals to analogue signals
- how data in a computer is represented using binary notation (bit, bytes, word length).

Understand and use binary format and the concepts of data storage, including:

- how characters can be represented in binary format and convert whole numbers into binary numbers (zero up to 10)
- conversion of binary numbers (up to 8 bits) to whole numbers (base 10)
- units used to describe memory and data storage (bit, byte, kilobyte, megabyte, gigabyte, terabyte, petabyte).

**What needs to be learnt****Learning aim C: Understand different types of software****Software**

Understand the concepts, differences and implications of software, including:

- software as a series of programs used to direct the operation of technology systems
- the differences between custom-made and off-the-shelf programs
- the advantages and disadvantages of using custom-made and off-the-shelf programs.

Understand the concepts, implications and structures of programming, including:

- the hierarchical structure of a computer as:
  - application software package (user interface)
  - high-level programming language
  - low-level programming language
  - machine code (binary number notation)
  - hardware
- the main characteristics of high-level programming languages, including imperative, procedural, event-driven and object-orientated programming languages
- the main characteristics of low-level programming languages, including assembly language and machine code
- the main distinctions between programs in high-level and low-level forms in terms of structure, closeness to spoken language and intuition of use.

**Introduction to computer programming concepts**

Understand, use and interpret flowcharts, including:

- flowchart symbols as described in the British Computer Society's *BCS Glossary of Computing and ICT* (ISBN 978-1-906124-00-7, or subsequent editions), including terminators, connectors, processes and decision boxes
- the purpose of simple processes represented in flowchart diagrams (decision making, finding largest/smallest number in a sequence, rates of discount/interest/payments)
- inputs and/or outputs from simple processes represented in flowchart diagrams, including currency conversions, converting marks to grades, calculating wages including overtime payments
- completion of flowchart diagrams with any missing decision statements and decision outcomes.

Recognise and understand:

- the terms used in a computer programs, specifically: declaration, input, output, assignment, variables (local and global) and constants, sub-routines, scope of variables
- the need to annotate code to allow for maintenance
- the use of data types, including character, string, integer, real and Boolean
- the use of data structures, including records and simple arrays.

*continued*

**What needs to be learnt****Operating systems and applications**

Understand the concepts, functions, and implications of operating systems, including:

- the role of an operating system in terms of file management, hardware management (drivers), resource allocation and security
- the role of utility applications, including disk defragmenters, firewalls and anti-virus software
- the differences between graphical user interfaces and command-line user interfaces
- the features of an operating system with a graphical user interface, including user interface, accessibility and ease of use
- the features and benefits of operating systems for mobile devices, including user interface, accessibility and ease of use
- the role of productivity applications, including office software, graphics, multimedia and web-authoring software
- the benefits of using suites of productivity applications
- the factors to consider when installing or upgrading an operating system or productivity application:
  - hardware platform
  - accessibility features
  - compatibility with preferred applications and hardware
  - cost (licence, set-up, training, maintenance)
  - speed
  - security features (including firewalls, malware management, setting user permissions, user support).

## Teacher guidance

### Resources

There are no special resources needed for this unit.

### Assessment guidance

This unit is assessed using an onscreen test. Pearson sets and marks the test. The test lasts for 1 hour and has 50 marks. The assessment is available on-demand.

Learners will complete an onscreen test that has different types of questions including objective and short-answer questions. Where appropriate, questions will contain graphics, photos, animations or video. An onscreen calculator is available for questions requiring calculations. An onscreen notepad is available for making notes. Each item will have an accessibility panel that allows a learner to zoom in and out, and apply a colour filter.

Learners should be encouraged to keep up to date with emerging technology as part of their learning experience.

Centres are encouraged to be aware of developments in systems and technologies. In terms of assessment, we will issue updates annually in April to be taken into account during delivery from the following September. External assessments will reflect updates from the subsequent January.

# Unit 3: A Digital Portfolio

Level: **1 and 2**

Unit type: **Mandatory**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

This unit is your chance to show off! A digital portfolio is an exciting onscreen way to showcase your achievements to potential employers or when applying for a course. It is all about:

- the projects you have created and developed
- your use of communication and presentation skills
- your capabilities and potential.

Digital portfolios can be viewed by anyone with a computer and an internet browser. You will learn how to create a digital portfolio that includes a series of web pages with links to content that you have created. You will learn how to make use of multimedia assets such as images, sound and video to make your portfolio appealing and engaging.

For this unit, your digital portfolio will have a clear purpose and audience to show them who you are and what you are capable of. It should have a structure that is logical and easy to navigate and must be in a format that can be uploaded and viewed on the web.

You should think of your portfolio as a shop window, carefully selecting a range of content including work done on this BTEC course as well as any other appropriate content. Every item should be clearly introduced, explaining why it is included and what it demonstrates to the viewer. Multimedia assets should be used to enhance the experience for the viewer, not as a substitute for good content.

This unit can be used as synoptic unit to bring together the content of all the optional specialist units in the course. It can be studied alongside the other units and completed at the end of the course.

## Learning aims

In this unit you will:

A design a digital portfolio

B create and test a digital portfolio

C review the digital portfolio.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Design a digital portfolio</b></p> <p><b>Basic project lifecycle</b></p> <p>Stages of the project lifecycle:</p> <ul style="list-style-type: none"> <li>• design (e.g. storyboards, structure chart, assets, software)</li> <li>• create/develop and test a product e.g. iterative cycle of development and feedback from test users</li> <li>• review (e.g. feedback from others).</li> </ul> <p><b>Digital portfolio structure</b></p> <p>Web pages, including:</p> <ul style="list-style-type: none"> <li>• home page with introduction and links to sections</li> <li>• section pages to introduce purpose of section and link to context pages</li> <li>• context pages to introduce and link to items of content.</li> </ul> <p><b>Digital portfolio user interface</b></p> <p>Interface to include:</p> <ul style="list-style-type: none"> <li>• page formatting – colour scheme, fonts</li> <li>• assets required for web pages – (e.g. images, sound, video)</li> <li>• navigation – navigation bar, links (internal, text, graphical, buttons), consistency.</li> </ul> <p><b>Digital portfolio content</b></p> <p>Consider:</p> <ul style="list-style-type: none"> <li>• selection – variety of extracts, snapshot of experiences and projects</li> <li>• file formats</li> <li>• compression</li> <li>• accessibility.</li> </ul> <p><b>What should go in the design?</b></p> <p>Designs to include:</p> <ul style="list-style-type: none"> <li>• audience and purpose             <ul style="list-style-type: none"> <li>◦ description of likely attributes</li> <li>◦ description of purpose</li> </ul> </li> <li>• timeline – outline schedule including key stages in the project lifecycle</li> <li>• content – files and assets required, formats, folder structure</li> <li>• structure chart to show how pages are linked</li> <li>• storyboards of webpages – illustrating panels for each page</li> <li>• user interface – formatting, assets, navigation</li> <li>• alternative design ideas</li> <li>• presentation of content – file folders, compression, accessibility.</li> </ul> <p style="text-align: right;"><i>continued</i></p>



**What needs to be learnt****Learning aim B: Create and test a digital portfolio****Prepare content**

For the content in a digital portfolio:

- prepare (including gathering and creating assets) extracts and other content for portfolio, i.e. to demonstrate achievements and potential
- convert to acceptable file formats (to ensure format is appropriate for users)
- create logical folder structure for content
- ensure all content is stored within the portfolio folder structure.

**Create web pages**

Use appropriate web authoring tools and techniques:

- colour schemes
- page formatting features
  - tables
  - fonts
  - alignment
  - colour
  - line spacing
  - bullets
- content for web pages, including
  - text – introductions, commentaries
  - images
  - sound or video
  - lines and simple shapes
  - internal hyperlinks (text, graphical, buttons)
  - navigation bar
- images/objects
  - position
  - crop and size
  - alignment
  - orientation
  - text wrapping
  - resolution.

*continued*

## What needs to be learnt

### Test the portfolio

To test a digital portfolio:

- check all the pages and content are within the portfolio folder structure
- activate links to internal content (external links are prohibited)
- test the digital portfolio for functionality and document actions taken, including:
  - that all links work and open correct content
  - that all web pages are error free
  - the effectiveness of the home page and other pages
- test the digital portfolio for usability and document any actions taken, including:
  - user interface
  - ease of navigation
  - impact of content, bearing in mind the purpose
  - clear and consistent content and style
- check functionality on another computer system and browser.

### Learning aim C: Review the digital portfolio

Review the content of a digital portfolio, including:

- considering the extent to which the portfolio meets the needs of the audience and the purpose
- evaluating the design documentation and any changes made during development of the portfolio
- incorporating comments from end reviewers
- making valid suggestions for further improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Design a digital portfolio</b>			
1A.1 Identify the audience and purpose for the design of a digital portfolio.	2A.P1 Describe the audience and purpose for the design of a digital portfolio.	2A.M1 Produce detailed designs for a digital portfolio, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• detailed storyboard of the layout and content of pages</li> <li>• a detailed structure chart with complete navigation routes</li> <li>• fully referenced sources for the ready-made assets.</li> </ul>	2A.D1 Justify the final design decisions, explaining how the digital portfolio will: <ul style="list-style-type: none"> <li>• fulfil the stated purpose</li> <li>• meet the needs of the audience.</li> </ul>
1A.2 Produce designs for a digital portfolio, with guidance, including: <ul style="list-style-type: none"> <li>• outline storyboards of the layout and content</li> <li>• a list of ready-made assets to be used.</li> </ul>	2A.P2 Produce designs for a digital portfolio, including: <ul style="list-style-type: none"> <li>• a timeline for the project</li> <li>• a storyboard of the layout and content of pages</li> <li>• a structure chart indicating navigation routes</li> <li>• a list of ready-made assets to be used, including sources.</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Create and test a digital portfolio</b>			
1B.3 Prepare portfolio content, with guidance.#	2B.P3 Prepare portfolio content and save in appropriate file formats, using folders, demonstrating awareness of purpose.#	2B.M2 Select and refine a range of portfolio content and save in appropriate file formats, using a logical folder structure and demonstrating awareness of the audience.#	2B.D2 Refine the portfolio to improve navigation and include commentaries that justify the choice of content.#
1B.4 Create a functional digital portfolio, with guidance.	2B.P4 Create a functional digital portfolio, including: <ul style="list-style-type: none"> <li>• home page and section pages</li> <li>• context pages.</li> </ul>	2B.M3 Develop the portfolio demonstrating awareness of the audience, using: <ul style="list-style-type: none"> <li>• a range of suitable assets on the web pages</li> <li>• consistent navigation</li> <li>• commentaries to explain the content.#</li> </ul>	
1B.5 Test the digital portfolio for functionality, with guidance	2B.P5 Test the portfolio for purpose and functionality on a different system and browser, and take appropriate action.	2B.M4 Gather feedback from others and use it to improve the portfolio, demonstrating awareness of audience and purpose.	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Review the digital portfolio</b>			
1C.6 Identify how the final portfolio is suitable for the intended purpose.	2C.P6 Explain how the final portfolio is suitable for the intended audience and purpose.	2C.M5 Review the extent to which the final portfolio meets the needs of audience and purpose, considering feedback from others.	2C.D3 Evaluate the final digital portfolio against the initial designs and justify any changes made, making recommendations for further improvement.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit are:

- web-authoring software (local or online)
- audio- and/or video-recording equipment and suitable editing software.

Learners must have work from their other BTEC First in Information and Creative Technology units available and completed in order to compile these and other materials into the portfolio.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

This unit assesses the learner's ability to create a self-contained digital portfolio to showcase evidence of their achievements, particularly their achievements on the BTEC I&CT course. Their digital portfolio will consist of the interface (i.e. the web pages) and content that can be accessed using it. Their portfolio must include work from their other completed units in the BTEC I&CT course.

Learners need to be aware of the requirements of this unit at the start of their course and could start planning for it from then. For instance, it would be beneficial to create a folder to store extracts from products and systems developed in their other internally assessed units, and keep a project diary where they can record comments that would form the basis of the portfolio commentaries. However, this unit should be completed at the end of the course.

The variety of content included in the portfolio will partly depend on the number of units completed on the course. But learners may wish to include evidence of other appropriate achievements, such as other qualifications, Duke of Edinburgh Award work, community work and/or personal qualities. As a guide, there should be at least three sections, each with three or more context pages. Of these, at least one section should relate to the BTEC I&CT course.

The portfolio must consist of a number of web pages in .html format linked together in a structure designed by the learner. It must be possible to view the evidence on another system using freely available software and readers.

Any suitable software may be used to construct the portfolio, locally or online. Web authoring software is recommended. However, if presentation or other software is used to develop the pages of the portfolio, learners must ensure that the files are saved in .html format; presentations or similar digital documents are **not** acceptable.

Learners should have given consideration to the best way of preparing and presenting their content. When using screenshots, for example, do they display all the required information and can they be read easily?

Context pages should present commentaries that 'set the scene', introduce the content and provide additional information about the choice of evidence.

## Learning aim A

**Please note: learners' portfolios must include work from other completed units in the BTEC I&CT course.**

Learners should allocate sufficient time for designing the overall style and how they will present the content in their digital portfolio, aiming for consistency of presentation, good layout and colour schemes, and considering how to use layout and colour in pages viewed onscreen. They should consider the extent to which designs will inform the creation of the digital portfolio, making sure it is clear what the audience will experience.

**For 2A.P1:** learners should describe the target audience and purpose for the design of their portfolio.

*For level 1, as a minimum, learners should identify the audience and purpose for the design of their portfolio.*

**For 2A.P2:** learners should produce design documents for their portfolio. Designs should include a clear idea of the timeline for the project, storyboard mapping out the layout and content (with a minimum of eight screens), a structure chart indicating navigation routes, and a list of ready-made assets. Assets for the web pages, such as text, images, audio and video, should be listed. It should be clear where these assets will be used.

*For level 1, as a minimum, learners should produce an outline design for their digital portfolio storyboard to illustrate the layout and content (with a minimum of four screens), and a list of ready-made assets, which together give an indication of what the product would be like.*

**For 2A.M1:** learners should produce outline alternative design solutions (e.g. a description of alternative styles and layouts), detailed storyboard (with a minimum of eight screens) showing what each web page will be like, and details of assets and where they will be found. A structure chart should show complete navigation and a sources table of ready-made assets should be given. The design documentation should be sufficiently detailed to allow someone else to visualise the completed portfolio.

**For 2A.D1:** learners should justify their design choices, explaining how each asset enhances the user experience and how their choice of navigation options makes the product easy to use, taking account of the intended audience.

## Learning aim B

Learners should prepare (including gathering and creating, where needed) a range of appropriate content, selecting extracts that show what they have achieved and give an indication of future potential. They should create the web pages for the portfolio, taking care to prepare assets that enhance the user experience and draw focus to the content.

**For 2B.P3:** learners should create a folder structure to store the portfolio content files and the web pages. They should ensure that all content is fit for purpose and is in appropriate file formats, such as .pdf, .html, .jpg and .mp3. It is essential that all content can be viewed on different systems using freely available software. Each item of content should be given an appropriate name.

*For level 1, as a minimum, learners should prepare and save the portfolio content with guidance.*

**For 2B.M2:** learners should refine the folder structure to ensure that it is logical and clear. They should select suitable content from their work and prepare a range of extracts which give a good overview of their achievements, demonstrating an awareness of the audience.

**For 2B.P4:** learners should create their digital portfolio.

The digital portfolio should include:

- a home page and section pages to introduce the learner and the purpose of the portfolio
- context pages containing appropriate assets, comments to introduce the portfolio content and links to the portfolio content.

Web pages should include comments to introduce items of portfolio content and should make some use of suitable multimedia assets.

*For level 1, as a minimum, learners should have created, with guidance, a functional digital portfolio including links to some appropriate content.*

**For 2B.M3:** learners should develop their portfolio further, demonstrating an awareness of audience. The context pages should include clear explanations for the choice of content and a range of assets, such as a video introduction or audio explanation of an item of content. Learners should not spend excessive time adding multimedia assets and should take care only to include those that improve the portfolio and do not detract from the content. The navigation and commentaries should be consistent throughout the portfolio.

**For 2B.P5:** learners should test and take appropriate action to ensure the portfolio is fully functional. Learners should check their portfolio can be viewed on another type of browser and another computer system.

*For level 1, as a minimum, learners should test the functionality of their portfolio, but will need guidance to do so.*

**For 2B.M4:** learners should test their portfolio and get feedback on it. Learners should think carefully about who they choose to be test users. Ideally, test users need to be part of the target audience or, at least, be able to represent it. Feedback should be gathered from others regarding the portfolio. Learners should acknowledge when a change was suggested but ignored, and give the reason.

**For 2B.D2:** learners should refine their digital portfolio so that it includes detailed commentaries that contextualise the content. The assets should enhance the user experience and the user should be drawn to the content.

### Learning aim C

Learners should objectively review the extent to which the final digital portfolio meets the requirements. Suggestions for improvement should be valid and specific. Feedback from others should be used to inform the review process.

**For 2C.P6:** learners explain two reasons why their portfolio is suitable for the intended audience and purpose.

*For level 1, as a minimum, learners identify why their portfolio is fit for purpose, for example, "My portfolio is to be part of a job application, so I have included different projects that use lots of different skills and ideas to show everything that I can do."*

**For 2C.M5:** learners should consider how well their portfolio addresses the needs of the intended audience and purpose of the portfolio. Learners should incorporate feedback from end reviewers into their review, rather than simply recording what was said. This will be of most value if reviewers are able to represent the target audience (e.g. adults, prospective employers), ensuring that comments are realistic and valid.

**For 2C.D3:** learners should evaluate the final portfolio against the design documentation, explaining the rationale for any changes that were made. They should identify further potential improvements, assisted by feedback from end reviewers.



## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

The context of a digital portfolio can cover a variety of areas, including:

- showcasing work to demonstrate for employers
- as part of an application to further or higher education
- showcasing products for potential customers

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.P2 2A.M1, 2A.D1, (1A.1, 1A.2)	Design a Portfolio	<p>You are applying for a job with an IT company. As part of the application process, the company wants to see examples of the products you have made and the projects you have completed.</p> <p>Design a digital portfolio to go alongside your application, which includes at least two products or projects you have worked on. The content of your portfolio should show a range of your IT skills and experience, and be related to the work of the IT company you are applying to.</p> <p>In your portfolio, specify audience and purpose. Include a timeline, structure chart, storyboards and details of assets required.</p> <p>Justify the choice of assets and the design of the portfolio in relation to the audience and purpose.</p>	<ul style="list-style-type: none"> <li>• Design documentation.</li> </ul>
2B.P3, 2B.M2 (1B.3)	Content of the Portfolio	<p>Create a logical folder structure to store the content.</p> <p>Select content and prepare extracts.</p> <p>Save the extracts in appropriate file formats and in appropriate folders.</p>	<ul style="list-style-type: none"> <li>• Screenshot of folder structure.</li> <li>• Content in folders.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P4, 2B.P5, 2B.M3, 2B.M4 2B.D2, (1B.4, 1B.5)	Make the Portfolio  Test the Portfolio	Create a home page, section pages and context pages using appropriate text and other assets such as audio or video. Build portfolio and activate links to content. Carry out testing for functionality, ensuring that all links work and open the correct content. Check the web pages for errors and make changes if necessary. Ask test users to try out portfolio and give feedback. Make changes if appropriate.	<ul style="list-style-type: none"> <li>Final digital portfolio.</li> <li>Final digital portfolio and documentation.</li> </ul>
2C.P6, 2C.M5, 2C.D3, (1C.6)	Reviewing your Portfolio	Evaluate the digital portfolio, including the extent to which it meets the needs of audience and purpose. Explain any changes to the product compared with the design, incorporate feedback from end reviewers and make recommendations for further improvements.	<ul style="list-style-type: none"> <li>Review document.</li> </ul>

# Unit 4: Creating Digital Animation

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

How are the amazing visual effects in science fiction and fantasy films, and computer games, made? This unit provides you with an introduction to tools/techniques and processes that are used commercially when creating computer animation.

Animation is the creation of moving images and has a long history. Today modern animations are usually created using a computer. It is an exciting and fast moving area of creative technology that provides an opportunity to combine creative and technical computing skills, and is one in which the UK excels. The creative industries have grown considerably in recent years and provide increasing employment opportunities. An animator can work in a number of different creative areas: creating effects for live-action films, feature-length animations and computer games. Non-narrative animations feature in online advertising and software interface design.

In this unit you will investigate the range of applications and features of existing animation products or sequences, that have been created for an intended audience and purpose. You will be able to apply your findings when creating your own computer animation which do not require user interaction.

You will then design, create and test your own animated product, in a similar way to how it is done in industry, and be introduced to the technology and techniques used by the professionals. You will be given a brief which will need to be fulfilled. You will also need to think about the creative aspect of the project as well as technical skills to use. You will review your completed animated product having obtained feedback from others.

In particular, this unit develops skills from *Unit 1: The Online World* and the following optional units: *Unit 5: Creating Digital Audio*, *Unit 6: Creating Digital Graphics* and *Unit 7: Creating Digital Video*. In addition, it supports the content of *Unit 8: Mobile Apps Development* and *Unit 13: Website Development*.

## Learning aims

In this unit you will:

- A understand the applications and features of digital animation products
- B design a digital animation product
- C create, test and review a digital animation product.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the applications and features of digital animation products</b></p> <p><b>Types of animation</b></p> <p>Know the different types of traditional and digital based animation, including:</p> <ul style="list-style-type: none"> <li>• flick book</li> <li>• cel animation</li> <li>• stop motion</li> <li>• cut-out (paper-based and computer-generated images either scanned or as graphics)</li> <li>• rotoscoping</li> <li>• skeletal animation</li> <li>• Flash animation</li> <li>• computer-generated imagery (CGI).</li> </ul> <p><b>Applications of digital animation</b></p> <p>Applications and purpose of digital animation, including:</p> <ul style="list-style-type: none"> <li>• different existing digitally animated products (e.g. TV programmes, films, computer games, music videos, advertisements, internet and mobile content, simulation, product development)</li> <li>• the effect (e.g. evoke emotion, educate) they have on different audiences (e.g. age, gender, interest, need).</li> </ul> <p><b>Features of digital animation</b></p> <p>Features of computer-animated products, e.g.:</p> <ul style="list-style-type: none"> <li>• type of animation</li> <li>• 2-D and 3-D models</li> <li>• image type (bitmap/photo and vector)</li> <li>• frames per second</li> <li>• resolution</li> <li>• timing and length</li> <li>• special effects (motion blur/fade, rendering effects, morphing, camera angles)</li> <li>• audio (speech, music, sound effects).</li> </ul>

**What needs to be learnt****Learning aim B: Design a digital animation product****What goes into the design?**

Designs include:

- intended audience (age, gender, interests), purpose and requirements (as defined in a brief)
- storyboards containing panels which outline the main assets (characters, objects, scenes, sounds) and which include some main panels that show how the assets combine, with timing, camera angles and flow shown
- list of any ready-made assets, with their sources documented and referenced in a sources table, e.g.:
  - graphics – characters and/or objects
  - audio clips – speech, sound effects and/or music
  - video clips
- alternative ideas for the design
- if required, prototypes of the animated product, e.g. characters, objects, video clips, audio clips, scenes (hand-drawn or computer-generated prototypes are acceptable formats for designs).

**What needs to be learnt****Learning aim C: Create, test and review a digital animation product****Creating the animation**

## Preparing assets

- Gather ready-made digital assets (characters, objects, audio clips, video footage) from other sources (e.g. internet, media such as CD or DVD).
- Hand draw or use graphic-editing software to create original assets (characters, objects and/or backgrounds).
- Import original and ready-made assets:
  - graphics and/or video files, e.g. .tga, .jpg, .png, .dpx, .iff, .avi, .mov (QuickTime), .ac (AC3D), .obj (Wavefront), .lwo (Lightwave), .motion capture, .mp4 and .mpg
  - audio files, e.g. .wav, .aiff, .au, .mp3
- reference ready-made assets appropriately in a sources table, considering copyright issues.
- Graphic-editing software:
  - vector editing tools/techniques, e.g.:
    - text
    - line and curve (types and thickness)
    - shading, colour fills, gradients, patterns
    - layering
  - photo editing tools/techniques, e.g.:
    - selecting and removing parts (lasso, eraser, marquee)
    - cropping and resizing images
    - shape fill with texture, solid colours, colour gradient or outline with colour
    - scale, rotate, reflect and distort layers.

If required for the product, record original audio and video, import assets into animation software and use software to edit the original assets.

*continued*

### What needs to be learnt

Animation-editing software

- 2-D digital animation techniques (3-D techniques are acceptable but not required):
  - cut-out (either scanned images or digitally generated graphics)
  - rotoscoping
  - skeletal animation
- animation-editing software tools/techniques:
  - edit key frames (e.g. insert, delete, copy)
  - tweening
  - layering
  - camera movement (e.g. panning, cuttings from one shot to another, zoom, angles)
  - rendering (e.g. shading, reflections, edge effects and shadows)
  - transition effects (e.g. motion blur/fade, morphing)
  - audio speech, sounds and/or music
  - lip-sync mouth movement to audio.

### Test the animation

Improving the animation:

- test the animated product for functionality (e.g. sound is audible, the animation runs, the length of the clip is appropriate)
- test that the animation is fit for purpose
- gather feedback from others on quality (e.g. the characters and/or objects move as intended, timing is accurate, sound quality is high), functionality, audience and purpose
- document any improvements and update the sources table for ready-made assets
- understand the reasons for exporting and compressing animation files (e.g. to ensure format is appropriate for reviewers and/or users)
- export and compress the animation product into a suitable final file type (e.g. .swf, .mpeg, .wmv, .sb, .mpg) and size.

### Review the animation

Review the finished digital animation product for:

- quality of the animation product
- fitness for audience and purpose
- suitability against the original requirements
- current legal and ethical constraints, e.g. copyright, eSafety, suitable content
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the applications and features of digital animation products</b>			
1A.1 Identify the intended purpose and features of two animation products.	2A.P1 Explain the intended purpose and features of two different animation products.	2A.M1 Review how the products are fit for purpose and their intended effect on the audience.	2A.D1 Discuss the strengths and weaknesses of two animation products.
<b>Learning aim B: Design a digital animation product</b>			
1B.2 Identify the audience and purpose for the design of an animation.	2B.P2 Describe the audience and purpose for the design of an animation.	2B.M2 Produce a detailed animation product design, including reasons why alternative ideas have been discarded.#	2B.D2 Justify the final design decisions, explain how they will: <ul style="list-style-type: none"> <li>• fulfil the stated purpose and requirements of the brief</li> <li>• meet the needs of the audience.#</li> </ul>
1B.3 Produce an outline design for an animation product, with guidance. The design must include an outline storyboard.	2B.P3 Produce designs for an animation product of at least 30 seconds duration. The design must include: <ul style="list-style-type: none"> <li>• description of requirements from the brief</li> <li>• a storyboard</li> <li>• a list of ready-made assets</li> <li>• audio.#</li> </ul>		



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Create, test and review a digital animation product</b>			
1C.4 Prepare assets for the animation, with guidance.	2C.P4 Prepare assets for the animation product, demonstrating awareness of purpose, with sources of assets listed.	2C.M3 Prepare assets for the animation product demonstrating awareness of audience with all sources of assets fully referenced.	2C.D3 Refine assets to create a high-quality animation product.*
1C.5 Edit assets to create an animation product of at least 20 seconds, testing the product for functionality with guidance.*	2C.P5 Edit assets to create an animation of at least 30 seconds which includes audio.*  Test the product for functionality and purpose against the original requirements, making any necessary improvements to the product.	2C.M4 Gather feedback from others on the quality of the product and use it to improve the product, demonstrating awareness of audience and purpose.*	
1C.6 Identify how the final animation product is suitable for the intended purpose.	2C.P6 Explain how the final animation product is suitable for the intended audience and purpose.	2C.M5 Review the extent to which the final animation product meets the needs of the intended audience and the purpose, considering feedback from others and any constraints.	2C.D4 Evaluate the final animation product and the initial design and justify any changes made, making recommendations for further improvement.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit are animation software, e.g.:

- Flash
- Toon Boom Studio
- Anime Studio
- Blender
- After Effects
- any other appropriate animation software

Other optional resources include:

- digital drawing tablet and pen
- digital scanner
- digital video recorder or web cam
- solid colour background (i.e. green screen)
- audio software packages such as Audacity and Apple Garage Band.

Learners will need access to a suitable assignment brief that specifies the intended audience, purpose of the animation and the user requirements.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Evidence for this unit requires learners to show that they understand the features of animation products and the processes involved in creating them. They also need to demonstrate practical skills when designing, creating, testing and reviewing a digital animation product of their own to meet a given brief.

Please note that it is not appropriate for learners to use ready-made animation scenes or templates, such as those found in PowerPoint, and a slideshow is not sufficient. Also, for the purpose of this qualification, stop-motion and cel animation techniques are prohibited.

To achieve all grading criteria, learners should have access to existing animation products.

### Learning aim A

Learners should investigate two different existing animation products created using different animation techniques, e.g. rotoscoping, flick book and cut-out, and one of these should be 3D animation. For each product they should identify technical features of the animation and content, audience and purpose. Learners should be encouraged to choose products themselves to investigate, such as computer games, computer-animated film clips, digitally animated music videos and product-design animations (e.g. for medical devices and buildings). The two animations should be designed for different purposes.

**For 2A.P1:** learners should explain the purpose of the animation products and identify features, including file type and size, length, quality, any details of any special effects, e.g. motion blur/fade, rendering effects, morphing and/or camera angles.

*For level 1, as a minimum, learners should identify the purpose of two animated products and limited features, e.g. file type and size, length, quality, 2-D or 3-D models.*

**For 2A.M1:** learners should review whether the animated products are fit for purpose and their intended effect on the audience.

**For 2A.D1:** learners should look at one animation in more detail and discuss the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

### **Learning aim B**

Learners should design a 2-D digitally animated product to meet a given brief. Learners are not prevented from creating 3-D animations but should recognise the significant additional challenges this would present. The design should be for an animation product for a specific audience and purpose that is between 30 seconds and 2 minutes long and which runs continuously **without** user interaction. The animation can be abstract but must demonstrate basic motion of at least one character.

Centres are encouraged to use evidence from the creation of an animated product as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** for the design, learners should describe the purpose and intended audience for the product (as outlined in the brief), for the design ideas for the product.

*For level 1, as a minimum, learners should identify the audience and purpose for their animation design.*

**For 2B.P3:** Learners should produce design ideas for an animation product, describing any design requirements from the brief. Initial design ideas can either be hand drawn or produced using editing software.

They should create a list of ready-made assets (graphics, audio and video) and a storyboard showing at least six main panels for characters, objects and audio assets and how these will be combined. Motion should also be indicated on the storyboard. Learners can create prototypes for their ideas, e.g. key frames, but these should not be finished products. Learners should include audio in their designs.

*For level 1, as a minimum, learners should produce an outline design for their animation product. An outline design would contain an outline storyboard containing at least three main panels that give an indication of what the product would be like and what it is about. Learners would need guidance when designing their animation.*

**For 2B.M2:** learners should extend their design documentation and increase the level of detail in their design documents, including outline design ideas, for example a description of alternative characters and storyline or alternative audience. Learners should give reasons why these ideas have been discarded and so should not be fully worked-up designs.

They should refine the chosen design idea, which must include a detailed storyboard showing a minimum of 12 panels, an indication of motion, and descriptions of what original and ready-made assets are included and how they are combined. Learners should also include details of animation effects, e.g. motion blur/fade, rendering effects, morphing and camera angles, and what edits are required to the ready-made assets.

**For 2B.D2:** learners should explain how each asset helps meet the purpose and original requirements in the brief. Learners should refer back to their storyboard and explain how the design meets the needs of the intended audience.

Learners may wish to do this by annotating their design documents and describing why (e.g. 'I have used a certain gesture here because ...'). They should also justify why they have chosen to combine assets in this way to fulfil the brief, and why the chosen design was selected.

### Learning aim C

Learners should create, test and review an original digital animation product of between 30 seconds and 2 minutes in length (excluding any repeated looped sections). Although learners may deviate from their plans (as often happens with any project) they should aim to create a final product that closely resembles their original design. Any major changes should be noted on their design with a brief reason for the change, e.g. 'I found a more appropriate character or sound effect'.

The type and nature of the graphics and video assets required by learners will depend on the animation techniques used. The following techniques are acceptable:

- cut-out – either scanned, hand drawn and/or ready-made images or computer-drawn graphics
- rotoscoping (video footage that is edited into a graphical format)
- skeletal animation (graphical characters).

**For 2C.P4:** learners should gather required ready-made graphic asset(s), e.g. for background scenes and objects, and video and audio asset(s), e.g. speech, music and sound effects. Video and audio assets can be ready-made and/or original. All ready-made asset(s) should be listed in a sources table.

Learners should prepare original graphics for the main characters and, if required, for objects and scenes, demonstrating awareness of purpose, e.g. if the computer animation is about a 'mad professor' then the character can be recognised as such and is appropriate for the purpose of the animation. Graphic assets can be hand drawn, created using editing software and/or, for the rotoscoping animation technique, they can be converted from video asset(s) into graphical assets using the animation editing software.

*For level 1, as a minimum, learners should gather and prepare some assets for the animation. Some of the graphical assets will be missing (e.g. characters, objects and scenes) or the main characters will be incomplete (e.g. characters may be missing limbs or shading may be unfinished) and audio assets may be omitted. Learners may need guidance to gather and prepare their assets.*

**For 2C.M3:** learners should gather and prepare graphics that are high quality, demonstrating awareness of the intended audience. For example, characters should be fit for audience in the use of characterisation, texture and colour, and the individual assets should have a common look and feel, e.g. as with the characters in the *South Park* cartoon.

The sources table should be detailed enough for another person to independently obtain all of the assets used.

**For 2C.P5:** learners should edit their original and ready-made graphics and audio assets to create their designed animation product. The animation must be at least 30 seconds long and not more than 2 minutes in length (excluding any repeated loop sections).

Learners should test their products for functionality, e.g. that the animation plays and volume levels are appropriate. The products should contain the correct assets, and the product should be fit for purpose. For this criterion, it is acceptable to have some brief interruptions in the motion and movement that is shaky and/or in the wrong direction. Learners should make any improvements based on their testing. Changes can be evidenced by annotating their design documents.

Learners should check whether their animation needs to be compressed and exported so that teachers can review their product quickly.

*For level 1, as a minimum, learners should edit the original and ready-made graphics to create an animation product of least 20 seconds (excluding any repeated looped sections). This product may not contain any audio assets and some of the assets will be missing or incomplete. The learner may need guidance to edit their animation product. Learners should test their product for functionality (e.g. that the animation plays and the volume levels are appropriate) with guidance.*

**For 2C.M4:** learners should gather feedback from at least one other person on the quality of their products. They should then respond to the feedback to improve the animation, demonstrating awareness of audience and purpose. For instance, the assets must integrate well together, with characters, objects and scenes sharing a similar style and colour scheme.

If rotoscoping is used then an attempt must have been made to reduce 'boil' (caused when the output slightly deviates from the image that varies between frames, which causes unnatural shake). This does not apply when 'boil' is being used as a required effect or style, which should be clearly stated in the design.

**For 2C.D3:** teachers should be aware that the process of creating a product is iterative.

The digital animation product should be refined to a high quality, which means the sound is free from noise, the motion is synchronised, smooth, realistic and flows as intended, and the timing is accurate. All of the ideas from testing, feedback and reviewing their designs as they create the animations should have been considered as how best to refine the product.

Learners should ensure there are copies of both the initial and refined versions of the animation product saved, with annotations on design documents where appropriate.

**For 2C.P6:** The learner should explain reasons why the product is suitable for audience and purpose. Learners should give at least one reason for audience and one for purpose.

*For level 1, as a minimum, learners should identify why their animation is fit for purpose, for example, "My animation is suitable for use in a toddler's TV show, as it is simple and easy to follow and brightly coloured".*

**For 2C.M5:** learners should build on the strengths, weaknesses and explanations in the Pass criteria to review how much the product is suitable for the intended audience and purpose as defined in the designs. They should also seek feedback from at least one other person. This could be asking a peer to watch and listen to the computer animation and give written/recorded feedback, or playing it to the class and asking them to fill in a short questionnaire. Learners should use this feedback when considering how suitable their product is.

Learners must consider any current legal and ethical constraints they encountered during the creation of the animation products, for instance copyright, eSafety and the use of content appropriate for the target audience.

**For 2C.D4:** learners should evaluate the final products against the initial designs in terms of audience, purpose and client requirements as required by the brief, and justify any changes that were made, explaining the rationale for those changes. They should also recommend at least three improvements but do not need to implement the enhancements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Possible scenarios for this unit are:

- animations for a music video
- a short children's cartoon
- an advertisement for chocolate milkshake.

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.M1 2A.D1, (1A.1)	Investigation	Consider at least two existing and different animation products and explain the use of animation features and the purpose of each. Look at how these features are suitable for the target audience and analyse the impact of the clip on the audience.  What are the strengths and the weaknesses of each animation?	<ul style="list-style-type: none"> <li>• Research report or a magazine article.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P2, 2B.P3 2B.M2, 2B.D2 (1B.2, 1B.3)	Smoking vs Health-design	<p>A charity has commissioned you to produce a short 2-D (or 3-D, for an additional challenge) computer animation about the dangers of smoking. The animation is for the charity's website and is aimed at young people 14–19 years old.</p> <p>Describe who are the audience for your animation, and what its purpose is. What are you going to design?</p> <p>Design an animation for the charity, including:</p> <ul style="list-style-type: none"> <li>• a storyboard</li> <li>• a list of assets to use, including some audio.</li> </ul> <p>Outline some alternative ideas for the animation, such as characters, plot or effects.</p> <p>Justify why your design meets the original requirements and why you have chosen some ideas above others.</p>	<ul style="list-style-type: none"> <li>• Design documentation and prototypes.</li> </ul>
2C.P4, 2C.M3 (1C.4), 2C.P5 2C.M4, 2C.D3 (1C.5)	Making the Animation	<p>Prepare by gathering assets together and create your animation, keeping the audience and purpose of your clip in mind. Note any changes you make to your design as you go through.</p> <p>Edit your assets together and test that your clip works.</p> <p>Get feedback from others on the clip and refine it to make it as high quality as you can, recording the sources of your assets and updating your design documents with each change you make.</p>	<ul style="list-style-type: none"> <li>• Completed digital animation product</li> <li>• Annotated and updated design documents</li> <li>• Records of feedback and comments.</li> </ul>



Criteria covered	Assignment	Scenario	Assessment evidence
2C.P6, 2C.M5 2C.D4, (1C.6)	Review	Evaluate the clip, justifying why it meets the brief, and suggest improvements and consider any constraints. Why is it suitable for the audience and purpose? Get feedback from others on your animation and use it in your explanation. Justify and explain any changes you made to the design through the process. How would you improve it further?	<ul style="list-style-type: none"> <li>• Evaluation report.</li> <li>• Feedback from others.</li> </ul>



# Unit 5: Creating Digital Audio

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

Audio products can be used to change an individual's mood, from the extremes of reducing them to tears to making them smile. Many companies now routinely use digital audio products, such as adverts on the TV, music, computer games, mobile phones and audible alerts or warnings. Mobile devices allow us to listen to audio at any time, so we can listen to a podcast on our MP3 player whenever and wherever we want. Job roles which use the creation of audio include sound designers, sound engineers and music artists and producers.

You will plan, record and edit digital audio products in a similar way to how it is done in industry and be introduced to the technology and techniques used by professionals. You will be given a brief that will need to be fulfilled. You will also need to think about creative aspects of the project as well as technical skills. You will need to record original audio and combine this with imported audio files to create an audio product. Once finished, you will review the products, having obtained feedback from others, and evaluate possible improvements.

In particular, this unit develops skills from *Unit 1: The Online World* and the following optional units: *Unit 4: Creating Digital Animation*, *Unit 6: Creating Digital Graphics* and *Unit 7: Creating Digital Video*. In addition, it supports the content of *Unit 8: Mobile Apps Development* and *Unit 13: Website Development*.

## Learning aims

In this unit you will:

- A understand the applications and features of digital audio products
- B design digital audio products
- C create, test and review digital audio products.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the applications and features of digital audio products</b></p>
<p><b>Applications of digital audio</b></p> <p>Applications and purpose including:</p> <ul style="list-style-type: none"> <li>• a range of different existing audio products or clips (e.g. podcasts, radio adverts, news, plays, comedy shows, live music, speeches)</li> <li>• the effect (e.g. evoke emotion, educate) they have on different audiences (e.g. age, gender, interest, need).</li> </ul> <p><b>Features of digital audio products</b></p> <p>Features, e.g.:</p> <ul style="list-style-type: none"> <li>• file types (e.g. .mp4, .wav, .wma, .aac)</li> <li>• file sizes</li> <li>• timing and length</li> <li>• quality</li> <li>• codecs</li> <li>• platforms and compatibility</li> <li>• special effects (e.g. echo, fade, distortion, change of pitch or tempo)</li> <li>• voiceovers</li> <li>• soundtracks</li> <li>• layering</li> <li>• transitions/mixing</li> <li>• multi tracks.</li> </ul>

**What needs to be learnt****Learning aim B: Design digital audio products****Designing a digital audio product**

Designs include:

- intended audience, purpose and any other requirements (as given in a brief)
- script (e.g. what will be included in the product, any dialogue, instructions, effects and directions)
- list of any ready-made digital assets (e.g. an individual digital audio recording of any type such as speech, music or sound effect). Sources for ready-made assets must be documented and referenced
- timeline, e.g. outlining what different assets are included and when different assets will be combined
- alternative design ideas
- if required, prototype design ideas of the digital audio assets (e.g. voice overs, soundtrack, cropping/mixing of recorded clips) and special effects (e.g. echo, fade, distortion, change of pitch or tempo)
- recording schedule (e.g. the day(s) on which learners plan to record, the equipment they will need and the people who will be involved)
- consideration of health and safety constraints while recording (e.g. trailing cables, carrying heavy equipment, high volume levels, use of headphones) and the environment where the recording will take place (e.g. no liquids near electrical equipment).

**What needs to be learnt****Learning aim C: Create, test and review digital audio products****Record original audio assets**

Use audio equipment:

- features of recording equipment (e.g. directional, covers/pop shields/muffs, range (Hz), length of cord/wireless, portability/clip-on, cost)
- types of equipment used for recording:
  - microphones
  - other equipment (e.g. dictaphones, in-camera, mobile phones)
- features of playback equipment (e.g. range (Hz), length of cord/wireless, cost)
- types of equipment for playback:
  - headphones
  - speakers.

**Prepare and test the equipment**

Use audio equipment:

- perform a soundcheck and adjust set up if necessary (e.g. to reduce background noise), distance from microphone and sound levels
- record original audio assets safely from different sources.

**Create digital audio products**

Prepare (gather and create) audio assets.

Gather ready-made audio assets from other sources (e.g. the internet, other media such as CD or DVD) and reference them in a sources table

Audio editing software, e.g.

- import audio files (e.g. .wav, .aiff, .au, and .mp3)
- editing, e.g.:
  - cut, copy, paste and delete clips
  - edit and mix tracks
  - fade the volume up or down smoothly
  - layering separate audio assets
- effects, e.g.:
  - change the pitch without changing the tempo, or vice versa
  - adjust volumes, balance, amplify, and normalise effects
  - special effects like echo and reverse speech
  - filters (e.g. pitch, tempo, pan)
- sound quality, e.g.:
  - clean the audio product of unwanted noise (e.g. static, hiss or hum)
  - understand tracks can have different sample rates or levels of quality (e.g. 24 bit or 32 bit).

*continued*

## What needs to be learnt

### Test audio products

Test and refine audio products

- Test the audio products for functionality (e.g. checking that the assets work, that sound is audible, the clip runs, the length of the clip is correct) and against the original requirements of the brief
- Gather feedback from others on feedback on quality (e.g. they are free of unwanted noise, the assets are synchronised and flow, timing is accurate and sound quality is high), functionality, audience and purpose.
- Document any improvements, including updating the sources table for ready-made assets.
- Understand the reasons for exporting and compressing audio files (e.g. to ensure format is appropriate for reviewers or users).
- Export and compress the audio product into suitable final file type (e.g. .mp3, .wav, .wma) and size.

### Review the audio products

Review the finished audio products for:

- quality of the audio product
- fitness for audience and purpose
- meeting the original requirements
- current legal and ethical constraints (e.g. copyright, eSafety, suitable content)
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the applications and features of digital audio products</b>			
1A.1 Identify the intended purpose and features of two digital audio products.	2A.P1 Explain the intended purpose and features of two different digital audio products.	2A.M1 Review how the products are fit for purpose and their intended effect on the audience.	2A.D1 Discuss the strengths and weaknesses of the digital audio products.



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Design digital audio products</b>			
1B.2 Identify the audience and purpose for the design of a digital audio product.	2B.P2 Describe the audience and purpose for the design of a digital audio product.	2B.M2 Produce detailed audio designs, including reasons why alternative ideas have been discarded.#	2B.D2 Justify the final design decisions, explaining how they will: <ul style="list-style-type: none"> <li>• fulfil the stated purpose and requirements of the brief</li> <li>• meet the needs of the intended audience.#</li> </ul>
1B.3 Produce outline design(s) for the digital audio product(s). Each design must include: <ul style="list-style-type: none"> <li>• outline script</li> <li>• timeline.</li> </ul>	2B.P3 Produce designs for two digital audio products, each of at least three minutes duration, which together include speech, music and sound effects. Each design must include: <ul style="list-style-type: none"> <li>• description of requirements from the brief</li> <li>• a script</li> <li>• a list of the ready-made digital audio assets to be used</li> <li>• a timeline.#</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Create, test and review digital audio products</b>			
1C.4 Record audio and gather audio assets, with guidance.	2C.P4 Carry out a soundcheck and record audio, demonstrating awareness of purpose, and prepare audio assets, listing sources used.	2C.M3 Record high quality original audio, demonstrating awareness of audience, with all sources of assets fully referenced.	
1C.5 Edit audio assets to create a digital audio product of at least three minutes duration, and test it for functionality, with guidance	2C.P5 Edit audio assets to create two digital audio products each of at least three minutes duration.  Test the products for functionality, purpose and against the original requirements, making any necessary improvements to the products.	2C.M4 Gather feedback from others on the quality of the digital audio products and use it to improve the product, demonstrating awareness of audience and purpose.	2C.D3 Refine audio assets to create two high-quality digital audio products.
1C.6 For each of the final digital audio products, identify how they are suitable for the intended purpose.	2C.P6 For each of the final digital audio products, explain how the final product is suitable for the intended audience and purpose.	2C.M5 Review the extent to which each of the final digital audio products meets the needs of the intended audience and the purpose, considering feedback from others and any constraints.	2C.D4 Evaluate the final digital audio products against the initial designs and justify any changes made, making recommendations for further improvements.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit are:

- suitable audio editing software package, e.g. Audacity, Adobe Audition, Apple Garage Band, Sony Sound Forge
- microphones and/or other recording equipment
- headphones/speakers.

Learners need access to assignment briefs that specify the intended audience and purpose for the audio products required.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Evidence for this unit will require learners to show that they understand the features of audio and the processes involved in recording and editing it. They also need to demonstrate practical skills in designing, creating, testing and reviewing an audio product of their own to meet a given brief.

To achieve all grading criteria, learners should have access to existing audio clips/products for investigation. They should also have access to equipment and software to allow them to create their own audio product through editing and testing audio assets.

Learners should record their own original audio assets to combine and edit into the final product. A final product should not only contain ready-made audio files edited together but must also include some original material.

### Learning aim A

Learners should investigate two different existing audio products and identify features about the technical qualities, the content, intended audience and purpose. Learners should be encouraged to choose their own products or clips and to investigate different types of products, such as podcasts, radio adverts, music, and recordings of speeches. The two digital audio products should be designed for different purposes.

**For 2A.P1:** learners should explain the purpose of the audio products or clips and the features used including file type and size, length, quality, details of any special effects, e.g. voiceovers, layering, mixing or use of multitracks.

*For level 1, as a minimum, learners should identify the purpose of two audio products/clips and limited features – file type and size, length and quality.*

**For 2A.M1:** learners should review whether the audio products/clips are fit for purpose and how they are intended to affect the audience.

**For 2A.D1:** learners should look at the digital audio products in more detail and discuss the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

## Learning aim B

Learners should design two audio products to given briefs. Each product should be between three and five minutes long and for a specific audience and purpose. Between the two products, they should have the opportunity to combine speech, music and sound effects. Learners should consider any health and safety requirements, e.g. trailing cables, carrying heavy equipment, high volume levels, use of headphones, and the environment where the recording will take place, e.g. possibly near a busy road.

Centres are encouraged to use evidence from the creation of audio products as part of the learner's digital portfolio (*Unit 3: A digital portfolio*).

**For 2B.P2:** for each design, learners should describe the purpose and target audience, relating this to their design ideas for the product.

*For level 1, as a minimum, learners should identify the audience and the purpose for their design.*

**For 2B.P3:** learners will generate design ideas for a digital audio product. Learners should include any requirements for the product required in the brief. They should create a list of ready-made assets to be combined, a script and a timeline showing how and when the different assets will be combined. The script should include the people involved and give an overview of what will be included, and any dialogue.

Learners could also include a recording schedule to help organise their recordings. Learners can create prototypes for their ideas, e.g. a sound effect, but these should not be finished products.

*For level 1, as a minimum, learners should produce an outline design for their audio products. An outline design would contain an outline script and a timeline to give an indication of what the product would be like and what it is about.*

**For 2B.M2:** learners should extend their design documentation and increase the detail in their design documents, including outlines of alternative ideas and give the reasons why they have discarded them, e.g. an outline of variations on the script or alternative audiences for their products. These should not be fully worked up designs, but annotations or sketches to demonstrate the development in their design process.

Learners should refine both designs, which must include a detailed script (including timing), any instructions or stage directions, note where assets are included, and include a detailed timeline for how the different assets will be combined. The detailed timeline should include details on what sort of transitions, fades, etc. are required.

**For 2B.D2:** learners should justify why they chose the final design ideas from the alternative ideas outlined for the Merit criteria. Learners should explain how each asset helps meet the purpose and requirements from the brief. Learners should refer back to their script and timeline for combining assets, and explain how the design meets the needs of the intended audience and purpose.

Learners may wish to do this by annotating their design documents and describing why, e.g. 'I have used sound fading in here because ...'. They should also justify why they have chosen to combine assets in this way to fulfil the brief, and why the chosen design was selected.

## Learning aim C

Learners should prepare and carry out recordings and gather and source additional ready-made assets such as music and sound effects. They should then use these to create their planned audio products.

Although learners may deviate from their plans (as happens with any project), they should aim to create final products that closely resemble their original design. Any major changes should be noted on their design with a brief reason for the change, e.g. 'Had to change an actor's voice due to illness' or 'Found a different, more appropriate piece of music'.

**For 2C.P4:** learners should check their equipment (as defined in their design) and carry out a soundcheck to make sure they are prepared for their actual recordings, making adjustments if necessary, e.g. ensuring minimal or no background noise and good sound levels. These could be evidenced by photographs and/or witness statements.

Learners should then carry out their recordings. If they need to carry out several recordings in different locations then they should complete a new soundcheck each time.

Learners should gather and prepare ready-made audio assets such as music and/or sound effects. To evidence gathering these audio assets, learners should include a table of sources. Learners should demonstrate an awareness of purpose for the product.

*For level 1, as a minimum, learners should create original recordings and gather prepared ready-made audio assets. They may not have carried out a soundcheck and their recordings may be of low quality. Learners may need guidance to prepare their assets.*

**For 2C.M3:** learners should ensure that their recordings are high quality, meaning that the recordings are clear with minimal background noise. The table of sources should be detailed enough for another person to independently obtain all of the assets used. Learners should demonstrate an awareness of the intended audience.

**For 2C.P5:** learners should edit their original recordings and gathered assets to create their designed audio products, while considering the requirements of the brief. Their two products must each be at least three minutes in length but no more than five minutes in length.

Learners should test their products for purpose and functionality, checking that the products play and that volume levels are appropriate, and that they are the correct length and contain the correct assets, and then make improvements based on that testing.

If required, when learners have completed their audio products, the products should be compressed and available in a suitable file type to enable review and feedback to take place.

*For level 1 as a minimum, learners should edit the original and gathered audio, and created audio product(s) of least three minutes. Learners may need guidance to create their digital audio product. Learners should test their product for functionality, with guidance.*

**For 2C.M4:** learners should gather feedback from at least one other person on the quality of their products. They should then respond to the feedback to improve the audio, demonstrating awareness of audience and purpose in the changes they make.

**For 2C.D3:** teachers should be aware that the process of creating a product is iterative.

The product should be refined to a high quality, which means the sound is free from noise, the assets are well synchronised and flow, and the timing is accurate. The product should be refined, using feedback from others where appropriate. Learners should ensure there are copies of both the initial and the refined versions of the audio products saved, with annotations on design documents where appropriate. All of the ideas from testing, feedback and reviewing their designs as they create the digital audio products should have been considered as how best to refine the product.

**For 2C.P6:** learners should explain reasons why the product is suitable for audience and purpose. Learners should give at least one reason for audience and one for purpose.

*For level 1, as a minimum, learners should identify how their products are fit for purpose, for example, 'My audio clip is for news radio programme, so it is short and keeps to the facts, with one person speaking and music only at the beginning and end'*

**For 2C.M5:** learners should build on the strengths, weaknesses and explanations from the Pass criteria to review how much the product is suitable for the intended audience and purpose as defined in the designs. They should also seek feedback from at least one other person. This could be by asking a peer to listen to their clip and give written/recorded feedback, or by playing it to the class and asking them to fill in a short questionnaire. Learners should use this feedback when considering how suitable their product is.

Learners must consider and explain any current legal and ethical constraints they encountered during the creation of the audio products. For instance, copyright, eSafety, and the use of appropriate content for the target audience.

**For 2C.D4:** learners should evaluate the final products against the initial designs in terms of audience, purpose and original requirements in the brief, and justify any changes that were made, explaining the rationale for those changes. They should also recommend at least three improvements but do not need to implement them.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Possible scenarios for this unit include:

- a short podcast (humorous or informative)
- a radio news segment
- a comedy sketch for radio
- a radio advert
- a trail for a radio drama
- a live music recording.

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.M1 2A.D1, (1A.1)	Research	<p>You are applying for a job with BBC Radio 4. As part of your application process, you have been asked to produce a trail for a new radio comedy programme and a short podcast to inform listeners about a recent scientific discovery.</p> <p>In order to design your two audio products, you first must do some research into trails and podcasts that are currently available.</p> <p>Review at least two existing and different audio products and explain features about the technical qualities, content and message/ purpose.</p> <p>Match these features to the target audience, analyse the impact of the clip on the audience.</p>	<ul style="list-style-type: none"> <li>• Research report or magazine articles.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P2, 2B.P3 2B.M2, 2B.D2 (1B.2, 1B.3)	Pre-production	<p>Using your experience from your research, you now can plan your trail and your podcast. Design two audio products based on the briefs. Describe the purpose and target audience for each. What are the requirements in the brief for these clips?</p> <p>Create a script and list of assets and plan for how the different assets will combine. Justify how this design entirely meets the briefs. How are they suited for the audience and purpose?</p>	<ul style="list-style-type: none"> <li>Design documents or prototypes including description of purpose and audience, script, list of assets, and timeline of how the assets will combine.</li> </ul>
2C.P4, 2C.M3 (1C.4)	Production and Post-production	<p>For each product, you have to prepare and carry out your recordings. Carry out a sound check and prepare to record, including checking sound levels. Record all original audio footage. Gather additional audio assets and create a bibliography for the sources of assets.</p>	<ul style="list-style-type: none"> <li>Evidence of soundcheck, e.g. completed checklist with photographs or video of learner carrying it out.</li> <li>Digital files of original audio recordings.</li> <li>Digital files of ready-made sound assets.</li> </ul>
2C.P5, 2C.M4 2C.D3, (1.C5)	Editing and testing	<p>Each of your products now needs to be edited and tested before being completed. Edit the original footage into audio clips, incorporating all the different gathered assets. Make sure your products are as high quality as you can make them.</p> <p>Test the products for functionality, check they are in a suitable format for review and gather feedback from another person.</p>	<ul style="list-style-type: none"> <li>Completed audio clips in native or compressed file type.</li> <li>Evidence of testing and feedback, e.g. completed questionnaire or witness statement.</li> </ul>



Criteria covered	Assignment	Scenario	Assessment evidence
2C.P6, 2C.M5, 2C.D4, (1.C5)	Review	At the interview, you will be expected to evaluate your products and discuss how you could improve them. Evaluate the final product, justifying how they meet the briefs and are suitable for the audience and the purpose. Suggest improvements and consider any constraints.	<ul style="list-style-type: none"> <li>Evaluation report.</li> </ul>



# Unit 6: Creating Digital Graphics

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

You will see graphics at work whenever you surf websites, play computer games, go shopping or read a user manual. Graphics are used to communicate messages in every part of our lives, such as advertising, music, fashion, interior design and architecture. It is the job role of a graphic designer to create digital graphics, that bring colour, information and interest to our lives for a wide range of industries.

In this unit you will investigate a range of applications and features of existing graphic products and consider their audience and purpose. You will be able to apply some of what you discover to your own digital graphic products.

You will design, create and test graphic products in a similar way to how it is done in industry and be introduced to the technology and techniques used by professionals. You will need to think about the creative aspects of the product as well as the technical (both vector-editing and photo-editing). Once finished, you will review the products, having obtained feedback from others, and evaluate possible improvements.

In particular, this unit develops skills from *Unit 1: The Online World* and the following optional units: *Unit 4: Creating Digital Animation* and *Unit 7: Creating Digital Video*. In addition, it supports the content of *Unit 8: Mobile Apps Development* and *Unit 13: Website Development*.

## Learning aims

In this unit you will:

- A understand the applications and features of digital graphic products
- B design digital graphic products
- C create, test and review digital graphic products.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the applications and features of digital graphic products</b></p>
<p><b>Applications of digital graphics</b></p> <p>Applications and purpose, including:</p> <ul style="list-style-type: none"> <li>• a range of different existing graphic products (e.g. logos, signs, posters, magazine covers, packaging, web graphics, engineering drawings, manuals, imagery in movies and computer games)</li> <li>• the effect (e.g. to invoke emotion, educate, inform, entertain) they have on different audiences (e.g. age, gender, interest, need).</li> </ul> <p><b>Features of digital graphics</b></p> <p>Features, e.g.:</p> <ul style="list-style-type: none"> <li>• type – vector graphic or bitmap image (photograph)</li> <li>• text</li> <li>• composition</li> <li>• use of colour and texture</li> <li>• size and position</li> <li>• characters and objects</li> <li>• file type and sizes</li> <li>• resolution.</li> </ul>

**What needs to be learnt****Learning aim B: Design digital graphic products****Design documents**

Designs include:

- intended audience, purpose and requirements as defined in a brief for two products, one vector with text and one bitmap with text
- initial design ideas/prototypes (an early sample or model built to test a concept) – to illustrate content and appearance and can either be produced using:
  - digital editing techniques (as given in learning aim C), or
  - traditional methods such as hand-drawn on paper
- a list of ready-made bitmap and/or vector digital graphic assets (e.g. a company logo, a character or an object) which can be combined with original graphic assets to create a product – sources for ready-made assets must be documented and referenced
- alternative design ideas
- consideration of current health and safety constraints while taking original photographs with a camera (e.g. carrying heavy equipment and the environment where the photography will take place, e.g. no liquids near electrical equipment).

**What needs to be learnt****Learning aim C: Create, test and review digital graphic products****Preparing assets**

Gathering and selecting ready-made vector and bitmap assets, considering:

- sources (e.g. the internet, other media such as CD or DVD), referencing them appropriately
- copyright for ready-made graphics.

**Graphics software**

Vector editing software tools/techniques, e.g.:

- line (types and thickness)
- shapes
- text
- shading and effects
- colour fills, gradients and patterns
- group and ungroup
- rotate and reflect
- scale and dimensions
- duplicate and clone
- combine shapes and paths
- edit and break apart paths
- layering.

Photo editing software tools/techniques, e.g.:

- importing and combining images
- selecting and removing parts (lasso, eraser and marquee)
- cropping and resizing images
- duplicate and clone
- colour selection and palettes
- gradients and opacity
- brush and spray effects
- contrast and greyscale
- filters
- scale, rotate, reflect and distort layers.

*continued*

**What needs to be learnt****Testing and refining graphic products**

Use different processes to test and refine graphic products:

- vector and bitmap asset properties (e.g. resolution, file type, filesize, compression)
- gather feedback from other people on quality (e.g. resolution, accuracy of the line drawing), audience and purpose
- document any improvements to the products, including updating the sources table for ready-made assets
- understand the reasons for exporting and compressing graphic product files (e.g. to ensure format is appropriate for reviewers or users)
- export and compress the graphic products into suitable final file types (e.g. .jpg, .gif, .swf)

**Reviewing products**

Review the finished graphic products for:

- quality
- fitness for audience and purpose
- suitability against the original requirements
- current legal and ethical constraints (e.g. copyright, eSafety, suitable content)
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the applications and features of digital graphic products</b>			
1A.1 Identify the intended purpose and features of two different graphic products.	2A.P1 Explain the intended purpose and features of at least two different graphic products.	2A.M1 Review how the products are fit for purpose and their intended effect on the audience.	2A.D1 Discuss the strengths and weaknesses of the graphic products.



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Design digital graphic products</b>			
1B.2 Identify the audience and purpose for the design of a graphic product.	2B.P2 Describe the audience and purpose for the design of a graphic product.	2B.M2 Produce detailed graphic product designs, including reasons why alternative ideas have been discarded.#	2B.D2 Justify the final design decisions, explaining how they will: <ul style="list-style-type: none"> <li>• fulfil the stated purpose and requirements in the brief</li> <li>• meet the needs of the audience.#</li> </ul>
1B.3 Produce outline design(s) for the digital graphic products. Each design must include outline product ideas.	2B.P3 Produce designs for two digital graphic products with different purposes and audiences. One design must be for a vector image and the other must be for a bitmap image. Each design must include: <ul style="list-style-type: none"> <li>• requirements of the brief</li> <li>• documented product ideas and/or prototypes</li> <li>• a list of any ready-made assets to be used.#</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Create, test and review digital graphic products</b>			
1C.4 Prepare assets for the graphic products, with guidance.	2C.P4 Prepare assets for the graphic products, demonstrating awareness of purpose, with a list of sources for ready-made assets.	2C.M3 Prepare high-quality assets for the graphic products, demonstrating awareness of audience, with all sources of assets fully referenced.	2C.D3 Refine assets to create two high-quality digital graphic products.*
1C.5 Edit assets to create graphic products, and test them for functionality, with guidance.*	2C.P5 Edit assets to create two graphic products that both include text.  Test the products for quality, purpose and against the original requirements, making any necessary improvements.*	2C.M4 Gather feedback on the quality of the products, and use it to improve the product, demonstrating awareness of audience and purpose.*	
1C.6 For each of the final graphic products, identify how the final product is suitable for the intended purpose.	2C.P6 For each of the final graphic products, explain how the final product is suitable for the intended audience and purpose.	2C.M5 Review the extent to which each of the final graphic products meets the needs of audience and the purpose, considering feedback from others and any constraints.	2C.D4 Evaluate the initial designs and the final graphic products and justify any changes made, making recommendations for further improvement.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit are:

- vector-graphics editing software (e.g. Illustrator, CorelDRAW, DrawPlus, Inkscape, Visio or any other suitable graphics-editing package)
- bitmap-graphics editing software (e.g. PhotoShop, PaintShop Pro, PhotoPlus or any other suitable graphics editing package)
- digital devices to capture images (e.g. scanner, webcam, digital camera, mobile phone).

Learners should have access to assignment briefs that specify the intended audience and purpose for the two graphic products required.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Evidence for this unit will require learners to show that they understand the features of graphic products and the processes involved in creating them. They also need to demonstrate practical skills when designing, creating, testing and reviewing graphic products of their own to meet the briefs. To achieve all grading criteria, learners should have access to existing graphic products for investigation.

Learners should prepare (gather, create) assets and edit them into the final products. The products must contain both ready-made and original vector and bitmap graphics that have been edited and both should also include text.

### Learning aim A

**For 2A.P1:** learners are required to review two graphic products created by others. Learners should explain features of the products, the technical qualities, the content, audience and purpose. Features should include composition, use of colour, size and position. The two graphic products should be designed for different purposes.

*For level 1, as a minimum, learners should identify the purpose of two graphics products and limited features – file type and size, length and quality.*

**For 2A.M1:** learners should review whether the graphics products are fit for purpose and their intended effect upon the audience.

**For 2A.D1:** learners should look at the graphic products in more detail and discuss the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

### Learning aim B

Learners should design two graphics products to meet the given briefs. Each product should have specific audiences and purposes and incorporate text. Between the two products, learners should have the opportunity to consider the features of their products, such as the use of colour, composition, textures and background images. One product should require the use of vector graphics and the other should require the use of bitmap images.

Centres are encouraged to use evidence from the creation of digital graphics products as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** for each design, learners should describe the purpose and intended audience for the product, relating this to design ideas.

*For level 1, as a minimum, learners should identify the intended audience and purpose for their designs.*

**For 2B.P3:** learners should generate design ideas for two graphic products. The designs must include text and must be for a minimum of one vector graphic product and one bitmap graphic product. Learners should include a list of ready-made assets to be used. Learners should describe the requirements for the product as outlined in the brief, for example the dimensions of a static advert.

The design documentation should illustrate the content and appearance of the two product ideas. The ideas can either be created using traditional hand-drawn methods or using a range of techniques from an appropriate editing software package. They must not be finished products but should demonstrate accuracy, e.g. where vector lines join or where backgrounds are removed from images. The products must incorporate text and be fit for their intended audience and purpose.

*For level 1, as a minimum, learners should create an outline design for their digital graphic products **or** complete a full design for one product only. An outline design would contain the purpose and outline design documentation to give an indication of what the product would be like and what it is about.*

**For 2B.M2:** learners should extend their design documentation to include outline alternative ideas, e.g. the same product photographed from different angles under different lighting conditions, and give the reasons why they have been discarded. These should not be fully worked-up designs but annotations or sketches to demonstrate the design ideas.

Learners should refine detailed designs for each graphic product (e.g. specify colours, font types, textures, photo images and characters) and as well as preparing designs accurately with a good sense of scale.

**For 2B.D2:** learners should justify why they chose the final design ideas and not their alternative designs. Learners should explain how each asset helps meet the purpose and requirements in the brief.

Learners should refer back to their design documentation and explain how the design meets the needs of the intended audience. They may wish to do this by annotating their design documents and describing why (e.g. 'I have used a texture here because ...'). They should also justify why they have chosen to fulfil the brief by combining graphics assets and text in this way, and why the chosen design was selected.

### **Learning aim C**

The designs will be used to create the digital graphic products. Although learners may deviate from their designs (as happens with any project), they should aim to create final products that closely resemble their original design. Teachers should recognise that the design process (the activities of gathering, creating and preparing assets and then editing them to create finished products) is iterative.

**For 2C.P4:** learners should prepare (gather and create) their assets. They should gather ready-made graphic assets such as photographs, logos and objects and list them in a table of sources. Learners should also create any original assets, e.g. take appropriate photographs using a camera and/or produce line (vector images) drawings using editing software. Original and ready-made assets should be prepared properly for inclusion in the digital products, e.g. cropped appropriately and created accurately (for example where vector lines join or where backgrounds are removed from images).

Both ready-made and original assets should demonstrate awareness of purpose for the product. These could be evidenced by the individual digital assets and through annotation on design documents.

*For level 1, as a minimum, learners should gather and prepare ready-made images and create and prepare original graphic assets. The quality of their assets is likely to be of low quality, e.g. images not cropped appropriately, vector lines that do not join appropriately and inaccurate removal of images from backgrounds, and/or individual assets required for their design may be missing. Learners will need guidance to gather and prepare their assets.*

**For 2C.M3:** learners should prepare assets, including gathering ready-made graphic assets such as bitmap images, e.g. logos and objects, and list them in a sources table. The table should be detailed enough for another person to independently obtain all the assets used. Learners should keep the purpose and requirements of the brief in mind.

Learners should create original and prepare ready-made high-quality graphic assets. For instance, vector drawings should be to scale and proportion and be an accurate representation of the object or character they portray. Bitmap images should be optimised, e.g. be an appropriate file type and size and suitable resolution (for example, images are no more than 72 dots per inch or 40-80 KB to facilitate fast loading for a website). They should demonstrate awareness of the intended audience.

**For 2C.P5:** learners should edit their ready-made and original graphic assets to create their digital graphic products, keeping the requirements of the brief in mind. Both products should include text; one product should require the use vector graphics and the other should require the use of bitmap images.

Learners should test the quality of their products, e.g. that images are cropped and vector lines join appropriately, any images have been removed accurately from backgrounds and all the required elements of the design have been included. Learners should also check that their products are fit for purpose and make improvements based on that testing.

If required, when learners have completed their graphic product they should compress the file into a suitable file type to enable it to be reviewed and feedback given.

*For level 1, as a minimum, learners should edit the ready-made and original graphic assets to create at least one digital graphic product. However, the quality of their product is likely to be low, e.g. images not cropped appropriately, vector lines that do not join appropriately and inaccurate removal of images from backgrounds, and/or individual assets required in their design may be missing. Learners will need guidance to edit their digital graphic product. Learners should test their product for functionality, with guidance.*

**For 2C.M4:** learners should gather feedback on the quality of their products from at least one other person, e.g. appropriate images have been used, vector drawings are to scale and proportion, assets are an accurate representation of the object or character they portray and a range of editing techniques have been used. They should then respond to the feedback to improve their product, demonstrating awareness of audience and purpose.

**For 2C.D3:** teachers should be aware that the process of creating a product is iterative.

The product should be refined to a high quality, e.g. a good selection of appropriate and compelling imagery, correct and appropriate use of formatting and editing techniques and a clear message. The products should have been refined using feedback from others, where appropriate. Learners can incorporate any other refinements into their design, noting any changes.

Learners should ensure that they have saved copies of both the initial and the refined versions of the graphics, with annotations on design documents where appropriate. All of the ideas from testing, feedback and reviewing their designs as they create the digital graphic products should have been considered.

**For 2C.P6:** learners should explain reasons why the product is suitable for audience and purpose. Learners should give at least one reason for the audience and one for the purpose.

*For level 1, as a minimum, learners should identify why their final product is suitable for audience and purpose. For example, 'This is a warning notice, so I have made sure the words are simple and clear, and the graphics are simple to understand. I have only used a few colours so it is easy to read quickly'.*

**For 2C.M5:** learners should build on the strengths, weaknesses and explanations from the Pass criteria to review how much the product is suitable for the intended audience and purpose as defined in the designs. They should also seek feedback from at least one other person. This could be by asking a peer to review their graphics and give written/recorded feedback, or by presenting them to the class and asking them to fill in a short questionnaire. Learners should use this feedback when considering how suitable their product is.

Learners must consider and explain any current legal and ethical constraints they encountered during the creation of the digital graphic products. These might include, for instance, issues surrounding copyright, eSafety and the use of content appropriate for the target audience.

**For 2C.D4:** learners should evaluate the final products against the initial designs in terms of audience, purpose and original requirements, and justify any changes that were made, explaining the rationale for those changes. The evaluation should include an explanation of how the resolution, size and compression of the final products make them fit for purpose and audience. Learners should also recommend at least three improvements but they do not need to implement them.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.M1 2A.D1, (1A.1)	Research – Technology Products	<p>You work for a company that makes technology products. You are asked to produce graphics for a promotional campaign for a new smartphone.</p> <p>Before you design your products, you must review graphics that are used currently.</p> <p>Review at least two different graphic products used in advertising and explain their features, including technical qualities, content and purpose.</p> <p>Consider whether these products are fit for purpose, and how they affect the audience.</p> <p>How have they been designed to be used in promotion?</p> <p>How would you improve these products?</p> <p>What are their strengths?</p>	<ul style="list-style-type: none"> <li>Research report or magazine articles.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P2, 2B.P3 2B.M2, 2B.D2, (1B.2, 1B.3)	A Promotional Campaign	<p>Your graphics need to be used to promote a new smartphone. The smartphone is aimed at the 16–25 age group and offers options to target both sexes.</p> <p>You need to design two graphic products to be used in the campaign.</p> <p>Design one vector and one bitmap graphic product, both including text. The graphics should include:</p> <ul style="list-style-type: none"> <li>• a user guide – line drawing(s) of the product illustrating the size and main features</li> <li>• an advert – including an image(s) of the product in use and compressed appropriately for viewing on screen (the website used to advertise the smartphone) and on paper (high-end magazine).</li> </ul> <p>The brief will include further requirements.</p> <p>Describe why the products will be fit for audience and purpose.</p> <p>Provide a sources table for the ready-made assets.</p> <p>Justify how this design meets the brief for your products.</p>	<ul style="list-style-type: none"> <li>• Design documents or prototypes including description of purpose and audience, list of ready-made assets, and illustrations of the products</li> <li>• A sources table of ready-made assets.</li> </ul>



Criteria covered	Assignment	Scenario	Assessment evidence
2C.P4, 2C.P5, 2C.M3, 2C.M4, 2C.D3 (1.C4, 1C.5)	Create Graphics	<p>The original and ready-made digital graphics should be prepared, created and combined with text to provide the main illustration for a user guide for the smartphone and an advert for the smartphone.</p> <p>Update the sources table.</p> <p>Test the products for quality, e.g. images are cropped appropriately and accurately, and vector lines join or backgrounds are removed from images competently.</p> <p>Check that the products are fit for purpose and audience, while considering the original requirements, and make any improvements as necessary.</p>	<ul style="list-style-type: none"> <li>• Digital files of ready-made graphic assets</li> <li>• Digital files of original graphic assets</li> <li>• Completed graphic assets in native or compressed file types</li> <li>• Evidence of testing and feedback, e.g. completed questionnaire or witness statement</li> <li>• Finished products in a suitable digital file format: <ul style="list-style-type: none"> <li>◦ a user guide illustration</li> <li>◦ an advert</li> </ul> </li> </ul> <p>(Files prepared to suit both types of specified media).</p>
2C.P6, 2C.M5, 2C.D4, (1C.6)	Review	Evaluate the final products, justifying how they meet the briefs and are fit for purpose and suitable for the audience. Suggest improvements you would make if you designed these products again and consider any constraints.	<ul style="list-style-type: none"> <li>• Evaluation report.</li> </ul>



# Unit 7: Creating Digital Video

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

Video is one of the most powerful ways to convey a message in modern society and different types of video are transmitted worldwide. These range from a documentary or news item that can change minds and encourage people to take action to a movie that will entertain, or a well-made advert that can increase product sales or raise money for a charity. Job roles which use digital video include camera operators who capture original footage, and editors who use computers to manipulate the original footage and combine it with other assets such as animations, audio and text.

In this unit you will investigate the range of applications and features of digital video products which have been created for a specific audience and purpose. You will apply some of your findings to your own digital products.

You will be given a brief to fulfil and will be introduced to the technology and techniques professionals use. You will need to think about the creative aspects of the product, as well as the technical. You will need to record original video assets and combine these with other assets, e.g. audio, as required. You will review your finished product having obtained feedback from others and evaluate possible improvements.

In particular, this unit develops skills from *Unit 1: The Online World* and the following optional units: , *Unit 5: Creating Digital Audio*, and *Unit 6: Creating Digital Graphics*. In addition, it supports the content of *Unit 4: Creating Digital Animation*, *Unit 8: Mobile Apps Development* and *Unit 13: Website Development*.

## Learning aims

In this unit you will:

- A understand the applications and features of digital video products
- B design a digital video product
- C create, test and review a digital video product.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the applications and features of digital video</b></p> <p><b>Applications of digital video products</b></p> <p>Applications and purpose, including:</p> <ul style="list-style-type: none"> <li>• a range of different existing digital video products/recordings (e.g. a TV news segment, a sketch for a comedy show, a section of documentary, a TV advert, a movie trailer, machinima)</li> <li>• the effect (e.g. evoke emotion, educate, entertain, inform) that they have on different audiences (e.g. age, gender, interest, need).</li> </ul> <p><b>Features of digital video</b></p> <p>Features, e.g.:</p> <ul style="list-style-type: none"> <li>• file types (.avi, .mpeg, etc.)</li> <li>• file sizes</li> <li>• timing and length</li> <li>• quality</li> <li>• codecs</li> <li>• platforms and compatibility</li> <li>• resolution (e.g. HD, for web)</li> <li>• bit rate</li> <li>• frames per second</li> <li>• layers (soundtrack, narrative, etc.).</li> </ul>

**What needs to be learnt****Learning aim B: Design a digital video product****Design documents**

Designs include:

- intended audience (age, gender, interests), purpose and the requirements defined in the brief
- initial design ideas
- script (e.g. what will be included in the product, dialogue, instructions, effects, stage directions)
- storyboard outlining the main panels of action showing characters, scenery, props and sounds and identifying timing, camera angles and flow
- list of ready-made digital assets (audio – speech, music and/or sound effects, graphics, and video recordings of any type). Sources for ready-made assets must be documented and referenced
- alternative design ideas
- recording schedule (e.g. the day(s) on which learners plan to record, the equipment they will need and the people who will be involved).
- logsheet (log of what scenes are recorded and their details)
- health and safety considerations of filming (e.g. trailing cables, risk of falling, slippery surfaces, sharp objects, heavy equipment and the environment where the recording will take place)

Carry out a recce (reconnaissance, an initial investigation) for the filming location(s):

- types of location, e.g.:
  - exterior
  - interior
  - stage
- considerations, e.g.:
  - indoor/outdoor
  - lighting
  - ambient sounds
  - weather
  - legalities
  - transport
  - security

Recruit a cast/crew:

- types of cast (e.g. lead actors, secondary actors, extras)
- job roles of crew, e.g.:
  - director
  - cinematographer (cameraman)
  - sound recordist
  - lighting technician.

**What needs to be learnt****Learning aim C: Create, test and review a digital video product****Recording original video clips**

Features of video recording equipment:

- digital video equipment: zoom, pan, placement of camera, use of tripod, camera angles, specifications of cameras (e.g. DV tape or digital storage, images sensors – e.g. CMOS/CCDs, connectivity to editing machine, cost)
- screen capture software: screen region, mouse pointer, narration.

Understand the difference between original video clips recorded onto tape and digital formats, and the saved digital format (usually .dv) and other wrapped formats (e.g. .avi, .qt), which are known as assets.

**Create a video product**

Gather ready-made video, audio and/or graphic asset(s) from other sources (e.g. internet, other media – such as CD or DVD).

Video editing software, e.g.:

- import video files and other files (e.g. music)
- editing tools and techniques, e.g.:
  - cut, copy, paste and delete clips
  - split and trim clips
  - transitions
  - text
- effects tools and techniques, e.g.:
  - filters
  - overlays
  - layering (video and audio)
  - picture in picture
- video quality tools and techniques, e.g.:
  - contrast
  - sharpen
  - saturation
  - white balance.

*continued*

## What needs to be learnt

### Test the video product

Test the video products for functionality during editing (e.g. checking that the clips' play and volume levels are appropriate, picture quality is usable, products are the correct length).

Gather feedback from others, including quality (e.g. that they only capture what is needed, the clips flow together well, timing is accurate, sound quality high – minimal or no noise, picture quality is high, and video is appropriate for audience and purpose).

Document any improvements, updating the sources table for ready-made assets.

Render the video (if required) into a suitable final size and format (e.g. .avi, .flv, .mpeg, .mov, .wmv). Understand the process of rendering and the reasons for doing it and consider technical aspects (e.g. format, file size, bandwidth, length, compression, frames per second (fps), bit rate).

### Review the video product

Review the finished video product for:

- quality
- fitness for audience and purpose
- suitability against the original requirements
- current legal and ethical constraints, e.g. copyright, eSafety and suitable content
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the applications and features of digital video products</b>			
1A.1 Identify the intended purpose and features of two different digital video products.	2A.P1 Explain the intended purpose and features of two different digital video products.	2A.M1 Review how the products are fit for purpose and their intended effect on the audience.	2A.D1 Discuss the strengths and weaknesses of one digital video product.
<b>Learning aim B: Design a digital video product</b>			
1B.2 Identify the audience and purpose for the design of a digital video product.	2B.P2 Describe the audience and purpose for the design of a digital video product.	2B.M2 Produce a detailed video design, including reasons why alternative ideas have been discarded. The design must include: <ul style="list-style-type: none"> <li>• logsheet</li> <li>• recce of filming locations.#</li> </ul>	2B.D2 Justify the final design decisions, explaining how the designs will: <ul style="list-style-type: none"> <li>• fulfil the stated purpose and requirements in the brief</li> <li>• meet the needs of the audience.#</li> </ul>
1B.3 Produce an outline design for a video product. The design must include: <ul style="list-style-type: none"> <li>• an outline script</li> <li>• an outline storyboard.</li> </ul>	2B.P3 Produce a design for a video product of at least 5 minutes duration. The design must include: <ul style="list-style-type: none"> <li>• description of requirements from the brief</li> <li>• a script</li> <li>• a storyboard</li> <li>• a cast/crew list</li> <li>• a list of any ready-made assets if used.#</li> </ul>		



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Create, test and review a digital video product</b>			
1C.4 Record video clips and, if required, prepare any other assets, with guidance.	2C.P4 Record video clips and, if required, additional audio clips and prepare any other assets, demonstrating awareness of purpose, with sources of assets listed.	2C.M3 Record high-quality video clips, demonstrating awareness of audience, with all sources for assets fully referenced.	
1C.5 Edit original video clips and, if required, any other assets to create a video product of at least 3 minutes' duration, and test for functionality, with guidance.	2C.P5 Edit original video clips, if required, audio clips and ready-made assets to create a video product of at least 5 minutes' duration.  Test the product for functionality and purpose, checking that it meets the original requirements, making any necessary improvements to the products.	2C.M4 Gather feedback from others about quality of the product and use it to improve the product, demonstrating awareness of audience and purpose.	2C.D3 Refine video and other assets to create a high-quality video product.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
1C.6 For the final video product, identify how the final product is suitable for the intended purpose.	2C.P6 For the final video product, explain how the final product is suitable for the intended audience and purpose.	2C.M5 Review the extent to which the final video product meets the needs of audience and the purpose, considering feedback from others and any constraints.	2C.D4 Evaluate the final video product and the initial designs and justify any changes made, making recommendations for further improvements.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit are:

- video cameras – either video recorders or screen capture software, e.g. Camtasia, Fraps or screen capture software for other material, e.g. game console footage – Hauppauge PVR (personal video recorder)
- video-editing software, e.g. Adobe Premiere (Pro or Elements), Sony Vegas, Final Cut (Express or Pro).

Learners need access to a suitable assignment brief, a cast and crew, and if required, audio equipment. Teachers should consider the maximum length of product appropriate for the brief.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Evidence for this unit will require learners to show they understand the features of video, and the processes involved in filming and editing digital clips. They will also need to demonstrate practical skills in designing, creating original recordings, editing, testing and reviewing a digital video product of their own, to meet a given brief that outlines requirements for the product. It is not acceptable to produce the product without using digital video editing software. Learners will need to record original video material: they cannot just use ready-made assets edited together.

To achieve all grading criteria, learners should have access to existing digital video products for investigation. They should also have access to equipment and software to allow them to produce their own video product through editing and testing video assets.

Please note that:

- it is not acceptable to use Windows Movie Maker editing software because, at the time of writing, the software does not provide the required technical functionality
- the video recording must be captured on digital cameras, either on hard drive or DAT tapes, rather than on 8 mm celluloid or similar.

### Learning aim A

Learners should investigate two existing digital video products for different purposes and consider features about the technical qualities, the content, and intended audience and purpose. Learners should be encouraged to choose their own clips, and to investigate different types of digital video products, such as a TV news segment, an outside broadcast for breakfast TV, a sketch for a comedy show, a section of documentary, a TV advert, movie trailer or training film. The two digital video products should be designed for different purposes.

**For 2A.P1:** learners should explain the purpose of the video clip and the use of features in the clip, including file type, file size, length, quality, any codecs used, resolution, frames per second and describe any use of layers.

*For level 1, as a minimum, learners should identify the purpose of video product and limited features, including file type, file size, length and quality.*

**For 2A.M1:** learners should review whether the clips are fit for purpose, and their intended effect on the audience.

**For 2A.D1:** learners should look at one digital video product in more detail and discuss the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

### Learning aim B

Learners should design their own digital video product to a given brief. The video should be at least 5 minutes long, but no longer than 10 minutes, for learners aiming to achieve a Level 2 Pass. Learners should consider health and safety constraints of filming, (e.g. trailing cables, risk of falling, slippery surfaces, sharp objects, heavy equipment and choice of location).

Centres are encouraged to use evidence from the creation of a digital video product as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** learners should describe the intended audience and purpose of the product, relating this to design ideas.

*For level 1, as a minimum, learners should identify the intended audience and purpose for the video product.*

**For 2B.P3:** learners will produce design ideas for a digital video product. Learners should describe any requirements for the product (as outlined in the brief). They should create a script and storyboard showing at least six main panels. The script should include the people involved (cast and crew), and give an overview of what will be included in the video. The storyboard should give an idea of what will happen from beginning to end, although it might not cover all aspects.

Learners should produce:

- a cast/crew list showing names of those involved, and the role they will take
- a list of any ready made-assets to be used.

The learner can use a recording schedule to plan and organise the production of their video.

*For level 1, as a minimum, learners should produce an outline design for their video product. An outline design would contain a script which may not be complete and a storyboard, which should include at least three main panels that should give an indication of what the video product will be about and what will be included.*

**For 2B.M2:** learners should produce detailed design documents, including outlines of alternative ideas and why they have discarded them, e.g. an outline of variations on the script or alternative audiences for their products. These should not be fully worked-up designs, but annotations or sketches to demonstrate the development in their design process.

Learners should give more detail in their design documents, considering purpose, intended audience and requirements given in the brief. This should include an explanation of what the learner must include in the designs to fulfil requirements, e.g. 'My target audience is x, therefore the video product needs to include ...'. The designs should be developed to include a detailed script that includes all dialogue, stage directions and instructions to cast and crew, including any equipment, e.g. camera positions. The documents should include a detailed storyboard, which includes at least 12 main panels and explains the action in detail. Information about timing and transitions between scenes should be noted, and the learner should include a logsheet to note which scenes/clips are recorded, their timing and details, and evidence of recce(s) to filming location(s). Learners can also include any prototype video and audio clip(s) in their design documents, but these should be draft versions only, and not the final versions of clips.

To meet this criterion, a learner does not need to record video at more than one filming location, but if their design requires multiple locations, then learners must complete multiple recce(s).

**For 2B.D2:** learners should justify why they chose the final design ideas from the alternative ideas outlined for the Merit criteria. Learners should explain how each asset helps meet the stated purpose and requirements in the brief, including reference to the script, storyboard, logsheet and recce report.

Learners may wish to do this by annotating their designs and describing why they have chosen an idea, e.g. 'I have used a fade transition in here because...'. They should also justify why they have chosen to combine assets in this way to fulfil the brief, and why the chosen design was selected.

### Learning aim C

Learners should prepare and carry out filming and prepare (create and gather) additional assets, such as music, graphics or sound effects. Learners should use these to create their planned digital video product. Although learners may deviate slightly from their plans (as happens with any project), they should aim to produce a final product that closely resembles their design. Any major changes should be noted on their design, with a brief reason for the change, e.g. 'had to change an actor due to illness' or 'found a different piece of music that better matched the images'.

**For 2C.P4:** learners should carry out the filming at the locations where they have done their recce(s), using the people in their cast/crew list. Learners should prepare and gather any other ready-made assets they need, such as music, sound effects or graphics. Learners should demonstrate an awareness of purpose for the product, while considering any requirements from the brief. The assets should have the sources they have used listed in a source table.

*For level 1, as a minimum, learners should have made original recordings and prepared and gathered any other assets needed, such as music. The quality of their filming and original video clips may be low and/or incomplete. Learners will need guidance to complete the recording and preparation.*

**For 2C.M3:** learners should ensure that their recordings are of a high quality, meaning that their video clips only capture what is needed, sound recording is clear and free from most noise, and the images are of a good quality. Learners should demonstrate an awareness of the audience. The bibliography of gathered sources should be detailed enough for another person to find all the specific sources used.

**For 2C.P5:** learners should edit their original video clips and gathered assets into their designed digital product. Their product should certainly be at least 5 minutes' duration, and no more than 10 minutes. Learners should also test their product for functionality, purpose, and against any requirements in the brief. Testing should include checking that the clips play, volume levels are appropriate, picture quality is usable, products are of the correct length, and the product follows the order in the storyboard. Improvements should be based on the results of testing.

If required, when learners have completed their video product, the product should be rendered and available in a suitable file type to enable review and feedback.

*For level 1, as a minimum, learners should have edited their original and ready-made clips to create a video product of least 3 minutes' duration. Learners may need guidance to create their digital video product. Learners should test their product for functionality (that the assets play and have suitable volume levels), with guidance.*

**For 2C.M4:** learners should gather feedback from at least one other person about the quality of their products. They should then respond to the feedback to improve the video, demonstrating awareness of audience and purpose.

**For 2C.D3:** teachers should be aware that the process of creating a product is iterative.

The product should be refined to a high quality, meaning it is clear, the assets flow well and are synchronised, the timing is accurate and the sound and picture quality is high. The product should be refined, using feedback from others where appropriate. Learners should ensure there are copies of both the initial and the refined versions of their video clips, with annotations on the designs where appropriate.

**For 2C.P6:** learners should explain reasons why the product is suitable for audience and purpose. Learners should give at least one reason for audience and one for purpose.

*For level 1, as a minimum, learners should identify how their product is fit for purpose, for example, 'My video is an educational video so it has short scenes and has a summary screen at the end'.*

**For 2C.M5:** learners should build on the strengths, weaknesses and explanations in the Pass criteria to review how much the product is suitable for the intended audience and purpose as defined in the designs. They should also seek feedback from at least one other person. This could be asking a peer or 'test buddy' to review their video product to suggest strengths, weaknesses and improvements (either written or recorded evidence). Alternatively, the class teacher (or a different teacher) could provide feedback. Learners should use this feedback when considering how suitable their product is.

Learners must consider and explain any current legal and health and safety constraints they encountered during the creation of the digital video products, for example, copyright constraints that affected the assets they used. They should consider health and safety in terms of using their equipment and filming on location. Their explanations should include typical health and safety measures, such as no trailing cables and no bare wires, and consider individual aspects relating to their filming locations.

**For 2C.D4:** learners should evaluate their final product against the initial design, identifying good and bad points, justifying why their product meets the needs of the audience, is fit for purpose and meets the brief, and justify changes made between the design and final product. They should make recommendations for at least three improvements. They do not need to act on the improvements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Possible scenarios for this unit include:

- a TV news segment
- an outside broadcast for breakfast TV
- a sketch for a comedy show
- a section of documentary
- a TV advert
- a movie trailer
- a training film (e.g. how to use screen capture software)
- machinima.

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.M1 2A.D1, (1A.1)	Research	<p>You work for a TV company that produces a breakfast TV programme. You've been asked to produce a new segment for the programme, providing a round-up of funny news items. Before you design a pilot segment to show the producers of the programme, you need to research existing video segments.</p> <p>Review at least three existing and different digital video products/clips and explain features about the technical qualities, content and the message/purpose.</p> <p>Match these features to the target audience and analyse the impact of the clip on the audience.</p> <p>What could be improved in the clip? What are the strengths of the clip?</p>	<ul style="list-style-type: none"> <li>• Research report or magazine articles.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P2, 2B.P3 2B.M2 2B.D2, (1B.2, 1B.3)	Pre-production	<p>Design a video clip based on the requirements of the brief you have been given by the producers of the programme. Explain the purpose and target audience.</p> <p>Write a complete script and storyboard, and create a recording schedule and logsheet.</p> <p>Recruit a cast/crew, and carry out a recce of filming location(s).</p> <p>Consider any alternative ideas in the design for the TV segment.</p> <p>Justify how this design entirely meets the brief from the producers.</p>	<ul style="list-style-type: none"> <li>Design documentation, including description of purpose and audience, script, storyboard, recording schedule, logsheet, cast/crew list and recce report.</li> <li>Prototype clips.</li> </ul>
2C.P4, 2C.M3 (1C.4)	Production and Post-production	<p>Record all original video clips and, if required, audio clips. Prepare any additional assets needed and describe any relevant constraints. Make sure you have noted any health and safety issues or legal issues for your TV segment.</p>	<ul style="list-style-type: none"> <li>Digital files of original video clips and, if required audio clips, demonstrating range of skills used.</li> <li>Digital files of acquired assets.</li> <li>Documentation of health and safety issues when filming (perhaps using annotated photographs).</li> <li>Report of legal issues.</li> </ul>
2C.P5, 2C.M4, 2C.D3, (1C.5)	Editing and Testing	<p>Edit the original video clips and assets into a digital video product. Render the finished TV segment into a suitable file format if you need to.</p> <p>Test that your clip is functional and get feedback from another person on your video. Is it fit for purpose? Is it suitable for the audience? Amend your clip to make sure it meets the original requirements in the brief.</p>	<ul style="list-style-type: none"> <li>Completed video clip in native format.</li> <li>Completed video clip in rendered format.</li> </ul>



Criteria covered	Assignment	Scenario	Assessment evidence
2C.P6, 2C.M5 2C.D4 (1C.6)	Review	<p>At the meeting with the producers, you will need to show that your TV segment meets the brief, the viewers will like it and you have reviewed your design.</p> <p>Obtain feedback from another person to act as the viewer. Evaluate the final product and justify why it meets the brief and suggest improvements.</p> <p>Describe legal and/or ethical constraints, and any health and safety considerations.</p> <p>Your evaluation could be used to present your thoughts and considerations to the producers in order to be asked to do another TV segment.</p>	<ul style="list-style-type: none"> <li>• Evidence of feedback, e.g. completed questionnaire.</li> <li>• Evaluation report/ presentation.</li> </ul>



# Unit 8: Mobile Apps Development

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

How many people do you know who have smartphones or mobile tablet devices? This means that they are carrying considerable computer power around with them. There has been an explosion of software applications, known as apps, to use on these devices. You can use apps for many different purposes; for example, a location app helps you to find your nearest shop, and a leisure app makes it easy to download your favourite music.

Software developers and engineers have scrambled to meet the demand for mobile apps, that are increasingly being used by businesses and organisations. The market for Apple, Android and other apps have boomed. Software engineers are involved with the design, development, testing and maintenance of apps. In addition, software businesses that develop apps employ other professionals, including creative designers, artists and sound engineers.

In this unit you will investigate the characteristics and uses of mobile apps, and learn how mobile apps are developed. Then you will design, develop, test and review your own mobile app. Rather than producing large amounts of original code from scratch, the emphasis in this unit is on you integrating predefined programs/code snippets (specific instructions for a mobile computer) with ready-made and original assets (e.g. buttons and sounds) by using some original code. This will save you significant amounts of time when developing your mobile app. You will review your finished app, having obtained feedback from others, and evaluate possible improvements.

You may even be able to get it published on the internet and take pride in people using an app you made.

In particular this unit develops skills from *Unit 1: The Online World* and *Unit 2: Technology Systems*. In addition, this unit develops the skills from the following specialist units: *Unit 4: Creating Digital Animation*, *Unit 5: Creating Digital Audio* and *Unit 6: Creating Digital Graphics*. It also complements the delivery of *Unit 12: Software Development*.

## Learning aims

In this unit you will:

- A understand the characteristics and uses of mobile apps
- B design a mobile app
- C develop and test a mobile app
- D review the finished mobile app.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the characteristics and uses of mobile apps</b></p> <p><b>The purpose of mobile apps</b></p> <p>Mobile apps are computer programs that instruct a computer's Central Processing Unit (CPU) to carry out the set of specific instructions given in a program for a specific reason and use.</p> <p><b>Typical uses of mobile apps</b></p> <p>Know why we develop mobile apps and know typical uses, including:</p> <ul style="list-style-type: none"> <li>• to give information (e.g. BBC, photo, video, music, Facebook, Instagram, Pinterest, Snapchat)</li> <li>• for navigation (in the physical world) (e.g. location identification, nearest tube stations, sandwich shop, WAZE, Google Maps)</li> <li>• for entertainment (e.g. YouTube, Spotify, NETFLIX, Google Play Books)</li> <li>• for leisure and fitness (e.g. tracking fitness, RunKeeper, MyFitnessPal)</li> <li>• for communication (e.g. Skype mobile, Live Messenger, Fone Time, WhatsApp, Microsoft Teams)</li> <li>• for augmented reality (e.g. Layar, Junaio).</li> </ul> <p><b>Features of mobile apps</b></p> <p>Key features and characteristics, e.g.:</p> <ul style="list-style-type: none"> <li>• purpose of the app</li> <li>• user requirements</li> <li>• user-friendliness (e.g. what are the features of the interface/screens that are presented to the user? How does the user communicate with the app and make things happen?)</li> <li>• dependence on particular hardware</li> <li>• interface elements</li> <li>• integration with standard operating-system software (e.g. contacts list, text messaging)</li> <li>• platforms and compatibility.</li> </ul> <p><b>Programming mobile apps</b></p> <p>Know there are types of programming language; including C++, Java and XML.</p> <p>Understand the reasons for compiling programs.</p>

## What needs to be learnt

### Learning aim B: Design a mobile app

#### Software development life cycle

Software development life cycle, including:

- requirements of the problem
- design specification (i.e. scope, inputs, outputs, processing, user interface)
- constraints (i.e. programming language and timescales for development)
- develop code
- test
- maintain code.

#### Designing a mobile app

Design to include:

- purpose
- user requirements or problem to solve.
- a proposed solution using design tools, e.g.:
  - a description of the main program tasks – input and output format (e.g. to add two numbers together and display a result)
  - screen layouts and navigation including prototypes (initial splashscreen, main activity screen, other screens or screen elements)
  - algorithms with a description of the method of solution and processing structure (flow charts, pseudocode and events)
  - control structures
  - data validation
- a brief outline of alternative solutions for the intended app (e.g. screen layouts and navigation)
- a list of any pre-defined programs, or code snippets to be used
- ready-made and original assets
  - video, graphics, audio and animation, e.g. sprites, sounds, images, movies, animations and buttons that will be integrated into the app (these are available on the internet and other media)
  - all sources for pre-defined programs and ready-made assets documented and referenced
- test plan with test data (e.g. testing the inputs and expected outputs and compilation of the code)
- constraints (e.g. device capabilities, such as connectivity, screen size, memory storage or programming language).

**What needs to be learnt****Learning aim C: Develop and test a mobile app****Preparing content to develop an app**

- Prepare and gather pre-defined programs, snippets and/or subroutines, and ready-made and original assets.
- Edit (using appropriate editing software) and optimise assets for a mobile platform (e.g. sacrificing quality for smaller file size).
- Use file formats that are appropriate for the intended platform.

**Develop and refine an app**

Use a development environment to write the code for a mobile app.

Integrate ready-made programs, code snippets and assets with some original code.

Use suitable program constructs to edit and create code:

- command words, e.g.:
  - comments
  - constants (variables with a constant value that cannot change)
  - operators; arithmetic ( +, -, \*, /, %) and logical ( <, <=, >, >=, AND, OR, true, false)
  - reserved words that have special meaning within the programming language and are used to write instructions in a program (e.g. in Java 'const' and 'goto' are reserved words)
  - input and output commands
  - local variables (variables that only exist inside the subroutine/function where they are declared and used)
  - global variables (variables that exist throughout the entire program and in subroutines/functions)
  - assignment
  - loops, (counter-controlled, conditional, iteration, [while do, repeat...until, for...to do])
  - sequential statements, selections (If... then...).
- Subroutines/functions/procedures (e.g. reading in data, printing out information).
- a range of data types, e.g.:
  - character
  - string (text)
  - integer and real (numbers)
  - Boolean.
- basic string handling commands to examine individual characters and substrings.

*continued*

### What needs to be learnt

- Event handling:
  - forms
  - assigning properties to screen components (e.g. buttons, boxes, data validation and drop-down lists)
  - actions.

Annotate code to demonstrate understanding and to allow effective repair/debugging of the program.

When required, compile the program into a suitable format to create an executable program.

### Quality of software programs

Know that software design and techniques affect the quality of the app developed:

- efficiency/performance, e.g. the amount of system resources a program consumes (processor time, memory space, accessing storage media)
- maintainability, i.e. the ease with which a program can be modified by its present or future developers in order to carry out corrective, perfective or adaptive alterations to the code
- portability, i.e. the range of computer hardware and operating system platforms on which the source code of a program can be run/compiled/interpreted
- usability, i.e. the ease with which an end user can use the program for its intended purpose or, in some cases, even unanticipated purposes.

### Test the app

Test the program solution:

- for functionality against the test plan with the test data
- is fit for purpose
- by reviewing the quality of the program in terms of efficiency/performance, maintainability, portability and usability
- gather feedback from others on the quality (efficiency/performance, maintainability, portability and usability) of the solution.

Document any changes to the design, including changes to the source table for pre-defined programs/snippets and ready-made assets.

Improve or refine the app (e.g. efficiency/performance, maintainability, portability, usability).

**What needs to be learnt****Learning aim D: Review the finished mobile app****Review the app**

Review the finished mobile app for:

- user requirements
- fitness for purpose
- constraints (e.g. programming language, time, copyright, device capabilities – connectivity and screen size)
- quality of the program (e.g. efficiency/performance, maintainability, portability, usability)
- strengths and improvements.



## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the characteristics and uses of mobile apps</b>			
1A.1 Identify the uses and features of two different apps.	2A.P1 Explain the uses and features of two different apps.	2A.M1 Review how the features of the apps affect the usability and intended use by the audience.	2A.D1 Discuss the strengths and weaknesses of the apps.
<b>Learning aim B: Design a mobile app</b>			
1B.2 Identify the purpose and user requirements for the app.	2B.P2 Describe the purpose and user requirements for the app.	2B.M2 Produce a detailed design for a mobile app, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• a detailed proposed solution using a range of design tools</li> <li>• test data.#</li> </ul>	2B.D2 Justify the design decisions, including: <ul style="list-style-type: none"> <li>• how they will fulfil the purpose and the user requirements</li> <li>• any design constraints.#</li> </ul>
1B.3 Produce a design for a mobile app with guidance, including an outline of the proposed solution.	2B.P3 Produce a design for a mobile app, including: <ul style="list-style-type: none"> <li>• a proposed solution</li> <li>• a list of any pre-defined codes/programs</li> <li>• a test plan</li> <li>• a list of sources for any pre-defined code and assets.#</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Develop and test a mobile app</b>			
1C.4 Prepare predefined code and assets with guidance.	2C.P4 Prepare predefined code snippets and assets for the app, demonstrating awareness of purpose, listing sources for assets used.	2C.M3 Optimise assets for the app, demonstrating good awareness of the user requirements, with all sources for assets fully referenced.	2C.D3 Refine the app, taking account of the quality of the code and user feedback.*
1C.5 Edit predefined code and integrate with assets to develop an app, with guidance, containing: <ul style="list-style-type: none"> <li>• one or more screens</li> <li>• constructs.*</li> </ul>	2C.P5 Edit predefined code and integrate with assets to develop an app which includes: <ul style="list-style-type: none"> <li>• one or more screens</li> <li>• constructs</li> <li>• commentary throughout the code.*</li> </ul>	2C.M4 Develop a functional multi-screen app containing original code, that meets the user requirements and purpose.*	
1C.6 Test the app for functionality and purpose, repairing any faults and documenting any changes made, with guidance.	2C.P6 Test the app for functionality and purpose, repairing any faults and documenting any changes made.	2C.M5 Gather feedback from others on the usability of the app, and use it to improve the app, demonstrating awareness of audience and purpose.	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the finished mobile app</b>			
1D.7 For the final app, identify how the final app is suitable for the user requirements and purpose.	2D.P7 For the final app, explain how the final app is suitable for the user requirements and purpose.	2D.M6 Review the extent to which the final app meets the user requirements and purpose, considering feedback from others and any constraints.	2D.D4 Evaluate the final app and the initial designs and justify any changes made to the quality of the code, making recommendations for further improvement.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit are:

- a software development kit for a mobile device programming language, e.g. Android App Inventor, Android Studio
- an onscreen emulator for a mobile device
- example mobile device(s) on which to run apps
- graphic and audio-editing software to edit and optimise ready-made and original assets.

Teachers may wish to use an application such as Scratch to introduce learners to the concepts of programming. Scratch is available free from

<http://scratch.mit.edu/download>.

Learners should be provided with a brief to design and develop an app, or decide on their own user requirements and purpose for the app.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

In this learning aim, learners will investigate the characteristics of mobile apps and how they are used.

**For 2A.P1:** learners should consider a range of existing mobile apps. It may be beneficial to offer a selection of apps, preferably ones with a clear purpose and audience, from which they can choose two. Learners should explain the features and intended use of each app. The two apps should be designed for different purposes.

*For level 1, as a minimum, learners should be able to identify the purpose and some of the features of at least two existing mobile apps, including presentation interface elements and compatibility.*

**For 2A.M1:** learners should review how the features of the two apps affect the intended use, usability and appeal to the audience.

**For 2A.D1:** learners should look at one app in more detail and consider the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

#### Learning aim B

Learners are not expected to find their own problems or create their own project brief. Suitable scenarios should allow learners to achieve all assessment criteria.

The user requirements should be given in the brief:

- purpose of the software program
- task(s) the software must perform
- a list of the required user inputs and outputs
- an outline of any processing/functions required.

Centres are encouraged to use evidence for the development of the software program as part of the learner's digital portfolio (Unit 3). For instance, a movie showing snapshots throughout the development process would be appropriate, as would an audio diary of the process, or blog entries as developments are made.

**For 2B.P2:** learners should describe the user requirements and purpose of the app for their design, as well as the user requirements for their design.

*For level 1, as a minimum, learners should identify the purpose of the app and the user requirements for the design.*

**For 2B.P3:** for a given problem outlined in a brief, learners should design their proposed solution. The design documents should include:

- a proposed solution using basic design tools, including a description of the main program tasks (data input and output, screen layouts and navigation, and descriptions of the method of solution)
- a list of any pre-defined programs/code snippets (including any functions or sub-routines) and assets, documenting the sources appropriately
- a test plan (to test for the logic and functionality).

Learners will produce design ideas for apps. Please note that learners do not have to create original assets unless they choose to do so. The original assets may have been produced in a unit such as *Unit 5: Creating Digital Audio* or *Unit 6: Creating Digital Graphics*.

*For level 1, as a minimum, learners should suggest an outline of a proposed solution which will contain:*

- *a description of the main program tasks – input and output (e.g. to add two numbers together and display a result)*
- *screen layouts (input and output) – templates or design sheets can be used to help learners with their design.*

**For 2B.M2:** in addition to the requirements for the pass grade, learners should produce:

- a detailed proposed solution, using a range of suitable tools (in addition to those used at pass) such as flowcharts, control structures pseudocode, events, data handling, and error handling and reporting)
- a brief outline of any alternative solutions for the intended software program,
- test data.

**For 2B.D2:** at this level, learners are expected to be able to justify their design decisions and how the chosen design fulfils the purpose and user requirements. They should consider the suitability for end users and the quality and thoroughness of their design work. They also need to review their design in light of any constraints (e.g. screen size) arising from the device and the programming language used. Learners should explain why alternative designs were rejected.

### Learning aim C

The designs will be used to create the mobile app. Although learners may deviate from their designs (as happens with any project), they should aim to develop final products that closely resemble their original design. The teacher should recognise that the activities of gathering and preparing code and assets, along with original code, is an iterative process.

**For 2C.P4:** learners should prepare (including gathering) predefined code and ready-made assets, such as buttons and images, and list them in a table of sources (please note, many assets will be included within the development environment, e.g. buttons). Chosen assets should demonstrate awareness of user requirements and purpose. The sources of assets should be listed.

*For level 1, as a minimum, learners should prepare ready-made assets required for the app. This may include sprites, sounds, images, movies, animation and buttons from a variety of sources.*

**For 2C.M3:** learners should optimise ready-made assets. For instance, bitmap images should be optimised (e.g. be an appropriate file type and size to increase the responsiveness of the app). Learners should demonstrate good awareness of audience and purpose. All predefined code and assets should be fully listed in a sources table, which should be detailed enough for another person to independently obtain the assets used.

**For 2C.P5:** learners should integrate the pre-prepared code snippets and assets by editing the code. They should then develop the app by:

- creating an interface which demonstrates an awareness of the user requirements and purpose of the app
- assigning code to assets, e.g. buttons to control behaviour
- writing comments within the code to explain how it works.

The interface may be a single screen with a number of assets that cause an event to happen.

*For level 1, as a minimum, learners should integrate and edit the assets and code to develop the app. Their app should contain one or more screens and simple constructs.*

**For 2C.M4:** learners should edit defined code and develop some original code to fulfil the design requirements of the app. The development process will include creating a multi-screen interface that reflects the planned interface, with assets on each screen. The app should be multifunctional.

**For 2C.P6:** learners should test the functionality of code, ensuring it is fit for purpose and adjust the code as required to fix any problems. They should document any changes to the program. Testing documentation might range from a simple checklist to a more elaborate testing schedule that includes due dates for completion of different parts of the project.

*For level 1, as a minimum, learners should test the app for functionality and fitness for purpose. They should fix any faults and document their changes.*

**For 2C.M5:** learners should gather feedback from others when testing the app, considering the user requirements and purpose of the app, and use it to improve the app.

**For 2C.D3:** teachers should recognise that the activities of developing and testing computer programs is iterative process and not sequential. Consequently, the Distinction criteria for this learning aim is assessed through using the learners' work from both the Pass and Merit criteria.

Learners should refine their mobile app, taking account of user feedback, where appropriate to do so, and the quality of the code, e.g. maintainability (how easily the code can be modified), portability (on different platforms) and usability. All of the ideas from testing, feedback and improving their designs as they create the apps should have been considered as how best to refine the product.

## Learning aim D

**For 2D.P7:** for the final review, learners should be able to explain why their app is suitable for the user requirements and purpose. Learners should give one reason for audience and one for purpose.

*For level 1, as a minimum, learners should identify why their app is suitable for the user requirements and purpose. This could be achieved through a discussion with the teacher about the outcomes of their project and evidence with a witness statement and observation record.*

**For 2D.M6:** for the final review, learners should review their app with others, discussing the extent to which their solution meets the needs of the original requirements and purpose of the app. Learners should consider how constraints, user feedback and testing has affected the suitability of the app.

**For 2D.D4:** at this level, learners should evaluate their initial designs and the completed app. They should identify any changes made from the design stage and justify these changes.

Learners should make at least three specific suggestions for improvement for the completed program to ensure it is fully functional, well coded and fit for purpose, including considerations of any constraints, user requirements and purpose.

Learners do not need to implement the enhancements.

## Programming constructs and techniques for level 1 assessment

It is recognised that some learners may fail to achieve a full Pass at level 2. Learners being assessed for the level 1 criteria for learning aims B and C are therefore not required to include all of the different programming constructs in their work for assessment.

The constructs that learners working at level 1 should be familiar with and include in their assessment evidence are shown below.

Use program constructs e.g.:

- command words:
  - comments
  - constants (variables with a constant value that cannot change)
  - arithmetic operators ( +, -)
  - reserved words which have special meaning within the programming language and are used to write instructions in a program e.g. in Java 'const' and 'goto' are reserved words
  - local variables – only exist inside the subroutine/function where they are declared and used
  - global variables – exist throughout the entire program and in subroutines/functions
  - assignment
  - counter controlled loops.
- a range of data types, e.g.:
  - string (text)
  - integer and real (numbers)

- event handling:
  - forms
  - assigning properties to screen components (e.g. buttons, boxes and drop down lists)
  - actions.



## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Reviewing Apps	<p>You work for a publishing company that is moving into increasing its digital publishing for handheld devices and smartphones.</p> <p>Your manager is going to ask you to lead on an app design project, and to investigate educational mobile apps currently available.</p> <p>Your manager wants to know how mobile apps could be used to:</p> <ul style="list-style-type: none"> <li>• support people with their learning and development</li> <li>• create a guidebook for a major city.</li> </ul> <p>They have asked you to prepare a presentation that describes the purpose, quality and features of both these apps.</p>	<ul style="list-style-type: none"> <li>• Presentation.</li> </ul>
1B2, 1B.3 2B.P2, 2B.M2, 2B.P3, 2B.D2	Design an Interactive Alphabet App	<p>A leading educational publisher has asked you to develop an interactive app. The app is intended to help children learn their alphabet. Learners should design an interactive app which will include pre-defined and edited code with assets.</p> <p>You should describe how your design meets the user requirements and purpose.</p> <p>Designs should include:</p> <ul style="list-style-type: none"> <li>• list of assets or code</li> <li>• proposed solution</li> <li>• test plan</li> <li>• alternative ideas for designs</li> </ul>	<ul style="list-style-type: none"> <li>• Processing structures, e.g. flowcharts and structure diagrams.</li> <li>• List of tools, functions and subroutines.</li> <li>• Report.</li> <li>• Screens (input and output).</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5, 1C.6 2C.P4, 2C.M3, 2C.P5, 2C.M4, 2C.P6, 2C.M5, 2C.D3	Developing and Testing	<p>You should now have everything you need to develop your interactive learning app.</p> <ol style="list-style-type: none"> <li>1. Gather, prepare and optimise predefined programs/code snippets and assets (e.g. images, sound, video) that you will use in the interactive app.</li> <li>2. Reference sources in a table.</li> <li>3. Develop the interactive app, using the predefined programs/code that you have gathered. Edit pre-defined code and any original code to create the app. Do not forget to include commentary within the code.</li> <li>4. Test the app against the test plan, checking the user requirements are still being met, and document any changes to the app. Correct any errors in the app.</li> <li>5. Get feedback from one other person on the app, including how easy it is to use and the quality of the code.</li> <li>6. Review and refine your app in light of feedback.</li> </ol>	<ul style="list-style-type: none"> <li>• Annotated code.</li> <li>• Annotated design.</li> <li>• User feedback.</li> <li>• Functional apps.</li> <li>• Test plans and data.</li> <li>• Source table for assets.</li> </ul>
1D.7 2D.P7, 2D.M6, 2D.D4	Review the App	<p>How could the app be improved?</p> <p>Consider strengths and points you could improve in your design.</p> <p>How suitable is your app for the audience and purpose? Does it meet the user requirements?</p> <p>Justify where your design has changed through the development, including what has changed following feedback, and explain how you would improve the program further.</p>	<ul style="list-style-type: none"> <li>• Annotated code.</li> <li>• Annotated design.</li> <li>• User feedback.</li> <li>• Evaluation report.</li> </ul>

# Unit 9: Spreadsheet Development

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

Spreadsheets are used to store, manipulate and analyse data and to present it in easy-to-understand ways. They are invaluable for collecting and manipulating data of all types. Spreadsheets can be formatted to create clear, concise reports and can be sorted, filtered and updated with the touch of a button.

Spreadsheets are used extensively in many organisations to help people carry out their job roles. For instance, accountants use spreadsheets to keep track of the money going into and out from a business, and scientists use them to analyse the results of their experiments and record the data for use in the future.

In this unit you will understand the many uses for spreadsheets and the tools and techniques that are available and become skilled at using them. You will be able to apply some of your findings to your own spreadsheet solutions.

In this unit, you will understand the many uses for spreadsheets. You will discover the many tools and techniques that are available in spreadsheet software and will become skilled at using them. You will investigate some of the ways spreadsheets used in real-life. You will design a spreadsheet solution for a brief. You will then develop and test your spreadsheet solution to store, manipulate and analyse a large amount of data and present the output data in easy-to-understand way. Once completed, you will review the finished spreadsheet solution having obtained feedback from others, and evaluate possible improvements.

In particular, this unit develops skills from *Unit 1: The Online World* and *Unit 2: Technology Systems*. In addition, it supports the content of *Unit 10: Database Development*.

## Learning aims

In this unit you will:

- A understand the uses of spreadsheets and the features available in spreadsheet software packages
- B design a spreadsheet
- C develop and test a spreadsheet
- D review the finished spreadsheet.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the uses of spreadsheets and the features available in spreadsheet software packages</b></p>
<p><b>What is a spreadsheet?</b></p> <p>Spreadsheet software stores, manipulates and analyses large amounts of data accurately and to present the output data in an easy-to-understand way.</p> <p><b>How and why spreadsheets are used</b></p> <p>Know why organisations use spreadsheets, e.g.:</p> <ul style="list-style-type: none"> <li>• improve productivity and accuracy</li> <li>• support decision making (e.g. scenario modelling, goal seek, regression and data mining)</li> <li>• present information</li> <li>• analyse data</li> <li>• perform calculations</li> <li>• manipulate large datasets.</li> </ul> <p>Activities where spreadsheets are used, e.g.:</p> <ul style="list-style-type: none"> <li>• cost modelling (e.g. in small- and medium-sized enterprises (SMEs))</li> <li>• analysis of data (e.g. scientific experiments or market research)</li> <li>• tracking progress and recording results (e.g. homework and test results in a school or college)</li> <li>• creating timetables and results (e.g. league table information for a football league)</li> <li>• stock control (e.g. in a shop or manufacturing organisation).</li> </ul> <p><b>Features of spreadsheet software</b></p> <p>Tools and techniques (e.g. cell replication and formatting, page setup and user interfaces (as listed in learning aim C)).</p> <p>Purpose of tools and techniques (e.g. aid usability, productivity, accuracy and the presentation of output data).</p>

## What needs to be learnt

### Learning aim B: Design a spreadsheet

#### Designing a spreadsheet

Designs include:

- intended purpose and user requirements
- design documentation that includes
  - worksheet structure diagram showing the proposed layout, calculations/processes (e.g. formulae and functions) and data input method (e.g. labeling and row and column use, forms, cell formatting, validation, conditional formatting)
  - user input interface identifying appropriate tools/techniques.
  - user output data (e.g. ideas for presentation showing format(s) and tools/techniques)
  - onscreen user navigation and guidance (e.g. navigation prompts, input messages and validation (including lists))
  - test plan with test data to test functionality (e.g. test, expected result, actual result)
  - a brief outline of alternative design ideas (e.g. choice of calculations and artistic style of the solution).

**What needs to be learnt****Learning aim C: Develop and test a spreadsheet****Developing a spreadsheet solution**

Use spreadsheet software tools and techniques, e.g.:

- cell manipulation (e.g. entering and editing data, autofilling, replication, conditional formatting (to highlight outcomes))
- cell formatting (e.g. colours, shading, merging cells, alignment)
- data manipulation (e.g. filters, sorts, pivot tables)
- formulae (e.g. add, subtract, divide, multiply)
- functions (e.g. sum, average, count and countIF, lookup, index)
- logical functions (e.g. IF, AND, OR, NOT)
- data validation
- relative and absolute cell referencing
- boxes (e.g. lists, drop-down)
- data entry forms
- lookup tables
- nested IF functions
- cell protection
- types of charts and graphs (e.g. bar, pie)
- chart and graph formatting (e.g. titles, resizing, labels)
- worksheets (e.g. headers, page breaks, links)
- conditional formatting
- named ranges, relative and absolute cell referencing
- goal seek – what if function
- macros.

**Test and refine a spreadsheet**

Test the spreadsheet solution for functionality and usability.

Provide onscreen user navigation and instructions.

Gather feedback from others, e.g. on user requirements, functionality, user experience (e.g. usability, performance, adaptability to different scenarios).

Improvements and/or refinements to the spreadsheet solution, e.g. adaptability, usability, productivity.

**What needs to be learnt****Learning aim D: Review the finished spreadsheet****Reviewing the spreadsheet solution**

Review the finished spreadsheet solution against:

- user requirements
- fitness for purpose
- user experience (e.g. usability, performance, adaptability)
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the uses of spreadsheets and the features available in spreadsheet software packages</b>			
1A.1 Identify how spreadsheets are used for two different activities and how the features are used in the spreadsheets.	2A.P1 Explain how spreadsheets are used for two different activities, and how the features are used in the spreadsheets.	2A.M1 Review how the features in the spreadsheets could improve productivity, accuracy and usability.	2A.D1 Discuss the strengths and weaknesses of the spreadsheets.
<b>Learning aim B: Design a spreadsheet</b>			
1B.2 Identify the purpose and user requirements for the spreadsheet.	2B.P2 Describe the purpose and user requirements for the spreadsheet	2B.M2 Produce detailed designs for a spreadsheet, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• detailed worksheet structure diagram</li> <li>• test data.</li> </ul>	2B.D2 Justify final design decisions, including: <ul style="list-style-type: none"> <li>• how the spreadsheet solution will fulfil the stated purpose and user requirements</li> <li>• any constraints to the design.</li> </ul>
1B.3 With guidance, produce a design for a spreadsheet including: <ul style="list-style-type: none"> <li>• worksheet structure diagram.</li> </ul>	2B.P3 Produce a design for a spreadsheet, including: <ul style="list-style-type: none"> <li>• worksheet structure diagram</li> <li>• how output data is to be presented</li> <li>• a test plan.</li> </ul>		



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim C: Develop and test a spreadsheet			
1C.4 With guidance, develop a spreadsheet with a given realistic dataset.	2C.P4 Develop a spreadsheet with a given realistic data set, containing a user interface for data input and presentation of output data.	2C.M3 Refine the spreadsheet to improve usability and accuracy using onscreen user navigation and guidance.	2C.D3 Refine the spreadsheet using automated tools/techniques to improve productivity, accuracy and presentation of output data.*
1C.5 With guidance, test the spreadsheet for functionality and purpose, and repair any faults, documenting any changes made.*	2C.P5 Test the spreadsheet for functionality and purpose and repair any faults, documenting any changes made.*	2C.M4 Gather feedback from others on usability, and use it to improve the spreadsheet, testing the additional functionality and repair any faults.*	
Learning aim D: Review the finished spreadsheet			
1D.6 For the final spreadsheet, identify how the final spreadsheet is suitable for the purpose.	2D.P6 For the final spreadsheet, explain how the final spreadsheet is suitable for the user requirements and purpose.	2D.M5 Review the extent to which the final spreadsheet meets the user requirements and purpose while considering feedback from others.	2D.D4 Evaluate the final spreadsheet against the initial designs and justify any changes that were made, making recommendations for further improvements to the spreadsheet.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resource for this unit is access to spreadsheet editing software. Learners will need to be given example spreadsheets and an assessment brief, giving a situation that requires a spreadsheet solution.

Learners should produce a spreadsheet solution to a problem in a given brief and with either a given dataset. The user requirements in the assessment brief should include:

- the purpose of the spreadsheet
- the task(s) the spreadsheet must perform
- the information the spreadsheet must supply, in what form, to whom
- an outline of the required processing/calculations.

This unit assumes that learners already have a basic understanding of and ability to use spreadsheets which cover basic spreadsheet tools and techniques such as using formulae, e.g. add, subtract, divide and multiply.

Learners can devise their own brief, but it must be approved by the centre before being used for assessment.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

**For 2A.P1:** learners should explain how two spreadsheets are used in the real world, for example to measure performance over time or to calculate profit and loss. They should describe how the tools and techniques included in the spreadsheets are used. The two spreadsheets should be designed for different purposes.

*For level 1, as a minimum, learners should identify how two spreadsheets are used in the real world and identify how the features (e.g. formulae, layout) are used in two given spreadsheets.*

**For 2A.M1:** learners should review how the features (e.g. functions, layout, structure) could improve productivity, accuracy and usability in the spreadsheets.

**For 2A.D1:** learners should look at the spreadsheets in more detail and consider the strengths and weaknesses of the spreadsheets. They should discuss at least one strength and one weakness.

#### Learning aim B

Learners need to design a spreadsheet solution for a specific purpose.

Centres are encouraged to use evidence from the development of the spreadsheet as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** learners should describe the user requirements and purpose of the spreadsheet in their designs.

*For level 1, as a minimum, learners should identify the purpose and the user requirements for their spreadsheet design.*

*For level 1, as a minimum, learners should have created an outline design for their spreadsheet solution, with guidance. An outline design would contain worksheet layout and data input diagram. Some annotations should indicate the processes and appropriate tools/techniques used, e.g. functions and formulas. This will give an indication of what the product would be like and what it is about.*

**For 2B.P3:** learners should design a spreadsheet solution. This should be a workable design and should include:

- a worksheet structure diagram including calculations and tools/techniques to be applied, e.g. cell formatting, functions, formulas, IF statements
- output data presenting the results/outcome
- a test plan.

**For 2B.M2:** the detailed spreadsheet design will contain:

- a brief description of alternative solutions, e.g. choice of calculations and style
- a detailed worksheet structure diagram indicating data validation (including lists), e.g. multiple worksheets, cell referencing, input messages, error messages, macros, cell protection and navigation between multiple worksheets
- test data, e.g. test, expected result, actual result.

**For 2B.D2:** learners should justify their design decision, explaining how they meet the brief. Learners may wish to do this by annotating their design documents and describing why (e.g. 'I have used a function here because ...').

They should also justify why they have chosen a specific design to fulfil the brief in terms of purpose and user requirements. Learners should explain why alternative designs were rejected, and consider any constraints.

### Learning aim C

Learners' designs will be used to create the spreadsheet solution. Although learners may deviate from their designs (as happens with any project), they should aim to create a final spreadsheet that closely resembles their original design (unless there is a good reason not to).

**For 2C.P4:** learners will develop a spreadsheet solution for a given purpose to meet the brief. The spreadsheet will contain a user interface for data input and for the presentation of output data. It will include simple functions and formulae. Data for the spreadsheet will be sorted and the spreadsheet will be formatted appropriately to promote ease of use. Learners will have created either a chart or a graph to present the result/output from the spreadsheet solution.

*For level 1, as a minimum, learners should develop a spreadsheet solution for a brief. The solution should include formulae and simple functions, some formatting, and basic output to present the outcome/result.*

**For 2C.M3:** learners will refine their spreadsheet solution to improve the usability of their spreadsheet. Onscreen user navigation and guidance includes:

- input messages
- validation (including lists)
- error messages
- navigation prompts and guidance
- conditional formatting
- labels
- data-entry forms
- a commentary explaining the output presentation.

**For 2C.P5:** learners should test the functionality of the spreadsheet and make changes based on these tests to repair any faults. The spreadsheet should be fully functional and fit for purpose. Changes to the spreadsheet should be documented: different versions from stages of development could be used to evidence this.

*For level 1, as a minimum, learners should test the spreadsheet solution for functionality and purpose and repair any faults, with guidance.*

**For 2C.M4:** learners should test the functionality of any additional tools/techniques used, repair any faults and gather feedback on their spreadsheet from potential users, and use it to improve the spreadsheet. They should cover the ease of use of the spreadsheet solution, both in terms of the storage, manipulation and analysis of data and the data output presentation.

**For 2C.D3:** teachers should recognise that the process of developing and testing a spreadsheet is iterative, and not a sequential process. Learners will refine the spreadsheet solution using automated tools/techniques to improve productivity, accuracy and the presentation of output data. Automated tools/techniques used to do this include macros, links, named ranges and pivot tables.

All of the ideas from testing, feedback and reviewing their designs as they create the spreadsheet solution should have been considered as how best to refine the product.

### **Learning aim D**

Learners will complete a review of their finished spreadsheet solutions. This is a reflective exercise to establish what the strengths and areas for improvement of the solution are against the purpose and user requirements.

**For 2D.P6:** learners should have assessed the functionality of their spreadsheet and should explain why their spreadsheet is suitable for user requirements and purpose. Learners should try to avoid identifying mundane points such as the colour used (unless that is particularly important) and instead think about why their solution is appropriate and how it can be made more appropriate.

*For level 1, as a minimum, learners should identify how their spreadsheet is suitable for the purpose and user requirements.*

**For 2D.M5:** learners should review the extent of how their spreadsheet solution meets the brief, based on feedback, and consider how the spreadsheet measures up against the original purpose and user requirements.

**For 2D.D4:** learners should evaluate their final spreadsheet solution against the initial designs and justify any changes made. Learners should make at least three recommendations for how they could further improve their spreadsheet.

Learners do not need to implement the enhancements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Learners should have access to an assessment brief that outlines the purpose and user requirements and a suitable data set (of at least 50 rows). Possible scenarios for this unit include:

- a spreadsheet showing potential costs for a series of mobile phone tariffs
- a membership list for a pop band's fan club showing age ranges and location of members
- fixtures, results and league table information for a football league
- a costing model for a charity event
- a profit-and-loss model for a clothing/sports shop, including incoming and outgoing stock.

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.M1 2A.D1, (1A.1)	Application of Spreadsheets	<p>You are completing a placement with the local football club in the administration department. Your manager wants you to investigate spreadsheets which could:</p> <ul style="list-style-type: none"> <li>• manage the season ticket holder information</li> <li>• manage the results, fixtures and league table information for the club.</li> </ul> <p>Before you design a spreadsheet for one of these uses, you must investigate ways in which different organisations use spreadsheets. Your manager is keen to make their spreadsheet systems as efficient as possible.</p> <p>For two given spreadsheets, you should present two reports entitled 'Top 10 spreadsheet tools/techniques'. They should highlight their use in the spreadsheets, describe their purpose, and explain how these tools/techniques improve productivity, accuracy and usability.</p>	<ul style="list-style-type: none"> <li>• Evidence of independent research into how organisations use spreadsheets</li> <li>• Top 10 spreadsheet tools/techniques in the form of pamphlet, presentation report or demonstration for a meeting.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P2, 2B.M2 2B.P3, 2B.D2, (1B.2, 1B.3)	Designing a Spreadsheet Solution	<p>You have been asked to produce a spreadsheet to manage the season ticket holder information. You will produce design documents for a spreadsheet solution to meet your manager's needs.</p> <p>Your design documents should consider the formatting of inputs to the spreadsheet, what processes (calculations) are required, and the output presentation of the result/outcome displayed as a chart, graph or table.</p>	<ul style="list-style-type: none"> <li>Design documents, including: <ul style="list-style-type: none"> <li>user needs</li> <li>purpose</li> <li>worksheet layout</li> <li>proposed functions, formula and calculations, named ranges</li> <li>potential output in charts and graphs</li> <li>a basic plan to test the spreadsheet.</li> </ul> </li> </ul>
2C.P4, 2C.M3, (1C.4), 2C.P5 2C.M4, (1C.5) 2C.D3	Developing and Testing a Spreadsheet Solution	<p>Now you will create a spreadsheet solution to manage the information about season ticket holders.</p> <p>You should complete a test plan that includes testing how well the spreadsheet solution is used by people in the administration team.</p> <p>You should test their spreadsheet for functionality, purpose and usability, gathering user feedback from the people who try the spreadsheet. You should record any changes made.</p>	<ul style="list-style-type: none"> <li>A spreadsheet solution to a proposed brief</li> <li>Test plan.</li> </ul>
2D.P6, 2D.M5 2D.D4, (1D.6)	Review	<p>Before you present your manager with your ideas for a spreadsheet solution, and demonstrate how it can be used, you must review your solution and design. The review should consider strengths and areas for improvement and justify changes you have made to your original design.</p> <p>You should make specific recommendations for further improvement of the solution.</p>	<ul style="list-style-type: none"> <li>Evaluation.</li> </ul>

# Unit 10: Database Development

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Do you use the internet to search for information, such as music tracks, items in an online shop or train times? If so, the chances are that you are using a database without realising it! Many IT systems involve the use of databases and it is important to understand how they work.

Databases are designed to hold data in a digital form, for example, a record for each computer game in a shop. Database tools can be used to ensure the data is valid and accurate. They also allow information to be restricted to certain individuals and to be analysed and presented in reports.

Job roles include database administrators who oversee the performance, integrity and security of a system and database managers who are responsible for the way a company manages, organises and stores its information.

In this unit you will investigate the features and uses of databases by exploring what they are and what you can do with them. You will be able to apply some of your findings to your own database solution.

You will also learn how to use database software to design, develop and test relational databases for a brief. Once completed, you will review your database, having obtained feedback from others, and evaluate possible improvements.

In particular this unit develops skills from *Unit 2: Technology Systems* and the following optional units: *Unit 9: Spreadsheet Development* and *Unit 12: Software Development*.

## Learning aims

In this unit you will:

- A understand the uses of and tools/techniques used in databases
- B design a relational database
- C develop and test a relational database
- D review the finished relational database.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the uses of and tools/techniques used in databases</b></p> <p><b>Why are databases used?</b></p> <p>The purpose of database software is to store, manage and extract a large amount of organised information for one or more users.</p> <p>Know why organisations use databases to:</p> <ul style="list-style-type: none"> <li>• improve productivity</li> <li>• make decisions</li> <li>• present information</li> <li>• interpret data</li> <li>• perform calculations</li> <li>• manage large datasets.</li> </ul> <p>Examples of uses of a database:</p> <ul style="list-style-type: none"> <li>• health (data – doctors, patients, appointments)</li> <li>• employment (data – name, payroll, department)</li> <li>• agencies (data – client, services, reservations)</li> <li>• sale of goods (data – orders, goods, invoices)</li> <li>• libraries (data – books, loans, members)</li> <li>• police (data – offenders, crime, officers).</li> </ul> <p><b>Tools and techniques used in a database</b></p> <p>Tools and techniques include, e.g.:</p> <ul style="list-style-type: none"> <li>• table structures</li> <li>• field characteristics</li> <li>• validation rules</li> <li>• indexing</li> <li>• records</li> <li>• relationships</li> <li>• forms</li> <li>• sorts</li> <li>• queries.</li> </ul> <p>(As listed in learning aim C.)</p> <p style="text-align: right;"><i>continued</i></p>



## What needs to be learnt

### Using databases to improve working practices

Improving productivity and accuracy in a database, e.g.:

- creating and presenting financial reports
- record keeping
- backing up data
- collaborative working
- searching and planning information.

### Databases and relationships

Types of databases, e.g.:

- local
- online (web)
- flat file (contains a single table of information)
- relational (uses common identifiers found within a data set consisting of two or more related tables).

Types of relationships, e.g.:

- one-to-one is a relationship between one record in the first table that corresponds to exactly one record in the related table
- one-to-many is a relationship where each record in the first table may have many linked records in the related table, but will still have only one corresponding record in the first table
- many-to-many is a relationship where each record in the first table may have linked records in the related table and vice versa.

## Learning aim B: Design a relational database

### Designing a database

Designs should be based around the intended purpose and user requirements as defined in a brief to solve a problem.

Design documentation, including:

- hardware, software and other resources required
- entity Relationship Diagram (ERD), including entities, attributes and relationships
- validation and verification procedures
- input and output screens/forms and reports
- constraints (e.g. hardware and software availability)
- test plan with test data to test functionality
- a brief outline of alternative design ideas.

**What needs to be learnt****Learning aim C: Develop and test a relational database****Software tools and techniques to develop a relational database**

Create and edit:

- single and multiple table structures with appropriate field characteristics, including
  - field names
  - field data types, e.g. alphabetic (text and memo), numeric (number, currency, and date/time), alphanumeric (text and memo), logical (yes/no and true/false), web (hyperlink), lookup wizards
  - field sizes (e.g. byte, integer, long integer, single, double and decimal)
  - field formats (e.g. fixed and decimal places)
  - default values
- validation rules and text, which applies to a range, format and length for different data types including input masks
- indexing (e.g. primary key, foreign key)
- create new records (e.g. populate tables with data manually or import a data set from an external source (text file or spreadsheet))
- edit and delete existing records of data
- create, edit and delete relationships
- use wizards.

Create and edit forms, including:

- simple forms (e.g. data-entry and main menu forms with limited functionality)
- customised forms, which suit users and purpose, e.g. a data-entry form that facilitates accurate data entry, has an appropriate user interface with programmable buttons that run events (navigation, add new record, delete record, print record) and main menu forms allowing users to access sub-forms (e.g. data-entry forms), run queries and view reports
- sub-forms
- forms should
  - allow navigation between sub-forms
  - enable the entry of data into single and multiple tables
  - have appropriate entry-form field lengths
  - provide clear labelling of entry-form fields
  - provide instruction fields where necessary
  - include validation checks on field entries as appropriate
  - delete existing forms.

*continued*

### What needs to be learnt

Use reports:

- create and edit reports to present meaningful information for a purpose and specific users, using features (e.g. titles, page layout, colours, field selection, date/time, grouping, introductions and images)
- delete existing reports.

Use sorts:

- sort records using a single field (alpha or numeric, ascending and descending)
- sort records using multiple fields.

Use queries:

- queries with single criteria on one or two fields using relational operators
- queries with multiple criteria using at least two tables, making use of logical operators (e.g. AND, OR, NOT) and wildcards.

Automation, security and usability e.g.:

- automated tasks using macros
- security to protect the database
- provide onscreen user navigation and instructions.

### Testing a database

The testing process:

- Test the relational database for functionality, purpose and usability
- Use feedback from others, for example, on the database's functionality, its usability, and its performance
- Consider possible improvements and/or refinements to the relational database, for example, additional tables, additional queries, forms, reports, automation (macros) and security
- Provide onscreen user navigation and instructions.

### Learning aim D: Review the finished relational database

#### Reviewing a database

Review the finished relational database for:

- the user requirements and user experience (e.g. usability and reliability)
- fitness for purpose
- any constraints (e.g. hardware and software availability)
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the uses of and tools/techniques used in databases</b>			
1A.1 Identify the uses of databases and how the tools/techniques are used in two different databases.	2A.P1 Explain the uses of databases and how the tools/techniques are used in two different databases.	2A.M1 Review how the tools/techniques are used in two databases to improve productivity, accuracy and usability.	2A.D1 Discuss the strengths and weaknesses of the databases.
<b>Learning aim B: Design a relational database</b>			
1B.2 Identify the purpose and user requirements for the database.	2B.P2 Describe the purpose and user requirements for the database.	2B.M2 Produce a detailed design for a relational database, including: <ul style="list-style-type: none"> <li>• alternative designs</li> <li>• a detailed database structure</li> <li>• test data.</li> </ul>	2B.D2 Justify final design decisions, explaining how the relational database will fulfil the stated purpose and user requirements, and any constraints in the design.
1B.3 Produce a design for a database with guidance, including a single table database structure with a data entry form.	2B.P3 Produce a design for a relational database, including: <ul style="list-style-type: none"> <li>• a database structure</li> <li>• a test plan.</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim C: Develop and test a relational database			
1C.4 Develop a database with a realistic data set with guidance, including: <ul style="list-style-type: none"><li>• a single table structure</li><li>• a data-entry form.</li></ul>	2C.P4 Develop a relational database with a realistic data set, which includes: <ul style="list-style-type: none"><li>• two tables</li><li>• sort records</li><li>• data-entry forms.</li></ul>	2C.M3 Develop the database demonstrating awareness of users' requirements and accuracy. To include: <ul style="list-style-type: none"><li>• customised data-entry forms</li><li>• queries and output data reports</li><li>• onscreen navigation and guidance</li></ul>	2C.D3 Refine the database solution using automated tools and techniques to improve productivity, accuracy and the presentation of output data, taking account of user feedback.*
1C.5 Test the functionality of the database and repair any faults with guidance.*	2C.P5 Test the functionality and purpose of the relational database for functionality, repairing any faults.*	2C.M4 Gather feedback from others and use it to improve the database and test any additional functionality, repairing any faults.*	
Learning aim D: Review the finished relational database			
1D.6 Identify how the final database is suitable for the user requirements and purpose.	2D.P6 Explain how the final database is suitable for the user requirements and purpose.	2D.M5 Review the extent to which the finished database meets the user requirements, considering feedback from others.	2D.D4 Evaluate the finished database against the design and justify any changes made, making recommendations for further improvements to the database.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resource required for this unit is database software that allows the creation and use of relational database structures.

Learners will also need a brief to design and develop a database against.

A brief should include:

- purpose
- 'client' and user requirements for the database
- task(s) the database must perform
- information the database must supply, in what form and to whom
- data to be input into the database, how and from where
- the processing that is required in the database
- the level of security needed to access the database.

The tasks, data and processing in the brief must meet the following requirements (as a minimum):

- at least two tables with appropriate field attributes, including names, sizes formats, data types, validation rules and text
- define appropriate primary and foreign keys
- a given data set containing at least 50 records
- at least one one-to-many relationship between at least two tables
- sort records using single and multiple fields
- at least two data-entry forms, which enables entry of data into single and/or multiple tables
- a main menu form, which links to the data-entry sub-forms and includes options to run queries and view reports
- at least five queries, which searches for meaningful information using single and multiple criteria in at least two tables, using relational and logical operators and wildcards
- at least three reports to present meaningful information for a purpose and audience.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

Learners will investigate databases by describing the main uses of databases, as well as the purpose of the tool/techniques they include.

**For 2A.P1:** learners should explain the uses of databases and how the tools/techniques are used in two given databases, e.g. an appointment system for a doctor's surgery that stores records of patients, appointments and medical history, with the intention of using features such as reports to identify the numbers of cancelled appointments in any given month. The two databases should be designed for different purposes.

*For level 1, as a minimum, learners should identify the uses of databases and how the tools/techniques are used for two databases, including tables, fields, records, queries and reports.*

**For 2A.M1:** learners should explain how the tools/techniques of the databases could improve productivity, accuracy and usability, e.g. sending an automated mail shot to every patient in the database using their address details, explaining important news about the surgery.

**For 2A.D1:** learners should look at the databases in more detail and consider the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

### **Learning aim B**

Learners should now have an understanding of what databases are and should be able to distinguish between different types of databases. They will be able to apply what they find out during their investigation of databases in the development of their own relational database.

Learners will design, develop and test a relational database.

Learners should be given a brief, which will allow them to design a relational database for a given purpose. The brief should ideally be written with a 'client' in mind, including clear objectives of what they want the database to perform and present. This will include a data set containing at least 50 records that learners will be expected to import into the database.

Centres are encouraged to use evidence from the development of the database as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** To produce a design for a relational database, learners must first be able to understand and interpret the purpose and users requirements for the product, relating this to design ideas for the product. They should be able to provide a description of the relational database and what it is intended to be used for.

*For level 1, as a minimum, learners should identify the user requirements and purpose for the design of their database.*

**For 2B.P3:** learners need to provide a database structure, including at least two tables with appropriate field attributes (e.g. names, sizes, formats, data types), an entity relationship diagram illustrating at least one, one-to-many relationship and a data input form. Learners must also provide a test plan giving an outline of the range of tests that they will perform when the relational database is developed.

*For level 1, as a minimum, learners should have created with guidance, an outline design for their relational database. Their outline design will contain a single table database structure with appropriate field attributes and input/output screen for a data entry form.*

**For 2B.M2:** learners will need to consider alternative design ideas to suit audience and purpose including:

- different ways of presenting reports and forms.
- A detailed database structure including what validation and verification procedures would apply to the data. Learners will also need to provide an input and output screen/form for a main menu with options to access at least two data-entry sub-forms, run queries and view reports. All forms at this stage should be customised to meet audience and purpose. Examples include applying appropriate logos, themes, titles and user instructions. Learners must include some test data as part of the test plan, which should reflect the user requirements.
- an outline of at least five queries and three reports that will extract and present meaningful information.

**For 2B.D2:** learners should justify their final design decisions, explaining how the relational database will fulfil the stated purpose and user requirements. Learners must also think about the constraints, e.g. software availability and whether or not this will have an impact on developing the relational database. If it does, learners should consider whether there are any alternatives for developing the same solution. Learners should explain why alternative designs were rejected.

### Learning aim C

Learners will have a design of what their intended database will do, how it will be structured and how it will be tested. They should therefore be ready to apply their practical skills and knowledge to develop and test a relational database.

**For 2C.P4:** learners should use appropriate software resources (identified in their design) to develop their relational database. The relational database that they design must demonstrate awareness of the purpose of the database and user requirements.

As a minimum, learners should have developed a relational database that demonstrates the following competencies (as defined in the brief):

- consists of at least two tables with appropriate field attributes including names, sizes formats, data types, validation rules and text
- has defined primary and foreign key(s)
- has tables populated with a combined data set containing at least 50 records
- has at least one example of a one-to-many relationship
- sorts records using single and multiple fields alphabetically or numerically in ascending or descending order
- includes at least two data-entry forms.

*For level 1, as a minimum, learners should have developed a database with assistance from the teacher, which includes a single table with appropriate field attributes and an input form for data entry.*

**For 2C.M3:** learners will develop the database, demonstrating an awareness of the intended user requirements and accuracy by:

- creating reports to present meaningful information, using features (e.g. titles, page layouts, colours, field selection, date/time, grouping, introductions and images)
- customising data-entry forms, to enable entry of data into single and multiple tables. The fields should have appropriate entry-form field lengths, have clear labelling of entry-form fields, provide instruction fields where necessary and include validation checks on field entries where appropriate and facilitate navigation
- creating and editing a main menu form with options to access other forms, queries and reports
- searching with single and multiple criteria on one or two fields in at least two tables, using relational and logical operators and wildcards
- onscreen user navigation and guidance.

**For 2C.P5:** learners will be expected to follow their test plans (as defined in their design) and test the functionality and purpose of their database.



Learners are likely to experience technical difficulties as they develop their database. Where this happens, learners will be expected to resolve these difficulties, and by doing so will have made the necessary repairs to their database. It is important that learners make appropriate comments on their designs and test plans about any issues they discover and how they resolved them.

*For level 1, as a minimum, Learners must show they have tested for the functionality of their database. Learners will need guidance to test their database.*

**For 2C.M4:** over and above the existing functionality testing, learners will also be required to test the functionality of the additional features of the database, as implemented for 2C.M3.

Learners will also complete usability testing with the help of at least one person who can act as the 'client'. The 'client' should comment on the functionality and usability of the relational database. Learners should record this feedback as part of the testing process.

**For 2C.D3:** teachers should recognise that the process of developing and testing a database is an iterative process. When making refinements to their database, learners should take into account their test results and feedback.

Learners should refine the database solution using automated tools and techniques to improve productivity, accuracy and the presentation of output data. The database should include:

- error messages resulting from validation and verification checks to data (including queries and reports) and the user interface (forms)
- onscreen user guidance to assist users with the user interface, particularly with instructions on how to navigate throughout the forms, data entry and data management, queries and reports
- automations (e.g. the ability to automate tasks using macros).
- Learners will also be expected to make refinements to their databases by taking account of their test results and feedback from the 'client'.

All of the ideas from testing, feedback and reviewing their designs as they create the database should have been considered as how best to refine the product.

### Learning aim D

**For 2D.P6:** learners should explain why their final database meets the user requirements and purpose.

*For level 1, as a minimum, learners should have identified how their database meets the purpose and user requirements.*

**For 2D.M5:** learners should build on the comments they made for the pass criteria, and should refer back to the user requirements as defined in their design when doing so. They should also seek feedback from another person about the final relational database. An interview would be an ideal way of discussing the relational database and recording the feedback. Learners should use this feedback to identify strengths and potential improvements.

**For 2D.D4:** learners should evaluate their design against the final database in terms of overall user experience and user requirements in the original brief. They should justify any changes that were made through the development of the database and explain the rationale for the changes. Refinements could include exporting data, using data to create mail shots, macros, complex queries, etc. They should also give at least three recommendations for any further improvements, but do not need to implement the enhancements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

An idea for a scenario is:

- an endangered animal's charity needs a database of all the animals that it supports.
- members will be able to use the database online to search for information and to generate reports.

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.M1, 2A.D1, (1A.1)	How and Why are Databases Used?	<p>You work for a local health authority and have been asked to develop simple information management systems for doctors' surgeries to use in the area. Before you design a database solution, you want to prepare a demonstration to show how databases are currently used in two different ways by organisations.</p> <p>Write a short description of the use and features of databases in two different organisations. How does each database improve productivity?</p>	<ul style="list-style-type: none"> <li>• A short report.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P2, 2B.M2 2B.P3, 2B.D2 (1B.2, 1B.3)	Designing a Database for a Doctor's Surgery	<p>You begin your design of an information system by designing a database for a doctor's surgery for a new appointment system. The surgery has five doctors.</p> <p>Design a database to store service users' details and their appointments, with appropriate fields. Your design should include:</p> <ul style="list-style-type: none"> <li>• at least two tables</li> <li>• an entity relationship diagram</li> <li>• input and output screens</li> <li>• at least two data-entry forms for new service users and appointments</li> <li>• at least one main menu form that accesses at least two data-entry sub-forms, including options to view queries and reports.</li> </ul> <p>The design should include the structure, validation, queries and reports that will extract and present meaningful information and a test plan with test data.</p> <p>Customise your forms.</p> <p>Justify how your design meets the requirements of the doctor's surgery.</p>	<ul style="list-style-type: none"> <li>• Database design documents</li> <li>• Structure</li> <li>• Justification.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2C.P4, 2C.M3, (1C.4), 2C.P5, 2C.M4, (1C. 5), 2C.D3	Developing Your Database	<p>You should now develop your pilot database and test it out with some users.</p> <p>Create the database structure and build a relationship between the tables. Add appropriate data validation.</p> <p>Your database should be able to sort records alphabetically or numerically, in ascending and descending order. Create two data-entry forms that are suitable for staff use, e.g. adding new patients and new appointments.</p> <p>Create one main menu form that will allow staff to navigate between all forms (e.g. data-entry sub-forms) and be able to run queries and view reports.</p> <p>Create appropriate queries that will search for patient or appointment data, e.g. a service user's address or medical history.</p> <p>Create appropriate reports that will extract and present information, e.g. a report of missed appointments in any given day, week or month.</p> <p>Populate your database with the given dataset.</p> <p>Test your database (including any validation rules). Repair any features that do not work.</p> <p>Get the opinion of at least one other person on your database in terms of how easy it is to use.</p> <p>Improve your database.</p>	<ul style="list-style-type: none"> <li>• Database</li> <li>• Annotated design documents</li> <li>• Witness statement and observation records</li> <li>• Updated versions of files</li> <li>• Feedback from users.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2D.P6, 2D.M5, 2D.D4	Reviewing Your Database	<p>You now need to review your database solution before you present it to your manager or roll it out across surgeries in the local area.</p> <p>Give at least three strengths and one improvement you could make to your database.</p> <p>Does your finished database meet the brief given by the doctor's surgery? How does it meet the requirements of the brief? How is it suitable for the users?</p> <p>What changes did you make to your designs? Explain any changes made. How would you improve your database to roll it out for other surgeries?</p>	<ul style="list-style-type: none"> <li>• A report</li> <li>• Annotation of design and feedback responses.</li> </ul>



# Unit 11: Computer Networks

Level: **1 and 2**

Unit type: **Mandatory or Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Computer networking is an important part of our daily business and personal lives that most people take for granted. Without networks, many of the tools and systems used by business and individuals would not function: we couldn't surf the worldwide web, send and receive emails, or use a variety of devices such as a smartphone, laptop or games console to communicate with friends and family online.

So, what is computer networking? In its simplest form, computer networking is a collection of interconnected, wired or wireless, hardware devices and associated software that allows computers to communicate and share resources with each other.

There are a number of job roles that involve working with computer networks. These include:

- network engineers who design, develop, test, operate and support computer networks and services
- network managers who ensure that the network capacity can meet an organisation's needs and that it is secure
- IT support technicians who find and correct software and hardware problems for computer users, including problems in computer networks.

In this unit, you will come to understand the features and uses of computer networks by exploring what networks are, as well as the different types of network and how they affect user experience. You will investigate issues such as reliability (frequency of network failure and performance) and how quickly data are transferred across the network under different conditions. You will be able to apply some of your findings to your own computer network. You will also learn about the different hardware and software devices needed for networking, and how these can be combined to make a computer network. You will also put your knowledge and skills into practice by designing, developing and testing your own computer network for a brief. Once completed, you will review your network against the brief and obtain feedback from the client and from others, and evaluate possible improvements.

In particular this unit develops skills from *Unit 1: The Online World*, *Unit 2: Technology Systems* and complements the skills in *Unit 12: Software Development*.

This unit is mandatory in the Systems Development and Support pathway.

## Learning aims

In this unit you will:

- A understand the features and uses of computer networking
- B design a computer network
- C develop and test a computer network
- D review the finished computer network.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the features and uses of computer networking</b></p> <p><b>Computer networks</b></p> <p>Computer networks are a collection of interconnected, wired or wireless, hardware components and software that allow computer devices to communicate and share data with each other.</p> <p><b>Features of computer networks</b></p> <p>Understand the different features of computer networks:</p> <ul style="list-style-type: none"> <li>• connection method (e.g. wired and wireless)</li> <li>• scope or scale (e.g. Local Area Network (LAN), Wide Area Network (WAN), Metropolitan Area Network (MAN), Personal Area Network (PAN), Storage Area Network (SAN))</li> <li>• architecture (e.g. peer-to-peer, client-server)</li> <li>• topology, including:             <ul style="list-style-type: none"> <li>◦ physical (e.g. star, bus, ring, mesh, tree and point-to-point)</li> <li>◦ logical (e.g. Ethernet and token ring)</li> </ul> </li> <li>• protocols and their function (e.g. Ethernet, Internet Protocol (IP), Transmission Control Protocol (TCP))</li> <li>• security (with regard to files, folders, data, network access, resources)</li> <li>• utilities (e.g. virus protection, access control, backup, remote desktop)</li> <li>• services (e.g. login, user account management, file/folder permissions to an individual user/group of users, security, software deployment)</li> <li>• users (e.g. can be used by individuals or groups of people arranged in different ways for different uses).</li> </ul> <p>Understand how data is transferred across the computer network, e.g. packet routing, transmission modes (half duplex, duplex, serial and parallel) and transfer rates.</p> <p><b>Uses of a computer network</b></p> <p>Use of networks, e.g.:</p> <ul style="list-style-type: none"> <li>• communication (e.g. email, instant messaging, social networking, blogs, forums, wikis, web conferencing)</li> <li>• sharing hardware resources (e.g. internet, printer, scanner, storage, processing power)</li> <li>• exchanging information (e.g. files, data and other types of information)</li> <li>• multi-user environments (e.g. gaming, collaborative working)</li> <li>• storage (e.g. files, data centres)</li> <li>• applications (e.g. online databases, online spreadsheets, intranet, extranet).</li> </ul> <p style="text-align: right;"><i>continued</i></p>



**What needs to be learnt**

Consider how these features could affect productivity or the user experience, e.g.:

- record keeping
- increasing speed
- sharing information securely
- backing up
- keeping individuals informed
- collaborative working
- playing computer games in a multi-player gaming environment.

**What needs to be learnt****Learning aim B: Design a computer network****Designing a network**

Requirements of the brief, to include:

- purpose
- requirements/objectives/activities (refer to assessment guidance)
- details of the users and their roles/function (including number of users)
- size/geographical spread/location
- costs (budget)
- constraints.

Initial design ideas and alternative solutions to developing the intended computer network. There will be more than one way to develop the same computer network using different topologies, hardware components and network architectures.

**Hardware components in the network**

Features of hardware components:

- their role/purpose
- how they connect
- how they communicate with other components in the intended computer network.

Hardware components, e.g.:

- computer systems/workstations/servers
- network adapters (wired/wireless)
- router (wired/wireless)
- hub
- switch
- network cabling (e.g. fibre optics, UTP, STP, coaxial; connectors)
- wireless (e.g. infrared, Bluetooth, laser, narrow-band [single-frequency] radio).

**Software components in the network**

Features of software components:

- their role/purpose
- their relationship with other components in the intended computer network.

Software components, to include:

- applications (e.g. internet browsers, firewalls, email, antivirus, network utilities (remote management), office applications)
- operating system with appropriate utilities capable of operating in a network environment.

Constraints to consider:

- costs (e.g. component cost for the intended computer network)
- technical constraints (e.g. hardware and software availability).

*continued*

**What needs to be learnt****Design documentation**

To include:

- computer network set-up and configuration, e.g. IP addressing/subnet masks (if appropriate), security, sharing files and folders, access permissions for users, managing user accounts (add, remove and amend), and sharing hardware/software resources, e.g. internet, printers, storage devices
- network user rights (e.g. administration rights, access control rights, shared resource rights)
- network diagram (e.g. structure of the network, components, positioning of the components, connection medium and IP addresses (if applicable))
- test plan with test data to test functionality (e.g. testing the connectivity between all devices on the network).

**What needs to be learnt****Learning aim C: Develop and test a computer network****Develop a computer network**

Develop a peer-to-peer or client-server network (depending on hardware and software resource availability) that meets the brief.

**Gathering components**

Network components to gather:

- a minimum of two computer systems/workstations/clients
- a server (if appropriate and resources available)
- simulated software, such as Packet Tracer (if no hardware and software resources are available)
- network adapters (wired or wireless)
- network cabling (if wired)
- a hub/router/switch (if networking more than two computer systems/workstations/clients)
- a server operating system (if building a client-server network)
- operating system (e.g. adding/removing/amending users, sharing files and folders, setting access permissions to files and folders, installing applications, sharing hardware resources, i.e. printer or any other network device)
- utilities (e.g. remote desktop management, user rights, access control, firewall configuration, anti-virus, scheduling).

**Health and safety when developing a network**

Health and safety issues, e.g. hardware, electrical connection risks and guidelines, handling equipment.

**Testing the network**

- Test the computer network for functionality/connectivity using command tools, such as ipconfig and ping (reliability, performance, e.g. time to transfer a file across the network).
- Use the full range of utilities/services provided by the operating system to test other aspects of the network (e.g. shared resources, user accounts, access control, file/folder permissions).
- Feedback from 'client' (e.g. functionality, usability, requirements, performance).
- Potential improvements to the computer network (e.g. performance, capacity, accessibility, portability, reliability, security).

**Learning aim D: Review the finished computer network**

Review the finished computer network against:

- user requirements
- purpose
- user experience (e.g. reliability, performance)
- constraints (e.g. hardware and software availability).

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the features and uses of computer networking</b>			
1A.1 Identify the uses and features of a different computer network.	2A.P1 Explain the uses and features of a different computer network.	2A.M1 Review how the uses and features of a different computer network affect the user experience.	2A.D1 Discuss the strengths and weaknesses of the network.
<b>Learning aim B: Design a computer network</b>			
1B.2 Identify the purpose and 'client' requirements for the network.	2B.P2 Describe the purpose and 'client' requirements for the network.	2B.M2 Produce a detailed design for a computer network including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• an outline of how the computer network will be set up and configured</li> <li>• test data</li> <li>• costs involved with setting up the computer network.</li> </ul>	2B.D2 Justify final design decisions, explaining how the computer network will fulfil the stated purpose and 'client' requirements, describing the impact of any constraints on the design.
1B.3 Produce a design for a computer network, with guidance, including: <ul style="list-style-type: none"> <li>• a list of hardware and software components</li> <li>• the number of network users</li> <li>• an outline network diagram.</li> </ul>	2B.P3 Produce a design for a computer network including: <ul style="list-style-type: none"> <li>• a list of hardware and software components, their role, and how they connect and communicate with each other</li> <li>• a network diagram</li> <li>• a test plan.</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
Learning aim C: Develop and test a computer network			
1C.4 Develop a computer network, with guidance, that has: <ul style="list-style-type: none"><li>at least two network users</li><li>network users sharing one folder and three files.</li></ul>	2C.P4 Develop a computer network that has: <ul style="list-style-type: none"><li>at least three network users</li><li>users sharing at least five folders and at least seven files.</li></ul>	2C.M3 Develop a complex computer network with at least one additional shared hardware device and network utility software resource, demonstrating awareness of the original requirements.	2C.D3 Refine the computer network in order to improve performance and reliability, taking account of feedback.
1C.5 Test the computer network for connectivity, with guidance.	2C.P5 Test the computer network for functionality, connectivity against original requirements, and repair any faults as necessary.	2C.M4 Test the computer network and gather feedback, and use it to improve the computer network on user experience for functionality and connectivity.	
Learning aim D: Review the finished computer network			
1D.6 For the final computer network, identify how it is suitable for the intended purpose and original requirements.	2D.P6 For the final computer network, explain how the final computer network is suitable for the intended original requirements and purpose.	2D.M5 Review the extent to which the final computer network meets the original requirements while considering feedback.	2D.D4 Evaluate the initial designs against the final computer network and justify any changes that were made, making recommendations for further improvements to the computer network.

## Teacher guidance

### Resources

The special resource required for this unit is access to networking hardware components and software. Learners can also use network simulators, such as Packet Tracer to develop their understanding of concepts.

Hardware and software resources will be needed for the practical aspects of the unit. As a minimum, each learner will need access to two PCs with network adapters, cabling (if wired), wireless router (if wireless) and appropriate software, and simple manuals for the setting up and testing of the computer network. If there are more than two PCs, a hub or router will be required to connect them together.

The practical activities, although limited, should take place in a workshop with appropriate tools, and take account of health and safety requirements. Access to technical support is valuable, unless the teacher is very experienced.

To illustrate concepts and aid demonstrations, a wide range of current hardware components should be available for learners to study and use.

Learners will require an appropriate brief in order to design the network, and access to the 'client' (potentially the teacher) in order to get feedback about the network.

What they observe and find out during the investigation in learning aim A can be applied in the development of their own computer network.

For this unit, learners will need good background materials in the form of handouts, and diagrams of network structures and network operations.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

Learners will investigate computer networks, describing the main uses and features of a network.

**For 2A.P1:** learners should explain the uses and features of a given computer network. For example, what features a computer network requires, allowing people to play computer games simultaneously in a multi-player gaming environment.

The two computer networks should be designed for different purposes.

*For level 1, as a minimum, learners should have identified uses and features of computer networks. For a given network, they are likely to have identified only the main features and the main uses of the network, without any description which relates the two together.*

**For 2A.M1:** learners should review how the uses and features of a given computer network could affect the user experience, e.g. reliability (frequency of network failure) and performance (how quickly data is transferred across the network under different conditions). The learner should explain how different features in the network affect the user experience, e.g. speed, connectivity, reliability.

**For 2A.D1:** learners should look at one computer network in more detail and discuss the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

## Learning aim B

Learners should now have an understanding of what computer networks are used for, and their features. Learners will design, develop and test their own computer network. They have a choice of designing either a **peer-to-peer** or **client-server** network, depending on hardware and software resource availability.

Learners should be given a brief, which will allow them to design a computer network. The brief should ideally be written with a 'client' in mind with clearly stated resource requirements and objectives.

The brief must include the following requirements (as a minimum):

- create at least three network users, one of whom must be a network administrator with full control over the computer network
- create at least five shared folders and seven shared files, with different access permissions for different users
- configure network users, e.g. place in groups, set login restrictions, disable accounts
- create at least one shared hardware network resource, e.g. printer, scanner, external storage device
- configure network users, e.g. add more users, remove existing users, change passwords(s), change access rights, set login restrictions, disable user accounts
- setup use of network utilities, e.g. remote desktop, instant messaging, antivirus, firewall.

Centres are encouraged to use evidence from the development of the network as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** in order to produce a design for a computer network, learners must first be able to understand and interpret the requirements from the brief for the product. They should be able to provide a description of the 'client' requirements for the computer network, and its intended use.

*For level 1, as a minimum, learners will identify the 'client' requirements for the network and its intended purpose.*

**For 2B.P3:** learners will design the network. This should include a description of users' needs, and their role when using the computer network. For example, one or more users may be given administrator responsibilities for maintaining the computer network. Learners need to provide a structure for their computer network, which must include a list of hardware components and software resources, the names and roles of the people that will be using the network, the role of the networking components and how they connect or communicate with each other. They should also provide a network diagram showing the structure of the network, network devices and other equipment, positioning of network devices and equipment, connection medium and IP address (if applicable).

Learners must also provide a test plan, giving an outline of the range of tests that they will perform when the network is developed.

*For level 1, as a minimum, learners should have created an outline design for their computer network. An outline design would contain a list of hardware and software components, the number of users, and an outline network diagram illustrating the network devices and their connections.*



**For 2B.M2:** learners should include some alternative solutions within their design documentation. For example, variations of how the same network can be developed, either by changing the physical or logical topologies or changing the network components. They must have also considered how their computer network will be set up and configured; for example, setting up IP addresses and subnet masks, and setting up different access permissions for individual or groups of network users. All network users will be expected to have a username and password to access the computer network. Learners must have also considered the costs involved with setting up a network, in terms of the hardware components and software resources. Learners must include some test data as part of the test plan, which should reflect the 'client' requirements.

**For 2B.D2:** learners should justify their design decisions, including their final choice of network design and why they chose one design compared to another. Learners should be able to reference that to the given purpose and 'client' requirements. Learners must also think about constraints, e.g. hardware and software availability, and whether or not this will have an impact on developing the computer network. If it does, are there any alternatives for developing the same solution? Learners should explain why alternative designs were rejected.

### Learning aim C

Learners will have a design of what their intended computer network will do, what it will consist of, where it will be located, how it will be connected, set up and configured, and how it will be tested. They should therefore be ready to apply their practical skills and knowledge to develop and test a computer network.

**For 2C.P4:** learners should use appropriate hardware components and software resources (identified in their design) to develop their computer network. The computer network that they build must demonstrate awareness of the purpose of the network and the 'client' requirements.

As a minimum, learners should have developed a computer network that has (as defined in the brief):

- at least three network users, one of whom is a network administrator
- users sharing of at least five folders and seven files, which have different access permissions for the three network users.

*For level 1, as a minimum, learners should have developed a computer network which shows that they have been able to set up at least two network users, and create and share one folder and three files (with no access permissions).*

**For 2C.M3:** as a minimum, learners will develop a more complex computer network, with the addition of at least one additional hardware device and software resource. These could include a printer, scanner, external storage device, internet or email. They will share and configure the hardware device(s) and utilities on the network.

**For 2C.P5:** learners will be expected to follow their test plans (as defined in their design) and test the functionality and connectivity of their computer network, in terms of checking the physical connections and electronic communication between devices. They should also test that the network meets their 'client' requirements.

Learners are likely to experience technical difficulties as they develop their computer network. Where this happens, learners will be expected to resolve these difficulties, and by doing so will have made the necessary repairs to their computer network. It is important that learners make appropriate comments in their designs and test plans about any issues they discover, and how they have resolved them. Where appropriate to do so, photographs of problems and solutions or witness statements and observation records can be used as evidence of this process.

Learners must adhere to all health and safety guidelines when undertaking practical activities with electronic equipment.

*For level 1, as a minimum, learners must show that they have tested connectivity between at least two network devices, e.g. computer systems in the network.*

**For 2C.M4:** learners will be required to test the functionality of the additional hardware device(s) and software resource(s) over and above the existing functionality testing.

Learners will also complete user-experience testing with the help of at least one person who can act as the 'client'. The 'client' should be commenting on the functionality, performance and reliability of the computer network. Learners should record this feedback as part of the testing process.

**For 2C.D3:** teachers should recognise that the process of developing and testing networks is an iterative process. When making refinements to their network, learners should take into account their test results and feedback.

Learners should refine their network to improve the reliability and performance. If it is not possible for learners to apply their improvements (for example, due to software or hardware constraints), learners should explain what they would do if they had the opportunity focusing on reliability and performance. Learners will also be expected to make refinements following their test results and the feedback from the 'client'.

Refinements could include configuring the computer network, such as configuring the users, e.g. adding more users, removing existing users, changing access rights, setting login permissions, disabling accounts, or demonstrating a range of networking utilities, such as remote desktop.

All of the ideas from testing, feedback and reviewing the computer network should have been considered as learners go through the refinement process.

### **Learning aim D**

**For 2D.P6:** learners should explain why their network is suitable for the intended purpose and the original requirements.

*For level 1, as a minimum, learners should have identified how their network is suitable for the purpose and the original requirements.*

**For 2D.M5:** learners should build on the explanations for the Pass criteria, and review how well the 'client' requirements and purpose have been met. They should also seek feedback from the 'client' about the final network. An interview would be an ideal way of discussing the computer network and recording the feedback.

Learners should use this feedback to identify strengths and potential improvements for their network.

**For 2D.D4:** learners should evaluate the initial designs/solutions against the final computer network in terms of costs, overall user experience, and purpose and 'client' requirements in the original brief. They should justify any changes that were made and explain the rationale for those changes. They should also give recommendations for at least three improvements, but do not need to implement the enhancements.

## Suggested assignment scenario

The information below is guidance only, and centres should refer to the suggested assessment outline table for more information.

### Suggested scenario

You work for a network development company called Dayce Networking Solutions.

A new 'client' wants your company to design and develop a small computer network for their office in a nearby town. There is currently a team of eight people working in the office. These people are all using stand-alone computer systems, one of which is connected to a laser printer.

The 'client' has given the following requirements.

- All team members must be able to access and use the computer network.
- The computer network must be configured to allow adding more users, changing access rights, and setting login restrictions.
- All team members must have their own individual folder on the computer network with full access rights. Everyone should be able to access each other's folders with different access rights. This should be configured for at least six people.
- Everyone will be working with a minimum of seven files on the network.
- All computers in the network must be able to connect to the laser printer.
- The computer network should make use of remote desktop to allow users to take control of other computers in the network.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Investigation	<p>For the scenario, the 'client' wants to know a little more about what a computer network is, its features and potential uses.</p> <p>The 'client' also wants to know how these features and uses could improve the user experience of the network.</p> <p>You need to consider strengths and weaknesses of two existing networks.</p> <p>Prepare a presentation or a report for the 'client'.</p>	<ul style="list-style-type: none"> <li>• Web page.</li> <li>• Presentation.</li> <li>• Report.</li> <li>• Interview.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.M2, 2B.P3, 2B.D2	Designing a Computer Network	<p>You have been given a brief by your company, Dayce Networking Solutions.</p> <p>Your task is to design a network solution to fulfil your 'client' requirements.</p> <p>Prepare design documentation to include:</p> <ul style="list-style-type: none"> <li>• a description of the computer network, and what it will be used for</li> <li>• a list of components, with an explanation about their role, and how they will connect/communicate with each other on the computer network</li> <li>• the names of all people that will become users of the computer network, and their role in the network</li> <li>• details of how the computer network will be configured</li> <li>• a network diagram</li> <li>• a list of hardware constraints and software availability</li> <li>• a test plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Web page.</li> <li>• Report.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.M3, 2C.P5, 2C.M4, 2C.D3	Developing a Computer Network	<p>Develop a computer network for your 'client'. You must include the following:</p> <ul style="list-style-type: none"> <li>• addition of at least three network users, one of whom must be a network administrator who has full control over the computer network</li> <li>• sharing at least five folders and seven files, which have different access permissions for different users</li> <li>• sharing at least one hardware/software network resource, e.g. printer, scanner, external storage device, internet, email</li> <li>• configuring network users, e.g. adding more users, removing existing users, changing a password, changing access rights, setting login restrictions, disabling accounts</li> <li>• use network utilities, e.g. remote desktop, instant messaging, antivirus, firewall.</li> </ul> <p>Test and document the computer network. Make any necessary improvements to the computer network as a result of troubleshooting the computer network. Meet with your 'client' to discuss your progress and to gather some feedback about your computer network. Refine your computer network, taking on board feedback from your 'client' and test results.</p>	<ul style="list-style-type: none"> <li>• Witness statements.</li> <li>• Observation records.</li> </ul>
1D.6 2D.P6, 2D.M5, 2D.D4	Review the Finished Computer Network	Evaluate the computer network, justifying why it meets the brief, suggest improvements and consider any constraints.	<ul style="list-style-type: none"> <li>• Report.</li> </ul>

# Unit 12: Software Development

Level: **1 and 2**

Unit type: **Mandatory or Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

We live in an age of computer devices, which organisations and individuals have come to rely on. Computer devices are everywhere and advances in these take place daily. It is essential for organisations and IT professionals to develop and maintain software programs that bring to life the technology we all rely on.

Being able to create software programs could give you a brilliant opportunity for a varied, interesting, challenging and prosperous career that few other vocational sectors can match. Software developers or engineers develop, test and maintain computer programs to solve problems and/or improve productivity. To create successful programs, you have to develop good problem-solving and creative-thinking skills. In addition, businesses are likely to employ teams of people to develop software programs, including system analysts who examine IT systems and business processes.

In this unit, you will learn the rules of a programming language and how to write code to develop a successful program. You will be able to apply some of your findings to your own software solutions.

In addition, you will learn what factors affect the quality of the program and how to produce good quality programs. You will design and develop your own software program to fulfil a brief. You will test your programs for functionality and purpose, and identify and repair faults. You will review your finished program, having obtained feedback from others, and evaluate possible improvements.

This unit is not platform dependent and a range of program-development environments can be used.

In particular this unit develops skills from *Unit 2: Technology Systems* and it complements the delivery of *Unit 8: Mobile Apps Development*.

This unit is mandatory in the Computer Science pathway.

## Learning aims

In this unit you will:

- A understand the characteristics and uses of a software program
- B design a software program
- C develop and test a software program
- D review the finished software program.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the characteristics and uses of a software program</b></p> <p><b>Why is software used?</b></p> <p>Software programs instruct a computer's central processing unit (CPU) to automatically carry out a set of instructions used to solve a problem and/or improve productivity.</p> <p>Know why we develop software programs and their uses, e.g.:</p> <ul style="list-style-type: none"> <li>• gaming and entertainment (e.g. computer games, CGI in movies, virtual worlds, social networking)</li> <li>• increasing productivity (e.g. automating processes in manufacturing, stock control systems)</li> <li>• information storage and management (e.g. stock control systems, booking systems)</li> <li>• completing repetitive tasks (e.g. control robotic arms in manufacturing) and dangerous tasks (e.g. defusing explosive devices, nuclear plants)</li> <li>• solving complex problems (e.g. weather forecasting).</li> </ul> <p><b>Characteristics of software programs:</b></p> <ul style="list-style-type: none"> <li>• programming languages</li> <li>• constructs and techniques.</li> </ul> <p><b>Programming languages</b></p> <p>Types of programming language, including procedural languages like Pascal, C and Cobol, and event-driven languages such as VB, VB.NET, VBA, Visual C++.</p> <p>Programming languages contain a range of constructs and techniques, including:</p> <ul style="list-style-type: none"> <li>• command words</li> <li>• subroutines</li> <li>• basic string handling</li> <li>• basic file handling</li> <li>• data structures</li> <li>• event handling.</li> </ul> <p>Understand:</p> <ul style="list-style-type: none"> <li>• the reasons for compiling programs</li> <li>• there are a variety of program design methods</li> <li>• how flowcharts can be used to represent the processes within programs.</li> </ul> <p style="text-align: right;"><i>continued</i></p>



**What needs to be learnt****Quality of software programs**

Know that software design and techniques affect the quality of the program developed:

- efficiency/performance, e.g. the amount of system resources a program consumes (processor time, memory space, accessing storage media)
- maintainability, e.g. the ease with which a program can be modified by its present or future developers in order to carry out corrective, perfective or adaptive alterations to the code
- portability, e.g. the range of computer hardware and operating system platforms on which the source code of a program can be run/compiled/interpreted
- reliability, e.g. the accuracy of its outputs
- robustness, e.g. the quality of the coding that ensures the extreme data can be processed without causing the program to crash
- usability, e.g. the ease with which an end user can use the program for its intended purpose or, in some cases, even unanticipated purposes.

**What needs to be learnt****Learning aim B: Design a software program****Software development life cycle**

Software development life cycle, which includes:

- assess requirements
- design specification, e.g.:
  - scope
  - inputs
  - outputs
  - processing
  - user interface
  - constraints (e.g. programming language and timescales for development)
- develop code
- test
- maintain.

**Designing software**

Designs include:

- intended purpose and user requirements (as defined in a brief)
- a problem definition statement
- a proposed solution using design tools, e.g.:
  - a description of the main program tasks – input and output format (such as to add two numbers together and display a result)
  - screen layouts and navigation, including prototypes (e.g. initial splash screen or main activity screen)
  - algorithms with a description of the method of solution (such as, flowcharts, pseudocode and events)
  - data structures
  - data storage
  - control structures
  - data validation
  - error handling and reporting
- a brief outline of alternative solutions for the intended software program (e.g. for screen layout and navigation)
- a list of any pre-defined programs and/or code snippets and their sources
- test plan with test data (e.g. testing the inputs and expected outputs and compilation of the code)
- constraints (e.g. device capabilities including connectivity, memory storage or programming language).

**What needs to be learnt****Learning aim C: Develop and test a software program****Developing software**

Develop software:

- understand a development environment to produce code
- develop and refine the software program using suitable programming language constructs and techniques
- use program constructs and techniques.

**Constructs and techniques**

Program constructs, e.g.:

- comments
- constants (variables with a constant value that cannot change)
- operators (arithmetic [+ , - , \* , / , %] and logical [< , <= , > , >= , AND , OR , true , false])
- reserved words (which have special meaning within the programming language and are used to write instructions in a program, e.g. in Visual Basic 'Get' and 'Repeat' are reserved words)
- input and output commands
- local variables (exist only inside the subroutine/function where they are declared and used)
- global variables (exist throughout the entire program and in subroutines/functions)
- assignment
- sequence
- counter controlled loops
- conditional loops
- iteration (while do, repeat ... until, for ... next)
- sequential statements, selections (if ... then ... else)
- recursion
- subroutines/functions/procedures.

Data types, e.g.:

- character
- string (text)
- integer and real (numbers)
- Boolean.

Use basic string-handling commands to examine individual characters and substrings.

*continued*

### What needs to be learnt

Basic file-handling operations, e.g.:

- open
- read
- write
- close.

Use data structures:

- user-defined data types and record structures
- arrays.

Event handling:

- forms
- assigning properties to screen components, e.g. buttons, boxes, data validation and drop-down lists
- actions
- imported structures.

Annotate the code to demonstrate understanding and to allow effective repair/debugging of the program and for maintainability.

Compile the program into a suitable format to create an executable program.

### Testing and refining the software

Test the program solution:

- for functionality against the test plan with the test data
- by reviewing the quality of the program in terms of reliability, usability, efficiency/performance, maintainability and portability
- gather feedback from others on the quality (reliability, usability, efficiency/performance, maintainability, portability) of the solution.

Document any changes to the design, including changes to the source table for pre-defined assets.

Improvements and/or refinements to the software program.

**What needs to be learnt****Learning aim D: Review the finished software program****Reviewing software**

Review the finished software program for:

- user requirements
- fitness for purpose
- user experience (e.g. ease of navigation)
- constraints (e.g. programming language, time, device capabilities (memory, connectivity))
- quality of the program (e.g. reliability, usability, efficiency/performance, maintainability, portability)
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the characteristics and uses of a software program</b>			
1A.1 Identify the purpose of two simple programs and their characteristics, including tools and techniques used.	2A.P1 Explain the purpose of two simple programs and their characteristics, including tools and techniques used.	2A.M1 Comment on the quality of one of the given simple programs, suggesting any improvements and provide a flowchart to show the processing.	2A.D1 Discuss the strengths and weaknesses of the software program.
<b>Learning aim B: Design a software program</b>			
1B.2 Identify the purpose and user requirements for the software program.	2B.P2 Describe the purpose and user requirements for the software program.	2B.M2 Produce a detailed design for a program, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• a detailed proposed solution using a range of design tools</li> <li>• test data.</li> </ul>	2B.D2 Justify the design decisions, including: <ul style="list-style-type: none"> <li>• how they will fulfil the stated purpose and user requirements</li> <li>• any design constraints.</li> </ul>
1B.3 Produce, with guidance, a design for a program, including: <ul style="list-style-type: none"> <li>• a problem definition statement</li> <li>• an outline of the proposed solution.</li> </ul>	2B.P3 Produce a design for a program, including: <ul style="list-style-type: none"> <li>• a problem definition statement</li> <li>• a proposed solution</li> <li>• a list of any pre-defined functions/subroutines</li> <li>• a test plan.</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Develop and test a software program</b>			
1C.4 With guidance, develop a program for a given brief, that contains: <ul style="list-style-type: none"> <li>• a user interface (input and output)</li> <li>• constructs/techniques.* (Please see guidance)</li> </ul>	2C.P4 Develop a program for a given brief, which includes: <ul style="list-style-type: none"> <li>• a user interface (input and output)</li> <li>• constructs/techniques</li> <li>• commentary throughout the code.*</li> </ul>	2C.M3 Develop a functional program that meets the given brief.*	2C.D3 Refine the software program, taking account of the quality of the code and user feedback.*
1C.5 With guidance, test the program for functionality and against the original requirements and repair any faults.	2C.P5 Test the program for functionality using the test plan and against the original requirements and repair any faults.	2C.M4 Test the program using the test data, gathering feedback from others on the usability and quality of the program, and use it to improve the software program. Repair any faults.	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the finished software program</b>			
1D.6 For the software program, identify how the final program is suitable for purpose and the original requirements.	2D.P6 For the software program, explain how the final software program is suitable for the original requirements and purpose.	2D.M5 Review the extent to which the software program meets the original requirements, considering feedback from others and any constraints.	2D.D4 Evaluate the final software programs against the initial designs and the quality of the code, and justify any changes made, making recommendations for further improvement.

\*Opportunity to assess mathematical skills



## Teacher guidance

### Resources

Centres should consider carefully which programming language(s) they are going to use and whether the language will allow learners to meet all the assessment criteria for this unit. Please note that at level 2 we do not expect learners to develop programs in an object-oriented language.

Teachers may wish to introduce learners to the concepts of programming using an application such as Scratch, available from <http://scratch.mit.edu/download>, or BYOB, which allows users to build their own subroutines. BYOB is available from <http://byobberkeley.edu/>.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Learners will investigate the characteristics of software programs. This includes:

- why software is used
- knowing that different programming languages exist and that they have different constructs/techniques
- functions of the constructs and techniques
- understanding how the quality of the software programs are affected by the design choice of techniques and constructs.

### Learning aim A

Learners will be given two sections of code or programs to investigate. The given programs should be appropriate for the level of the learner, including a good range of program constructs and techniques given in learning aim C.

**For 2A.P1:** learners should explain the purpose of the code for each of the two given programs, e.g. to carry out calculations, and explain the characteristics, including constructs and techniques being used within the program, e.g. variables and functions. The two software programs should be designed for different purposes.

*For level 1, as a minimum, learners should be able to identify the purpose of the code and identify the constructs and techniques, e.g. variables and functions.*

**For 2A.M1:** learners should review the quality (e.g. efficiency/performance, maintainability and usability) of the program. Learners should provide specific suggestions for improving the quality of this program. Learners should also include a flowchart showing how the program functions.

**For 2A.D1:** learners should look at one software program in more detail and discuss the strengths and weaknesses of the product. They should discuss at least one strength and one weakness.

## Learning aim B

Learners should have access to a suitable assessment brief, which contains the user requirements of the program, including:

- the purpose of the software program
- the task(s) the software must perform
- what the required user inputs and outputs are
- an outline of any processing/functions required.

Centres are encouraged to use evidence from the development of the software as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** learners should describe the user requirements and purpose of the program for their designs.

*For level 1, as a minimum, learners should identify the user requirements and the purpose of the program for their designs.*

**For 2B.P3:** for a given problem outlined in a brief, learners should outline their proposed solution. The design documentation should include:

- a problem definition statement
- a proposed solution using basic design tools – a description of the main program tasks, (e.g. data input and output format), screen layouts and navigation, simple data structures and algorithms or descriptions of the method of solution
- a list of any pre-defined programs and/or subroutines documenting the source
- a test plan (to test for the logic and functionality).

*For level 1, as a minimum, learners should identify the purpose and user requirements for the program. The outline of a proposed solution will contain:*

- *a problem definition statement*
- *a description of the main program tasks – input and output (e.g. to add two numbers together and display a result)*
- *screen layouts (input and output) – templates or design sheets can be used to help learners with their design.*

**For 2B.M2:** in addition to the requirements for the pass grade, learners should produce:

- a detailed proposed solution using a range of suitable tools (in addition to those used at pass level) such as algorithms, e.g. flowcharts, data structures, data storage, control structures, data validation and error handling and reporting
- a brief outline of any alternative solutions for the intended software program
- test data.

**For 2B.D2:** learners are expected to be able to justify their design decisions and how the chosen design fulfils the stated purpose and user requirements for the given brief. They should consider the suitability for the end user and the quality and thoroughness of their design work. Learners need to consider their design in light of any constraints arising from the programming. For example, language used, and the device capabilities (e.g. memory) in terms of the quality of the user interface, manipulation and storage of data, and ease of use. Learners should explain why alternative designs were rejected.

## Learning aim C

Learners will develop and test their program for a given brief.

**For 2C.P4:** learners should develop their solution to the given brief by implementing their design. Some learners will find that their designs do not allow them to implement a solution. In this case, learners should amend their program but should not revisit the design work at this stage. Learners should ensure that they are developing solutions using some constructs/techniques from the level 2 content in learning aim C. These include conditional-controlled loops, Boolean data types and functions. The program should also include commentary built into the program and have a user interface with both input and output facilities.

*For level 1, as a minimum, learners should use their designs and their understanding of the level 1 constructs/techniques to create simple programs to solve the given problem.*

**For 2C.M3:** at this level, learners will produce a functional program that satisfies the brief. Learners are likely to need to adapt their designs to create a fully functioning software solution.

**For 2C.P5:** learners should compile/run (depending on the programming language being used) and test their program using their test plan. During the testing process they should keep evidence of any changes made to the code, and repair any faults. Learners should test that their program meets the original requirements from the brief.

*For level 1, as a minimum, learners should compile/run their program and test the program's main functions to ensure that data can be input, processed and output.*

**For 2C.M4:** learners should compile/run (depending on the programming language being used) and test their program using the test data. They should correct any errors found in the code and produce evidence to show any changes made to the program. Learners should work with others to obtain feedback on the quality and functionality of their program, and use this to improve the program.

**For 2C.D3:** teachers should recognise that the process of developing and testing software is an iterative process. When making refinements to their software, learners should take into account their test results and user feedback.

Learners should refine the software program, taking account of user feedback and the quality of the code, e.g. maintainability, portability, usability.

All of the ideas from the testing, feedback and reviewing the software program should have been considered in when refining the product.

## Learning aim D

**For 2D.P6:** learners should review their program in light of the results of their testing and should explain how their program is fit for purpose and meets the original requirements.

*For level 1, as a minimum, learners should identify how their software meets the original requirements and the purpose.*

**For 2D.M5:** learners should consider the outcomes of their testing and should review the extent to which the program solves the given problem. Learners should gather feedback from others and consider changes they would like to make in the light of this feedback.

**For 2D.D4:** learners should evaluate their initial designs and the completed program. They should identify any changes made from the design stage and justify these changes in terms of the requirements and the features of the language used, and any other constraints.

Learners should make at least three specific suggestions for improving the completed program to ensure it is fully functional, well coded and fit for purpose.

Learners do not need to implement the enhancements.

## Programming constructs and techniques for level 1 assessment

It is recognised that some learners may fail to achieve a full Pass at level 2, so learners being assessed for the level 1 criteria for learning aims B and C are not required to include all of the different programming constructs in their work for assessment.

The constructs that learners working at level 1 should be familiar with and include in their assessment evidence are shown below.

Use program constructs and techniques, e.g.:

- program constructs, e.g.:
  - comments
  - constants – variables with a constant value that cannot change
  - operators – arithmetic ( +, –)
  - reserved words – which have special meaning within the programming language and are used to write instructions in a program, e.g. in VisualBasic 'Get' and 'Repeat' are reserved words
  - local variables – only exist inside the subroutine/function where they are declared and used
  - global variables – exist throughout the entire program and in subroutines/functions
  - assignment
  - sequence
  - counter controlled loops
- subroutines/functions/procedures
- use a range of data types, e.g.:
  - character
  - string (text)
  - integer and real (numbers)
- use data structures:
  - user-defined data types and record structures
- event handling:
  - forms
  - assigning properties to screen components, e.g. buttons, boxes and drop-down lists
  - actions.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Reviewing Programs	<p>You are a programmer working for a software development company.</p> <p>Your manager has asked you to look at two programs. For each program, comment on:</p> <ul style="list-style-type: none"> <li>• characteristics of the code</li> <li>• constructs/techniques used</li> <li>• purpose.</li> </ul> <p>For one of the programs, review:</p> <ul style="list-style-type: none"> <li>• the quality of the code</li> <li>• any improvements you would make to the program</li> <li>• the processes within the program.</li> </ul>	<ul style="list-style-type: none"> <li>• Annotated code.</li> <li>• Draft replacement code.</li> <li>• Report.</li> <li>• Flow chart.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.M2, 2B.P3, 2B.D2	Design a Password Program	<p>Your manager has asked you to design a program that converts different currencies based on a given exchange rate.</p> <p>You should explain how your design meets the user requirements when addressing the problem.</p> <p>You will need to design a software program that meets the user requirements and purpose, and include in your design:</p> <ul style="list-style-type: none"> <li>• a problem definition statement</li> <li>• a proposed solution</li> <li>• a description of the main program tasks, (e.g. data input and output format), screen layouts and navigation, simple data structures and algorithms or descriptions of the method of solution</li> <li>• a list of any pre-defined programs and/or subroutines and include the source</li> <li>• a test plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Processing structures, e.g. flow charts and pseudocode.</li> <li>• List of tools, functions and subroutines.</li> <li>• Data validation.</li> <li>• Report.</li> <li>• Data structures and data storage.</li> <li>• Screens (input and output).</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.M3, 2C.P5, 2C.M4, 2C.D3	Develop and Test	<p>Develop the program, including commentary within the code.</p> <p>Test the program against the test plan, checking the 'client' requirements are still being met and documenting any changes to the program.</p> <p>Fix any faults in the program.</p> <p>Get feedback on the program from one other person, including how easy it is to use and the quality of the code.</p> <p>Review and refine your program in light of feedback.</p>	<ul style="list-style-type: none"> <li>• Annotated code.</li> <li>• Annotated design.</li> <li>• User feedback.</li> <li>• Functional program.</li> <li>• Test plans and data.</li> </ul>
1D.6 2D.P6, 2D.M5, 2D.D4	Review the Program	<p>How could the program be improved?</p> <p>Include strengths and points you could improve.</p> <p>Justify where your design has changed during the development, including what has changed following feedback, and explain how you would improve the program further.</p>	<ul style="list-style-type: none"> <li>• Annotated code.</li> <li>• Annotated design.</li> <li>• User feedback.</li> <li>• Evaluation report.</li> </ul>





# Unit 13: Website Development

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Have you ever viewed a website and wondered how it was created? Many different elements can be included in the website, such as text, graphics, animation, video and programs (client-side computer scripts). Many websites also contain sophisticated interactive features such as database search facilities, online purchasing and messaging. To be successful, a website must be visually interesting, while remaining easy to use.

With the internet being central to how most organisations and individuals communicate and do business, the creation and maintenance of websites is an important job role. There is a strong demand in the job market for web developers with appropriate technical and creative skills. For instance, a web-developer is a technical role involved with designing and developing websites, a content manager is responsible for keeping a website up to date and a search engine optimisation specialist encourages user traffic from internet search engines to specific websites.

In this unit, you will investigate the features and uses of websites by exploring what they are and how their integrated components and applications interact with each other.

You will also learn how to design, develop and test a website for a brief. Once this is completed you will review your website, having obtained feedback from others.

In particular this unit develops skills from *Unit 1: The Online World* and *Unit 2: Technology Systems*. It also develops the skills from the following units: *Unit 4: Creating Digital Animation*, *Unit 5: Creating Digital Audio*, *Unit 6: Creating Digital Graphics*, and *Unit 7: Creating Digital Video*. *Unit 12: Software Development* could also complement the content of this unit.

## Learning aims

In this unit you will:

- A understand the uses and features of websites
- B design a website
- C develop and test a website
- D review the finished website.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the uses and features of websites</b></p> <p><b>Why are websites used?</b></p> <p>The purpose of a website is to present information to an audience by using a collection of related web pages, traditionally hosted on a web server. This information may include text, graphics, video or other digital assets.</p> <p>Typical uses of websites, including:</p> <ul style="list-style-type: none"> <li>• presenting information (e.g. advertising, news)</li> <li>• storing information (e.g. archiving, cloud)</li> <li>• browsing and searching for information (e.g. real-time information)</li> <li>• improving productivity (e.g. email, collaborative working)</li> <li>• making decisions (e.g. financial, managerial)</li> <li>• communicating with people (e.g. social networking, video conferencing)</li> <li>• media sharing (e.g. listen to live radio, watch films)</li> <li>• e-commerce (e.g. shopping, banking)</li> <li>• education (e.g. libraries, online learning, assessments)</li> <li>• downloading information (e.g. data, media).</li> </ul> <p><b>Features of websites:</b></p> <ul style="list-style-type: none"> <li>• hyperlinks</li> <li>• action buttons</li> <li>• hot spots</li> <li>• templates</li> <li>• email links</li> <li>• registration and logins</li> <li>• forms (user input and feedback)</li> <li>• accessibility, e.g. text to speech.</li> <li>• e-commerce facilities</li> <li>• online forums</li> <li>• aesthetics, e.g. colours, layout, graphics/video/animation, audio, text, styles (use of style sheets).</li> </ul> <p style="text-align: right;"><i>continued</i></p>

**What needs to be learnt****Types of websites:**

- static
- dynamic.

Static websites are a collection of web pages primarily coded in HyperText Markup Language (HTML). These types of websites present static information to their audience, e.g. a brochure.

A dynamic website is a collection of web pages that often changes or customises itself frequently and automatically.

**How can user experience of websites be improved?**

Different features of websites can improve the user experience for an individual, business or organisation, e.g.:

- forms that allow customers to leave feedback
- dynamic interactions when socialising online
- applying style sheets to keep the same look and feel for a website
- making websites interactive by embedding digital assets.

**What needs to be learnt****Learning aim B: Design a website****Designing a website**

Designs include:

- intended purpose and user requirements as defined in a brief
- • documented design ideas/prototypes, including:
  - original and/or ready-made digital assets (e.g. digital animation, digital graphic, digital audio, digital video or any combined assets). Sources for ready-made assets must be documented and referenced.
  - storyboard, containing a number of panels, showing the intended content and structure of the website
  - home page and folder structure
  - site map, to illustrate how web pages are interlinked
  - styles, templates and formats (e.g. colours, font size, font type, text and image alignment, page layouts)
- hardware, software and other resources required
- constraints, e.g. hardware and software availability, accessibility, browser compatibility, file and file formats, client-side functionality, and performance (bandwidth, processor, memory), availability of web plug-ins, e.g. ActiveX, Flash
- test plan, to test functionality
- a brief outline of alternative design ideas.

**What needs to be learnt****Learning aim C: Develop and test a website****Develop and test a website**

Prepare assets and create a website:

- Prepare (gather or create) suitable assets e.g. graphics, audio, video, other content such as text and external links
- Use appropriate software tools/techniques
- create and edit web pages including:
  - text
  - tables
  - forms (e.g. text field, text area, buttons, radio buttons, check boxes)
  - frames
  - navigation (e.g. menus, hyperlinks (internal and external), anchors)
  - interactive components (e.g. hot spots, pop-ups, buttons, menus, rollover images)
  - colour schemes, styles and templates (e.g. cascading style sheets, page layout, size and position (text, links, assets, forms), text wrapping, background colours)
  - embedded multimedia/digital asset content (e.g. digital graphics, digital video, digital audio, digital animation)
  - simple client-side scripts (e.g. embed JavaScript code to display a name in a pop-up box)
  - other formatting (e.g. HyperText Markup Language (HTML), Dynamic HyperText Markup Language (DHTML))
  - accessibility features (e.g. alternative tags, zoom features, text-to-speech)
  - check browser compatibility to present web pages
  - export and compress any digital assets into suitable file types (e.g. resolution and size appropriate for web pages)
  - suitable file names for web pages.

Website hosting:

- web server
- domain name
- web hosting services.

Test the website:

- Test the website for functionality, quality and usability
- gather feedback from others (e.g. on content, presentation, navigation, usability, accessibility, performance and purpose).
- improve and/or refine to the website to improve accessibility, e.g.:
  - alternative text tags
  - zoom features
  - text to speech features
- improve and/or refine the website to enhance performance, e.g.:
  - export and compress digital assets
  - add dynamic functionality.

**What needs to be learnt****Learning aim D: Review the finished website****Reviewing a website**

Review the finished website for:

- fitness for purpose and user requirements
- functionality
- information/content including digital assets
- user experience (e.g. usability, quality, performance)
- constraints
- strengths and potential improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the uses and features of websites</b>			
1A.1 Identify the intended use and features of two websites.	2A.P1 Explain the intended uses and features of two different websites.	2A.M1 Review how the features in two websites improve presentation, usability, accessibility, and performance.	2A.D1 Discuss the strengths and weaknesses of the websites.
<b>Learning aim B: Design a website</b>			
1B.2 Identify the purpose and user requirements for the website.	2B.P2 Describe the purpose and user requirements for the website.	2B.M2 Produce a detailed design for a website, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• aesthetic features</li> <li>• interactive components.#</li> </ul>	2B.D2 Justify the final design decisions, including: <ul style="list-style-type: none"> <li>• how the design will fulfil the purpose and user requirements</li> <li>• including any design constraints.#</li> </ul>
1B.3 Produce a design for a four page interlinked website, with guidance, including an outline of the proposed solution.	2B.P3 Produce a design for an eight page interlinked website, including: <ul style="list-style-type: none"> <li>• a proposed solution</li> <li>• a list of assets</li> <li>• a test plan.#</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Develop and test a website</b>			
1C.4 Prepare assets and content for the website, with guidance.	2C.P4 Prepare assets and content for the website, demonstrating awareness of purpose, listing sources of assets.	2C.M3 Prepare assets and content for the website demonstrating awareness of the users' requirements, with all sources fully referenced.	2C.D3 Refine the website, to improve accessibility and performance, taking account of user feedback and test results.
1C.5 Develop a website containing four interlinked web pages, with guidance.	2C.P5 Develop a website containing at least eight interlinked web pages, demonstrating awareness of purpose.	2C.M4 Develop a website including interactive components, demonstrating awareness of user requirements and taking account of usability.	
1C.6 Test the website for functionality and purpose repairing any faults and documenting changes, with guidance.	2C.P6 Test the website for functionality and purpose, repairing any faults, and documenting changes.	2C.M5 Test interactivity and gather feedback from others on the quality of the website, and use it to improve the website, showing awareness of user requirements.	



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the finished website</b>			
1D.7 Identify how the final website is suitable for the intended purpose.	2D.P7 Explain how the final website is suitable for the intended audience and purpose.	2D.M6 Review the extent to which the finished website meets the needs of purpose and user requirements, while considering feedback from others and constraints.	2D.D4 Evaluate the final website against the design and justify any changes made, making recommendations for further improvements.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resource required for this unit is website authoring software that allows the creation of websites.

Learners should have access to an assignment brief to allow the learner to design a website for a given purpose. The brief should ideally be written with a 'client' in mind, and should have clear objectives of what they want the website to present. The brief should include details of any required text and digital assets (e.g. digital animation, digital video, digital audio, digital graphics).

If the brief requires learners to create assets for the website, they will also need access to suitable software in order to create audio, video, animation or graphics.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

Learners will investigate websites in order to understand the uses of two websites and the purpose of their features. The websites should be designed for different purposes.

**For 2A.P1:** learners should explain the uses of two websites and the features they include, e.g. a theatre website that allows users to purchase tickets in advance using online payment methods, or a banking website that allows users to manage their bank accounts securely.

*For level 1, as a minimum, learners should have identified the intended uses of two websites and their features, including text, digital assets and links.*

**For 2A.M1:** learners should review how the features of the websites improves the presentation, usability and accessibility, e.g. allowing users to customise the website format so that people with visual difficulties can enlarge the text.

**For 2A.D1:** learners should look at the websites in more detail to discuss their strengths and weaknesses. They should discuss at least one strength and one weakness.

#### Learning aim B

Learners will design, develop and test a website.

Scenarios suitable for a brief should allow learners to achieve all assessment criteria. The brief should include:

- the purpose of the website
- the user requirements
- the information (e.g. text) that must be provided
- features that must be included (e.g. text, forms, frames, tables)
- the user interaction that is required
- digital assets to be included (e.g. digital animation, digital graphics, digital audio, digital video).

Centres can allow learners to devise their own scenario for the brief. However, all scenarios should be approved by the centre before being used in order to ensure access to all assessment criteria.

Centres are encouraged to use evidence for the design and development of the website as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** learners should describe the purpose and user requirements for their website.

*For level 1, as a minimum, learners should identify the purpose and user requirements for their website.*

**For 2B.P3:** learners must produce a design for an eight-page interlinked website. The design documentation should include:

- the proposed solution containing:
  - a storyboard (with at least eight panels – one per web page) that outline the layout, content (e.g. text, assets and features)
  - a description of styles, templates, formats and interactive features
  - a site map including home page and file structure
  - a description of the ready-made and/or original assets to be used
- a list, in a sources table, of any original and/or ready-made assets
- a test plan, giving an outline of the range of tests to check the functionality of the website.

Learners should include a collection of website ideas or prototypes in their designs. Learners should describe any styles, templates or formats, and include details of any interactive features. They should outline at least four different original and/or ready-made assets that they intend to use, and list the sources for these assets in a sources table.

*For level 1, as a minimum, learners should design an outline proposed solution. The outline of a proposed solution will contain a website structure including at least four panels in a storyboard, a site map and an outline of two original or ready-made asset to be used.*

**For 2B.M2:** learners will be expected to add to their original design documentation by considering complex tools and techniques.

Learners should include:

- how colour schemes and page styles will be applied consistently in all of the web pages
- how interactive components that make use of simple client-side scripting will be embedded, e.g. display a message to welcome the user, and how to make it easier for users to navigate.
- a brief outline of any alternative solutions for the intended website, e.g. the use of different assets for the intended website. These do not have to be fully worked-up designs.

**For 2B.D2:** learners should justify their design decisions, including why alternative designs were rejected, explaining how the website will fulfil the stated purpose and user requirements. Learners must also think about the constraints, e.g. software availability and whether or not this will have an impact on developing the website. If it does, are there any alternatives for developing the same solution?

## Learning aim C

Learners will apply their practical skills and knowledge to develop and test a website.

**For 2C.P4:** learners should prepare assets (by gathering assets and creating them, if required), and list the sources for ready-made assets. At least four assets should be included, such as graphic images, audio clips and animations, as outlined in their designs. They should demonstrate an awareness of the purpose of the website.

*For level 1, as a minimum, learners should prepare their assets with guidance. Learners should include at least two assets in their websites.*

**For 2C.M3:** learners should prepare their assets and content for the website which has considered the user requirements of the website. All ready-made assets should be fully referenced in a sources table, with enough detail for another person to individually obtain the assets used.

**For 2C.P5:** learners should use appropriate website authoring software develop their website using appropriate tools/techniques. They should demonstrate an awareness of the purpose and the website should be based on their designs. Learners should have developed a website that includes at least eight interlinked web pages with:

- at least four different assets
- internal and external hyperlinks
- text
- at least one table
- forms
- menus
- colour schemes and styles.

*For level 1, as a minimum, learners should have developed a website, with guidance, which includes at least four interlinked web pages, with text, a table, hyperlinks and two assets.*

**For 2C.M4:** learners should improve their website, taking account of usability and user requirements. Learners should include interactive components that make use of simple client-side scripting, e.g. JavaScript code that displays the date and time.

An example of improving usability would be consistent colour schemes and styles in all web pages (using a method like cascading style sheets).

**For 2C.P6:** learners will be expected to follow their test plans (as defined in their design) and test the functionality of their website, and check that it is fit for purpose.

Learners are likely to experience technical difficulties as they develop their website. Learners will be expected to make the necessary repairs to their website. It is important that learners make appropriate comments on their designs and test plans about any issues they discover, and how they have resolved them.

*For level 1, as a minimum, learners should have tested the website for functionality and fitness for purpose. For this activity they will have needed guidance.*

**For 2C.M5:** learners should test the functionality of the interactivity features of the website. They should also test that the website meets the user requirements.

Learners should complete user-experience testing, with the help of a test user. Learners should record this feedback as part of the testing process. While considering the feedback, they should keep the user requirements of the website in mind. Learners should use their feedback and test results to improve the website.

**For 2C.D3:** teachers should recognise that the process of developing and testing a website is an iterative process. When making refinements to their websites, learners should take into account their test results and feedback from the 'client'.

Learners should refine their website using tools and techniques to cater for accessibility requirements and performance enhancements. For instance, learners could use:

- alternative text tags, text-to-speech to improve accessibility for users with hearing or visual impairments
- optimising assets to improve how quickly the website presents to the audience; if not appropriately compressed, video, animation and graphics can slow a website.

### **Learning aim D**

**For 2D.P7:** learners should explain why the product is suitable for the purpose and user requirements. Learners should give one reason for the purpose and one relating to user requirements.

*For level 1, as a minimum, learners should have identified how their website is fit for purpose, for example, 'My website is suitable to advertise films as it includes posters for recent film releases and links to film company websites and local cinemas'.*

**For 2D.M6:** learners should build on the explanations given in the Pass criteria, and refer back to the user requirements and purpose as defined in their design. They should also seek feedback from users about the final website. An interview would be an ideal way of discussing the website with notes used to record the feedback.

**For 2D.D4:** learners should evaluate the initial design ideas/prototypes against the final website in terms of overall user experience and 'client' requirements in the original brief. They should justify any changes that were made during development, and explain the rationale for any changes. They should also give at least three recommendations for improvements, but do not need to implement the enhancements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
2A.P1, 2A.M1 2A.D1, (1A.1)	Investigating Websites	<p>You work for a web-development company and you have been asked to prepare a presentation to the directors of a prospective 'client'.</p> <p>The 'client' wants you to look at two existing competitors' websites, describing the features used.</p> <p>Explain how these features could improve the presentation, user experience, accessibility and performance of the websites.</p> <p>Think about the strengths and weaknesses of the websites.</p>	<ul style="list-style-type: none"> <li>• Presentation slides and notes.</li> <li>• Supporting material.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2B.P2, 2B.M2 2B.P3, 2B.M3 2B.D2, (1B.2, 1B.3)	Designing the Website	<p>The 'client' has now provided some detailed requirements.</p> <p>You have been asked to develop and document a design.</p> <p>The designs should include:</p> <ul style="list-style-type: none"> <li>• purpose and user requirements</li> <li>• website ideas/prototypes</li> <li>• styles, templates and formats</li> <li>• interactive features</li> <li>• site map</li> <li>• storyboards to show the layout and structure of the website</li> <li>• digital assets to be used</li> <li>• a test plan</li> <li>• a table of sources for the digital assets to be used.</li> </ul> <p>Explain why any ideas you are not using have been rejected. Justify your design choices, relating back to the user requirements.</p> <p>Describe any constraints that have affected your design.</p>	<ul style="list-style-type: none"> <li>• Supported design documentation.</li> <li>• Sources table.</li> <li>• Diagrams.</li> <li>• Prototype ideas or images.</li> <li>• List of assets.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
2C.P4, 2C.P5 2C.P6, 2C.M3, 2C.M4, 2C.M5 2C.D3, (1C.4) (1C.5, 1C.6)	Creating the Website	<p>The 'client' has asked you to develop the website according to the design. Your website should contain assets, hyperlinks, text, tables, forms, menus, colour schemes, styles, and interactive components (that include simple client-side scripting).</p> <p>Improve the website by improving navigation, accessibility and performance.</p> <p>Test the website for functionality, presentation and usability repairing any problems that arise. Get feedback from the 'client' on your website. Refine your final website.</p>	<ul style="list-style-type: none"> <li>Website at different stages, supporting material and documented discussion, annotated designs, updated source table.</li> </ul>
2D.P7, 2D.M6 2D.D4, (1D.7)	Reviewing the Website	<p>Having completed the website, you now need to review it with the 'client'. Why is your website suitable for the 'client' and the purpose of the website? Include any improvements you could make, and what the strengths of your design are. Evaluate your website against your designs. Justify your changes.</p>	<ul style="list-style-type: none"> <li>Completed test plan, review feedback, supporting reports.</li> </ul>



# Unit 14: Installing and Maintaining Computer Hardware

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Technology systems can include a multitude of external hardware devices and internal hardware components. Over time it is necessary to maintain the system to repair faults (such as a loose component) and improve performance or upgrade the system's functionality (for instance by installing a faster processor). Job roles that demonstrate installing and maintaining computer hardware include computer technician, technical support engineer, service team leader, and helpdesk engineer.

In this unit, you will develop an understanding of the benefits and implications of installing and maintaining hardware in technology systems. For a specific brief, you will install and maintain hardware in a technology system. This will involve finding and repairing faults with the internal hardware components of a computer, such as the processor or internal bus, and upgrading other internal components, such as adding a network card or additional memory. You will also learn how to install a new external hardware device, such as a printer or barcode scanner.

The technology system will then be tested for functionality and performance. Once completed, you will review your modified technology system against the brief and obtain feedback from the 'client', and evaluate possible improvements.

In particular, this unit develops skills from *Unit 2: Technology Systems* and supports *Unit 11: Computer Networks*, *Unit 15: Installing and Maintaining Computer Software* and *Unit 16: Automated Computer Systems*.

## Learning aims

In this unit you will:

- A understand the benefits and implications of installing and maintaining hardware in technology systems
- B plan installation and maintenance of hardware in a technology system
- C install, maintain and test hardware in a technology system
- D review the modified technology system.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the benefits and implications of installing and maintaining hardware in technology systems</b></p> <p><b>Computer hardware</b></p> <p>Hardware to include:</p> <ul style="list-style-type: none"> <li>• internal components of a computer, e.g. network card, memory, processor</li> <li>• external hardware devices, e.g. printer, network router, barcode reader.</li> </ul> <p><b>Reasons to maintain technology systems</b></p> <p>Know why we maintain technology systems, e.g.:</p> <ul style="list-style-type: none"> <li>• to prevent faults occurring and/or to repair faults</li> <li>• to upgrade internal components, e.g. processor, memory and/or storage, to improve performance</li> <li>• to upgrade external hardware devices to improve performance</li> <li>• to change system functionality, e.g. to network the technology system or allow printing/scanning.</li> </ul> <p>Know that:</p> <ul style="list-style-type: none"> <li>• computer faults are often connected to errors, mistakes, defects and/or failures found with some components of a technology system</li> <li>• examples of typical faults include power supply faults, loose connections, and graphics, sound or network card faults</li> <li>• faults vary depending on the hardware technology being maintained as hardware evolves over time.</li> </ul> <p><b>Benefits and implications of installing and maintaining hardware</b></p> <p>Benefits, e.g.:</p> <ul style="list-style-type: none"> <li>• to reduce costs</li> <li>• to improve performance, e.g. efficiency and effectiveness</li> <li>• to improve/maintain customer service</li> <li>• to improve health and safety awareness.</li> </ul> <p style="text-align: right;"><i>continued</i></p>

**What needs to be learnt**

Implications, e.g.:

- training
- compatibility
- decommissioning
- service level agreements
- risks, such as:
  - electrostatic discharge (damage to components including printed circuit boards, memory cards)
  - component damage
  - data risk, (data loss, data corruption)
  - other risks (e.g. service loss).

How these implications could impact on an individual or organisation, e.g.:

- upgrading a hard disk drive could mean losing valuable data
- causing an electrostatic discharge to a new processor could damage the component resulting in a financial loss.

## What needs to be learnt

### Learning aim B: Plan installation and maintenance of hardware in a technology system

#### Planning for installation and maintenance

##### Plan to include:

- purpose of the installation or maintenance, e.g. compatibility, increased capacity, increased speed, increased reliability, software requirements, network requirements
- requirements of the brief ('client'/user requirements)
- alternative ideas for installing and maintaining hardware, i.e. there will be more than one way of improving the performance of the technology system, e.g. by increasing the memory or upgrading the processor
- hardware required, e.g.:
  - internal components of a computer, such as:
    - motherboard
    - central processing unit (CPU) or graphics processing unit (GPU)
    - memory
    - sound/video/network cards
    - heat dispersal systems, e.g. fans, heat sinks
    - storage devices, e.g. solid state, optical, magnetic
    - power supply unit (PSU)
    - connectors/ports
  - external hardware devices, such as:
    - monitor
    - printer
    - scanner
    - webcam
    - router
    - storage devices
    - broadcasting devices
    - lighting and/or sound devices
- tools required, e.g.:
  - antistatic equipment, e.g. antistatic packaging, wrist straps, antistatic mats
  - computer toolkits, e.g. chip inserter, chip extractor, assembly tweezers, slotted screwdriver, Phillips screwdriver, Torx screwdriver
- software resources, e.g. printer driver, installation setup and configuration
- installation and maintenance activity list, e.g. replace the motherboard battery, remove the heat sink and fan to access the processor, back up data and add a printer (external device) as part of an upgrade
- constraints (costs and technical), e.g. component cost, hardware and software availability, tools and component/device compatibility
- test plan and, if appropriate, test data (for functionality and performance).

**What needs to be learnt****Learning aim C: Install, maintain and test hardware in a technology system****Install and maintain hardware**

Preparation, e.g.:

- read manufacturer's hardware instructions
- test selection
- test configuration
- health and safety considerations, including antistatic equipment, precautions
- obtain resources (tools, hardware components and devices, access rights, software resources)
- check equipment
- other tasks (backing up data, recording serial numbers).

**Fault finding**

Tools and techniques, e.g.:

- utility
- run-time analysers
- test procedures, e.g. follow a test plan
- validating information
- responding to test plan (error messages, inconsistent data)
- loose connections
- jumper settings
- power support
- power-on self-test (POST)
- diagnostic software.

**Installation and maintenance activities**

Activities including, e.g.:

- fit new components and reconnect components and devices
- reassemble the computer system
- download software resources (hardware drivers)
- clean
- carry out safety checks
- system test
- dispose of packaging
- other tasks (i.e. restore data).

Feedback from 'client', e.g. functionality and performance.

Potential improvements to the technology system (e.g. performance, capacity, accessibility, reliability, security, user requirements).

*continued*

**What needs to be learnt**

Health and safety issues throughout the installation and maintenance of a computer system, e.g.:

- hardware
- electrical connection risks and guidelines
- handling equipment.

**Learning aim D: Review the modified technology system**

Review the modified technology system against:

- the original brief ('client'/user requirements)
- purpose
- choice of hardware components
- constraints, e.g. budget and compatibility of hardware components.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the benefits and implications of installing and maintaining hardware in technology systems</b>			
1A.1 Identify the benefits of installing and maintaining hardware for two different technology systems.	2A.P1 Explain the benefits of installing and maintaining hardware for two different technology systems.	2A.M1 Review how installing and maintaining hardware for one technology system could impact an individual or organisation.	2A.D1 Discuss the strengths and weaknesses of hardware for a given technology system.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Plan installation and maintenance of hardware in a technology system</b>			
1B.2 Identify the purpose and 'client' requirements for installing and maintaining hardware in a technology system.	2B.P2 Describe the purpose and 'client' requirements for installing and maintaining hardware in a technology system.	2B.M2 Produce a detailed plan including reasons why alternative ideas for installing and maintaining hardware have been discarded.	2B.D2 Justify final decisions, explaining how the technology system will fulfil the stated purpose and 'client' requirements, describing the impact of any constraints on the plan.
1B.3 Produce a plan for installing and maintaining hardware in a technology system, with guidance, including: <ul style="list-style-type: none"> <li>• a list of installation and maintenance activities</li> <li>• a list of hardware components and devices and software resources required for an upgrade.</li> </ul>	2B.P3 Produce a plan for installing and maintaining hardware in a technology system including: <ul style="list-style-type: none"> <li>• a list of installation and maintenance activities</li> <li>• a description of hardware components and devices and software resources required for an upgrade</li> <li>• a description of fault-finding tools and techniques</li> <li>• a test plan.</li> </ul>		



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Install, maintain and test hardware in a technology system</b>			
<p>1C.4 Install and maintain hardware in a technology system, with guidance, that includes the:</p> <ul style="list-style-type: none"> <li>• repair of at least one different internal hardware component faults</li> <li>• upgrade of at least one internal hardware component.</li> </ul>	<p>2C.P4 Install and maintain hardware in a technology system that includes the:</p> <ul style="list-style-type: none"> <li>• repair of at least two different internal hardware component faults</li> <li>• upgrade of at least two different internal hardware components</li> <li>• installation of at least one additional external hardware device.</li> </ul>	<p>2C.M3 Install and maintain hardware in a technology system, using appropriate tools and techniques to protect the data and system settings, demonstrating awareness of the user requirements and taking account of usability.</p>	<p>2C.D3 Refine the modified technology system in order to improve performance, taking account of feedback.</p>
<p>1C.5 Test the modified technology system for functionality and repair any faults, with guidance.</p>	<p>2C.P5 Test the modified technology system for functionality against the purpose and repair any faults as necessary.</p>	<p>2C.M4 Test the modified technology system and gather feedback, and use it to improve the technology system for user experience.</p>	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the modified technology system</b>			
1D.6 For the modified technology system, identify how it is suitable for the intended purpose and original requirements.	2D.P6 Explain how the modified technology system is suitable for the intended purpose and original requirements.	2D.M5 Review the extent to which the modified technology system meets the original requirements, considering feedback from others and any constraints.	2D.D4 Evaluate the initial plan against the modified technology system and justify any changes that were made, making recommendations for further improvements.

## Teacher guidance

### Resources

As a minimum, each learner will need to access a technology system that can be dismantled, repaired and upgraded to meet a brief. Learners will need:

- access to internal hardware components in a computer, e.g. a memory card, processor, hard disk drive, optical storage device, graphics card
- at least one additional external hardware device, e.g. a printer, scanner, webcam.

It is important that the hardware components and devices have the accompanying manuals and any software installation disks (or at least links to download these from the manufacturer's website).

The practical activities should take place in a workshop with appropriate tools and take account of health and safety requirements.

Learners need access to a brief. The brief can either be created by the centre or be generated by the learner and approved by the centre.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

Learners will develop an understanding of the computer hardware in two different technology systems, describing the benefits and implications of maintaining them.

**For 2A.P1:** learners should explain the benefits of installing and maintaining hardware in two different technology systems. For example, a benefit for a computer owner of maintaining their own technology system is saving on consultancy and labour costs.

*For level 1, as a minimum, learners should have identified the benefits of installing and maintaining the hardware in two different technology systems. They are likely to have listed only two examples, without any description.*

**For 2A.M1:** learners should review how installing and maintaining the hardware in one technology system could affect an individual or organisation. For example, hardware components could be damaged during an installation or upgrade because of mishandling, resulting in a financial loss to a business.

**For 2A.D1:** learners should discuss the strengths and weaknesses of hardware for a given technology system. For example, one weakness of the hardware could be that the manufacturer's warranty could be void if anyone attempts to upgrade the technology system. Learners should discuss at least one strength and at least one weakness.

#### Learning aim B

Learners should have an understanding of the typical faults found in most technology systems, as well as the range of hardware components that could be upgraded to improve performance.

Learners will establish the requirements for installing and maintaining hardware in a technology system based on a brief. The brief should allow learners to explore different possibilities for fulfilling the requirements. It should also allow them to produce a plan, outlining their ideas for repairing and upgrading a technology

system, for both the internal hardware components of the computer and external hardware devices. The brief should ideally be written with a 'client' in mind and must include the following requirements (as a minimum):

- the reason (purpose) for a change to the hardware in a technology system and/or user requirements, and the requirements of any 'client' for the system
- a description of at least two different faults (arising from malfunctioning internal hardware components of a technology system)
- an outline of at least two different performance enhancements that would require the internal hardware components of a computer to be upgraded, e.g. additional memory to stream video
- a description of additional system functionality that would require the addition of at least one new external hardware device
- any special requirements/instructions/configuration
- timeframe
- budget (costs)
- constraints.

Centres are encouraged to use evidence for the installation and maintenance of the technology system as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** in order to produce a plan for the installation and maintenance of hardware in a technology system, learners must first be able to understand and interpret the requirements from the brief. Learners should be able to provide a description of the purpose and 'client' requirements for installing and maintaining hardware in a technology system.

If it is to be upgraded, learners will need to investigate the technology system to get an idea of its current state of repair and of its capabilities. It is expected that learners will 'lift the lid' of the technology system to maintain and upgrade what is inside.

*For level 1, as a minimum, learners will identify the 'client' requirements and purpose for installing and maintaining hardware in a technology system.*

**For 2B.P3:** learners will plan the installation and maintenance of hardware in a technology system.

They should include:

- a list of installation and maintenance activities
- a description of internal hardware components and external hardware devices
- software resources they would need to carry out an upgrade, including the role of the software and its relationship to the technology system and user
- a description of fault-finding tools and techniques to determine the hardware faults (observation, diagnostic tools).

They should also provide a test plan to cover the installation and maintenance of hardware in a technology system, giving an outline of the range of tests that they will perform once the technology system is modified. The test plan should also clearly show how they would find system faults, e.g. use of diagnostic tools and software.

*For level 1, as a minimum, learners should produce a plan for the installation and maintenance of hardware in a technology system. An outline plan would contain a list of installation and maintenance activities to be carried out, and a list of hardware components and devices and software resources needed for the upgrade.*

**For 2B.M2:** learners should consider alternative ideas for an upgrade within their plan. For example, in a scenario to increase the performance of a technology system, the alternatives to achieve this could include increasing the memory, swapping the processor or replacing magnetic hard disk drives for new solid state disk drives.

**For 2B.D2:** learners should justify decisions in their plan, explaining why they have chosen different hardware components, fault-finding tools and techniques while rejecting others, making reference to the given purpose and the 'client' requirements. Learners must also think about constraints, e.g. the availability of tools and hardware and whether or not this will have an impact on maintaining the hardware in a technology system. If it does, are there any alternatives for modifying the technology system to meet the same requirements? For example, if the 'client' requires an 80 GB hard disk drive but the only size available is 160 GB, consideration of this would be sufficient to cover the requirements.

### Learning aim C

Learners will install and maintain hardware in a technology system. They should apply their practical skills and knowledge to do this.

**For 2C.P4:** learners should use appropriate resources and fault-finding tools and techniques (as identified in their plan) to install and maintain the hardware in a technology system.

As a minimum, learners should have used appropriate fault-finding tools and techniques to identify and repair at least two different internal hardware faults in a technology system. They should also install and configure (upgrade) at least two internal hardware components and add at least one additional external hardware device.

*For level 1, as a minimum, learners should repair at least one internal hardware faults and upgrade at least one internal hardware component.*

**For 2C.M3:** learners should demonstrate good practice to protect data and system settings when maintaining hardware in a technology system. Learners should use appropriate tools and techniques to safely back up data prior to making any modifications to the technology system. They should also safely restore the data and system settings to the technology system after the modifications are complete. The modified technology system must demonstrate the learner's awareness of purpose, meet the user requirements and improve the usability of the system.

**For 2C.P5:** learners will be expected to follow their test plans (as identified in their plan) and test for functionality and purpose against the original requirements of the modification.

Learners are likely to experience technical difficulties as they install and maintain the hardware in a technology system. Where this happens, learners are expected to troubleshoot and resolve the difficulties, finding and repairing any internal computer hardware faults. It is important that learners make appropriate comments in their plans and test plans about any issues they discover and how they resolved them. Where appropriate to do so, it is acceptable to photograph problems and solutions or use witness statements and observation records as evidence of this process.

Learners must adhere to all health and safety guidelines when undertaking practical activities with electronic equipment.

*For level 1, as a minimum, learners should test their system and repair any faults.*

**For 2C.M4:** learners will be required to test the functionality of the technology system while ensuring that data is safely backed up and that system settings can be restored. Learners will also complete user-experience testing with the help of at least one person who can act as the 'client'. The 'client' should be commenting on the usability and the user-experience of the modified technology system. Learners should record this feedback as part of the testing process.

**For 2C.D3:** teachers should recognise that the process of installing, maintaining and testing hardware in technology systems is an iterative one.

Learners should refine the modified technology system in order to improve its performance. Learners are also expected to make further refinements based on their test results and feedback. These refinements will probably involve customising the hardware components to suit the 'client'. Other refinements could include accessing the advanced settings of the hardware components to see if they can be customised to make full use of their features and capabilities in a way that satisfies the 'client' or user, for example, by using software drivers to optimise a graphics card that takes full advantage of memory and processing power. This can be achieved by either reallocating physical memory resources or utilising USB flash drives to extend and support the memory, for example, ReadyBoost. Cleaning the internal hardware components, such as the power supply unit or heat sink, will also improve the performance of a technology system and prevent any overheating caused by particle build-up.

If it is not possible for learners to apply their refinements (for example, because of software or hardware constraints), learners should explain what they would do if they had the opportunity, focusing on performance. For example, the scarcity of high-performance graphics cards could prevent learners from refining the modified technology system. However, they could discuss how these graphics cards would improve performance with an explanation of how they would be configured.

All of the ideas from testing, reviewing and receiving feedback on the modified technology system should be considered as learners go through the refinement process.

### Learning aim D

**For 2D.P6:** learners should explain why their modified technology system is suitable for the intended purpose and the original requirements.

*For level 1, as a minimum, learners should identify how their modified technology system is suitable for the purpose and the original requirements.*

**For 2D.M5:** learners should build on the explanations for the Pass criteria, and review how well the 'client' requirements and purpose have been met, and should include details of how any constraints have affected the modified system. They should also seek feedback from the 'client' about the modified technology system. An interview would be an ideal way of discussing the modified technology system and recording the feedback.

Learners should consider any constraints that they have had to deal with when modifying the system.

**For 2D.D4:** learners should evaluate their initial plans against the modified technology system. They should justify any changes that were made and explain the rationale for those changes. They should also give recommendations for at least three improvements but do not need to implement any enhancements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Investigation	<p>You work as a consultant for an IT company that specialises in maintaining technology systems.</p> <p>For this scenario, a 'client' manages a small company with employees who use technology systems. They have found a few technical problems.</p> <p>Before the 'client' decides whether to buy a brand new system, they would like some advice from you about repairing and maintaining the existing system.</p> <p>They want to know:</p> <ul style="list-style-type: none"> <li>the benefits of installing and maintaining hardware in at least two different technology systems</li> <li>the implications for the organisation of maintaining hardware in at least one technology system.</li> </ul> <p>You need to consider the strengths and weaknesses of the hardware for a given technology system.</p> <p>Prepare a presentation or a report for the 'client'.</p>	<ul style="list-style-type: none"> <li>Web page.</li> <li>Presentation.</li> <li>Report.</li> <li>Interview.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.M2, 2B.P3, 2B.D2	Planning	<p>The 'client' would like you to upgrade and maintain the hardware in one technology system.</p> <p>Your task is to plan the installation and maintenance of hardware to fulfil your user requirements for the 'client'.</p> <p>Produce a plan to include:</p> <ul style="list-style-type: none"> <li>• a list of the installation and maintenance activities</li> <li>• a description of hardware components and devices and software resources required for an upgrade</li> <li>• a description of fault-finding tools and techniques</li> <li>• a test plan.</li> </ul> <p>You must also consider alternative ideas, e.g. alternative hardware solutions that will fulfil the same purpose.</p> <p>It is important that you explain how the plan meets the purpose and 'client' requirements and what effect it will have on users.</p>	<ul style="list-style-type: none"> <li>• Web page.</li> <li>• Report.</li> </ul>



Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.M3, 2C.P5, 2C.M4, 2C.D3	Repair and Upgrade	<p>You should now have everything you need to start maintaining the technology system.</p> <p>You must demonstrate that you can follow your plan to:</p> <ol style="list-style-type: none"> <li>1) safely back up all data and system settings in preparation for a system restore</li> <li>2) fault-find and repair at least two different hardware faults within the technology system</li> <li>3) install and configure at least two different internal hardware components in a technology as part of an upgrade</li> <li>4) install and configure at least one external hardware device as part of an upgrade</li> <li>5) restore all data and system settings.</li> </ol> <p>Test the modified technology system for functionality and performance and record the results.</p> <p>Meet with your 'client' to discuss your progress and to gather some feedback about your modified technology system.</p> <p>Make any necessary improvements to the modified technology system to improve the overall performance, taking on board feedback from your 'client' and test results.</p>	<ul style="list-style-type: none"> <li>• Witness statements.</li> <li>• Observation records.</li> </ul>
1D.6 2D.P6, 2D.M5, 2D.D4	Review	Evaluate the modified technology system, explaining why and how it meets the brief, suggesting improvements and considering any constraints.	<ul style="list-style-type: none"> <li>• Report.</li> </ul>



# Unit 15: Installing and Maintaining Computer Software

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Computer software brings technology systems to life and is the main way we control and communicate with systems. Types of software include the operating system (OS), which supports the communication and management of resources, and application software, such as office programs and graphics packages designed to help the user perform specific tasks.

Over time it is necessary to install and maintain software in a system. This includes customising software applications to improve productivity, for instance to create new menus and keyboard short cuts. Job roles that require installing and maintaining computer software include computer technician, technical support engineer, service team leader, and helpdesk engineer.

In this unit, you will develop an understanding of the benefits and implications of installing and maintaining software in technology systems. As specified in a brief, you will learn how to install and maintain software in a technology system. This will involve installing and upgrading an operating system and different software applications, such as office or multimedia programs.

You will also customise different components of software applications to improve productivity, for example to create new toolbars and automate a range of tasks using a macro. The technology system will be tested for functionality, usability and productivity. Once completed, you will review your modified technology system against the brief and obtain feedback from the 'client', having obtained feedback from others, and evaluate possible improvements.

In particular, this unit develops skills from *Unit 2: Technology Systems*, *Unit 9: Spreadsheet Development*, *Unit 8: Mobile Apps Development*, *Unit 12: Software Development*, and supports *Unit 11: Computer Networks* and *Unit 14: Installing and Maintaining Computer Hardware*.

## Learning aims

In this unit you will:

- A understand the benefits and implications of installing and maintaining software in technology systems
- B plan installation and maintenance of software in a technology system
- C install, maintain and test software in a technology system
- D review the modified technology system.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the benefits and implications of installing and maintaining software in technology systems</b></p> <p><b>Computer software</b></p> <p>Types of software, e.g.:</p> <ul style="list-style-type: none"> <li>• software applications (computer programs such as word processing, spreadsheets, databases, email)</li> <li>• system software (such as operating systems, system utilities, network utilities, device drivers)</li> <li>• programming software (such as compilers, interpreters, integrated development environments).</li> </ul> <p><b>Why we install and maintain computer software</b></p> <p>Reasons to install and maintain computer software, e.g.:</p> <ul style="list-style-type: none"> <li>• to keep up to date with modern technologies</li> <li>• to customise different components of software applications to meet users' needs</li> <li>• to prevent software problems occurring and/or to repair software problems</li> <li>• to upgrade software (such as office applications, operating systems, device drivers)</li> <li>• to change system functionality (such as media centre, network, other specialist purposes).</li> </ul> <p><b>Benefits and implications of installing and maintaining software</b></p> <p>Benefits:</p> <ul style="list-style-type: none"> <li>• to reduce costs</li> <li>• to improve productivity, e.g. configuration and customisation, specialist tools, time saving, error reduction, improved user perception</li> <li>• for customisation, e.g.:             <ul style="list-style-type: none"> <li>◦ speed (reducing key strokes)</li> <li>◦ accuracy (control data entry)</li> <li>◦ ease of use</li> <li>◦ style consistency (standardised templates)</li> </ul> </li> <li>• to improve performance, e.g. efficiency and effectiveness</li> <li>• to improve user experience</li> <li>• to improve communication</li> <li>• to improve/maintain customer service</li> <li>• to apply software updates made available by manufacturer</li> <li>• to improve security or stability, e.g. piloting software to evaluate how it integrates with current technology systems.</li> </ul> <p style="text-align: right;"><i>continued</i></p>

**What needs to be learnt**

Implications, e.g.:

- training requirements
- compatibility issues
- decommissioning
- service level agreements
- increase in complexity
- support needs
- costs and licensing, including copyright
- software issues, such as a new release of software can often present unforeseen faults (bugs) that are usually repaired through later software updates
- risks:
  - data risk (such as data loss, data corruption)
  - other risks (such as service loss)
- issues of software piracy
- registration.

How installing and maintaining computer software could improve the productivity for an individual or organisation, e.g.:

- updating the operating system will ensure that any new software applications are compatible with the latest standards
- customising a spreadsheet using macros to automate calculations and functions will result in saved time and improved efficiency.

**What needs to be learnt****Learning aim B: Plan installation and maintenance of software in a technology system****Planning to install and maintain software**

Plan to include:

- purpose of the installation or upgrade, e.g. compatibility, change in system functionality, upgrade, improve productivity (performance, speed, reliability)
- requirements of the brief ('client'/user requirements)
- alternative ideas for installing and maintaining software, e.g. there will be more than one system software or software application available that will contain the same features and perform the same function
- tasks/activities, e.g. install or upgrade an operating system, customise a spreadsheet to suit user's requirements, install or upgrade an office application, install software updates to the operating system
- software resources required, such as:
  - software applications, e.g.:
    - office applications, e.g. word processors, spreadsheets, databases, desktop publishing, email, web browsers
    - bespoke applications, e.g. custom-built specialist software designed for a specific purpose
  - system software, e.g.:
    - operating systems, e.g. open source, Windows-based, Mac-based
    - utility software, e.g. antivirus, home protection, security, data and system backup and restoration, defragmenter
    - software drivers, e.g. new hardware device installation
  - tools, e.g.
    - installation disks
    - operating instructions
    - registration information
    - software licence/product keys, e.g. creative commons, single or multi-user licence
- constraints (costs and technical), e.g. software costs/licensing, software availability, tools
- test/troubleshoot plan to test functionality and usability.

**What needs to be learnt****Learning aim C: Install, maintain and test software in a technology system****Install and maintain software in a technology system**

Preparation, e.g.:

- read manufacturer's software instructions
- test selection and configuration
- obtain resources, e.g. access rights, software installation resources and tools
- determine software installation source, e.g. media type, internet-based, synchronisation application, critical update from software provider
- check compatibility, e.g. software specification, storage requirements, technology system requirements, user requirements
- other tasks, e.g. backing up data, setting restore points, uninstalling existing software, software licence keys
- establish configuration, e.g. setting correct date/time, language settings, network and establish customisation, e.g. toolbars, menus, shortcuts, other user preferences.

**Installation and maintenance activities**

Process, e.g.:

- identify software and purpose, (operating system software, software applications, bespoke software applications, utility software)
- download or gather software resources
- carry out pre-installation and post-installation checks
- back up data and system settings
- set restore points
- customise software applications
- system test
- dispose of/recycle packaging
- other tasks, e.g. restore data and system settings.

**Customisation**

Tools and techniques, e.g.:

- creating or changing components, e.g.:
  - default settings
  - menus
  - toolbars
  - templates
  - shortcuts
  - forms
  - macros.

Feedback from client, e.g. functionality, usability, productivity.

Refinements to the technology system to improve productivity, e.g. customising software applications by creating macros and forms.

Potential improvements to the technology system, e.g. performance, accessibility, reliability, security, 'client' requirements.

**What needs to be learnt****Learning aim D: Review the modified technology system**

Review the finished software installation against:

- original client and user requirements
- purpose
- suitability of choice of software resources
- any special requirements
- constraints.



## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the benefits and implications of installing and maintaining software in technology systems</b>			
1A.1 Identify the benefits of installing and maintaining software for two different technology systems.	2A.P1 Explain the benefits of installing and maintaining software for two different technology systems.	2A.M1 Review how installing and maintaining software in one technology system could improve productivity for an individual or organisation.	2A.D1 Discuss the strengths and weaknesses of software for a given technology system.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Plan installation and maintenance of software in a technology system</b>			
1B.2 Identify the purpose and 'client' requirements for installing and maintaining software in a technology system.	2B.P2 Describe the purpose and 'client' requirements for installing and maintaining software in a technology system.	2B.M2 Produce a detailed plan including reasons why alternative ideas for installing and maintaining software have been discarded.	2B.D2 Justify final decisions, explaining how the technology system will fulfil the stated purpose and 'client' requirements, describing the impact of any constraints on the plan.
1B.3 Produce a plan for installing and maintaining software in a technology system, with guidance, including: <ul style="list-style-type: none"> <li>• a list of installation and maintenance activities</li> <li>• a list of software resources required for an installation or upgrade.</li> </ul>	2B.P3 Produce a plan for installing and maintaining software in a technology system including: <ul style="list-style-type: none"> <li>• a list of installation and maintenance activities</li> <li>• a description of software resources required for an installation or upgrade</li> <li>• a description of customisation tools and techniques</li> <li>• a test plan.</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Install, maintain and test software in a technology system</b>			
<p>1C.4 Install and maintain software in a technology system, with guidance, that includes the:</p> <ul style="list-style-type: none"> <li>• installation or upgrade of at least one different software applications</li> <li>• customisation of at least two different components in software application(s).</li> </ul>	<p>2C.P4 Install and maintain software in a technology system that includes the:</p> <ul style="list-style-type: none"> <li>• installation or upgrade of one operating system</li> <li>• installation or upgrade of at least two different software applications</li> <li>• customisation of at least three different components in software application(s).</li> </ul>	<p>2C.M3 Install and maintain software in a technology system, using appropriate tools and techniques to protect the data and system settings, demonstrating awareness of the user requirements and taking account of usability.</p>	<p>2C.D3 Refine the modified technology system in order to improve productivity, taking account of feedback.</p>
<p>1C.5 Test the modified technology system for functionality and repair any faults, with guidance.</p>	<p>2C.P5 Test the modified technology system for functionality against the purpose, and repair any faults as necessary.</p>	<p>2C.M4 Test the modified technology system, gather feedback, and use it to improve the technology system for functionality, productivity and user experience.</p>	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning Aim D: Review the modified technology system</b>			
1D.6 For the modified technology system, identify how it is suitable for the intended purpose and original requirements.	2D.P6 Explain how the modified technology system is suitable for the intended original requirements and purpose.	2D.M5 Review the extent to which the modified technology system meets the original requirements while considering feedback from others and the effect of any constraints.	2D.D4 Evaluate the initial plan against the modified technology system and justify any changes that were made, making recommendations for further improvements.

## Teacher guidance

### Resources

As a minimum, each learner will need access to a technology system that will allow them to install, upgrade, maintain and customise software to meet a brief.

Learners will need:

- operating system software, e.g. open source, Windows-based, Mac-based
- at least two different software applications capable of customisation, e.g. office software, media software.

It is important that software resources are accompanied by the relevant manuals, installation disks (or software package downloaded in advance from the manufacturer's website), software licence/products keys, and any registration information.

The practical activities should take place with appropriate resources and tools.

It is recommended that free resources are obtained for the practical activities.

Learners need access to a brief. The brief can either be created by the centre or be generated by the learner and approved by the centre.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

Learners will investigate and understand the computer software in two different technology systems, explaining the benefits and implications of installation and maintenance.

**For 2A.P1:** learners should explain the benefits and implications of installing and maintaining computer software in two different technology systems. For example, a benefit would include staying up to date with the latest security software to capture and quarantine new viruses. An implication may include the prohibitive costs of some software licences.

*For level 1, as a minimum, learners should identify the benefits of installing and maintaining the software in two different technology systems. They are likely to have listed only two examples, without any description.*

**For 2A.M1:** learners should review how installing and maintaining the software in one technology system could improve productivity for an individual or organisation. For example, customising a spreadsheet using a macro could save time and improve efficiency for an organisation by automating calculations and function.

**For 2A.D1:** learners should discuss the strengths and weaknesses of software for a given technology system. For example, one weakness of software is that it could be reliant on specialised hardware attached to the technology system. Learners should discuss at least one strength and at least one weakness.

#### Learning aim B

Learners will establish the requirements for installing and maintaining software in a technology system, based on a brief. The brief should allow learners to explore different possibilities for fulfilling the requirements. It should also allow them to produce a plan of their ideas for installing and/or upgrading system software and software applications, as well as for customising software applications for a given

purpose. Ideally, the brief should be written with a 'client' in mind, with clearly stated resource requirements and objectives.

The brief must include the following requirements (as a minimum):

- the reason (purpose) for a change to the software in a technology system and user/'client' requirements
- an outline of the technology system that requires an installation or upgrade of an operating system
- an outline of at least two different computer enhancements that would require an installation or upgrade of software applications, e.g. to upgrade existing office software to take advantage of new features and to keep office documents consistent for all users
- an outline of at least three different components of one or more software applications that could be customised to meet a given purpose, e.g. creating a new menu in an office program that displays a list of user's most-used functions
- an outline of any refinements that would require macros and/or forms to be created as part of customising a software application, e.g. a macro to automate a calculation task in a spreadsheet
- any special requirements/instructions/configuration
- timeframe
- budget (costs)
- constraints.

Centres are encouraged to use evidence for the installation and maintenance of the technology system as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** in order to produce a plan for the installation and maintenance of software in a technology system, learners must first be able to understand and interpret the requirements from the brief. Learners should be able to provide a description of the purpose and 'client' requirements for installing and maintaining software in a technology system.

If the technology system is to be upgraded or customised, learners will need to investigate it to get an idea of its current state and what it is capable of doing.

*For level 1, as a minimum, learners will identify the 'client' requirements and purpose for installing and maintaining software in a technology system.*

**For 2B.P3:** learners will plan the installation and maintenance of software in a technology system.

They should include:

- a list of installation and maintenance activities
- a description of software resources required for the installation or upgrade
- a description of the customisation tools and techniques needed to meet the 'client' requirements.

They should also provide a test plan to cover the installation and maintenance (including customisation) of software in a technology system, giving an outline of the range of tests that they will perform once the system is modified.

*For level 1, as a minimum, learners should produce a plan for the installation and maintenance of software in a technology system. An outline plan should contain a list of installation and maintenance activities to be carried out, and a list of software resources needed for the installation or upgrade.*

**For 2B.M2:** learners should consider alternative ideas for installing and maintaining software within their plan. For example, in a scenario where the technology system is intended to be used for working with digital images, there are different graphics and artwork packages available that users can use to achieve the same purpose. Learners should consider the distinctive features and benefits of different types of software when suggesting ideas in their plan.

**For 2B.D2:** learners should justify decisions in their plan, explaining why they have chosen different software resources and customisation tools and techniques while rejecting others, making reference to the given purpose and the 'client' requirements. Learners must also think about constraints, for example the availability of tools and software, and whether or not this will have an impact on maintaining the software in a technology system. If it does, are there any alternatives for modifying the system to meet the same requirements? For example, if the 'client' requires an operating system but there is no budget for purchasing a new operating system, it would be sufficient to obtain an open-source operating system from the internet and install this, to meet the same requirements.

### Learning aim C

Learners will install and maintain software in a technology system. They should apply their practical skills and knowledge to do this.

**For 2C.P4:** learners should use appropriate resources and customisation tools and techniques (as identified in their plan) to install and maintain the software in a technology system.

As a minimum, learners should have installed or upgraded and appropriately configured an operating system. They should have also installed or upgraded at least two different software applications, for example an office program or a multimedia program, as well as customised at least three different components of any installed software applications, for example create a new menu, change a toolbar or create a keyboard shortcut.

*For level 1, as a minimum, learners should install or upgrade at least one software application and customise at least two different components in one or more software applications. It is assumed that learners will be provided with a technology system that already has an operating system installed.*

**For 2C.M3:** learners should demonstrate good practice to protect data and system settings when maintaining software in a technology system. Learners should use appropriate tools and techniques to safely back up data prior to making any modifications to the technology system. They should also safely restore the data and system settings to the technology system after the modifications are complete.

The modified technology system must demonstrate the learner's awareness of the user requirements and improve the usability of the systems.

**For 2C.P5:** learners will be expected to follow their test plans (as identified in their plan) and test for functionality and purpose against the original requirements.

Learners are likely to experience technical difficulties as they install and maintain the software in a technology system. Where this happens, learners are expected to troubleshoot and resolve these difficulties, finding and resolving any software problems. It is important that learners make appropriate comments in their plans and test plans with regard to any problems they discover and how they have resolved them. Where appropriate to do so, it is acceptable to photograph or take screenshots of problems and solutions or use witness statements and observation records as evidence of this process.

*For level 1, as a minimum, learners should test their system and repair any faults.*

**For 2C.M4:** learners are required to test the usability of the technology system while ensuring that data is safely backed up and system settings can be restored. Learners will complete user-experience testing, with the help of at least one person who can act as the 'client'. The 'client' should be commenting on the functionality and usability of the modified technology system. Learners should record this feedback as part of the testing process.

**For 2C.D3:** teachers should recognise that the process of installing, maintaining and testing software in technology systems is an iterative process.

Learners should refine the modified technology system to improve productivity. Learners are also expected to make further refinements based on their test results and feedback. This must include customising software applications by either creating a macro or by creating a form for a given purpose. For example, they might create a new macro in a spreadsheet that will automate calculations and functions, or they might create a new user-friendly form that will allow users to enter records into a database.

All of the ideas from testing, reviewing and receiving feedback on the modified technology system should be considered as learners go through the refinement process.

### Learning aim D

**For 2D.P6:** learners should explain how their modified technology system is suitable for the intended purpose and the original requirements.

*For level 1, as a minimum, learners should identify how their modified technology system is suitable for the purpose and the original requirements.*

**For 2D.M5:** learners should build on the explanations for the Pass criterion, and review how well the 'client' requirements and purpose have been met. They should also seek feedback from the 'client' about the modified technology system. An interview would be an ideal way of discussing the modified technology system and recording the feedback. Learners should provide details of how any constraints have affected the modified system.

**For 2D.D4:** learners should evaluate their initial plans against the modified technology system. They should justify any changes that were made and explain the rationale for those changes. They should also give recommendations for at least three improvements but do not need to implement any enhancements.



## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment title	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Investigation	<p>You work as a software installation engineer for an IT company that specialises in maintaining technology systems.</p> <p>For this scenario, a 'client' manages a small company with employees that use technology systems.</p> <p>They want to know:</p> <ul style="list-style-type: none"> <li>the benefits and implications of installing and maintaining software in at least two different technology systems</li> <li>how software in at least one technology system could help improve productivity in their organisation.</li> </ul> <p>You need to consider the strengths and weaknesses of the software for a given technology system.</p> <p>Prepare a presentation or a report for the 'client'.</p>	<ul style="list-style-type: none"> <li>Web page.</li> <li>Presentation.</li> <li>Report.</li> <li>Interview.</li> </ul>

Criteria covered	Assignment title	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.M2, 2B.P3, 2B.D2	Planning	<p>The 'client' would like you to install and maintain the software in one technology system.</p> <p>Your task is to plan the installation and maintenance of software to fulfil your 'client' requirements.</p> <p>Produce a plan to include:</p> <ul style="list-style-type: none"> <li>• a list of the installation and maintenance activities</li> <li>• a description of software resources required for an installation or upgrade</li> <li>• a description of customisation tools and techniques you will use when customising software applications to improve productivity</li> <li>• a test plan.</li> </ul> <p>You must also consider alternative ideas, e.g. different software or customisation tools and techniques of software installation that will fulfil the same purpose.</p> <p>It is important that you explain how the plan meets the purpose and 'client' requirements and what effect it will have on users.</p>	<ul style="list-style-type: none"> <li>• Web page</li> <li>• Report.</li> </ul>

Criteria covered	Assignment title	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.M3, 2C.P5, 2C.M4, 2C.D3	Installing and Maintaining	<p>You should now have everything you need to start maintaining the technology system.</p> <p>You must demonstrate that you can follow your plan to:</p> <ul style="list-style-type: none"> <li>• safely back up all data and system settings in preparation for a system restore</li> <li>• install or upgrade and appropriately configure an operating system</li> <li>• install or upgrade at least two different software applications</li> <li>• customise at least three different components in one or more installed software applications</li> <li>• make further refinements to the technology system by customising software applications to improve productivity – this must include implementing either a macro or form</li> <li>• restore all data and system settings.</li> </ul> <p>Test the modified technology system for functionality and usability and record the results.</p> <p>Meet with your 'client' to discuss your progress and to gather some feedback about your modified technology system.</p> <p>Make any necessary improvements to the modified technology system to improve the overall performance, taking on board feedback from your 'client' and test results.</p>	<ul style="list-style-type: none"> <li>• Witness statements</li> <li>• Observation records.</li> </ul>

Criteria covered	Assignment title	Scenario	Assessment evidence
1D.6 2D.P6, 2D.M5, 2D.D4	Review	Evaluate the modified technology system, explaining why it meets the brief, suggesting improvements and considering any constraints.	<ul style="list-style-type: none"><li>• Report.</li></ul>

# Unit 16: Automated Computer Systems

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Automated computer systems feature heavily in our technological lifestyles. We are surrounded by technology systems that monitor and perform activities on our behalf, from central heating controllers regulating our environment to robots exploring the universe.

The development of automated computer systems is becoming essential across the world for manufacturing, security systems and home, industrial and transportation systems. Being able to develop and work with automated systems could lead to a challenging, varied and exciting career in any number of various roles in different companies, for example an electronic engineer and software engineer.

In this unit, you will investigate the characteristics, including benefits and features, of existing automated systems. Using a suitable self-assembly kit, you will design and develop an automated system for a brief. You will develop the system by making progress in small steps and building up programs that can control hardware devices by monitoring sensors and controlling outputs. To do this, you will learn some control programming, hardware assembly and trouble shooting skills.

You will review your final automated system and identify any further improvements.

This unit develops skills from *Unit 2: Technology Systems*, *Unit 8: Mobile Apps Development*, *Unit 11: Computer Networks*, *Unit 12: Software Development* and *Unit 14: Installing and Maintaining Computer Hardware*.

## Learning aims

In this unit you will:

- A understand the characteristics of automated systems
- B design an automated system
- C develop and test an automated system
- D review the finished automated system.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the characteristics of automated systems</b></p> <p><b>Automated systems</b></p> <p>Automated systems contain hardware devices that are controlled by software programs that undertake specific activities based on inputs and outputs.</p> <p><b>Characteristics of automated systems</b></p> <ul style="list-style-type: none"> <li>• Features</li> <li>• Benefits</li> <li>• Reasons for use</li> </ul> <p><b>Why automated systems are used</b></p> <p>Reasons, e.g.:</p> <ul style="list-style-type: none"> <li>• operating in hazardous environments, e.g. satellites in space</li> <li>• completing monotonous tasks, e.g. food-packaging machinery</li> <li>• completing precision tasks, e.g. manufacturing engineering components</li> <li>• monitoring and control, e.g. temperature control system.</li> </ul> <p>Benefits, e.g.:</p> <ul style="list-style-type: none"> <li>• reduced costs</li> <li>• improved performance, e.g. efficiency and effectiveness</li> <li>• customisation, e.g. custom-made engineered parts</li> <li>• improved repeatability (completing the same activity with a high degree of accuracy)</li> <li>• improved customer service.</li> </ul> <p><b>Features of automated systems</b></p> <p>Know that automated systems comprise hardware and control software programs.</p> <p>Systems include:</p> <ul style="list-style-type: none"> <li>• hardware devices, including:             <ul style="list-style-type: none"> <li>◦ programmable devices/microcontrollers</li> <li>◦ input devices, e.g. touch and temperature sensors</li> <li>◦ output devices, e.g. LEDs, motors</li> <li>◦ other components, e.g. power source, mechanical structures</li> </ul> </li> <li>• control software programs, e.g. code to make a light or LED flash or to operate a line-following robot.</li> </ul> <p>Use flow charts to represent processes within basic control programs.</p>

**What needs to be learnt****Learning aim B: Design an automated system****Designing an automated system**

Design to include:

- intended purpose and 'client'/user requirements (as defined in a brief)
- at least one programmable device, one input and one output device
- system hardware diagrams showing:
  - the devices to be used (further guidance in learning aim C)
  - the input/output data flow between devices
  - device communication method (either serial or parallel)
  - any mechanical structures, e.g. chassis and wheels and the assembly method of devices/components
- a control program specification including:
  - a description of the main program tasks – input and output format
  - algorithms, e.g. structured English, flow charts, pseudocode
- a list of any predefined code and their sources, e.g. the internet
- a brief outline of alternative solutions for the intended automated system, e.g. alternative sensor types and hardware configurations
- a test plan and, if appropriate, test data (to test the system inputs and expected outputs)
- constraints, e.g. device capabilities including connectivity and availability, memory storage or programming language.

**What needs to be learnt****Learning aim C: Develop and test an automated system****Develop an automated system**

Assemble hardware, including:

- programmable devices/controllers that can read from input devices (e.g. sensors) and control output devices (e.g. actuators, motors) and store and process data (e.g. Lego RCX/NXT, Arduino, PIC)
- input devices, e.g. light-dependent resistors, touch sensors, switches, accelerometers, infrared sensors, potentiometers, sound sensors, touch sensors, temperature sensors
- output devices, e.g. LEDs and LED arrays, lights, motors, servo valves, linear actuators, sound emitters (e.g. piezo speakers, buzzers, amplifiers), relays (e.g. H-bridge ICs for motor control)
- other components:
  - power source, e.g. photovoltaic cells and batteries
  - mechanical structures, e.g. protective/aesthetic shell, chassis (a framework that supports a manmade object), axles, wheels
  - data storage, e.g. solid state storage device.

Consider Health and safety issues, e.g. hardware, electrical connection risks and guidelines, handling equipment

**Develop control software program**

Use a development environment to produce original code and edit predefined program or code.

Develop and refine the control program using suitable programming language constructs and techniques.

Annotate the code to demonstrate understanding of the constructs/techniques and processing to allow effective repair/debugging of the program and for maintainability.

**Programming constructs and techniques**

Program constructs, e.g.:

- comments
- constants (variables with a constant value that cannot change)
- operators (arithmetic [ + - \* / % ] and logical [ < <= > >= AND OR true false])
- reserved words, which have special meaning within the programming language and are used to write instructions in a program, e.g. in NXT 'motor' and 'while' are reserved words.
- input and output commands
- local and global variables
- assignment
- sequence
- counter controlled and conditional loops (while do, repeat ... until, for ... next)
- sequential statements, selections (if ... then ... else)
- data types, e.g. integer and real (numbers), string (text), Boolean

*continued*



**What needs to be learnt**

- data structures, e.g. arrays, user-defined variables
- data storage, e.g. within hardware devices, on removable media
- subroutines/functions/procedures.

**Testing and refining the automated system**

Test automated system for functionality, e.g. against test plan, and if required, test data.

Gather feedback from others, e.g. 'client', users on the automated system.

Briefly document any changes to the design, including:

- changes to the references of sources for predefined code
- annotations on the code
- improvements and/or refinements to the automated system.

**Learning aim D: Review the finished automated system**

Review the finished automated system against:

- original requirements and purpose (as defined in the brief)
- constraints, e.g. programming language, time, device capabilities such as memory, connectivity, availability
- strengths and potential improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the characteristics of automated systems</b>			
1A.1 Identify the features and benefits of two different given automated systems.	2A.P1 Explain the features and benefits of two different given automated systems.	2A.M1 Review what one of the given automated systems does, providing a flow chart to show the processing of the control system.	2A.D1 Discuss the strengths and weaknesses of the automated systems.
<b>Learning aim B: Design an automated system</b>			
1B.2 Identify the purpose and user requirements for an automated system.	2B.P2 Describe the purpose and user requirements for an automated system.	2B.M2 Produce a detailed design for an automated system, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• two or more system hardware diagrams</li> <li>• a detailed control program specification.*</li> </ul>	2B.D2 Justify final design decisions, explaining how the automated system will fulfil the stated purpose and the user requirements, describing the impact of any constraints on the design.*
1B.3 Produce a design for an automated system, with guidance, including: <ul style="list-style-type: none"> <li>• an outline system hardware diagram</li> <li>• an outline control program specification</li> <li>• a list of any predefined code.*</li> </ul>	2B.P3 Produce a design for an automated system, including: <ul style="list-style-type: none"> <li>• a system hardware diagram</li> <li>• a control program specification</li> <li>• a list of any predefined code</li> <li>• a test plan.*</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Develop and test an automated system</b>			
1C.4 Develop an automated system, with guidance, containing: <ul style="list-style-type: none"> <li>• at least one programmable device, input device and output device</li> <li>• a control program using appropriate constructs/techniques.*</li> </ul> (Please see guidance.)	2C.P4 Develop an automated system containing: <ul style="list-style-type: none"> <li>• at least one programmable device, input device and output device</li> <li>• a control program using appropriate constructs/techniques, which is appropriately annotated.*</li> </ul>	2C.M3 Develop a functional automated system that meets the given brief and contains a default fail-safe state.*	2C.D3 Refine the automated system, using feedback from others, to improve the system's performance.*
1C.5 With guidance: <ul style="list-style-type: none"> <li>• test the automated system for functionality</li> <li>• repair any hardware and/or program faults.</li> </ul>	2C.P5 Test the automated system for functionality using the test plan and against the original requirements. Repair any hardware and/or program faults.	2C.M4 Test the automated system, including additional functionality, against the original requirements, gathering feedback from others. Repair any hardware or program faults.	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the finished automated system</b>			
1D.6 Identify how the final system is suitable for the original requirements and purpose.	2D.P6 Explain how the final system meets the original requirements and purpose.	2D.M5 Review the extent to which the system meets the original requirements, considering feedback from others and any constraints.	2D.D4 Evaluate the final system against the initial designs and justify any changes that were made, making recommendations for further improvement.

\*Opportunity to assess mathematical skills

## Teacher guidance

### Resources

As a minimum, each learner will need access to hardware devices found in a suitable self-assembly kit for automated systems, specifically:

- a programmable device/microcontroller, e.g. Arduino, PIC, Lego programmable brick (RCX or NXT) with programming interface and cabling
- a programming environment, e.g. Arduino, PICAXE Programming Editor, PICLogicator, Lego NXT Mindstorms environment, LabVIEW, Flowol 4
- input devices, e.g. sensors for touch, light, sound, humidity, resistance, temperature, infrared, Hall Effect
- output devices, e.g. motors, servos, LEDs, lights, linear actuators
- other components, e.g. mechanical structure, power source, storage media (e.g. SD card).

It is important that hardware devices and components include the accompanying manuals, software installation disks or installation packages (downloaded in advance from the manufacturer's website).

The practical activities should take place in a workshop with appropriate tools and should take account of health and safety requirements.

Learners should be provided with a brief which allows them to meet the assessment requirements of the unit. Briefs can either be generated by the centre, or by the learner, and then approved by the centre.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

Learners need access to a selection of different automated systems. At least two systems should be investigated: one should be a basic automated (e.g. line-following) vehicle and the other should be a commercial system, e.g. controlling temperature or traffic lights. These can be placed into context by the use of case studies or local examples, and demonstrated in the classroom.

**For 2A.P1:** learners should explain the characteristics of two given and different automated systems. The description should cover the what the systems do, their benefits and features, for example hardware devices and control programs of the automated system.

*For level 1, as a minimum, learners should identify the characteristics of two given and different automated systems. They are likely to be presented as a list without a description of how the system works.*

**For 2A.M1:** learners should review what one of the classroom-demonstrated automated systems does and provide a flow chart to show the processing in the control program.

**For 2A.D1:** learners should discuss the strengths and weaknesses of one of the classroom-demonstrated automated systems. Learners should consider at least one strength and at least one weakness.

## Learning aim B

Learners should understand the functionality of a range of hardware devices and components. They should also be familiar with the control program programming environment and a range of constructs/techniques used within the programming language.

Learners will establish the requirements for developing an automated system given in a brief. The brief should:

- allow learners to explore the possibilities when fulfilling the requirements of the brief
- allow learners to produce an automated system using a suitable kit-based system
- be written with a client in mind with clearly stated resource requirements and objectives.

The brief must include the following requirements (as a minimum):

- a description of the purpose of the automated system, e.g. an automated vehicle designed to carry a 1 kg mass and follow a line, turning right and left as required over a 5 m route
- any special requirements/instructions/configuration
- a timeframe
- a budget (costs)
- the constraints, e.g. system is to operate in an internal, dry environment.

Centres are encouraged to use evidence for the development of the automated system as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

**For 2B.P2:** learners should describe the user requirements and purpose of the automated system for the design.

*For level 1, as a minimum, learners should identify the user requirements and the purpose for the design of the automated system.*

**For 2B.P3:** learners will produce a design for an automated system built using a self-assembly kit of appropriate hardware devices. As a minimum, the system will contain at least one programmable device, one input device and one output device. Learners' designs should include:

- a description of purpose and the requirements of the client/user
- a system hardware diagram showing the devices to be used and illustrating the mechanical structures, e.g. chassis and wheels and the assembly of devices/components
- a control program specification describing the main program tasks, e.g. data input and output format
- a list of any predefined code
- test plan, outlining a range of tests for logic and functionality.

*For level 1, as a minimum, learners should produce an outline design for an automated system containing at least one programmable device, one input device and one output device. The design should include:*

- *an outline system hardware diagram showing the devices and components to be used*
- *an outline control program specification containing a description of the main program tasks e.g. data input and output format*
- *a list of any predefined code.*

**For 2B.M2:** in addition to the requirements for the pass grade, learners should produce:

- at least two system hardware diagrams:
  - at least one showing the devices to be used, input and output data flow between devices, and the device communication method
  - at least one illustrating any mechanical structures and the assembly method of devices/components
- a detailed control program specification describing the main program tasks and algorithms, e.g. structured English, flow charts, pseudocode outlining how the control program will work
- a brief outline of any alternative solutions and why they were configured in a certain way.

**For 2B.D2:** learners are expected to be able to justify their design decisions and how the chosen design fulfils the stated purpose and user requirements for the given brief. They should consider suitability for the end user and the quality and thoroughness of their design work. Learners need to review their design in light of any constraints arising from the hardware (for example operational range of sensors, the availability of devices) and control programming language. Learners should justify why alternative design ideas were rejected.

### Learning aim C

This learning aim is all about developing and testing an automated system for a given brief.

**For 2C.P4:** learners will implement their design. Some learners will find that their designs do not allow them to implement a solution. In this case, learners should amend their automated system and record changes to their design. They should develop their automated system by:

- assembling (while adhering to all health and safety guidelines) a range of hardware devices – as a minimum the system should contain at least:
  - one programmable device/controller, e.g. Lego RCX/NXT, Arduino, PIC
  - one input device, e.g. light-dependent resistors, touch sensors, switches
  - one output device, e.g. LED arrays, motors, relays, servo valves
  - other components, e.g. power source, mechanical structures
- develop a control program for the automated system by editing predefined code and some original code using appropriate constructs and techniques. The program must include reading from at least one sensor and result in at least one output to a device. Learners should also ensure that they develop solutions using some constructs/techniques from the more complex content in learning aim C (the constructs/techniques for level 1 assessment are shown at the end of this guidance). These include conditional-controlled loops and functions.

The code should be annotated to demonstrate understanding and to allow effective repair/debugging of the program and maintainability.

*For level 1, as a minimum, learners should use their designs to develop an automated system. They will assemble a range of hardware devices (at least one programmable device, one input device and one output device) and develop a control program using level 1 constructs/techniques (identified at the end of this guidance).*

**For 2C.M3:** learners should produce an automated system that satisfies the brief. The system should contain a fail-safe default state, for example, the system shuts down if the system limits are breached. Learners are likely to need to adapt their designs to create a fully-functioning system.

**For 2C.P5:** learners will test the automated system for functionality against the original requirements and using their test plans. For example, does the system meet its stated purpose; do input devices and output devices respond as expected? The automated system should function; however, it may not fully meet the brief.

As they develop their automated system, learners are likely to experience hardware and control programming technical difficulties. Where this happens, learners should troubleshoot and resolve these difficulties, finding and repairing any faults. To aid this process, learners may want to use a console to monitor the state of the system during operation. It is important that learners make appropriate comments in their code and briefly document any changes made to both the hardware and control program.

Where appropriate, it is acceptable to photograph problems and solutions or to use witness statements as evidence of this process.

*For level 1, as a minimum, learners should develop and test the automated system's main functions and repair any hardware and control program faults.*

**For 2C.M4:** learners should test their automated system including any additional functionality and the fail-safe state, using test data as appropriate. The default fail-safe state should operate when certain limits are breached.

They should correct any hardware and control program faults found in the code and produce evidence to show any changes made to the system.

Learners should obtain feedback on their automated system from others, for example from someone acting as a user of the system. Their system should fully meet the original requirements of the brief.

**For 2C.D3:** Teachers should recognise that the process of developing and testing automated systems is iterative and not a sequential process. Consequently, this criterion is assessed during an iterative development process.

Learners should refine the automated system, taking account of feedback from others to improve the system's performance, for example to complete a task more efficiently or more accurately. Examples include controlling temperature within a smaller tolerance or introducing ability to adapt to different external conditions, e.g. an automated vehicle designed to transport a 1 kg mass between two points could adapt to the terrain by changing speed, using less energy and reducing power consumption.

### **Learning aim D**

**For 2D.P6:** learners should describe how their automated system meets the original requirements and purpose in light of the results of their testing. Learners should be encouraged to celebrate the strengths of their work.

*For level 1, as a minimum, learners should identify how their automated system meets the original requirements and purpose.*

**For 2D.M5:** learners should build on the outcomes for the Pass criterion, to consider the outcomes of their testing and describe the extent to which the automated system meets the original requirements of the brief. Learners should gather feedback from others and consider changes they would like to make in the light of this feedback. Learners should consider any constraints that they have had to deal with when modifying the system.

**For 2D.D4:** learners should evaluate their initial designs and the completed automated system. They should identify any changes made from the design stage and justify them against the requirements and the features of the hardware and control programming language used. Learners should make at least three specific suggestions for improving the completed system, for example, identifying points of potential failure and suggesting how the system could be improved to prevent it. Learners do not have to implement the enhancements.



## Control program constructs/techniques for level 1 assessment

Some learners may fail to achieve a full Pass at level 2, so learners being assessed for the level 1 criteria for learning aims B and C are not required to include all of the different control programming constructs in their work for assessment.

The constructs that learners working at level 1 should be familiar with and include in their assessment evidence are shown below.

Use program constructs and techniques, e.g.:

- program constructs, e.g.:
  - comments
  - constants—variables with a constant value that cannot change
  - operators—arithmetic ( +, – )
  - reserved words – that have special meaning within the programming language and are used to write instructions in a program
  - input and output commands
  - local variables - only exist inside the subroutine/function where they are declared and used
  - global variables
  - assignment
  - sequence
  - counter controlled loops
- use a range of data types, e.g. character, string (text), integer and real (numbers)
- use data structures, e.g. user-defined data types and record structures.

## Suggested assignments

The table below shows a programme of suggested assignment outlines that cover the pass, merit and distinction criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Please note that for the Automated Systems in Action assignment teachers should allow learners to investigate two different systems. One system should be a working kit-based system that can be demonstrated in the classroom and the other should be a commercial system. For the basic classroom system, the control program should be made available for learners to investigate.

Criteria covered	Assignment title	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Automated Systems in Action	<p>You work for a company that specialises in developing automated systems. A potential customer wants to know more about the characteristics of automated systems. You have been asked to prepare a presentation on the benefits and features of the following two systems:</p> <ul style="list-style-type: none"> <li>• a basic line-following automated vehicle that will move through a simple predetermined route and avoid obstacles</li> <li>• a commercial city-centre traffic light control program – the system monitors the flow of traffic based on inputs from inductance sensors in the road and alters the timing of the lights during each 24 hour period depending on the volume of traffic.</li> </ul> <p>So that the customer understands how the control program works, you have also been asked to provide a flow chart showing the algorithms used to control the basic automated vehicle.</p>	<ul style="list-style-type: none"> <li>• Presentation or report</li> <li>• Flow chart.</li> </ul>

Criteria covered	Assignment title	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.P3, 2B.M2, 2B.D2	Design for an Automated Vehicle	<p>The customer liked the presentation and would now like to see a design for a prototype automated vehicle which can be used to demonstrate the principles of a commercial system. The prototype vehicle should be capable of delivering a 1 kg mass between two points that are 5 m apart, avoiding any obstacles.</p> <p>The design should include an alternative solution and explain how the automated vehicle will fulfil the stated purpose and the user requirements. Any constraints that impact on the design should be covered.</p> <p>Prepare a justification for the customer to explain why you have designed the system the way you have, and what you considered.</p>	<ul style="list-style-type: none"> <li>• A description of purpose and user requirements</li> <li>• System hardware diagram(s)</li> <li>• A control program specification</li> <li>• A description of alternative solutions</li> <li>• A list of any predefined code</li> <li>• Test plan.</li> </ul>
1C.4, 1C.5 2C.P4, 2C.P5, 2C.M3, 2C.M4, 2C.D3	Develop and Test the Automated Vehicle	<p>Develop and test the prototype automated vehicle. The control program must allow the automated vehicle to travel between two points that are 5 m apart to deliver a 1 kg mass and avoid any obstacles.</p> <p>Refine the prototype, based on feedback from the customer or your manager where appropriate, to improve the performance of the system. For example, you might reduce the time taken to deliver the 1 kg mass or make the vehicle adapt to different external conditions, for example the nature of the terrain.</p>	<ul style="list-style-type: none"> <li>• Video of the automated guided vehicle</li> <li>• Annotated control program</li> <li>• Test results</li> <li>• Feedback from the customer or manager.</li> </ul>

Criteria covered	Assignment title	Scenario	Assessment evidence
1D.6 2D.P6, 2D.M5, 2D.D4	Review the Automated Vehicle	<p>Review the prototype automated vehicle, describing its strengths and potential further improvements. Consider the extent to which the automated system meets the original requirements and addresses feedback given from the customer.</p> <p>Justify how your design has changed during the development, including what has changed following feedback, and explain how you would improve the prototype system further.</p>	<ul style="list-style-type: none"> <li>• Evaluation report</li> <li>• Feedback from the customer</li> <li>• Annotated design documents.</li> </ul>

# Unit 17: Multimedia Products Development

Level: **1 and 2**

Unit type: **Mandatory or Optional Specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

When you play computer games, visit exhibitions, or go shopping online you will experience multimedia in action. You will also encounter it every time you watch a DVD, use online learning materials or visit a social networking site.

Multimedia plays an ever expanding and increasingly important role in daily life. It allows you to access information in new and inspiring ways, using combinations of assets such as video, sound effects, music, animation, images and text to create interactive products that are stimulating and easy to use. Relevant job roles include multimedia specialists who use software to manipulate assets into products and software developers/programmers who add functionality by writing computer code.

To be successful, a multimedia product must be suitable for the intended purpose and audience (for a linear product) or user requirements (for an interactive product). It must also be visually interesting, retain attention and present an intuitive interface that you will not need to learn, but instinctively know how to use.

Multimedia products include interactive presentations, information points and virtual reality simulations, as well as computer-based games and movies. These products have massive markets and there is real demand for people with the imagination and appropriate technical skills to create them.

In this unit, you will understand how multimedia products are used and the typical features they contain. You will be able to apply some of your findings when creating your own multimedia products. You will design, develop and test your own multimedia products against a brief.

Once completed you will review your work and obtain feedback from others.

In particular, this unit develops skills from *Unit 1: The Online World*, *Unit 4: Creating Digital Animation*, *Unit 5: Creating Digital Audio*, *Unit 6: Creating Digital Graphics* and *Unit 7: Creating Digital Video*. *Unit 12: Software Development* will also complement the content of this unit.

## Learning aims

In this unit you will:

- A understand the uses and features of multimedia products
- B design multimedia products
- C develop and test multimedia products
- D review the finished multimedia products.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the uses and features of multimedia products</b></p> <p><b>Purpose of multimedia products</b></p> <p>The purpose of multimedia products is to present content to and engage an audience using a collection of assets, such as video and graphics, to provide an enhanced, multi-sensory, experience.</p> <p>Content can include the different assets: video clips, sound effects, music, animation sequences and images, as well as text.</p> <p><b>Know why individuals or organisations use multimedia products</b></p> <p>Uses of multimedia products:</p> <ul style="list-style-type: none"> <li>• present information, e.g. interactive slideshows, virtual tours</li> <li>• communicate with people, e.g. social networking, video conferencing</li> <li>• entertainment and leisure, e.g. computer games and movies</li> <li>• commerce, e.g. promotion of products and services</li> <li>• education, e.g. computer-aided learning, interactive assessments</li> <li>• develop skills, e.g. flight simulators.</li> </ul> <p><b>Features of multimedia products</b></p> <p>Types of multimedia product:</p> <ul style="list-style-type: none"> <li>• linear products – presenting pages or screens to an audience in a pre-determined sequence, e.g. a slideshow or movie.</li> <li>• interactive products – built in screen navigation and other features that allow users to interact with the product, e.g. computer games and simulations.</li> </ul> <p>Different features of products, e.g.:</p> <ul style="list-style-type: none"> <li>• ease of navigation</li> <li>• interactivity</li> <li>• appropriateness of content</li> <li>• game elements (i.e. light effects, characters)</li> <li>• game play (i.e. scoring, levels, rules, controls).</li> </ul> <p>Know how these features of multimedia products are used to improve the user experience for an individual, for example, how sound effects are used in computer games, video clips are embedded in learning packages, or animations are used in information points.</p>

## What needs to be learnt

### Learning aim B: Design multimedia products

To design a linear product and interactive product.

#### Design documentation

Documentation to include:

- requirements of the brief (audience, purpose and user requirements)
- documented ideas/prototypes including:
  - records of stimulus materials and mind maps of first ideas
  - storyboard, containing a number of panels, showing the intended layout, content and structure of the product
  - timelines for animations and movie clips with synchronised sound
  - hierarchy chart, to illustrate navigation, how screens are accessed
  - styles and formats, e.g. mood boards for colours, fonts and images
  - original and ready-made digital assets, e.g. animation, graphics, audio (e.g. sound effects and voice) and video clips. Sources for ready-made assets and details of editing should be documented and referenced
- hardware, software and other resources required
- test plans, to test functionality and user experience
- a brief outline of alternative design ideas, e.g. different characters, layouts/structures and styles.

**What needs to be learnt****Learning aim C: Develop and test multimedia products****Develop linear and interactive multimedia products**

Use multimedia authoring tools/techniques, e.g.:

- create and edit assets:
  - text
  - images and other graphics
  - video clips, e.g. cut and join together, add effects
  - navigation, e.g. menus, hyperlinks (internal and external)
  - interactive components, e.g. hot spots, buttons, menus, rollover images
  - colour schemes, fonts and styles
  - animations, such as cut-out (i.e. tweens), rotoscoping and skeletal
  - audio, including synchronisation of sound effects, music and voice over
- update the sources table with details of any ready-made assets
- combine assets to create multimedia products
- export and compress assets into suitable file types and sizes
- if original video or audio is produced then consideration should be given to health and safety while recording, e.g. trailing cables, carrying heavy equipment, high volume levels and the environment where the recording will take place (e.g. on location).

**Testing multimedia products**

Test multimedia products for functionality, quality and usability.

Obtain feedback from others, for example, effectiveness, content, presentation, interaction, usability, performance and purpose.

Make improvements and/or refinements to multimedia products in response to testing and feedback from others.

**Learning aim D: Review the finished multimedia products**

Review the finished multimedia products against:

- fitness for purpose
- audience (for a linear product)
- user requirements (for an interactive product)
- functionality
- user experience, e.g. usability, quality, performance
- constraints
- strengths and potential improvements.



## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the uses and features of multimedia products</b>			
1A.1 Identify the intended uses and features of two different multimedia products.	2A.P1 Explain the intended uses and features of two different multimedia products.	2A.M1 Review how the multimedia products are fit for purpose and their intended effect on the audience/users.	2A.D1 Discuss the strengths and weaknesses of two multimedia products.
<b>Learning aim B: Design multimedia products</b>			
1B.2 Identify the audience/user requirements and purpose for the design of an interactive multimedia product.	2B.P2 Describe the audience/user requirements and purpose for the design of one linear and one interactive multimedia product.	2B.M2 Produce detailed designs for the multimedia products, including reasons why alternative ideas have been discarded.	2B.D2 Justify the final design decisions, explain how they will: <ul style="list-style-type: none"> <li>• fulfil the stated purpose and requirements of the brief</li> <li>• meet the needs of the audience/users.</li> </ul>
1B.3 Produce an outline design for an interactive multimedia product, with guidance.	2B.P3 Produce designs for one linear and one interactive multimedia product. Each design must include: <ul style="list-style-type: none"> <li>• documented product ideas/prototypes</li> <li>• a list of ready-made assets</li> <li>• a test plan.#</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Develop and test multimedia products</b>			
1C.4 Prepare assets for an interactive multimedia product, with guidance.	2C.P4 Prepare assets and content for the multimedia products, demonstrating awareness of purpose and listing sources of assets.	2C.M3 Prepare assets and content for the multimedia products, demonstrating an awareness of audience/user requirements, with all sources fully referenced.	2C.D3 Refine the high-quality multimedia products, taking account of feedback from others to enhance the audience/user experience.
1C.5 Develop an interactive multimedia product using suitable tools/techniques to combine assets and content, with guidance.	2C.P5 Develop one linear and one interactive multimedia product using suitable tools/techniques to combine assets and content, demonstrating awareness of purpose.	2C.M4 Develop one linear and one interactive multimedia product, demonstrating an awareness of audience/user requirements and taking account of usability.	
1C.6 Test the interactive multimedia product for functionality and purpose, repairing any faults and documenting changes, with guidance.	2C.P6 Test the multimedia products for functionality and purpose, repairing any faults and documenting changes.	2C.M5 Test any additional functionality and gather feedback from others on the quality of the products and use this to improve the products, demonstrating an awareness of audience/user requirements.	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the finished multimedia products</b>			
1D.7 Identify how the final interactive multimedia product is suitable for the intended purpose.	2D.P7 Explain how the final multimedia products are suitable for the intended audience/user requirements and purpose.	2D.M6 Review the extent to which the final multimedia products meet the needs of the audience/user requirements, while considering feedback from others and constraints.	2D.D4 Evaluate the final multimedia products against the designs and justify any changes made, making recommendations for further improvements.

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit include multimedia authoring software that enables the creation and editing of digital assets, including graphics, video, sound and animation. For example:

- graphics – Adobe Illustrator, Adobe Photoshop and Coreldraw
- game Authoring – Gamemaker, Unity, GDeveloper, Multimedia Fusion and Flash
- sprite Production – Fireworks, Serif Draw Plus and Spriteforge
- 3-D Modelling – Google Sketchup (Free) and Blender (Free)
- audio – Audacity, Soundation (online) and Adobe Soundbooth
- video – Apple iMovie, Microsoft Moviemaker and Corel VideoStudio
- media players – QuickTime Player and Windows Media Player.

Presentation software must **not** be used in the development of both products.

Learners will need a brief specifying the requirements for a linear multimedia product and an interactive multimedia product. The brief can either be created by the centre or by the learner and approved by the centre.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

#### Learning aim A

Learners will investigate at least one linear and one interactive multimedia product to understand the uses of these products and their features. The products should be designed for different purposes.

**For 2A.P1:** learners should explain the uses and features of two different multimedia products. The multimedia products should be selected to cover a range of multimedia uses and features to provide learners with an opportunity for a broad and stimulating investigation.

*For level 1, as a minimum, learners should identify the intended uses and features of two multimedia products.*

**For 2A.M1:** learners should review how the multimedia products are fit for purpose and their intended effect on the audience/users.

**For 2A.D1:** learners should look at the multimedia products in more detail to discuss their strengths and weaknesses. They should consider at least one strength and at least one weakness.

#### Learning aim B

Learners should now have an understanding of what makes up a multimedia product. As learners develop their own multimedia products, they will be able to apply concepts that they discover or observe during their investigation.

Learners will design, develop and test two multimedia products, one linear product and one interactive product.

Scenarios suitable for a brief should allow learners to achieve all assessment criteria. The brief must include the following requirements for each product (as a minimum):

- a description of the purpose (clear objectives of what the multimedia products are intended to achieve)
- a description of the intended audience for the linear product and intended user requirements for the interactive product.
- location of the product, e.g. for a projector and screen or a mobile device.

Centres are encouraged to use evidence for the multimedia products as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

The learner may use any appropriate digital medium for presenting evidence, for instance a movie showing snapshots throughout the development process would be appropriate, as would blog entries as developments are made.

**For 2B.P2:** for the multimedia products learners should describe the purpose and audience (for the linear product)/user requirements (for the interactive product).

*For level 1, learners should identify the purpose and audience/user requirements for an interactive multimedia product.*

**For 2B.P3:** learners must first understand and interpret the brief for each multimedia product. They should produce design documentation that includes:

- ideas/prototypes that clearly indicate the idea and what the multimedia products might look like. These should include:
  - storyboard, containing a number of panels, to illustrate the layout, content (including interactive features) and structure of the product
  - timelines for any animations and movie clips, with synchronised audio
  - sources tables identifying ready-made digital assets, e.g. animation, graphics, music and sound effects, voice over, video clips
- test plans (to test for functionality).

*For level 1, as a minimum, learners should design an interactive multimedia product. The outline design ideas will contain a product structure, including a storyboard containing a number of panels. They should identify at least two assets that are to be incorporated into the product.*

**For 2B.M2:** in addition to the requirements for the pass grade, learners should produce detailed designs for their multimedia products. The detailed documents should include:

- records of stimulus materials and mind maps of first ideas
- styles and formats, e.g. mood boards for colours, fonts and images
- hierarchy chart of the content, to illustrate navigation, how screens are accessed
- hardware, software and other resources required for their products.

Learners should include a brief outline of alternative solutions for the intended multimedia products, giving reasons why some solutions were discarded.

**For 2B.D2:** learners should justify their design decisions, explaining how the multimedia products will fulfil the stated purpose and original requirements. Learners should justify the use of specific features which have been incorporated to enhance the user experience.

Learners may wish to do this by annotating their design documents and describing why, for example 'I have used sound fading in here because ...'. They should also justify why they have chosen to combine assets in this way to fulfil the brief and why the chosen design was selected and others rejected.

### Learning aim C

Learners will have a design of what their intended multimedia products will do, look like and how they will be tested. They should now be ready to apply their practical skills and knowledge to combine mainly ready-made assets to develop their products and test their outcomes. Many of the ready-made assets will have either been gathered from third parties, for example available from the internet while taking due consideration of copyright or created by completing units 4, 5, 6 and 7 on *Creating Digital Animation*, *Creating Digital Audio*, *Creating Digital Graphics* and *Creating Digital Video* respectively. Learners can produce additional original assets, but this should not be the focus of this unit.

**For 2C.P4:** learners should prepare assets (by gathering and editing assets and, if required, creating them) and list the sources for any ready-made assets. At least four assets should be included in each product, such as audio clips and animations, as outlined in their designs. They should demonstrate an awareness of the purpose of the multimedia products.

*For level 1, as a minimum, learners should prepare their assets for their interactive product for example, a graphic should be cropped appropriately. Learners should include at least two assets (one audio and one animation).*

**For 2C.M3** learners should prepare their assets and content for the products, while taking into consideration the audience for the linear product and user requirements for the interactive product. All ready-made assets should be fully referenced in a sources table, with enough detail for another person to independently obtain the assets used.

**For 2C.P5:** learners should use appropriate software tools/techniques to combine their assets and develop their multimedia products, while demonstrating an awareness of the intended purpose.

As a minimum, the linear product should contain interlinked screens with:

- combinations of images with text
- suitable colour scheme and fonts
- screen transitions
- at least **two video clips**
- entry and exit effects applied to assets
- title screen(s).

As a minimum, the interactive product should contain:

- user interface for navigation and control
- suitable colour scheme and fonts
- at least **two animated assets**
- background sound track
- title screen(s).

If original video or audio is required as part of the design then due consideration should be given to health and safety issues while recording, e.g. the environment where the recording is due to take place.

*For level 1, as a minimum, learners should have used appropriate tools/techniques to combine assets to develop at least the interactive multimedia product. The minimum expected is a user interface for navigation and control, background sound track, at least two animated assets and a title screen.*

**For 2C.M4:** learners must continue to use tools and techniques to improve the multimedia products, demonstrating an awareness of audience for the linear product and user requirements for the interactive product.

For the linear product learners should take account of:

- suitable animation of text
- consistency of colour scheme and layout
- whether video clips are edited and combined with other assets
- automated running.

For the interactive product learners should take account of:

- controls such as stop, rewind, replay, navigation and character movement
- whether sound is synchronised to the animated assets
- fade in/out of music and voice over.

**For 2C.P6:** learners will be expected to follow their test plans and test the functionality of their multimedia products, checking that they are fit for purpose.

Learners are likely to experience technical difficulties as they develop their products. Learners will be expected to repair their multimedia products. It is important that learners make appropriate comments on their test plans or in accompanying logs about such issues and how they have resolved them.

*For level 1, as a minimum, learners should test the functionality and fitness for purpose of their products and repaired faults. They should document any changes made.*

**For 2C.M5:** over and above the existing functionality testing learners will be required to test the functionality of the additional usability features, as implemented for 2C.M4.

Learners should complete user-experience testing, with the help of at least one person who can act as a representative of the target audience for the linear product and intended users for the interactive product. The test user should be commenting on the effectiveness of the multimedia experience provided. Learners should record this feedback as part of the testing process.

**For 2C.D3:** teachers should recognise that the process of developing and testing multimedia products is an iterative and not sequential process. When making refinements to their products, learners should take into account their test results and feedback from others.

The multimedia products should engage the intended audience/users. For instance, a linear product, such as a film trailer, should combine video clips, high quality voice over and synchronised sound effects, with text and an interactive product, such as a computer game, should be highly playable, original, creative and interactive.

### **Learning aim D**

**For 2D.P7:** learners should explain why the final products are fit for purpose and suitable for the intended audience/user requirements. For each product, learners should give one reason why it is fit for purpose and one reason relating to audience/user requirements.

*For level 1, as a minimum, learners should identify how their final interactive multimedia product is fit for purpose, for example, 'My simple game is suitable for Key Stage 2 children as it includes fun characters which are easy to control'.*

**For 2D.M6:** learners should build on the explanations given in the Pass criteria and refer back to the original requirements and purpose, as defined in the brief. They should also seek and record feedback from others about the suitability of the final multimedia products and consider the impact of any constraints.

**For 2D.D4:** learners should evaluate the initial design ideas/prototypes against the final multimedia products, concentrating on the overall user experience and any original requirements given in the brief. They should justify any changes that were made during development and explain the rationale for any changes.

Learners should use this feedback to identify at least three further potential improvements but do not have to implement the enhancements.

*For level 1, as a minimum, learners should have identified at least one strength and one potential improvement to their multimedia product.*



## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that cover the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

### Brief 1

Design, develop and test a multimedia presentation intended to introduce the work of a charity concerned with the conservation of the rainforest. The presentation should be aimed at Key Stage 4 school pupils. It should be designed to inform them of the problems associated with the loss of the rainforest. The presentation is to be shown in school classrooms, using a large screen and data projector. The final presentation must include a list of all the digital assets used in its development.

### Brief 2

Design, develop and test a simple, single player computer game based on a maze. The game should be fun to play, aimed at Key Stage 2 children and maintain interest by incorporating levels of increasing difficulty. The game is to be played on laptops and standard PCs and should include user instructions on game play.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Investigation	<p>You are a consultant working for a multimedia development company. A customer (the 'client') has approached you asking for more information about multimedia products.</p> <p>You have been asked to produce a presentation which describes the uses and features of at least one linear and one interactive multimedia product.</p> <p>The customer would also like to find out how the multimedia products are fit for purpose and what their intended effect is on the audience/users.</p> <p>Think about the strengths and weaknesses of the multimedia products.</p>	<ul style="list-style-type: none"> <li>• Presentation slides and notes.</li> <li>• Supporting materials.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.P3, 2B.M2, 2B.M3, 2B.D2	Design Multimedia Products	<p>The customer would like you to develop two multimedia products based on two briefs.</p> <p>You have been asked to develop and document a design for each product. Each design should include:</p> <ul style="list-style-type: none"> <li>• purpose and audience/user requirements</li> <li>• product ideas/prototypes, including styles, templates and formats</li> <li>• storyboard to show the layout and structure</li> <li>• digital assets</li> <li>• timeline to indicate how assets combine</li> <li>• hierarchy chart of content</li> <li>• a table of sources</li> <li>• a test plan.</li> </ul> <p>Each multimedia product design should include alternative solutions and explain how they fulfil the stated purpose and audience/user requirements. Explain why any ideas you are not using have been rejected.</p> <p>Describe any constraints that have affected your design.</p>	<ul style="list-style-type: none"> <li>• A description of purpose and audience/user requirements for each multimedia product.</li> <li>• Proposed and alternative solutions for each multimedia product.</li> <li>• A list in a sources table of original and ready-made assets for each multimedia product.</li> <li>• A test plan for each multimedia product.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5, 1C.6 2C.P4, 1C.P5, 2C.P6, 2C.M3, 2C.M4, 2C.M5, 2C.D3	Develop and Test Multimedia Products	<p>You should now have everything you need to develop two multimedia products for the customer. This will involve:</p> <ol style="list-style-type: none"> <li>1. preparing (if required create, edit and optimise) digital assets that you will use in each multimedia product</li> <li>2. developing each multimedia product to fulfil the stated purpose and requirements set out in a brief</li> <li>3. testing each multimedia product against the test plan, checking the original requirements are still being met and documenting any changes made.</li> </ol> <p>Refine each multimedia product, based on feedback from others, where appropriate to do so, to enhance the audience/user experience.</p>	<ul style="list-style-type: none"> <li>• Functional multimedia products.</li> <li>• Annotated design.</li> <li>• Updated sources table.</li> <li>• Test plans and data.</li> <li>• Feedback from others.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1D.7 2D.P7, 2D.M6, 2D.D4	Review the multimedia products	<p>Having completed the multimedia products, you now have to review them. Review your products and explain why they are suitable for the 'client' (based on the requirements and purpose given in the brief), while considering feedback from others and any constraints.</p> <p>Justify where your design has changed during the development (from design to final product). Consider what you have changed following feedback and explain how you would improve each multimedia product further.</p>	<ul style="list-style-type: none"> <li>• Evaluation report.</li> <li>• Feedback from others.</li> <li>• Annotated design documents.</li> </ul>

# Unit 18: Computational Thinking

Level: **1 and 2**

Unit type: **Mandatory or Optional Specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

Computers influence much of the world around us and are used to solve a range of problems, including complex problems such as generating the visual effects in films and landing the Curiosity Rover (unmanned robot) on Mars. Computational thinking enables us to solve these problems using mathematics and logic.

Therefore, computational thinking skills are required extensively in any IT/computing career. This unit provides a coherent and formalised introduction to computational thinking. Employability skills, such as communication, numeracy and teamwork, are also important in the workplace. Some of these skills occur naturally within other units in the BTEC in Information and Creative Technology.

In this unit you will understand some of the mathematical methods, such as Boolean operations and functions, that underpin computational thinking skills used to solve problems. There are three types of computational thinking skills, specifically:

1. Logical thinking is about using readily available information to solve problems without making assumptions or taking short cuts and to check the validity of the result. The number puzzle Sudoku is an example of a problem which can be solved this way.
2. Algorithmic thinking involves using a predefined set of instructions to solve problems. For example, in strategy games like noughts and crosses or chess, players will use set moves (instructions) to try to gain advantage over their opponent and win.
3. Optimal thinking involves refining one of the many possible solutions to a problem to make it more efficient, i.e. the quickest and/or most effective method to obtain the desired result. For example, completing the Towers of Hanoi or a Rubik's Cube puzzle using the fewest moves.

In this unit you will use computational thinking (logical, algorithmic and optimal), underpinned by mathematical methods, to solve a problem.

This unit supports all of the optional specialist units in the Pearson BTEC Level 1/ Level 2 Firsts in Information and Creative Technology.

## Learning aims

In this unit you will:

- A understand mathematical methods for calculations and their uses in computational thinking
- B understand mathematical methods for functions and Boolean operations and their uses in computational thinking
- C apply computational thinking to solve a simple problem.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand mathematical methods for calculations and their uses in computational thinking</b></p> <p><b>Types of numbers</b></p> <ul style="list-style-type: none"> <li>• Natural numbers (1, 2, 3 ...).</li> <li>• Integers (... -2, -1, 0, 1, 2, ...).</li> <li>• Rational numbers (integers, fractions, decimals).</li> </ul> <p><b>Number systems</b></p> <ul style="list-style-type: none"> <li>• Base 10 (decimal).</li> <li>• Base 2 (binary).</li> <li>• Base 16 (hexadecimal).</li> </ul> <p><b>Using basic calculations</b></p> <ul style="list-style-type: none"> <li>• Brackets and the hierarchy of operations (BIDMAS).</li> <li>• Rounding, e.g. specified number of decimal places, whole number, degree of accuracy.</li> <li>• Errors, e.g. generated by rounding and truncation due to size of memory locations, division by zero, underflow, overflow.</li> <li>• Powers, e.g. use of the laws of indices, writing numbers using powers, expressing numbers using standard form</li> <li>• Convert between number systems, e.g. binary to hexadecimal, using positive numbers up to a maximum of 6 bits in size (1 to 63 in decimal).</li> <li>• One and two's complement notation representing signed integers up to 4 bits in size.</li> </ul> <p><b>Example uses of number systems in computers, e.g.:</b></p> <ul style="list-style-type: none"> <li>• computer memory representing integers and rational numbers, including:             <ul style="list-style-type: none"> <li>◦ bits, bytes and word length</li> <li>◦ two's complement</li> <li>◦ registers, e.g. 8-bit, 16-bit, 32-bit.</li> </ul> </li> <li>• character encoding schemes, including:             <ul style="list-style-type: none"> <li>◦ ASCII (American Standard Code for Information Interchange) – 7 bits</li> <li>◦ UTF8 (UCS Transformation Format) – 8 bits.</li> </ul> </li> <li>• colour models, including:             <ul style="list-style-type: none"> <li>◦ RGB (Red Green Blue)</li> <li>◦ CMYK (Cyan Magenta Yellow Key-Black)</li> <li>◦ hexadecimal.</li> </ul> </li> </ul>

**What needs to be learnt****Learning aim B: Understand mathematical methods for functions and Boolean operations and their uses in computational thinking****Defining a function**

- Inputs (domain).
- Outputs (range).
- Types of functions, including:
  - linear, e.g.  $y = mx + c$   
(gradient of a straight line is defined by ' $m$ ' and the y-axis intercept is defined by ' $c$ ')
  - quadratic, e.g.  $y = ax^2 + bx + c$

**Graphical representation of functions**

Using software, e.g. spreadsheet or graphics package, to represent linear and quadratic functions.

**Example uses of functions in computers, e.g.:**

- graphics, e.g. positioning objects on screen or obtaining the function from a straight line graph.
- programming, e.g. sorting numbers, calculations, randomising numbers.

**Boolean algebra**

Know that Boolean algebra is an alternative of elementary algebra of numbers differing in its values, operations and laws. Boolean algebra is the algebra of truth values 0 and 1.

- Operations – AND; OR; NOT; XOR.
- Truth tables.
- Logic gates.

**Example uses of Boolean operations in computers, e.g.:**

- software programs
- design of circuits and chips in technology systems
- cryptography.

**What needs to be learnt****Learning aim C: Apply computational thinking to solve a simple problem****Representation of a problem**

Understand that mathematical methods can be used to represent a sub-problem or solution to a problem, e.g.:

- calculations
- truth tables for logical (Boolean) operations: AND, OR, NOT, XOR
- simple functions, e.g. linear, quadratic and algorithms.

**Computational thinking skills**

Know that computational thinking can be broken down into logical thinking, algorithmic thinking and optimal thinking.

*Logical thinking*

Know that logical thinking is about using readily available information to solve problems without making assumptions or taking short cuts and checking the validity of the result. These thinking skills can be used to solve problems, e.g. developing a set of rules to create a three by three number square using the numbers 1 to 9.

*Algorithmic thinking*

Know that algorithmic thinking involves using a predefined set of instructions to solve problems. These thinking skills can be used to solve problems, e.g. converting base 10 numbers to binary representations.

*Optimal thinking*

Know that optimal thinking involves refining one of the many possible solutions to a problem to make it more efficient, e.g. the quickest or with minimal waste and/or most effective, e.g. to obtain an improved result. These thinking skills are used to solve the problems, e.g. compare algebraic and graphical methods to solve functions.

**A computational thinking process**

A process using computational thinking to create a solution to a problem follows:

- 1 Breaking down a problem into a number of smaller, more manageable sub-problems with defined inputs and outputs.
- 2 Use of visualisation tools (such as diagrams, flow charts, functions, storyboards and models) to represent an existing problem or system.
- 3 Designing a solution to a problem using mathematical methods, e.g. pseudocode, a flow chart, Boolean operations or an algorithm.
- 4 Create/develop a solution to a problem (for the purposes of this unit a model of the solution with local and global variables is sufficient).
- 5 Test the solution using test data (normal, extreme and erroneous values) to demonstrate the validity of the solution.
- 6 Use optimal thinking (e.g. by recognising the similarities and patterns of output data) to refine the solution (e.g. to reduce waste or to increase the speed of calculating the solution).



## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand mathematical methods for calculations and their uses in computational thinking</b>			
1A.1 Identify the computational uses of calculations and use calculations, with guidance, to: <ul style="list-style-type: none"> <li>• write numbers using power notation</li> <li>• convert from decimal to binary and hexadecimal number systems.*</li> </ul>	2A.P1 Explain the computational uses of calculations and use calculations to: <ul style="list-style-type: none"> <li>• write numbers using power notation</li> <li>• convert from decimal to binary and hexadecimal number systems.*</li> </ul>	2A.M1 Use calculations to: <ul style="list-style-type: none"> <li>• identify rounding errors</li> <li>• show how natural numbers are represented in a computer</li> <li>• convert between all the three number systems.*</li> </ul>	2A.D1 Discuss how integers and rational numbers can be represented in a computer.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Understand mathematical methods for functions and Boolean operations and their uses in computational thinking</b>			
1B.2 Identify the computational uses of functions, and with guidance: <ul style="list-style-type: none"> <li>• identify linear functions</li> <li>• obtain the function of a straight line from a graph.*</li> </ul>	2B.P2 Explain the computational uses of functions and: <ul style="list-style-type: none"> <li>• identify linear and quadratic functions</li> <li>• obtain the equation of a straight line from a graph.*</li> </ul>	2B.M2 Use software to represent and define the range and domain of different types of linear and quadratic functions.*	2B.D2 Discuss how functions are used to calculate the position of objects and generate the information needed to plot shapes on screen.*
1B.3 Identify the computational uses of Boolean operations, and with guidance, produce truth tables and logic gates corresponding to at least <b>two</b> different operations.*	2B.P3 Explain the computational uses of Boolean operations, and produce truth tables and logic gates corresponding to at least three different operations.*	2B.M3 Use more complex Boolean operations to produce truth tables and logic gates corresponding to at least three different combinations of operations in series.*	2B.D3 Use logic gates to solve simple problems.*

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Apply computational thinking to solve a simple problem</b>			
1C.4 Design a solution, with guidance, including: <ul style="list-style-type: none"> <li>• a description of the problem divided into smaller sub-problems as required</li> <li>• visualisation tools to represent the problem</li> <li>• mathematical methods to represent a possible solution to the problem.*</li> </ul>	2C.P4 Design a solution, including: <ul style="list-style-type: none"> <li>• a description of the problem divided into smaller sub-problems as required</li> <li>• appropriate visualisation tools to represent the problem</li> <li>• mathematical methods to represent a possible solution to the problem.*</li> </ul>	2C.M4 Design a detailed solution to a problem using: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• test data.*</li> </ul>	2C.D4 Justify the design decision taken, including: <ul style="list-style-type: none"> <li>• how it will solve the problem</li> <li>• any design constraints.*</li> </ul>
1C.5 With guidance, create a model of the solution and test the model for functionality.*	2C.P5 Create a model of the solution and test the model for functionality and repair any faults.*	2C.M5 Create a functional model which solves the problem and use test data to demonstrate the validity of the solution. Repair any faults.*	2C.D5 Use optimal thinking to refine the model.*

\*Opportunity to assess mathematical skills

## Teacher guidance

### Resources

Learners will need access to a computer system with a spreadsheet package.

If not provided by the spreadsheet, graphing facilities capable of satisfying the outcomes described will need to be available. A good range of case study examples and exercises is needed.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson.

Please read this guidance in conjunction with *Section 8 Internal assessment*.

Learners will be familiar with the content of the National Curriculum programme of study for mathematics in Key Stage 3.

It is suggested that this unit is assessed using a series of assignments.

It may be appropriate to use prepared exercises to provide evidence for some of the criteria in this unit, but it is recommended that, where possible, these be set to a vocational context. It is not expected that the assignments should be completed under controlled conditions.

If any exercises are used to provide evidence then outcomes should be considered against the assessment criteria rather than the award of a grade or numeric mark.

Where the unit content asks for a particular set of calculations to be completed, then all calculations must be completed successfully by individual learners and workings must be shown where appropriate.

Although some of this unit will be evidenced on paper or using a spreadsheet, centres should consider the use of assessment methods such as presentations, posters, leaflets, videos and podcasts. The use of these methods will allow assignments to be set in vocational contexts.

All three learning outcomes could be assessed in a similar way, with learners producing material for technical audiences specified by learners or the teacher.

Learners should use evidence from this unit as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

### Learning aim A

It is important for learners to understand the purpose and uses of calculations as part of the fundamental concepts of computational thinking. Learners are expected to demonstrate how to use calculations by using appropriate mathematical methods to find solutions to a set of given problems. Learners need to be familiar with working with different types of numbers, including natural, integer, rational and binary. Most learners may be less familiar with binary and hexadecimal number systems and may need to spend additional time working with them.

**For 2A.P1:** learners are required to explain the computational uses of calculations and use calculations to write numbers using power notation. Therefore, they need to be familiar with numbers raised by powers and numbers expressed in standard form. Learners need to be given sufficient opportunities to practise the use of these numbers to ensure that they are comfortable with them. Teachers may wish to concentrate on working with powers of two in order to support the work with binary numbers later in the unit.

Learners are required to use calculations to convert positive decimal numbers to binary and hexadecimal number systems. Decimal numbers should be from 1 to 63.

*For level 1, as a minimum, learners should identify the computational uses of calculations and use calculations to write numbers using power notation. Learners will also convert positive decimal numbers (in the range of 1 to 63) to binary and hexadecimal.*

**For 2A.M1:** Learners need to be aware that using technology to carry out calculations can introduce errors, such as the rounding of numbers during calculations due to the amount of memory available to store the numbers. should be able to use calculations to identify rounding errors.

Learners should concentrate on using an 6-bit representation to demonstrate how numbers from 1 to 63 can be represented in computer memory. Their previous work on powers of two should support these activities.

Learners are required to use calculations to convert between all the three number systems, including binary to hexadecimal and hexadecimal to decimal.

**For 2A.D1:** learners are required to discuss how integers and rational numbers can be represented in computer memory. Therefore, they should be able to represent real numbers in two's complement format and be able to explain the purpose of two's complement representations in computer memory. Real numbers can be converted to binary and represented in computer memory.

### Learning aim B

It is important for learners to understand the purpose and uses of functions and Boolean operations as part of the fundamental concepts of computational thinking. Learners are expected to demonstrate how to use functions and Boolean operations by using appropriate mathematical methods to find solutions to a set of given problems.

**For 2B.P2:** learners are required to explain the computational uses of functions and identify linear and quadratic functions. Learners should be presented with a series of simple problems such as 'Two brothers bought ten pens. If one brother bought four pens, calculate how many pens were bought by the other brother.' Learners should practise expressing these problems as functions.

Learners are also required to obtain the equation of a straight line from a graph. Therefore, learners need to develop their skills in the use of coordinates to allow them to describe a given straight line on a graph in terms of  $y = mx + c$ . Learners should gain experience of lines with both positive and negative gradients and different y-axis intercepts.

*For level 1, as a minimum, learners should identify the computational uses of functions and use functions to identify linear functions, and obtain the function of a straight line from a graph.*

**For 2B.M2:** learners are required to use software to represent and define the range and domain of different types of linear and quadratic functions. Therefore, learners should be able to use software to represent a range of applications for different types of functions. Learners should consider the practical applications for these functions.

**For 2B.D2:** learners are required to discuss how functions are used in programming output to screen-based devices. Therefore, they should be able to demonstrate an understanding of how functions are used to produce designs for screen layouts. They should also be able to explain how the mathematical concepts are used to create and position objects, such as circles, on screen.

**For 2B.P3:** learners are required to explain the computational uses of Boolean operations and produce truth tables and logic gates corresponding to at least **three** different operations. Therefore, learners should become familiar with the range of Boolean operations given in the unit content. In many cases learners may find it easier to relate these operations to real-life situations to understand the output related to the inputs. For example, if searching for boys who are more than 11 years old then an AND operation would be TRUE if the input was 'boy' and '12' and FALSE if the input was 'boy' and '10'. Learners should be able to draw up truth tables for each of the operations.

Learners should be introduced to the practical use of Boolean operations through the construction of logic gates. They need to appreciate that logic gates can have several inputs but only one output.

*For level 1, as a minimum, learners should identify the computational uses of Boolean operations (AND, OR, NOT, XOR) and produce truth tables and logic gates corresponding to at least **two** different operations.*

**For 2B.M3:** learners are required to use more complex Boolean operations to produce truth tables and logic gates corresponding to at least **three** different combinations of operations in series. Therefore, learners need to be able to produce truth tables that represent the use of a combination of Boolean operations.

**For 2B.D3:** learners are required to use logic gates to solve simple problems. Therefore, learners should be able to demonstrate that they can solve problems that involve multiple inputs (at least **three**) and represent more complex processes. For example, this combination of NOT, AND and OR gates has three inputs: A, B and C. The outputs from the NOT and AND gates are combined through the OR gate to give the final output Z. A NOT gate has just one input. NOT gates are often used in emergency-stop buttons on machine tools. If an OR gate is used in a simple lighting circuit with two switches in parallel, the lamp will light if either switch is pressed. If an AND gate was used, both switches would have to be pressed at the same time.

### Learning aim C

Learners will now relate the theory and application of different mathematical methods of calculations, functions and Boolean operations to solve a given problem by using computational thinking. Learners should have access to a suitable assessment brief, which outlines the problem.

Learners should apply logical thinking skills to solve a problem. Examples of problems could include:

- defining the  $n$ th term in a number sequence based on a practical problem
- combining logic gates to analyse data and provide correct output
- allocating network addresses to hosts (computers), routers, servers and switches using number systems
- designing control systems, including the way routers and switches organise traffic using logic gates.

Learners should also apply algorithmic thinking skills to solve a problem. Examples of problems could include:

- solving equations
- plotting graphs of linear and quadratic functions
- applying file permissions on web servers and other networked file systems
- calculating the route taken for data to travel across the network using linear and quadratic functions
- the route taken by the data, represented by linear and quadratic functions.

Learners should also apply optimal thinking skills to solve a problem. Examples of problems could include:

- refine algorithms to carry out procedures in the fewest possible steps
- perfective maintenance of a computer program.

**For 2C.P4:** learners should design a solution to the given problem. The design documentation should include:

- a description of the problem divided into smaller sub-problems (as required)
- appropriate visualisation tools to represent the problem, e.g. flow chart, logic gate diagrams
- mathematical methods to represent a possible solution.

*For level 1, as a minimum, learners should design a solution to the given problem. The proposed solution will contain:*

- *a description of the problem divided into smaller sub-problems (as required)*
- *visualisation tools to represent the problem*
- *mathematical methods to represent a possible solution.*

**For 2C.M4:** in addition to the requirements for the pass grade, learners should produce a detailed solution to a problem using:

- alternative solutions, e.g. using different mathematical methods, for example by using different functions
- test data (containing normal, extreme and erroneous values) to demonstrate the validity of the result.

**For 2C.D4:** learners are expected to be able to justify their design decisions, including a justification of how it will solve the problem, and to explain any design constraints.

**For 2C.P5:** learners should create a model of the solution. Learners should test their model for functionality and repair any faults.

For a pass grade, the model may not produce a valid result in all cases/situations.

*For level 1, as a minimum, learners should create a model of the solution and test the model for functionality.*

**For 2C.M5:** learners should create a functional model which solves the problem and use test data to demonstrate the validity of the solution. Learners are likely to need to adapt their designs to create a fully functioning model.

**For 2C.D5:** learners should use optimal thinking to refine their model – for example, make the solution more efficient, i.e. the quickest and/or most effective way to obtain the desired result.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Calculations	<p>A company has asked you to produce a learning tool, such as an induction booklet, for work experience learners, which will be applied in the workplace to solve real-world problems.</p> <p>The company would like you to support your brief guide by demonstrating how calculations can be used to solve problems. Calculations should include:</p> <ul style="list-style-type: none"> <li>• conversions on number systems</li> <li>• rounding of errors</li> <li>• representing natural numbers, integers and rational numbers in a computer.</li> </ul>	<ul style="list-style-type: none"> <li>• Booklet.</li> <li>• Posters.</li> <li>• Set of mathematical tasks.</li> <li>• Podcast.</li> <li>• Video.</li> </ul>



Criteria covered	Assignment	Scenario	Assessment evidence
1B.2 2B.P2, 2B.M2, 2B.D2	Functions	<p>The company now asks you to put together a brief guide to demonstrate how problems can be written as functions and to identify the type of functions that would be useful in representing data in graphs, and obtain an equation for a straight line from a given graph.</p> <p>The guide should include a section explaining the significance and use of software to represent the range and domain of linear and quadratic functions.</p> <p>The company would like you to support your guide by demonstrating how the functions are used in a software package such as a spreadsheet. In particular, to calculate the position of objects and generate simple shapes onscreen.</p>	<ul style="list-style-type: none"> <li>• Booklet.</li> <li>• Posters.</li> <li>• Set of mathematical tasks.</li> <li>• Podcast.</li> <li>• Video.</li> </ul>
1B.3 2B.P3, 2B.M3, 2B.D3	The Logical Choice	<p>The company would now like you to put together a presentation on Boolean operations and how they are used in digital devices.</p> <p>The company would like you to demonstrate the use of logic gates and truth tables to solve simple problems using three or more different operations in series.</p>	<ul style="list-style-type: none"> <li>• Booklet.</li> <li>• Posters.</li> <li>• Set of mathematical tasks.</li> <li>• Podcast.</li> <li>• Movie (combining still images with text/narration).</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.P5, 2C.M4, 2C.M5, 2C.D4, 2C.D5	Solving a Problem	<p>The company has presented you with a problem to solve using computational thinking.</p> <p>The problem is to sort a large list of numbers in order.</p> <p>Design a solution to a problem including:</p> <ul style="list-style-type: none"> <li>• a description of the problem divided into small sub-problems</li> <li>• appropriate visualisation tools to represent the problem</li> <li>• structured mathematical methods to represent a possible solution</li> <li>• alternative solutions</li> <li>• test data.</li> </ul> <p>Create a model of the solution and test the model for functionality. Repair any faults as necessary.</p> <p>Use optimal thinking to refine the model – for example, to improve the efficiency of the process to gain the desired result.</p>	<ul style="list-style-type: none"> <li>• Working model.</li> <li>• Design documentation.</li> <li>• Test plan.</li> </ul>

# Unit 19: Computing in the Workplace

Level: **1 and 2**

Unit type: **Mandatory or Optional Specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Have you ever thought about why you are studying this qualification, what it could lead on to and how social media and communication technology is changing the delivery of projects in the workplace? This unit will help you answer these questions and help to prepare you for your career.

In this unit you will understand the personal characteristics, such as communication and self-management skills, which are valued by employers and you will demonstrate some of these characteristics. You will prepare an application for one job in the IT sector and creative computing industries (e.g. computer games developer or IT technician) demonstrating your technical and employability skills and using your digital portfolio to showcase your achievements. This will also help you decide which skills you should develop further and which career to pursue.

You will investigate what social media and communication technologies are and how they impact on our working lives, as individuals, on organisations and society. This will help you to prepare for your career and for future innovations in computing.

Organisations often split work into projects and it is important for projects to be successful. In a similar way your course will be split into a number of projects, focused either around particular units or on products and/or systems you develop. Through delivering these projects you will demonstrate how social media and communications technology can be used to improve the delivery of a project. Improvements could include saving time, boosting the morale of staff and customers, and/or increasing the quality of the outputs.

This unit supports all the optional specialist units in the Pearson BTEC Level 1/Level 2 Firsts in Information and Creative Technology.

## Learning aims

In this unit you will:

- A understand and demonstrate the personal characteristics valued by employers in the workplace
- B prepare an application for an IT/computing job role
- C understand how social media and communication technologies are used in the workplace
- D demonstrate how social media and communication technologies can be used to improve the delivery of a project.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand and demonstrate the personal characteristics valued by employers in the workplace</b></p> <p><b>Personal characteristics valued in the workplace:</b></p> <ul style="list-style-type: none"> <li>• communication and literacy, i.e. ability to produce clear, structured written work and oral literacy, including listening and questioning and non-verbal communication (body language)</li> <li>• self-management, i.e. being responsible, flexible and reliable, demonstrating time-management skills, integrity and a readiness to improve own performance, and the ability to maintain a positive attitude</li> <li>• teamworking, i.e. respecting others, cooperating, negotiating, persuading and contributing to discussions</li> <li>• problem solving, i.e. analysing facts and circumstances and applying creative thinking (including artistic appeal) to develop appropriate solutions</li> <li>• application of IT or digital literacy, i.e. the general ability/skills to use computers to support learning, working and leisure activities (e.g. word processing, presentation software and file management skills)</li> <li>• application of numeracy, i.e. the manipulation of numbers, general mathematical awareness and its application in practical contexts</li> <li>• business and customer awareness, i.e. the basic understanding of the key drivers for business success (e.g. cash flow) and the need to provide customer satisfaction to appropriately meet the needs of customers</li> <li>• technical knowledge, i.e. understanding the specific area of IT/computing and specific legislation (e.g. health and safety and data protection)</li> <li>• leadership and organisation, including managing projects, being decisive and inspiring others.</li> </ul> <p>Understand why these personal characteristics are valued in the workplace, such as communication skills, including:</p> <ul style="list-style-type: none"> <li>• sharing ideas, concepts and other information with colleagues</li> <li>• sharing information and socialising with suppliers and customers</li> <li>• undertaking work as part of a team</li> <li>• reducing the likelihood of errors.</li> </ul> <p>Know that the personal characteristics required for a job role are often described in a technical and employability skills review.</p>

**What needs to be learnt****Learning aim B: Prepare an application for an IT/computing job role****Key job roles in the IT sector, including:**

- hardware, e.g. engineering and development, manufacture, repair, installation
- software, e.g. commercial programming, mobile app development, in-house software support, database administration
- network, e.g. engineers, technicians, administrators
- support, e.g. in-house support, external support
- security, e.g. in-house security, network security, anti-virus
- online, e.g. e-commerce management, search engine optimisation.

**Key job roles in the creative computing industry, including:**

- digital graphics, e.g. advertising, product design, packaging design
- animation, e.g. CGI in films, animated film-making, games characters and environment animation
- development, e.g. games programming, website development
- audio, e.g. radio broadcasts, film and game soundtracks
- post-production, e.g. testing, online marketing.

**Working in the IT sector and creative computing industries, including:**

- types of working environments, e.g. open-plan office, laboratories, field locations such as telecommunication sites, in-house, public-facing
- types of contracts and hours, e.g. permanent, fixed term, temporary, shift, contractual, annual hours, flexi-time, overtime
- relevant legislation and policies, e.g. data protection, non-disclosure agreements, Computer Misuse Act, acceptable usage policy, health and safety
- types of dress code, e.g. casual or formal dress code, uniform, identification
- security, e.g. low-key or high security such as a military organisation
- social media and communication technologies commonly used to improve productivity, remote working and the '24-hour office', e.g. web conferencing, cloud technology, mobile and tablet computing.

**Searching for IT and/or creative computing job roles, including:**

- places to search for IT and/or creative computing jobs, e.g. employment websites, company websites, publications, job centres, noticeboards, word of mouth
- criteria to use when searching for IT and/or creative computing jobs
- understanding the features of a job advertisement
- technical skills, e.g. programming, computer networking skills
- personal characteristics, e.g. communication and literacy, self-management, teamworking
- matching personal characteristics and technical skills to those advertised
- recognising suitable opportunities.

*continued*

**What needs to be learnt****Applying for IT and/or creative computing job roles, including:**

- speculative applications
- the process once a suitable job advert has been found
- requesting an application form and/or more information about the role
- online versus paper-based applications
- using your digital portfolio as part of the application process
- the process once the application has been submitted.

**Application for IT and/or creative computing job roles, including:**

- documents used in applications and their structure – length and formatting, e.g. covering letter, curriculum vitae, application form, technical and employability skills review
- outlining relevant education, skills and interests
- how to meet employers' expectations
- evidencing technical skills and abilities
- detailing achievements to date, e.g. school or college awards, sporting achievements, voluntary work
- how any gaps can be addressed, e.g. on-the-job training, further reading, course completion
- presentation of application, e.g. form filled correctly, spelling, formal language, format and structure
- checking accuracy of application, e.g. no embellishments, facts are correct.

**What needs to be learnt****Learning aim C: Understand how social media and communication technologies are used in the workplace**

Social media and communication technologies are based on web and mobile applications that allow interactive communications between organisations and individuals. Technologies (as listed in learning aim D) include:

- blogs
- picture-sharing
- wall-postings
- email
- instant messaging
- music-sharing
- crowdsourcing (outsourcing tasks to a distributed group of people)
- voice over IP (Internet Protocol).

Delivery platforms, the software or hardware that enable social media and communications technology to be accessed by all, including:

- portable devices, e.g. smartphones, tablet computers
- browser-based, e.g. desktop computers, portable devices
- specialist applications, e.g. for desktop computers, for laptops
- network-based, e.g. intranet, internet, cloud-based
- use of system resources, e.g. inbuilt cameras, sharing of bandwidth.

Characteristics of impact:

- scale:
  - individual
  - organisation
  - social
  - global
- nature:
  - positive
  - negative
- timescale:
  - immediate
  - over time.

*continued*

### What needs to be learnt

Types of impact:

- individuals, including:
  - security threats, e.g. cyber-bullying, phishing, malware
  - current legislation
  - ethics, e.g. privacy, piracy, intellectual property rights
  - additional and ongoing training needs, e.g. new technologies
  - working practices, e.g. remote working, health and safety (such as stress and electrical equipment) and work/life balance
  - access to information, e.g. globalisation of the internet, distinguishing between bias and truth of information, individual requests under the Freedom of Information Act, instant reporting (such as live footage and blogging from events as they happen)
- organisations, including:
  - security threats, e.g. fraud, phishing, malware
  - current legislation
  - ethics, e.g. privacy, piracy, intellectual property rights, freedom of information
  - working practices, e.g. remote working, health and safety, and automation, outsourcing and virtual teams (geographically dispersed)
  - compatibility, e.g. software, hardware, verbal/written language (especially in organisations operating in more than one country)
  - skill levels, e.g. maintaining productivity
  - competitiveness, e.g. better interaction with customers and share ideas with colleagues
  - direct communication with customers, e.g. different ways to communicate, instant and real-time communication, customer expectations and organisation etiquette
- society (social), including:
  - security threats, e.g. cyber terrorism, fraud, malware
  - current legislation
  - ethics, e.g. changes to social practice (expectation of use, services accessible through internet only)
  - environment, e.g. paperless office, less transportation and travel
  - political, e.g. the Arab Spring protests and uprising.
- Global impacts are similar to more local social impacts except that they occur across a larger geographical area.



**What needs to be learnt****Learning aim D: Demonstrate how social media and communication technologies can be used to improve the delivery of a project**

How social media and communication technologies can be used in the workplace to improve the delivery of project(s), e.g.:

- saving time
- higher-quality outputs
- saving money
- morale of staff and customers.

Identify and use appropriate tools and techniques, which can span more than one category and improve the efficiency and effectiveness of undertaking activities, including the following:

- Productivity, including:
  - web conferencing and desktop sharing, e.g. WebEx, Adobe Connect, Elluminate, DimDim
  - time management, e.g. personal calendars, Google Calendar, Deadline and Achieve Planner (time-management software)
  - alerts, e.g. Google Alerts and Notify Me
  - personal organisers, e.g. Microsoft OneNote and Evernote
  - image, audio and video-based applications, e.g. Twitpic, Instagram, Jing, AudioBoo and iMovie
  - others, e.g. Zinkmo to synchronise bookmarks across computers and browsers and Wordle to generate 'word clouds' from text.
- Communication between individuals and organisations, including:
  - voice over IP, e.g. Skype and sipgate
  - real-time messaging, e.g. Microsoft Messenger
  - email, e.g. Microsoft Outlook, Gmail and Hotmail.
- Collaboration and networking for teamworking and sharing of ideas/reporting, including:
  - public social networks, e.g. Facebook, Yammer, LinkedIn and Google+
  - private collaborative spaces for groups or communities, e.g. blogger.com, Dropbox and WordPress
  - sharing content from one website to be republished (syndicated) by another, e.g. Really Simple Syndication (RSS) and Atom
  - micro-blogging, e.g. Twitter and 'status updates' on public social networks.
- Problem solving to aid the development of appropriate solutions, including:
  - mind mapping, e.g. Think and iMindMap
  - online forums, e.g. Moodle, customer forums, fan forums, Q+A
  - crowdsourcing, e.g. Threadless, crowdSPRING and Jig
  - search engine and discovery tools, e.g. Google Search, Bing and Searchbots and Spezify.

*continued*

**What needs to be learnt**

- Learning tools for creating, delivering, managing and/or tracking learning and/or providing a formal social learning environment, including:
  - information and/or instruction, e.g. iTunes U, OpenAcademy, YouTube EDU and TED (Technology, Entertainment, Design)
  - content sharing, e.g. Moodle and Drupal.
- Technology for social media and communication, including:
  - software, e.g. applications, apps, browsers
  - hardware, e.g. desktop, portable device, webcam, microphone
  - licensing, e.g. open source, free, Creative Commons, paid for
  - create logins or profiles as required
  - register application as required.
- Interconnected social media and communication technologies, including:
  - RSS 'ticker' application on a PC or mobile app, which allows others to submit a message for broadcast to those who are subscribed to this feed
  - Google Docs to produce, edit and share documents online, including spreadsheets, presentations and drawings to other users in the same circles
  - Facebook timelines automatically update as soon as someone creates a new Twitter post
  - Twitter to create new hash tag groups, e.g. #Unit19 and inviting followers to contribute or stay up to date with the latest announcements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand and demonstrate the personal characteristics valued by employers in the workplace</b>			
1A.1 Identify the personal characteristics valued by employers and demonstrate at least <b>four</b> characteristics.	2A.P1 Explain the personal characteristics valued by employers and demonstrate at least <b>six</b> characteristics.	2A.M1 Review the personal characteristics valued by employers, analysing why they are valued.	2A.D1 Discuss your own personal characteristics for employment.
<b>Learning aim B: Prepare an application for an IT/computing job role</b>			
1B.2 Prepare an application for at least <b>one</b> job role in the IT and/or creative computing industries, with guidance, by including a: <ul style="list-style-type: none"> <li>• covering letter</li> <li>• generic one-page curriculum vitae.#</li> </ul>	2B.P2 Prepare an application for at least <b>one</b> job role in the IT and/or creative computing industries by including a: <ul style="list-style-type: none"> <li>• covering letter</li> <li>• tailored two-page curriculum vitae.#</li> </ul>	2B.M2 Review the job role against your suitability to perform the roles and responsibilities given and enhance your application by including at least <b>two</b> of the following: <ul style="list-style-type: none"> <li>• an application form</li> <li>• a technical and employability skills review</li> <li>• a digital portfolio.#</li> </ul>	2B.D2 Refine your job application to meet employers' expectations, taking into account feedback from others.#

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Understand how social media and communication technologies are used in the workplace</b>			
1C.3 Identify at least <b>two</b> different social media and communication technologies used in an organisation.	2C.P3 Explain at least <b>three</b> different social media and communication technologies used in an organisation and how they can be accessed.	2C.M3 Review the impact resulting from using technologies in an organisation.	2C.D3 Discuss the positive and negative effects of using technologies in an organisation.
<b>Learning aim D: Demonstrate how social media and communication technologies can be used to improve the delivery of a project</b>			
1D.4 Prepare and set up at least <b>three</b> different social media and communication technologies, with guidance.	2D.P4 Prepare and set up at least <b>five</b> different social media and communication technologies.	2D.M4 Prepare and set up at least <b>one</b> interconnected system that uses two or more technologies.	2D.D4 Refine the social media and communication technologies used to improve the delivery of a project, taking into account feedback from others.
1D.5 Use at least <b>three</b> different social media and communication technologies to improve the delivery of a project, with guidance.	2D.P5 Use at least <b>five</b> different social media and communication technologies to improve the delivery of a project.	2D.M5 Use at least <b>one</b> interconnected system that uses two or more technologies to improve the delivery of a project.	
1D.6 Identify how each social media and communication technology has been used to improve the delivery of a project.	2D.P6 Explain how each social media and communication technology has been used to improve the delivery of a project.	2D.M6 Review how each technology has been used to improve the delivery of a project, while considering feedback from others and any constraints.	2D.D5 Evaluate how the technologies were used to improve the delivery of a project and make recommendations for further improvements.

#Opportunity to assess English skills

## Teacher guidance

### Resources

Learners will need to find or be given job advertisements, specifications and application forms. Access to standard resources, such as the internet and word-processing software, is essential.

For learning aims C and D, learners will need access to technologies required for different social media and communication methods chosen. This may include access to specific websites or using equipment such as microphones and webcams. They may wish to use their own technology, such as a smartphone, which is acceptable.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Learners will understand the personal characteristics valued by employers in the workplace, particularly in the IT and creative computing industries, and demonstrate some of those skills and attributes. They will use their understanding of characteristics and of job roles, and prepare an application for at least **one** job role in the IT and creative computing industries. Finally, learners will understand how social media and communication technologies are used in the workplace, before demonstrating their use to improve delivery of a project, which can be, for example, a product and/or system they are developing in another unit.

Learners should include evidence from undertaking this unit as part of their digital portfolio (*Unit 3: A Digital Portfolio*).

### Learning aim A

Learners will understand the personal characteristics valued by employers in the IT and creative computing industries. Examples from both industries **must** be considered. They should then demonstrate a number of those characteristics throughout their course.

**For 2A.P1:** learners should explain the personal characteristics valued by employers as outlined in the unit content. This could be done in several ways, such as a presentation, a short video or a web page. They should also demonstrate at least **six** characteristics. This could be completed throughout their course of study; witness statements or video could be the best way to produce evidence of this.

*For level 1, as a minimum, learners should identify the personal characteristics valued by employers in the IT and creative computing industries, and demonstrate at least **four** characteristics, which could be in the course of their lessons.*

**For 2A.M1:** learners should review the personal characteristics valued by employers in the IT and creative computing industries, going into more detail and giving examples of why they are valued. For example:

1. problem-solving skills, including:

- resolving problems in order to contribute towards the goals of the organisation
- helping the organisation evolve
- improving the competitiveness of the organisation

2. self-management, including:

- accepting responsibility for completing activities
- learning new skills and improving own/colleagues' performance
- identifying issues in a timely way.

This could be achieved in several ways, such as a presentation. When learners are demonstrating at least six characteristics, they must be presented in business situations – for example, a meeting with others, teamwork, tasks in other units or simulated situations using role play.

**For 2A.D1:** learners should discuss their personal characteristics, applying their knowledge of those which are valued by employers. They could discuss which characteristics they have, and which they have yet to develop or could develop further, and suggest how they might do that. They could also discuss how they know they have the skills, giving examples of when they have used them. This will be useful for learning aim B where they will be applying for a job role.

### Learning aim B

Learners will prepare an application for at least **one** job role by producing a covering letter and curriculum vitae, and producing at least **two** from the following list:

- application form
- technical and employability skills review
- digital portfolio.

They will have the opportunity to gather some feedback and refine their job application to meet employers' expectations.

Learners do not need to include their personal details and may add fictional, realistic information.

Ideally, learners should find the job themselves. However, at least **one** or a range of jobs can be provided to them with the job advertisements, job specifications and application forms.

Learners should **not** submit their application to the organisations, but the process of applying should be simulated, including strict submission deadlines.

**For 2B.P2:** learners should prepare an application for at least **one** job role in the IT and/or creative computing industries by producing a covering letter and a two-page curriculum vitae tailored for the job role.

*For level 1, as a minimum, learners should prepare an application for at least **one** job role in the IT and/or creative computing industries by producing a covering letter and a one-page curriculum vitae. The curriculum vitae can be generic, which is suitable for applying to most IT and/or creative computing job roles.*

**For 2B.M2:** learners should review the job role against their own suitability to perform the roles and responsibilities given. They should enhance their job application by including at least **two** of the following:

- a detailed application form
- a technical and employability skills review
- a digital portfolio (from *Unit 3: A Digital Portfolio*), which showcases their talents.

Learners may be provided with a mock-up application form, providing they are suitable for the job position.

**For 2B.D2:** learners should refine the content of their job application, thus making them more attractive to employers. Learners should comment on how they intend to address any skills gaps, showing the employer that this is one aspect they have considered and want to develop further. They should use evidence from a range of sources, including education, work, hobbies and any other relevant activities, to demonstrate that they are a good candidate for the job. They should also gather feedback from others, such as their teacher, their head of department or their peers,

and make improvements, which should be grammatically accurate, concise, tailored to the job advert and error free. Other refinements may include improving the presentation of the application.

### Learning aim C

Learners will understand how social media and communication technologies are used in the workplace. They will be able to explain the range of social media and communication technologies used in an organisation, and review the impact on individuals, organisations and society. This should focus on the workplace rather than the use of computing for social or other purposes.

Social media and communication technologies impact every area of our working lives, as individuals, organisations and society. Impacts can be positive, negative or both, and have consequences on those directly involved but also have wider-reaching effects that change over time.

This would be an excellent opportunity to invite visiting speakers or arrange visits to organisations.

Learners should ideally be presented with a case study of an organisation that uses social media and communication technologies to support and/or promote its business. Although any organisation should be suitable, it might be advisable to use medium or large businesses so as to give enough scope for investigation. The organisation could be commercial or a not-for-profit organisation, such as a school, charity, the police force or military.

Learners are also welcome to identify and investigate their own organisation if they so wish, but they should check with their teacher before starting. They may want to use organisations in which they have carried out work experience. Learners could relate this activity to that given for undertaking a work experience project for *Unit 25: IT Work Experience*.

**For 2C.P3:** learners should explain at least three different social media technologies used in an organisation that they have been given or selected, and explain how they can be accessed. For example, a telecommunications company uses instant live chat to talk to customers online via a browser-based platform accessible on portable devices and desktop computers.

*For level 1, as a minimum, learners should identify at least two different social media and communication technologies used in any organisation.*

**For 2C.M3:** learners should review the impact of using social media and communication technologies in the organisation that they have been investigating. Impacts, such as current legislation, security and ethical, affect individuals (e.g. customers, clients, employees), organisations (e.g. internally and other organisations) and society.

**For 2C.D3:** learners should discuss the positive and negative effects of using social media and communication technologies in the organisation that they have been investigating. For example, the positive effects of using web-conferencing tools to communicate and exchange information with other colleagues across the organisation are that they improve the productivity of individuals and save the organisation money. The negative effects for the individual and organisation are that it can be difficult to pick up non-verbal communication messages and that it is more difficult to build a relationship with colleagues.

## Learning aim D

Learners will demonstrate their ability to use social media and communication technologies professionally and appropriately. The focus of these tasks should be on practical elements. This should be done in the context of a project, which is undertaken as part of the Pearson BTEC Level 1/Level 2 Firsts in Information and Creative Technology course. For example:

- A. Creating Digital Audio:* learners could use social media to arrange the venue(s) for audio recording, booking audio equipment and working with a team.
- B. Mobile Apps Development:* learners could use social media tools to present prototypes of their mobile app and communicate with others using web or video chat, and polls to gather feedback.

**For 2D.P4:** learners should decide on at least **five** different social media and communication technologies they will set up and use. Learners should be provided with the appropriate resources to allow them to prepare these social media and communication technologies. This may have involved acquiring or downloading software, setting up equipment, accessing websites and other activities. They should prepare each one so that they are ready to use. If they already use the technology (e.g. already have an account), they should explain what preparation is needed to get it ready to use (e.g. explain how to set up an account). Evidence could be provided through photographs, video, witness statements and other methods.

*For level 1, as a minimum, learners should prepare and set up at least **three** different social media and communication technologies to use.*

**For 2D.M4:** learners should prepare and set up at least **one** interconnected system using two or more social media and communication technologies, e.g.:

- Facebook to an online media organisation, e.g. BBC or Guardian
- image-based media to Facebook, Twitter, Google+ or all at once
- Google+ to create and manage circles, allowing the sharing of information to other users
- Google Hangouts to communicate with other users within the same circles, such as video chat, group chat and screen share
- Twitter announcements automatically update as soon as someone creates a new Facebook status
- Facebook to conduct polls and gather feedback from others.

They should use technologies that are connected. Evidence could be provided through photographs, video, witness statements and other methods.

**For 2D.P5:** once learners have successfully prepared and set up their choice of at least **five** different social media and communication technologies, they are now ready to use them. Learners must use these technologies to improve the delivery of a project. Evidence could be provided by video screen capture, printouts of conversations or emails, witness statements and other methods.

*For level 1, as a minimum, learners should use at least three different social media and communication technologies to improve the delivery of a project.*

**For 2D.M5:** learners should use at least **one** interconnected social media technologies to improve the delivery of a project – for example, use instant messaging, update a status or import news feeds from Facebook using Skype.

Evidence could be provided by video screen capture, printouts of conversations or emails, witness statements and other methods.



**For 2D.D4:** learners should have identified a number of ways they could refine the use of social media and communication technologies to improve the delivery of a project. Where possible, learners should make refinements, while taking into account informal feedback from others, such as making notes from discussions with peers, but this does **not** require learners to complete a questionnaire. If those refinements cannot be made due to constraints, learners should explain how those refinements would have been made. For example, learners could improve the way information is communicated to others by creating a web blog, which integrates Twitter announcements, Facebook news and RSS 'ticker' feeds. The information is available in one place, making it quicker and easier for others to access that information.

**For 2D.P6:** now that learners have experienced using different social media and communication technologies, they should be able to explain how those technologies have been used to improve the delivery of a project. For example, they may have used a blog as a way of inviting others to formally review a finished product they have developed, and found that this method is much better than gathering feedback using a traditional paper-based questionnaire as it saves time.

*For level 1, as a minimum, learners should identify how each social media and communication technology has been used to improve the delivery of a project. For example, email was used to submit my design document.*

**For 2D.M6:** learners should review how each of their chosen social media and communication technologies has improved the delivery of a project, taking account of feedback from others. The technologies may have been used to improve the productivity of the learner working on the project and/or the communication between individuals (such as between the teacher and the learner) and/or to help solve problems. For example, learners could have used Google Calendars to manage their project and their teachers were given access so they could monitor progress and arrange meetings. Learners should gather feedback from others, especially anyone who has interacted and used the technology along with the learner. They should also consider any constraints that could have an effect on the way the technologies are used and managed, along with any impacts on the delivery of a project.

**For 2D.D5:** learners should evaluate the choice of social media and communication technologies they have been using to improve the delivery of a project. They should discuss the good and bad points. They could look at the difficulty of preparing the equipment, what details need to be given in signing up to services, whether there is a fee or if the user must be a member of a different service to access it (e.g. must use Facebook). They should also consider how it has improved the delivery of a project, commenting upon fitness for purpose, success of the project (against time, budget and quality requirements) and experience of using the technology. They should also give recommendations for at least **three** further improvements of things they would do differently next time.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Characteristics of a Candidate	<p>You work as an editor in the jobs section of a local newspaper company. Your line manager has been speaking to two clients that want to advertise two job positions in the newspaper:</p> <ul style="list-style-type: none"> <li>• The first client is the local police force wishing to hire a new Network Administrator.</li> <li>• The second client is a computer games studio wishing to hire an Animator.</li> </ul> <p>Your line manager has asked you to produce job advertisements for each position, stating the personal characteristics needed. Your line manager would like you to review these characteristics, with an explanation of why they are valued by these clients.</p> <p>You are also seen as a role model for others within your department, and you should demonstrate at least six characteristics.</p> <p>While you are working on this, you should also discuss your personal characteristics for employment.</p>	<ul style="list-style-type: none"> <li>• Witness statements.</li> <li>• Web page/blog.</li> <li>• Report.</li> <li>• Presentation.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2 2B.P2, 2B.M2, 2B.D2	Applying for a Job	<p>You are looking for employment in the IT and/or creative computing industries. Search and apply for one job.</p> <p>You should include the following as part of your job application:</p> <ul style="list-style-type: none"> <li>• a covering letter</li> <li>• a curriculum vitae</li> </ul> <p>and at least two of the following:</p> <ul style="list-style-type: none"> <li>• an application form</li> <li>• a technical and employability skills review</li> <li>• a digital portfolio.</li> </ul> <p>You should discuss your job application with others and gather feedback on how to improve it so that you meet the employers' expectations.</p> <p>You should make the necessary refinements to your job application to make it look attractive to potential employers.</p>	<ul style="list-style-type: none"> <li>• Curriculum vitae.</li> <li>• Covering letter.</li> <li>• Application form.</li> <li>• Technical and employability skills review.</li> <li>• Digital portfolio.</li> </ul>
1C.3 2C.P3, 2C.M3, 2C.D3	Computing in the Workplace	<p>You are working as a consultant on the efficient and effective use of computer technology in the workplace and have been invited into an organisation to research how social media and communication technologies are used, and the impact of these on individuals, organisations and society.</p> <p>Prepare a report that explains different social media and communication technologies used in the organisation, and review the impact on individuals, the organisation and society. This should include both positive and negative points.</p>	<ul style="list-style-type: none"> <li>• Report.</li> <li>• Web page/blog.</li> <li>• Presentation.</li> <li>• Case study.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1D.4, 1D.5, 1D.6 2D.P4, 2D.M4, 2D.P5, 2D.M5, 2D.P6, 2D.M6, 2D.D4, 2D.D5	Using Social Media and Communication Technologies	<p>Identify a project you are currently working on or about to start in this course.</p> <p>Prepare, set up and use at least five different social media and communication technologies, which you feel will help you improve the delivery of your project. For example, the technologies could be to provide and manage communication between yourself and others.</p> <p>You should include at least one interconnected system that uses two or more technologies, e.g. Google Calendars connected to a smartphone's email or calendar software and, where available, notification centre.</p> <p>Gather some feedback on the use of these technologies and make appropriate refinements to improve the delivery of your project.</p> <p>Review how each technology has been used to improve the delivery of your project while considering feedback from others and any constraints.</p> <p>Evaluate how the technologies have been used and make recommendations for further improvements.</p>	<ul style="list-style-type: none"> <li>• Video.</li> <li>• Presentation.</li> <li>• Demonstration.</li> <li>• Witness statement.</li> <li>• Observation record.</li> </ul>

# Unit 20: Building a Personal Computer

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

Building a personal computer (PC) is a really good way to better understand how computers work, and to develop the skills needed to build and maintain technology systems (which comprise more than one computer).

This unit develops skills from *Unit 2: Technology Systems*, which gives an introduction to how technology systems and computers work. It is particularly useful if you are considering a career in the IT sector, as it covers the key practical concepts and processes of building a computer. The unit is relevant for many roles in industry, and the skills applied here are transferable to many tablet/mobile computers. Suitable job roles for people who have studied this unit include IT technician, helpdesk support and computer systems engineer.

In this unit, you will explore the different uses of personal computers, e.g. for playing games, and the types and cost of components they contain. You will also investigate how the choice of components within a computer affects the performance of a PC.

Based on a brief, you will plan and build a personal computer, while following appropriate health and safety procedures. Once built, you will test that the personal computer is functional and meets its intended purpose. You will also test the performance of the computer, and consider the likely impact on performance of alternative solutions.

This unit develops skills from *Unit 2: Technology Systems* and supports *Unit 11: Computer Networks*, *Unit 14: Installing and Maintaining Computer Hardware*, *Unit 15: Installing and Maintaining Computer Software*, *Unit 16: Automated Computer Systems*, *Unit 22: Computer Security in Practice* and *Unit 23: Computer Systems Support in Practice*.

## Learning aims

In this unit you will:

- A understand the uses, costs and specifications of different personal computers
- B produce a plan to build a personal computer
- C build and test a personal computer.

## Learning aims and unit content

### What needs to be learnt

#### Learning aim A: Understand the uses, costs and specifications of different personal computers

A personal computer is a machine that processes digital data and contains a complete collection of components (hardware, software, peripherals, power supplies, communication links), making up a single computer installation.

Uses of personal computers, e.g.:

- computer gaming
- multimedia file editing
- home entertainment system
- office work.

#### Hardware components

Know the main hardware components inside a personal computer and their typical costs.

Main hardware components:

- processor, e.g. socket type, cores (dual, quad, hexa, octa), manufacturer, capacity and speed, types of cooling fans and/or heat sinks available
- motherboard, e.g. devices it supports, cable types (SATA, IDE), power consumption, compatible processors, compatible memory
- form factor, e.g. size and shape of motherboard, types of case that will support the components (tower, desktop, slim, micro, bespoke modifications), power supply unit required, size and shape of cooling fans and/or heat sinks
- storage, e.g. type of storage (solid state/magnetic hard disk), speed of storage (revolutions per minute [RPM]), type of connector used by storage
- input and output connectors, e.g. connections and connector types on motherboard, number of USB (or similar) sockets, connections to case (if needed)
- external data connection, e.g. wireless (802 standards), Bluetooth, wired connection type
- memory, e.g. clock rate of memory, capacity of motherboard, capacity of memory, socket type, solid state versus dynamic memory
- other, e.g. data bus types, case, heat sinks and fans, power supply unit.

#### Operating system software

Know the choice of operating system software available for a personal computer, e.g. open-source (Linux), Windows-based, Mac-based, and their typical costs.

*continued*

**What needs to be learnt****Personal computer specification**

Understand that PC specification and performance are a compromise between many different factors, including:

- costs
- technical skills and expertise of the people building the PC
- processor type and specification, e.g. AMD, Intel
- choice of processor informing choice of motherboard and vice versa
- motherboard and attached components need to be able to fit in the case
- choice of graphics card, e.g. AMD, NVIDIA
- memory type and size, e.g. DDR, SDRAM
- choice of operating system software
- choice of X86 or X64 architectures (which determine the type and amount of memory)
- storage devices, e.g. solid state drives (SSDs) versus magnetic
- component compatibility, e.g. motherboard and memory, processor and graphics card.

**What needs to be learnt****Learning aim B: Produce a plan to build a personal computer****Planning to build a personal computer**

Plan should include:

- purpose of the build, e.g. to meet a specific user requirement
- requirements of the brief ('client'/user requirements)
- alternative design ideas for building a personal computer system, e.g. using different components (e.g. processors, memory, storage devices)
- hardware components required, e.g.:
  - processor
  - motherboard
  - storage device
  - memory
  - external input/output devices
  - data transmission device (wireless, Bluetooth, wired)
  - case (and connectors)
  - power supply unit
  - cooling devices
  - graphics card
- software resources required, e.g.:
  - operating system software, e.g. Windows, Mac OS, Linux, OS service packs, drivers software
  - performance testing software, e.g. NovaBench, BambooHR
- tools required, e.g.:
  - antistatic equipment, e.g. antistatic packaging, wrist straps, antistatic mats
  - computer toolkits, e.g. chip inserter, chip extractor, assembly tweezers, slotted screwdriver, crosshead screwdriver, Torx screwdriver
  - heat compound for processor/cooling connection
- compatibility check of hardware and software components, e.g. case connectors, drive connectors, processor/socket connectors, memory/slot connections
- a health and safety assessment of the build process, including:
  - personal electrical safety
  - antistatic to computer being assembled
- installation sequence, e.g. collect tools, prepare workstation, assemble motherboard, fit storage devices, install operating system software
- constraints (costs and technical), e.g. component cost, hardware and software availability, tools and component/device compatibility, software costs/licensing
- test plan covering:
  - functionality, e.g. testing that the personal computer powers on
  - performance, e.g. testing how well different hardware components perform (speed, reliability and efficiency) individually and together within a personal computer, such as the processor, memory and graphics.



**What needs to be learnt****Learning aim C: Build and test a personal computer****Prepare to build a personal computer**

- Read component manufacturer's hardware and software instructions.
- Consider health and safety including taking electrical shock precautions.
- Consider the risk of static while protecting the equipment from discharge.
- Obtain hardware components (tools, hardware and devices).
- Obtain software resources (operating system installation media, performance testing software, software licence keys).
- Establish software configuration, e.g. setting correct date/time, language settings.
- Check tools required.

**Assemble the personal computer**

Understand the assembly process and be able to complete this in a safe manner while protecting oneself, others and the equipment in use, ensuring that:

- the planned installation sequence is followed
- all components are assembled without damage
- all antistatic precautions are followed during assembly
- the processor and cooling fan are correctly seated on the motherboard
- the motherboard is correctly assembled, with processor, and seated in case
- connectors are correctly inserted from any devices
- cards/memory are correctly seated
- storage devices are correctly fixed in case
- the motherboard is correctly connected to the case
- the case is correctly closed and secured
- all external devices are correctly connected
- all packaging is disposed of in an environmentally friendly way
- all safety checks are performed
- operating system software is installed and configured
- performance testing software is installed and configured.

Be aware of health and safety issues throughout the assembly of a personal computer, e.g. hardware, electrical connection risks and guidelines, handling equipment.

Be aware of anti-static issues throughout the assembly of a personal computer, ensuring oneself is 'earthed'.

*continued*

**What needs to be learnt****Test the hardware components**

Understand the process used to test the hardware components installed, ensuring that the:

- personal computer is functional, e.g. powers on and all devices are working, including the video display, memory, storage and output devices
- BIOS (Basic Input Output System)/UEFI (Unified Extensible Firmware Interface) is configured on the personal computer to accept all devices installed.

Complete a systematic fault-finding process if any functional device does not appear to be working.

**Performance testing**

Understand the different types of tests available to determine the performance of a computer.

Know the types of current performance testing software available, e.g. cnet, Performance Test™ and NovaBench. Performance tests should cover:

- the performance of individual hardware components such as the processor and external storage devices
- the overall performance of the personal computer.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the uses, costs and specifications of different personal computers</b>			
1A.1 Identify the uses of at least <b>two</b> different personal computers and determine the cost to build each computer.	2A.P1 Explain the uses of at least <b>two</b> different personal computers and determine the cost to build each computer.	2A.M1 Review how the processor choice for a personal computer can affect performance.	2A.D1 Discuss how the specification for a personal computer can affect performance.
<b>Learning aim B: Produce a plan to build a personal computer</b>			
1B.2 Identify the purpose and 'client' requirements to build a personal computer.	2B.P2 Describe the purpose and 'client' requirements to build a personal computer.	2B.M2 Produce a detailed plan to build a personal computer, including at least <b>two</b> alternative design ideas and an explanation of the installation sequence.	2B.D2 Justify final decisions, explaining how the personal computer will fulfil the stated purpose and 'client' requirements, and describing the impact of any constraints on the plan and design.
1B. 3 Produce a plan to build a personal computer, with guidance, including: <ul style="list-style-type: none"> <li>• a list of hardware components and software resources</li> <li>• a list of tools required</li> <li>• a compatibility check of hardware components and software resources</li> <li>• a health and safety assessment.</li> </ul>	2B.P3 Produce a plan to build a personal computer, including: <ul style="list-style-type: none"> <li>• a description of hardware components and software resources</li> <li>• a list of tools required</li> <li>• a compatibility check of hardware components and software resources</li> <li>• a health and safety assessment</li> <li>• a test plan.</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Build and test a personal computer</b>			
1C.4 Build a personal computer, with guidance, ensuring that: <ul style="list-style-type: none"> <li>all hardware components are assembled correctly</li> <li>all software resources are installed and configured correctly</li> <li>all health and safety checks are performed.</li> </ul>	2C.P4 Build a personal computer, ensuring that: <ul style="list-style-type: none"> <li>the planned installation sequence is followed</li> <li>all hardware components are assembled correctly</li> <li>all software resources are installed and configured correctly</li> <li>all health and safety checks are performed.</li> </ul>	2C.M3 Modify the personal computer, using at least <b>two</b> of the alternative design ideas from the plan.	2C.D3 Using the test results, explain how further refinements to the personal computer could improve performance.
1C.5 Test the personal computer for functionality, with guidance, and repair any faults.	2C.P5 Test the personal computer for functionality against the purpose, and repair any faults.	2C.M4 Test the modified personal computer for functionality against purpose, and repair any faults.	
1C.6 With guidance, carry out performance tests on the functional personal computer.	2C.P6 Carry out performance tests on the functional personal computer.	2C.M5 Carry out performance tests on the modified functional personal computer, and explain any changes in performance.	

## Teacher guidance

### Resources

The special resources required for this unit are the tools, antistatic equipment, and personal computer hardware components and software resources required for learners to build a personal computer.

It is important that the hardware components and software resources have the accompanying manuals (or at least links to download these from the manufacturers' websites), installation disks (or relevant software package downloaded in advance from the manufacturers' websites), software licence/product keys, and any software registration information.

The practical activities should take place in a workshop with appropriate tools, and take account of health and safety requirements.

It is recommended that free resources are obtained for the practical activities, especially when obtaining performance software testing such as LogicMonitor, Hardware Monitor, SpeedFan, Prime95, Intel BurnTest, MemTest86+, FurMark, rthdrbil and those listed in the unit content.

Learners need access to a vocational brief. The brief can either be created by the centre or be generated by the learner and approved by the centre.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Centres are encouraged to use evidence for building a personal computer as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

### Learning aim A

Learners will develop an understanding of the uses, costs and specification of two different personal computers, while reviewing how the processor choice and specification as a whole can affect the overall performance.

**For 2A.P1:** learners should explain the uses of at least **two** different personal computers and determine the cost to build each computer. For example, a home entertainment computer can be used to show television programmes, movies and photos, as well as play music to family and friends. Home entertainment computers bring a whole new dimension to the way we enjoy entertainment using technology systems.

Learners should be given a catalogue of the main hardware components including prices, so that they can create a specification for the build of a personal computer that meets a particular purpose. Most PC retailers have websites that would allow learners to create their own specification for a personal computer. Learners are encouraged to use such resources to determine the costs to build a personal computer.

*For level 1, as a minimum, learners should have identified the uses of at least two different personal computers and determine the cost to build each computer. They are likely to have identified the uses without giving any further description.*

**For 2A.M1:** learners should review how the processor choice for a personal computer can affect performance, e.g. in terms of speed, reliability and efficiency. For example, using CPU benchmark data, low-end processors tend not to perform that well. They might be ideal for office-based personal computers that do not require so much processing power. However, they would not be ideal for personal computers intended to be used for computer gaming as the computer graphics features require faster processing in order to deliver a true gaming experience.

**For 2A.D1:** learners should discuss how the specification (all components as a whole) of a personal computer can affect performance. Learners are not only required to think about the processor, but should also consider other hardware components and software resources, both independently and when working together as part of the overall performance of the personal computer. For example, to maximise the benefits of a particular graphics card, the manufacturer might stipulate a specific model and type of processor and memory that should be used alongside it, so that the personal computer runs exceptionally well.

### Learning aim B

Learners will establish the requirements for building a personal computer. The brief should allow learners to explore different possibilities for fulfilling the same requirements. It should also allow them to produce a plan to build a personal computer. The brief should ideally be written with a 'client' in mind and must include the following requirements (as a minimum):

- the reason (purpose) for building a personal computer, and the requirements of the 'client' for the system
- scope to allow for the personal computer to be modified, using a different choice of hardware components, e.g. processor, motherboard, storage devices, while still meeting the 'client' requirements
- any special requirements/instructions/configuration
- constraints.

**For 2B.P2:** in order to produce a plan for the building of a personal computer, learners must first be able to understand and interpret the requirements of the brief. They should be able to provide a description of the purpose and 'client' requirements for building the personal computer.

*For level 1, as a minimum, learners will identify the 'client' requirements and purpose for building a personal computer.*

**For 2B.P3:** learners will plan the building of a personal computer. They should include:

- a description of required hardware components and software resources
- a list of the tools required
- a compatibility check of hardware components and software resources
- a health and safety assessment.

They should also provide a test plan, giving an outline of the range of 'functional' tests they will perform to ensure that the system is working, as well as a range of tests to measure the overall performance.

*For level 1, as a minimum, learners should produce a plan for building a personal computer. An outline plan would contain a list of hardware components and software resources (including tools), a compatibility check of hardware components and software resources, and a health and safety assessment.*

**For 2B.M2:** learners should consider at least **two** alternative design ideas, e.g. using different hardware components (such as selecting two different types of processor, if available) and/or software resources (such as Windows or Linux, if available), as one idea may be better than the other and could improve the performance of the personal computer. Learners should also explain the installation sequence that they are intending to follow when they build the personal computer.

**For 2B.D2:** learners should justify decisions given in their plan, explaining why they have chosen different hardware components and software resources in each of their designs, and why they feel one design idea may be best suited compared with another. Learners should make reference to the given purpose and 'client' requirements.

Learners must also think about constraints, e.g. the availability of hardware components, software resources and tools, and whether or not this will have an impact on building a personal computer. If it does, are there any alternatives for building a personal computer to meet the same requirements?

### Learning aim C

Learners will build a personal computer. They should apply their practical skills and knowledge to do this.

**For 2C.P4:** learners should use appropriate resources and tools to build the personal computer, following a planned installation sequence (as identified in their plan). They should also ensure that all hardware components are assembled correctly and all software resources are installed and configured correctly.

As a minimum, learners should have access to resources that will enable them to build a 'functional' personal computer. This should also include an operating system and a selection of performance testing software applications.

Learners must adhere to all health and safety guidelines when undertaking practical activities with electronic equipment.

Where appropriate to do so, it is acceptable to photograph or record the process of building the personal computer, or use witness statements and observation records as evidence of this process.

*For level 1, as a minimum, learners should build a personal computer. Learners are unlikely to follow a planned installation sequence when building a personal computer.*

**For 2C.P5:** learners are expected to follow their test plans (as identified in their plan) and test for functionality and purpose against the original requirements while repairing any faults that may be highlighted. Learners are expected to ensure that the personal computer is fully functional.

Learners are likely to experience technical difficulties as they build the personal computer. Where this happens, learners are expected to troubleshoot and resolve the difficulties, finding and repairing any hardware faults. It is important that learners make appropriate comments in their test plans about any issues they discover and how they resolved them. Where appropriate to do so, it is acceptable to photograph problems and solutions, or use witness statements and observation records as evidence of this process.

*For level 1, as a minimum, learners should test their personal computer for functionality and repair any faults.*

**For 2C.P6:** learners are expected to carry out performance tests on their functional personal computer. The range of tests will vary depending on the choice of hardware components installed. As a minimum, learners must use software performance testing applications (as identified in their plan and installed as part of the build process) to measure how well their personal computer is performing in terms of speed, reliability and efficiency.

Performance tests should cover:

- the performance of individual hardware components, e.g. processor, memory, graphics, audio, external storage devices
- the overall performance of the personal computer.

*For level 1, as a minimum, learners should carry out performance tests on their functional personal computer.*

**For 2C.M3:** learners are expected to modify the personal computer using at least **two** of their alternative design ideas (as identified in the plan). Examples include swapping a processor, memory card or external storage device, or installing an additional hardware component (if resources are available and compatible).

Learners must adhere to all health and safety guidelines when undertaking practical activities with electronic equipment.

**For 2C.M4:** learners are expected to use their test plan (as included in their build plan) and test the modified personal computer for functionality and purpose against the original requirements, repairing any faults that may be highlighted.

**For 2C.M5:** learners are expected to carry out performance tests on their modified personal computer, including testing any new or replacement hardware components. The performance tests must also cover the overall performance of the personal computer.

**For 2C.D3:** learners are expected to use their test results (functional tests and performance tests) to explain how further refinements to the personal computer could improve its performance. For example, learners may discover that replacing a low-end graphics card with a high-end graphics card would ultimately improve the graphics element of the personal computer. They should give at least three refinements but do not need to implement any enhancements.



## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	A Personal Computer	<p>In this scenario, the 'client' wants to know a little more about the uses of at least two given personal computers and what they would cost to build.</p> <p>The 'client' also wants to know how the processor choice for a personal computer can affect its performance, in terms of speed, reliability and efficiency.</p> <p>You also need to discuss how the specification (considering all hardware components and software resources) for a personal computer can affect the overall performance.</p> <p>Prepare a presentation or a report for the 'client'.</p>	<ul style="list-style-type: none"> <li>• Presentation.</li> <li>• Report.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.P3, 2B.M2, 2B.D2	Planning	<p>The 'client' would like you to build a personal computer. Your task is to plan its build to fulfil the 'client' requirements.</p> <p>Produce a plan to include:</p> <ul style="list-style-type: none"> <li>• a description of required hardware components and software resources</li> <li>• an explanation of the installation sequence</li> <li>• a list of the tools required</li> <li>• a compatibility check of hardware components and software resources</li> <li>• a health and safety assessment</li> <li>• a test plan.</li> </ul> <p>You must also consider at least two alternative design ideas, e.g. different processors that would fulfil the same purpose and requirements.</p> <p>It is important that you explain how the plan meets the purpose and 'client' requirements, describing the impact of any constraints on the plan and design.</p>	<ul style="list-style-type: none"> <li>• Plan.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5, 1C.6 2C.P4, 2C.P5, 2C.P6, 2C.M3, 2C.M4, 2C.M5, 2C.D3	Building and Testing	<p>You should now have everything you need to build the personal computer.</p> <p>You must demonstrate that you can follow your plan when building it, ensuring that:</p> <ul style="list-style-type: none"> <li>the planned installation sequence is followed</li> <li>all hardware components are assembled correctly</li> <li>all software resources are installed and configured correctly</li> <li>all health and safety checks are performed.</li> </ul> <p>Test the personal computer for functionality and record the results.</p> <p>Carry out performance tests on the functional personal computer.</p> <p>Modify the personal computer to include at least two of the alternative design ideas, e.g. replace or install a new hardware component such as a processor or memory.</p> <p>Using the test results, explain how further improvements to the personal computer could improve performance.</p>	<ul style="list-style-type: none"> <li>Witness statements.</li> <li>Observation records.</li> <li>Photographs.</li> <li>Screen shots.</li> <li>Reports.</li> </ul>



# Unit 21: A Technology Business

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Computer technology is found in every sector of the economy and society. This means that technology businesses are diverse and commonplace, from individuals selling mobile apps or offering digital design services like animations and graphics, to businesses supplying outsourced information technology services. This unit provides an introduction into how to turn a technology-based idea into a business.

Technology businesses benefit society by developing innovative technological products and/or services that individuals and organisations require and by providing employment. This requires a range of employability skills, from creative problem solving to teamworking.

In this unit, you will understand some of the principles of marketing and use these to investigate successful technology-based products and services. To be successful the idea behind the business needs to meet customers' needs, the technology needs to perform as intended and the business needs to function well.

You will select different ideas for a technology business, based on a range of prototype technology-based products or services completed on the Pearson BTEC Firsts in Information and Creative Technology – for example, a mobile app, a database product, a software program or an automated computer system. You will review the suitability of your ideas and select the most appropriate one. Once you have made your choice, you will carry out market research on the prototype technology-based product or service.

You will then investigate some of the financial principles you will need to understand to produce a basic breakeven analysis for your product or service.

You will bring together the market research, the basic breakeven analysis and major risks to create a business plan for your proposed technology business. Finally, you will present your plan to a review panel.

This unit develops skills from the other units in the Pearson BTEC Level 1/Level 2 Firsts in Information and Creative Technology.

## Learning aims

In this unit you will:

- A understand the principles of marketing and investigate successful technology-based product(s) and service(s)
- B select and conduct market research on a prototype technology-based product or service
- C produce a basic breakeven analysis for a prototype technology-based product or service
- D produce and present a business plan for a technology-based product or service.

## Learning aims and unit content

### What needs to be learnt

#### Learning aim A: Understand the principles of marketing and investigate successful technology-based product(s) and service(s)

##### What is a technology business?

A technology business is an organisation engaged in the trade, for money, of technology-based products or services to customers.

##### Principles of marketing

Know why marketing is important to businesses, including to:

- gain market share
- identify new market opportunities for products and/or services
- evaluate competitor products
- encourage customer loyalty.

Understand that many commercial products and services are developed by organisations, such as Apple or Moonpig, with significant resources and experience.

Understand the difference between:

- features – what a product or service contains
- functions – what the product or service can do
- benefits – advantages that consuming a product or service brings to the customer.

For example, in an operating system a feature is user administration rights and the corresponding functions are to add and delete users. The customer benefits of this feature are to control the access rights of users.

Know the different measures of product or service success, e.g. financial, social, brand awareness, customer satisfaction, and customer benefits.

##### Technology businesses

Know about existing successful technology businesses, e.g.:

- Microsoft, e.g. software products including operating systems, application software
- Apple, e.g. hardware devices including iPhone, iPad, iPod
- Google, e.g. services including search engine, email, office documents
- Moonpig.com, e.g. graphics-based and animation-based greeting cards
- Rovio Entertainment, e.g. mobile phone computer games including 'Angry Birds'
- Double Negative, e.g. visual effects for films including Harry Potter and the Deathly Hallows Part 2 and The Dark Knight Rises.

Know why some successful technology-based products and services are successful, e.g.:

- Microsoft was first to market with user-friendly software products
- Apple introduced a brand new class of user-friendly technology products combining high-quality manufacturing with excellent customer service
- Moonpig was a trendsetter and early adopter of customised greeting cards using technology
- Rovio Entertainment created fun and tempting computer games

*continued*

**What needs to be learnt**

- Double Negative provides creative ideas for visual effects and works closely with clients to produce bespoke solutions for films.

Know that unique selling points (USPs) are features, functions or benefits of a product or service which make it different from others that are available.

**What needs to be learnt****Learning aim B: Select and conduct market research on a prototype technology-based product or service****Idea selection and review**

Know that different types of prototype technology-based products or services have been created or developed in the course. These prototypes include:

- products, such as a mobile app, website, software program or an automated computer system
- services, like an IT helpdesk or renting out network capacity.

Select potential prototype technology-based products or services from the course. If this is not possible, use another well-known technology-based product or service.

Criteria to select a suitable product or service as the basis for a technology business include:

- likelihood of success or failure, e.g. access to prospective customers, future demand, estimating profitability and estimating the size of the benefit
- estimating resources required to develop the ideas, including:
  - own time, others' time, skills and areas of expertise required
  - personal commitment
  - finance, premises, materials, equipment (hardware and software)
- identification of major barriers for the business, e.g. large start-up costs, cash flow, licences, competitors.

**Market research**

Understand that the purpose of market research in this unit, is to conduct a feasibility study into the proposed product or service.

For example, market research is used to find:

- target markets – a gap in the market based on the perceived strengths and weaknesses of competitor products
- consumer behaviour and motivations – how does current business practice fit with the needs and wants of customers and how will customers react to the proposed product or service?
- market trends – the value of a market (sales revenue) and the rate at which it is growing, the level of competition in the market and the number of products in the market.

Market research tools and techniques (covering types and sources of data), including:

- primary (field-based research), e.g. questionnaires and interviews
- secondary (desk-based research), e.g. researching databases and the worldwide web.

Understand the uses of different types of data to support marketing activity, including quantitative (e.g. online surveys and wikis) and qualitative (e.g. focus groups, data).

Understand trends and making predictions.

Identify areas of interest or gaps in the market.

Understand methods of collection, including desk-based research, questionnaires and interviews.

*continued*



## What needs to be learnt

### Primary field-based research

The purpose of primary field-based research is to test the characteristics of a product or service with potential customers and to estimate potential sales volumes.

Product or service characteristics are defined in terms of:

- the product or service, e.g. features, functions, benefits, any Unique Selling Points (USP) and the price
- a comparison with a competitor product and service, e.g. features, functions, benefits, USP and price.

### Secondary desk-based research

The purpose of desk-based research is to better understand the target market for the technology-based product or service. This should include:

- an investigation of the main competitor products or services, e.g.:
  - price
  - product or service – features, functions and benefits including USPs
- an estimate of the:
  - total number of competitors in a defined geographical area
  - size of the market base in terms of revenue (e.g. in pounds sterling).

**What needs to be learnt****Learning aim C: Produce a basic breakeven analysis for a prototype technology-based product or service****Understand the costs involved in a technology business**

Understand that expenditure for a business consists of:

- start-up costs equals the costs incurred when setting up a business or investing in a new area
- running costs equals the cost of sales, e.g. raw materials, packaging and distribution, **plus** overheads, e.g. rent, salaries, insurance and public utilities such as internet connectivity and heating that are incurred in the day-to-day running of a business.

Know that broadly direct costs are costs of sales and indirect costs are overheads.

**Understand how businesses make a profit**

Understand how businesses generate revenue from selling products or services.

Know how to identify sources of revenue for a business and be able to calculate revenue.

Understand that businesses must know how much money is coming in (revenue) and going out (expenditure) before they can work out whether the business has:

- made a profit
- made a loss.

Total costs, revenue and profit/loss are calculated as:

$$\text{total costs} = \text{fixed costs} + \text{variable costs}$$

$$\text{revenue} = \text{number of sales} \times \text{price per unit}$$

$$(+)\text{profit}/(-)\text{loss} = \text{revenue} - \text{running costs}$$

Know that over time the profitability of a business will vary depending on the costs and revenue generated.

**Breakeven analysis**

Breakeven is achieved when a business has made enough revenue from the sales of products and/or services to cover the cost of making the product or delivering the service (no profit and no loss).

Understand and know about the different types of cost, including fixed costs that do not change with the amount of products/services produced, variable costs that change with the amount of products/services produced, and total costs are the sum of fixed and variable costs.

*continued*

**What needs to be learnt**

Know how to interpret a breakeven chart, including:

- breakeven point
- profit/loss
- variable costs
- fixed costs
- total revenue (based on price and volume)
- total costs
- margin of safety.

Know how to calculate the breakeven using a table of data, stating assumptions, and how to present the information graphically on a breakeven chart.

Understand the effect on the breakeven point if revenue or fixed and variable costs change, and the possible impact of these changes on the business.

Understand the importance of breakeven analysis and profit/loss forecasting to businesses when planning for financial success, e.g. profitability, and as a tool for making business decisions, e.g. changing costs or prices.

## What needs to be learnt

### Learning aim D: Produce and present a business plan for a technology-based product or service

A business plan is a formal document outlining the business's rationale, goals, the reasons why the goals are achievable and a plan for reaching the goals.

As a minimum a business plan should contain the following sections:

- a description of the idea
- market research
- finance
- risk planning.

#### Contents of the business plan

The business plan should cover:

- a brief description of the business idea and why it was selected
- market research:
  - results from the primary and secondary market research including the product/service (features, functions, benefits, any USPs and price)
  - comparison with a major competitor product or service in terms of the features, functions, benefits, any USPs and price
- financial:
  - breakeven analysis and the effect of changing revenue and costs on the business model
- risks:
  - potential risks, e.g. competition from established IT businesses, or difficulties in raising start-up funds
  - ways of reducing and removing risks, including:
    - developing a competitive pricing strategy
    - planning to pitch for finance
    - marketing campaign to attract competitors' customers
    - contingency planning – financial and time planning.

Improvements and/or refinements to the business plan.

#### Review of business plan

The panel should review the business plan for:

- fitness for purpose
- meeting potential customers' needs
- quality of the business plan in terms of marketing, finance and planning – how well thought through the plan is.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the principles of marketing and investigate successful technology-based product(s) and service(s)</b>			
1A.1 Identify the features and functions of at least <b>one</b> successful technology-based product and service.	2A.P1 Explain the features and functions of at least <b>one</b> successful technology-based product and service.	2A.M1 Review the benefits of at least one successful product and service.	2A.D1 Discuss the unique selling point(s) of at least one successful product or service.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Select and conduct market research on a prototype technology-based product or service</b>			
1B.2 With guidance, select a product or service, describing why it was chosen from a list of alternatives considered.	2B.P2 Select a product or service, explaining why it was chosen from a list of alternatives considered.	2B.M2 Carry out detailed market research to: <ul style="list-style-type: none"> <li>• validate the reasons for choosing the product or service idea</li> <li>• compare the chosen product or service against a major competitor's product or service.*#</li> </ul>	2B.D2 Refine the product or service, taking account of both primary and secondary market research, justifying why changes were made.*#
1B.3 With guidance, carry out secondary market research for a product or service, covering: <ul style="list-style-type: none"> <li>• a major competitor's product or service</li> <li>• the potential size of the market.*#</li> </ul>	2B.P3 Carry out secondary market research for a product or service, covering: <ul style="list-style-type: none"> <li>• a major competitor's product or service</li> <li>• the potential size of the market.*#</li> </ul>		
1B.4 With guidance, carry out primary market research for a product or service to test the product's or service's characteristics and to estimate sales volume.*#	2B.P4 Carry out primary market research for a product or service to test the product's or service's characteristics and to estimate sales volume.*#		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Produce a basic breakeven analysis for a prototype technology-based product or service</b>			
1C.5 With guidance, produce a breakeven analysis, with assumptions, for the product or service.*	2C.P5 Produce a breakeven analysis, with assumptions, for the product or service.*	2C.M3 Review the effect of changing revenue and costs on the breakeven analysis.*	2C.D3 Evaluate how the breakeven analysis can be used to inform business decisions.*
<b>Learning aim D: Produce and present a business plan for a technology-based product or service</b>			
1D.6 Produce a business plan for a product or service with guidance, including an outline: <ul style="list-style-type: none"> <li>• description of the business idea and why it was selected</li> <li>• summary of the market research</li> <li>• summary of the breakeven analysis.#</li> </ul>	2D.P6 Produce a business plan for a product or service including a: <ul style="list-style-type: none"> <li>• description of the business idea and why it was selected</li> <li>• summary of the market research</li> <li>• summary of the breakeven analysis.#</li> </ul>	2D.M4 Produce a detailed and accurate business plan, including: <ul style="list-style-type: none"> <li>• a comparison with a major competitor's product or service</li> <li>• the effect of changing revenue and costs on the breakeven analysis</li> <li>• a list of potential risks.#</li> </ul>	2D.D4 Justify the business planning decisions, including: <ul style="list-style-type: none"> <li>• why the product or service should be successful</li> <li>• the main financial and other contingencies.#</li> </ul>
1D.7 Present the business plan, identifying why the product or service is suitable for the intended purpose.	2D.P7 Present the business plan, explaining why the product or service is suitable for the intended purpose and how it meets potential customers' needs.	2D.M5 Deliver a clear and well-structured presentation for a business plan, and confidently respond to any questions raised.	2D.D5 Justify how the product or service will be successful compared with a competitor's product or service, explaining why the contingencies are required.

\*Opportunity to assess mathematical skills

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources needed for this unit depend on the business activities that learners are undertaking. When planning the activities, learners are expected to take into account the resources available to them.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

This unit should be completed towards the end of the course so that learners have covered most or all the units that could provide an idea for a technology-based product or service. Teachers should alert learners to this concept at the start of the course so that higher-ability learners can prepare accordingly.

Learners are expected to identify and select a suitable prototype technology-based product or service, which they have created or developed from another unit within the course. Examples of prototype technology-based products or services could be:

- a mobile app
- an automated device
- a software program
- a website
- a computer game.

Learners should use evidence from this unit as part of their digital portfolio (*Unit 3: A Digital Portfolio*).

### Learning aim A

Learners should investigate at least **one** successful technology-based product and service. They should be encouraged to choose their own technology-based product and service. Learners will need to undertake research to explain the features and functions, while reviewing the benefits of a successful technology-based product and service. For example, features of a digital TV include the size, shape, screen resolution and type of technology used (OLED, LED, LCD or plasma), functions include internet connectivity and being able to change the colour, size and contrast of the picture, and benefits include the viewing experience and interactivity with different broadcast services.

Finally, learners will discuss the unique selling point(s) of the product or service they have chosen while comparing them with those of similar products or services.

**For 2A.P1:** learners are required to explain the features and functions of at least **one** successful technology-based product and service with examples of how they are used. Example features for a mobile fitness app, e.g. RunKeeper, include GPS activity tracking (distance and time), and audio interval cues. Example functions for RunKeeper include an auto-pause function to stop the application at a red traffic light, a targeted heart zone training function, and activity sharing on Twitter and Facebook.

*For level 1, as a minimum, learners should identify the features and functions of at least **one** successful technology-based product and service. The features and functions for the product and service they have chosen are likely to be a limited list with no further explanation given.*



**For 2A.M1:** learners should review the benefits of at least one successful technology-based product and service that they have been investigating. Benefits can often be identified by starting a statement with '*This means that ...*'. For example, the user benefits for a personal fitness app are that the user can measure improvements, set personal targets and share information with like-minded friends.

**For 2A.D1:** learners should discuss the unique selling point(s) of at least one successful product or service they have been investigating compared with those offered by competitors' products and/or services. For example, Runkeeper allows users to set up a leaderboard so that they can compare themselves against their friends each month.

### Learning aim B

Learners should identify and select a suitable technology-based product or service, which they have developed (or are in the process of developing) as part of another unit within the Pearson BTEC in Information and Creative Technology course. Learners will also carry out market research for their prototype technology-based product or service, with the intention of setting up a business (commercialising it).

Learners are advised to use and make reference to publicly available market research reports when they are carrying out market research, as well as investigating competitors' products or services.

**For 2B.P2:** learners should select a prototype technology-based product or service, explaining why it was chosen from a list of alternatives. They need to clearly indicate why the product or service has a better chance of success compared with other ideas considered – for example, by considering potential customer benefits and USPs or due to the accessibility of potential customers.

*For level 1, as a minimum, learners should select a prototype technology-based product or service, giving a brief description of why it was chosen from a list of alternatives.*

**For 2B.P3:** learners are required to carry out secondary market research for their chosen prototype technology-based product or service. This should include:

- a review of the major competitor's product or service, or a substitute product or service if there are no existing direct competitors
- an estimate of the potential size of the market.

The price, features, functions, benefits and any USP(s) (collectively referred to as characteristics) of a suitable competitor or substitute product or service need to be considered. Learners could research trade technology journals that will have articles on products and services similar to what is being proposed so that they can identify the price range, features and functions that would be acceptable to potential customers.

Learners should also estimate the total number of competitors, and the size of the market in terms of revenue (e.g. in pounds sterling) in a defined geographical area.

*For level 1, as a minimum, learners should carry out secondary market research for their chosen prototype technology-based product or service. They should include:*

- *the closest competitor or a substitute product or service if there are no existing direct competitors*
- *the potential size of the market.*

**For 2B.P4:** learners are required to carry out primary market research for their chosen prototype product or service. They should test the product's or service's characteristics (features, functions, benefits, USP(s) and price) with potential customers and estimate sales volume for the idea. If potential customers cannot be accessed then suitable members of the public, such as parents and teachers, should be approached. Learners should ensure that suitable **health and safety precautions** are taken while undertaking this work.

Learners could produce a questionnaire to better understand what potential customers are willing to pay for such a product, and what potential customers think about it (e.g. the features and functions), and whether the benefits would meet their needs.

Learners should also compare the characteristics (e.g. features and functions) of their prototype product or service against a major competitor's product or service. For example, if the learner has selected a new fitness mobile app then they would need to review similar mobile apps, like RunKeeper. This would allow the learner to identify areas within their own app idea that could be improved to meet customer needs more effectively, e.g. additional information available on the learner's mobile app which is not available within the competitor's mobile app.

*For level 1, as a minimum, learners should carry out primary market research for their chosen prototype technology-based product or service to test the product's or service's characteristics. The information is likely to be limited, and may not give an adequate view of what potential customers think of the product or service, and a comparison with competitors' products or services is likely to be limited.*

**For 2B.M2:** in addition to the requirements for the Pass grade, learners should conduct detailed market research to validate the reasons why the idea for a product or service was chosen, e.g. because a particular function would be unique or because the number of competitors is low. If learners discover through their market research that their initial reasons for choosing a product or service idea are incorrect, they should document this.

Learners should also compare the characteristics, e.g. the features and functions, of their own prototype product or service against a major competitor's product or service, or a substitute product or service if a direct comparison is not available.

**For 2B.D2:** learners should refine their chosen prototype technology-based product or service, taking account of both primary and secondary market research. Learners are not required to improve their actual prototype product or service, but should document the types of refinements they would make to the product or service. This includes what learners could do if, as a result of the market research, the initial reasons for selecting a product or service idea turn out to be incorrect.

They should justify why those changes should be made, e.g. 80 per cent of respondents to the primary market research thought that the mobile app should have a particular function because this would provide a particular customer benefit.

### Learning aim C

Learners should have gathered information from their market research and made some decisions on how they would commercialise their prototype product or service. Learners are now expected to produce a breakeven analysis showing that they have an understanding of the costs involved in setting up a technology business.

**For 2C.P5:** learners should produce a breakeven analysis for their prototype technology-based product or service. The breakeven analysis should show the estimated revenue and major costs. Learners should state any assumptions used to create the breakeven analysis. The analysis should cover:

- breakeven point
- profit or loss
- variable costs
- fixed costs
- total revenue
- total costs
- margin of safety.

*For level 1, as a minimum, learners should produce a breakeven analysis for their chosen prototype technology-based product or service. They should clearly state any assumptions used in the model.*

**For 2C.M3:** from the breakeven analysis learners should review the effect of changing the revenue and major costs (often referred to as variables within the model). For example, if the revenue was half of what was expected, what would this do to the breakeven point? Or if a major cost was double that expected, what would this do to the breakeven point?

**For 2C.D3:** learners should evaluate how the breakeven analysis can be used to inform business decisions. For example, if revenue was half of what was expected, what costs could the business reduce to ensure the breakeven point was achieved at the same sales volume and what effects might this have on the business?

### Learning aim D

Learners are expected to produce a business plan for their chosen prototype technology-based product or service. They will then present their business plan to a review panel.

The review panel can be made up of at least one person. The presentation could be arranged in a friendly '*Dragons' Den*' format where entrepreneurs have the opportunity to present their proposals for a product or service to the panel.

**For 2D.P6:** learners should produce a business plan for a prototype technology-based product or service.

Learners should be encouraged to investigate real business plans used by entrepreneurs. Good examples can be found on the internet. Some banks have freely available business plan templates which learners can use and submit as part of the assessment. Much more information will be given on the template than is required as part of the BTEC course so the teacher should amend the templates accordingly.

The business plan should include a:

- description of the business idea and why it was selected
- summary of the market research
- summary of a breakeven analysis explaining what this means to the business.

*For level 1, as a minimum, learners should produce a business plan for a prototype technology-based product or service, including a description of the business idea and why it was selected, a summary of the market research and a breakeven analysis.*

**For 2C.M4:** in addition to the requirements for the Pass grade, learners should include:

- a comparison with a major competitor's product or service
- an explanation of the effect of changing revenue and costs on the breakeven analysis
- a list of potential risks.

At Merit level, learners are expected to produce a more detailed and accurate business plan.

**For 2C.D4:** learners are expected to justify their business plan decisions, including why they believe the prototype product or service should be successful. They should also outline the main financial and other contingencies. Learners could explain how the business would react in certain situations – for example, what the business would do if the revenue was half what was expected (e.g. reduce major costs and/or conduct further market research to determine why the revenue was not as expected).

**For 2D.P7:** learners should present their business plan, explaining why the prototype technology-based product or service is suitable for the intended purpose and how it meets potential customers' needs. The presentation should cover a description of the idea and why it was selected, a summary of the market research, and an overview of the financial forecast model and a breakeven analysis.

*For level 1, learners should present the business plan, identifying why the prototype product or service is suitable for the intended purpose. It is likely that learners will lack confidence and the plan will lack structure and coherence.*

**For 2D.M5:** learners should deliver a clear and well-structured presentation for a business plan. Learners should present the business plan, demonstrating good awareness of marketing, finance and planning, and confidently respond to any questions raised. Learners are expected to have completed the activity without using too many words, and should have focused on the main points.

**For 2D.D5:** learners should justify how the prototype technology-based product or service will be successful compared with a competitor's product or service, explaining why contingencies are required – for example, what financial contingencies have been included if costs were higher than expected or the revenue was lower than expected. Learners should also explain what the business might consider doing in such situations. The justification will form part of the presentation.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Successful Technology-based Product(s) and Service(s)	<p>You have been asked to carry out an investigation into how technology-based product(s) and service(s) can be successful.</p> <p>Explain the features and functions of at least <b>one</b> successful technology-based product and service.</p> <p>Review the benefits of at least <b>one</b> successful technology-based product and service.</p> <p>Discuss the unique selling point(s) of at least <b>one</b> successful technology-based product or service.</p>	<ul style="list-style-type: none"> <li>• Web page/blog.</li> <li>• Report.</li> <li>• Presentation.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3, 1B.4 2B.P2, 2B.P3, 2B.P4, 2B.M2, 2B.D2	Select a Product or Service and Conduct Market Research	<p>Select a prototype technology-based product or service and carry out detailed market research, including:</p> <ul style="list-style-type: none"> <li>• secondary research considering any major competitor's product or service, and the potential size of the market</li> <li>• primary research, to test the product's or service's characteristics, including features, functions, benefits, unique selling point(s) and price, with potential customers.</li> </ul> <p>Compare the product's or service's characteristics against a major competitor's product or service.</p> <p>Refine the chosen product or service by suggesting improvements which take account of results from the market research.</p> <p>Justify why the changes were made.</p>	<ul style="list-style-type: none"> <li>• Report.</li> <li>• Research notes.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.5 2C.P5, 2C.M3, 2C.D3	Produce a Breakeven Analysis	<p>Produce a breakeven analysis for the product or service, including:</p> <ul style="list-style-type: none"> <li>• breakeven point</li> <li>• profit or loss</li> <li>• variable costs</li> <li>• fixed costs</li> <li>• total revenue</li> <li>• total costs</li> <li>• margin of safety.</li> </ul> <p>Review the effect of changing the revenue and major costs.</p> <p>Evaluate how the breakeven analysis can be used to inform business decisions.</p>	<ul style="list-style-type: none"> <li>• Breakeven analysis chart.</li> <li>• Report.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1D.6 2D.P6, 2D.M4, 2D.D4	Produce a Business Plan	<p>Produce a detailed and accurate business plan for the product or service, including:</p> <ul style="list-style-type: none"> <li>• a description of the business idea and why it was selected</li> <li>• summary of the market research</li> <li>• summary of a breakeven analysis explaining what this means to the business</li> <li>• a comparison with a major competitor's product or service</li> <li>• the effect of changing revenue and costs on the breakeven analysis</li> <li>• a list of potential risks.</li> </ul> <p>Justify your business planning decisions, explaining why you believe the product or service should be successful, and outline the main financial and other contingencies.</p>	<ul style="list-style-type: none"> <li>• Business plan.</li> </ul>
1D.7 2D.P7, 2D.M5, 2D.D5	Present the Business Plan	<p>Present the business plan to a review panel, explaining why you feel the product or service is suitable for the intended purpose and how it meets potential customers' needs.</p> <p>Explain how you have considered marketing, finance and planning as part of your business plan, and why you feel the product or service will be successful compared with a competitor's product or service.</p>	<ul style="list-style-type: none"> <li>• Presentation.</li> <li>• Observation record.</li> <li>• Report.</li> </ul>



# Unit 22: Computer Security in Practice

Level: **1 and 2**

Unit type: **Mandatory or Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Computers and technology systems are commonplace, and we have come to rely on them, as well as the information, ranging in value and sensitivity, contained within them. These systems and devices have different vulnerabilities and are under constant threat of attack that evolves over time, so it is impossible to provide 100 per cent protection. Therefore there is always a compromise between the:

- security protection measures versus computer/system usability
- value of a loss from the computer/system versus the cost of the measures.

In this unit you will investigate and apply the fundamentals of computer security in practice, which will help you in an IT and IT security career. You will also gain valuable employability skills, such as communication, planning and self-organisation. There is a wide range of security roles you might consider, including information security manager, computer auditor, security technician/engineer, and IT fraud and forensic consultant.

In this unit, you will become aware of the common security threats that may affect computers and systems and the range of common protection measures available. You will learn how to assess the security risks to a computer or system and be able to assess the vulnerabilities. You will be able to apply some of your findings from your investigation to protect your own technology system.

Based on a brief you will plan a series of security measures to protect a technology system from attack. You will then implement the plan, where feasible to do so, to protect a system. You should also consider internal security threats from people, such as accidental disclosure of data. Finally, you will review the finished security measures taken to protect a technology system.

In particular, this unit develops skills from *Unit 1: The Online World*, *Unit 2: Technology Systems*, *Unit 11: Computer Networks*, *Unit 14: Installing and Maintaining Computer Hardware*, *Unit 15: Installing and Maintaining Computer Software*, *Unit 20: Building a Personal Computer* and *Unit 23: Computer Systems Support in Practice*.

This unit is mandatory in the Systems Development and Support pathway.

## Learning aims

In this unit you will:

- A understand the common security threats and vulnerabilities that affect computers and technology systems and common security protection measures
- B plan security measures to protect a technology system
- C implement security measures to protect a technology system
- D review the finished security measures taken to protect a technology system.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the common security threats and vulnerabilities that affect computers and technology systems and common security protection measures</b></p>
<p><b>Computer devices and technology systems</b></p> <p>Understand:</p> <ul style="list-style-type: none"> <li>• a computer is a device/machine, e.g. a server, personal computer, laptop, tablet or smartphone, that processes digital data – input–process–output from storage or via a network</li> <li>• a technology system is the complete collection of at least two computer devices and components, e.g. hardware (such as a router, wireless access point or switch), software, peripherals, power supplies, communication links, and input and output devices.</li> </ul> <p><b>Security threats</b></p> <p>Understand that security threats to computer and technology systems are categorised as either:</p> <ul style="list-style-type: none"> <li>• external threats, which originate from sources without authorised access to the system/device or the organisation, e.g. hackers probing networks, malware (such as a computer virus, worm, rootkit, spyware, Trojan horse, adware, botnet, zombie and malicious chatterbot), denial of service (DoS) attacks, and phishing emails, texts and apps</li> <li>• internal threats, which originate from sources with authorised access to the system/device or organisation, e.g. accidental disclosure of data, users overriding security controls and users stealing/leaking information, use of flash storage, downloads from the internet, visiting untrustworthy websites.</li> </ul> <p>Understand that all computers and technology systems are vulnerable to loss.</p> <p>Types of losses include:</p> <ul style="list-style-type: none"> <li>• information, e.g. theft of sensitive and/or valuable information, damage/corruption of information</li> <li>• property, e.g. hardware theft or vandalism</li> <li>• financial, e.g. from corruption or fraud</li> <li>• service(s), e.g. loss of banking services or supermarket shopping service, limited data services, loss of specialist resource access</li> <li>• reputation and customers, e.g. adverse media coverage, large-scale loss of data, loss of core services</li> <li>• staff trust, e.g. involvement in industrial espionage, employee discontent, affording privileged access, vetting of personnel</li> <li>• current legislation</li> <li>• competitive advantage, e.g. industrial espionage undertaken by a competitor.</li> </ul> <p>Understand that different security threats could lead to different types of loss, e.g. malware could result in the loss of sensitive information and services.</p> <p style="text-align: right;"><i>continued</i></p>

## What needs to be learnt

### Vulnerabilities

Understand that all computers and technology systems are vulnerable to attack from external and internal threats that could result in loss.

Understand that different types of computer and technology systems may be exposed to different threats and vulnerabilities.

Vulnerabilities include:

- any open firewall ports, e.g. User Data Gram (UDP) and Transport Control (TCP), traffic not 'in reply' to traffic from a network
- insufficient file permissions, e.g. inappropriate read, write or execute permissions, not securing at system administrator level
- insecure users, e.g. users with write or execute rights, anybody with root or supervisor/super-user access and insecure passwords
- resident Trojans, e.g. unchecked by anti-malware, Sub7, zombies
- untrustworthy software, e.g. may not have a trust certificate, from an untrusted source, torrented software, illegal copies
- un-updated operating system, e.g. from base installation, automatic updates, vendor security alerts
- separation of staff duties, e.g. super-user (root), group-level user, users with write/execute rights, users with read-only rights, regular audit of user access.

Understand that different security threats exploit different computer/system vulnerabilities, e.g. hackers can exploit open firewall ports to obtain sensitive information, such as password, and to copy files from the hard drive.

### Protection measures

Understand that computer security aims to protect computers and technology systems from loss, while allowing the information and property to remain accessible and productive to its intended users.

Understand that more than one measure is normally used to protect a system and the different measures are interlinked.

Know the three common categories of protection measures:

1. Users, e.g. training on data protection, password management and an employee policy.
2. Technology, including:
  - software, e.g. anti-malware, anti-spyware and anti-adware applications, encryption of data, software firewall, secure sockets layer (port 443) such as the padlock in a web browser
  - hardware devices and settings, e.g. physical security locks, cards, biometric scanners, firewall settings, virtual private networks, wireless encryption.
3. Tools and techniques, e.g. backing up data, updating security software, scanning for malware, and restricting system and data access.
  - Know that protection measures are usually built into a computer/technology system from the start rather than added at a later date.
  - Understand that the different protection measures have different strengths and weaknesses, such as costs, degree of protection, reliability, ease of implementation and system usability. For example, anti-malware software can provide real-time security protection against malware, but the weaknesses are that the software costs money to purchase, it needs to be constantly updated to protect against new forms of malware and it can never be 100 per cent effective.

**What needs to be learnt****Learning aim B: Plan security measures to protect a technology system****Plan security measures for a technology system**

Know how to produce a security plan for a technology system containing at least two computers (or equivalent devices) networked together.

**Assess computer/technology system vulnerabilities**

Know and apply basic tools and techniques used to assess the vulnerabilities of computers or technology systems. These include:

- port scanners, e.g. NMAP, Angry IP scanner, Unicornscan
- checkers, e.g. Windows Registry Checker Tool, CCleaner
- website vulnerability scanners, e.g. Spoiler Alert, Wireshark
- general vulnerability detection and management software, e.g. OpenVAS, QualysGuard, Nmap, Firesheep
- assessing user vulnerabilities, e.g. training, staff vetting, security audit
- assessing the vulnerabilities of current protection measures, e.g. security audit and penetration testing.

**Risk severity**

Understand that an IT risk is a future event that could result in some form of loss from a computer and/or technology system.

Know how to calculate IT risk severity, i.e. the probability that a threat to a computer and/or technology system will occur multiplied by the expected size of the loss.

*Risk severity = probability of the threat occurring × expected size of the loss*

Basic measures for each of these variables:

- risk severity = low, medium, high and extreme
- probability of the threat occurring = unlikely (e.g. every two years), likely (e.g. every month) and very likely (e.g. once or more times on most days)
- size of the loss = minor (e.g. less than £100), moderate (e.g. hundreds or thousands of pounds) and major (e.g. tens of thousands of pounds).

The resultant risk severity is illustrated in the following matrix:

Probability of threat occurring	Very likely	Medium	High	Extreme
	Likely	Low	Medium	High
	Unlikely	Low	Low	Medium
		Minor	Moderate	Major
Size of the loss				

*continued*

## What needs to be learnt

### Risk assessment approach

Know that a basic approach to risk assessment is to:

- identify possible threats and assess the probability of different threats occurring
- assess the vulnerabilities of a computer or technology system to specific threats
- determine the risk severity (low, medium, high and extreme)
- identify ways to prevent severe risks (medium, high and extreme) from occurring and reduce the severity of the risk if it does occur.

Understand that acceptable security measures include:

- risk transfer to a third party, e.g. by using insurance
- risk avoidance by stopping an activity
- risk acceptance, e.g. a low or medium risk following a full risk assessment.

Know that risk assessment needs to be undertaken at regular intervals or following a security breach as the computers and systems are under constant threat of attack and the threats are continuous and ever changing.

Know that many organisations need to undertake frequent audits, including vulnerability assessments and risk assessment, for different computers and technology systems to check their overall security risk.

Know that a plan to protect a technology system should include:

- requirements from the brief ('client'/user requirements) and purpose
- a risk assessment, including a list of devices that need protection and a summary of the system vulnerabilities
- a report describing how to protect the system from the most severe risks, including:
  - a summary of how the system will be protected
  - users, e.g. an employee policy with access rights and information availability
  - technologies:
    - a list of software resourced required, e.g. anti-malware software, Windows Defender, software firewall, port scanning software
    - a list of hardware devices required, e.g. firewalls, routers, switches, wireless access points
  - a description of the tools and techniques, e.g. regular scheduled back-ups and running anti-virus scans
  - alternative solutions for protecting the system and reducing the severity of risks, e.g. off-site storage, cloud services, regular audits
  - any technical and financial constraints, e.g. software license costs, hardware and software availability, tools and device/component compatibility.

**What needs to be learnt****Learning aim C: Implement security measures to protect a technology system****Prepare the technology system**

Be able to prepare the technology system, including:

- read manufacturer's hardware and software instructions
- back up systems data and save system settings
- obtain security protection hardware devices/components (e.g. firewall/router/wireless device) and software (e.g. anti-malware software, software firewall).

**Computer security protection measures**

Be able to use tools and techniques to resolve existing security threats, e.g.:

- isolating the computer by disconnecting it from the internet/network
- running a full scan while the operating system is not active
- recording what infections have occurred (if any)
- tracing the source of the infection (if required)
- identification of possible cross infection to other local systems.

Be able to apply computer security protection measures across the three categories:

- users, e.g.:
  - provide training, such as on data protection
  - user guides, such as changing a password
  - information encryption
  - password protection
- technology, including:
  - software, e.g.:
    - install applications, such as anti-virus and anti-spyware
    - configure software applications, such as browser settings
    - maintain software applications, such as downloading and installing patches and updates
  - hardware (devices and settings), e.g.:
    - physical security locks
    - cards
    - biometric scanners
    - firewall settings
- tools and techniques, e.g.:
  - backing up data
  - restricting access to information
  - scheduling and running malware scans
  - inspecting log files and acting on information contained in them.

Be able to test computer security protection measures for:

- functionality, e.g. backing up and restoring data and system settings, scheduling and running scans, and installing security software
- degree of protection, e.g. does it meet the intended requirements?

*continued*

**What needs to be learnt****Learning aim D: Review the finished security measures taken to protect a technology system**

Review the finished technology system:

- against the original brief ('client'/user requirements)
- against the original purpose
- constraints (e.g. hardware and software availability)
- users and, if possible, administrator's experience (e.g. systems performance, ease of access, system availability and use of resources)
- results of security threats and vulnerability scans (before and after taking measures)
- recommendations for further improvement, e.g. ongoing assessment of threat levels, contingency plans, reporting procedures.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the common security threats and vulnerabilities that affect computers and technology systems and common security protection measures</b>			
1A.1 Identify at least <b>four</b> different security threats that could affect <b>two</b> different computers and/or systems.	2A.P1 Explain how at least <b>six</b> different security threats could affect <b>two</b> different computers and/or systems.	2A.M1 Review how different security threats could exploit the vulnerabilities in a computer or system.	2A.D1 Discuss the strengths and weaknesses of different security protection measures for a given computer or system.
<b>Learning aim B: Plan security measures to protect a technology system</b>			
1B.2 Identify the purpose and 'client' requirements to protect a system.	2B.P2 Describe the purpose and 'client' requirements to protect a system.	2B.M2 Produce a detailed security plan to protect a system, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• an explanation of how the system will be protected, covering users, technology, and tools and techniques.</li> </ul>	2B.D2 Justify final decisions, explaining: <ul style="list-style-type: none"> <li>• how the system will fulfil the stated purpose and 'client' requirements</li> <li>• any constraints on the plan.</li> </ul>
1B.3 Produce a security plan to protect a system, with guidance, including: <ul style="list-style-type: none"> <li>• a risk assessment</li> <li>• an outline summary of protection measures covering technology.#</li> </ul>	2B.P3 Produce a security plan to protect a system, including: <ul style="list-style-type: none"> <li>• a risk assessment</li> <li>• a summary of protection measures covering technology and tools and techniques.#</li> </ul>		



Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Implement security measures to protect a technology system</b>			
<p>1C.4 Implement security measures for a technology system, with guidance, that includes:</p> <ul style="list-style-type: none"> <li>• a software firewall</li> <li>• back-up of data</li> <li>• running a malware scan.</li> </ul>	<p>2C.P4 Implement security measures for a technology system that includes:</p> <ul style="list-style-type: none"> <li>• installing security software including a firewall and anti-malware applications</li> <li>• scheduling an automatic malware scan</li> <li>• restricting user access</li> <li>• updating software and changing settings</li> <li>• completing periodic back-ups.</li> </ul>	<p>2C.M3 Implement enhanced security measures for a technology system that includes:</p> <ul style="list-style-type: none"> <li>• an employee policy</li> <li>• meeting specific firewall port-based rules</li> <li>• preventing external access to local shared storage.</li> </ul>	<p>2C.D3 Refine the modified technology system in order to improve protection against security threats, taking account of feedback from testing.</p>
<p>1C.5 Test the modified technology system for functionality, with guidance.</p>	<p>2C.P5 Test the modified technology system for functionality against the original requirements and repair any faults as necessary.</p>	<p>2C.M4 Test the additional functionality, repairing any faults, and gather feedback from others.</p>	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the finished security measures taken to protect a technology system</b>			
1D.6 For the modified system, identify how it is suitable for the intended purpose and original requirements.	2D.P6 Explain how the modified system is suitable for the intended purpose and original requirements.	2D.M5 Review the extent to which the modified system meets the original requirements, considering feedback from others and any constraints.	2D.D4 Evaluate the initial plan against the modified system and justify any changes that were made, making recommendations for further security improvements.

#Opportunity to assess English skills

## Teacher guidance

### Resources

The special resources required for this unit are security hardware components and software. Learners can also use virtual machines and Linux, therefore ensuring that this is a safe/secure unit, allowing learners to explore network security in a contained environment.

Learners could benefit from visiting an organisation to observe how computer security protection measures are implemented and managed, particularly with data.

A computer network is typically at least two computers that are interconnected, via either a switch or a wireless device. The term 'computer' is now a very loose label and can include smartphones as well as tablet devices, all of which have different security needs.

Most of the security software mentioned is free and can be easily obtained in a brief search of the internet. While learners are expected to complete security and malware scans, they must not have access to intentional malware or a system where they do not have permission to run a scan. It is important that learners experience the process of completing malware and security scans. If learners do not find anything when running the malware scan, they should continue as if the system 'may have' been infected.

Apache Server, which can be found at [www.apache.org](http://www.apache.org), is available to download as a free tool, which enables learners to perform software security scans, as well as searching for open network ports and configuring a firewall to change the 'visibility'. All operating system firewalls, as well as many home routers, come with the option to open or close ports.

The practical activities, although limited, should take place in a workshop with appropriate tools, and take account of health and safety requirements. Access to technical support is valuable, unless the teacher is experienced in this area.

To illustrate concepts and aid demonstrations, a wide range of current hardware and software components should be available for learners to study and use.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Learners should include evidence from this unit as part of their digital portfolio (*Unit 3: A Digital Portfolio*).

### Learning aim A

Learners should explore the different types of current and common internal and external security threats and have the opportunity to understand how these can cause loss for any organisation or individual.

**For 2A.P1:** learners should be able to understand and explain the idea of how at least six different security threats could affect two different computers and/or systems. They must clearly explain how the impact may have a detrimental effect, coming from the entire list of losses provided in the unit content. For example, phishing emails could result in the loss of financial assets or accidental disclosure of data could result in the loss of reputation and customers.

*For level 1, as a minimum, learners should have identified at least two internal and two external threats. They must be current and must relate to a computer device and/or technology system.*

**For 2A.M1:** learners should critically review commonplace vulnerabilities in a computer or system and synthesise the effect that this would have on an organisation as well as on individuals. For example, employees can exploit insufficient file permissions to obtain information, which may result in financial fraud. The inclusion of malware, intentionally or unintentionally, can compromise a system.

**For 2A.D1:** learners should explore a range of protection measures, looking at examples from all common categories listed in the unit content. They should discuss the strengths and weaknesses of these protection measures for a given computer system. For example, one strength when configuring software applications is that you can tailor the program to meet specific user needs, e.g. locking or protecting cells in a spreadsheet.

### **Learning aim B**

Learners should plan and put into practice some of the security techniques explored in learning aim A. It is important that this is done in a safe environment, where learners do not have access to any resources which they lack the permission to 'analyse'.

**For 2B.P2:** in order to produce a security plan to protect a technology system, learners must first be able to understand and interpret the requirements from a brief. They should be able to provide a description of the 'client' requirements to protect a technology system.

*For level 1, as a minimum, learners will identify the 'client' requirements to protect a technology system.*

**For 2B.P3:** learners will produce a security plan to protect a technology system. This should include a risk assessment, which covers the basic approaches (e.g. identify possible threats and assess the probability of different threats occurring). Learners should also give a summary of how the technology system will be protected, by choosing the most appropriate protection measures, including:

- technology (hardware, e.g. firewall, and software, e.g. anti-virus software)
- tools and techniques they would need to apply, e.g. backing up data.

Learners will need to refer to the given 'client' requirements when doing so.

*For level 1, as a minimum, learners should have produced security plan to protect a technology system, which includes a risk assessment, an outline summary of protection measures covering technology.*

**For 2B.M2:** learners should provide a security plan with a detailed explanation of how the system will be protected, by choosing the most appropriate protection measures to cover all three common protection categories (users, technology, and tools and techniques). An example of a protection measure for users is an employee policy that outlines access rights and information availability.

Learners should include some alternative solutions within their security plan to meet the 'client' requirements, e.g. off-site storage, cloud services and other effective methods of protecting a technology system. Learners will need to refer to the given 'client' requirements when doing so.

**For 2B.D2:** learners should justify the decisions made in their security plan, including the final choice of measures to protect a technology system. Learners will need to refer to the given 'client' requirements. Learners must also think about the constraints (e.g. hardware and software availability) and whether or not these will impact the protection of a technology system. If they do, are there any alternative solutions? Learners should explain why alternative solutions were rejected.

### Learning aim C

Learners should apply security measures to protect a technology system.

**For 2C.P4:** as a minimum, learners should protect a technology system, including:

- installing security software, such as a firewall and anti-malware applications
- scheduling an automatic malware scan
- restricting user access
- updating software and changing settings
- the completion of periodic back-ups.

*For level 1, as a minimum, learners should have protected a technology system, which shows that they have been able to install or configure a software firewall, back up data and run a malware scan.*

**For 2C.M3:** in addition to fulfilling the requirements given in 2C.P4, learners should continue to add to the protection measures to cover all three common protection categories (users, technology, and tools and techniques). As a minimum this will include:

- an employee policy that outlines access rights and information availability
- meeting specific firewall port-based rules
- measures to prevent external access to local shared storage.

Local shared storage can be implemented in a virtual machine and be scanned by a range of applications.

**For 2C.P5:** learners will be expected to test the functionality of their technology system in terms of checking that any security threats (if identified) have been removed and any protection measures have been implemented successfully. They should also test that their technology system meets the original requirements.

Learners are likely to experience technical difficulties as they apply protection measures to their technology system. Where this happens, learners will be expected to resolve these difficulties, and by doing so will have made the necessary repairs to their technology system. It is important that learners make appropriate comments in their security plan and test plan about any issues they discover, and how they have resolved them. Where appropriate to do so, photographs of problems and solutions or witness statements and observation records can be used as evidence of this process.

Learners must adhere to all health and safety guidelines when undertaking practical activities with electronic equipment.

*For level 1, as a minimum, learners will be required to test the functionality of their technology system.*

**For 2C.M4:** learners will test the additional functionality, as implemented in 2C.M3, of the modified technology system and repair any faults.

They should also gather feedback from others, e.g. the 'client', as part of testing their technology system and record the feedback. The feedback should be used to help identify areas where security can be improved.

**For 2C.D3:** learners should recognise that the process of modifying and testing a technology system is an iterative process.

Learners should refine their technology system to improve protection against security threats using all ideas from vulnerability testing, functionality testing, feedback and reflection. If it is not possible for learners to apply their improvements (e.g. due to software or hardware constraints), they should explain what they would do if they had the opportunity, focusing on improving security protection. Learners will also be expected to make refinements following their test results and feedback from the 'client'.

Refinements could include setting different times when users can access specific information, automatic deletion of files/folders containing sensitive information and/or encrypting data.

### **Learning aim D**

**For 2D.P6:** learners should explain why their technology system is suitable for the intended purpose and the original requirements.

*For level 1, as a minimum, learners should have identified how their technology system is suitable for the purpose and original requirements.*

**For 2D.M5:** learners should build on the explanations for level 1, and review how well the original requirements and purpose have been met. They should also seek feedback from the 'client' about the modified technology system. An interview would be an ideal way of discussing the technology system and recording the feedback.

**For 2D.D4:** learners should evaluate their initial plans/solutions in terms of how effective the technology system is protected against external and internal security threats, and consider the purpose and 'client' requirements in the original brief. They should justify any changes that were made and explain the rationale for those changes. They should also give recommendations for at least three further security protection improvements, but do not need to implement the enhancements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Interview	You have been invited to attend an interview for a 'IT Technician' position at a local company. You have been asked to prepare a web page or presentation explaining the common threats, vulnerabilities and methods of protection when dealing with computer systems security.	<ul style="list-style-type: none"> <li>• Web page.</li> <li>• Presentation.</li> </ul>
1B.2, 1B.3 2B.P2, 2B.P3, 2B.M2, 2B.D2	Plan, Assess and Evaluate	Congratulations, you've got the job! Your line manager has asked you to review and plan how to protect a technology system, taking heed of any risks and constraints that may be present.	<ul style="list-style-type: none"> <li>• Web page/blog.</li> <li>• Presentation.</li> <li>• Report.</li> <li>• Observation/witness statement.</li> <li>• Screen grabs.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.P5, 2C.M3, 2C.M4, 2C.D3	Doing the Deed	<p>You have been asked to work on the computer security for a new customer, which is a small training company.</p> <p>You will need to present a detailed plan and carry out some security tasks, including:</p> <ul style="list-style-type: none"> <li>• setting up a firewall, and changing specific rules</li> <li>• back-up of data and ensuring periodic back-ups</li> <li>• installing security technology (software and hardware)</li> <li>• running (and scheduling) a malware scan</li> <li>• restricting user access</li> <li>• updating software and changing settings</li> <li>• preventing external access to local shared storage</li> <li>• an employee policy.</li> </ul> <p>Once the changes have been established, you will need to test the technology system, then look at ways of improving the security.</p>	<ul style="list-style-type: none"> <li>• Report.</li> <li>• Observation/witness statement.</li> <li>• Screen grabs.</li> </ul>
1D.6 2D.P6, 2D.M5, 2D.D4	Reviewing the Results	<p>Using feedback from others, review how the modified technology system is suitable for the intended purpose and original requirements. Evaluate the plan against the modified system, justifying any changes that were made, making recommendations for at least three further improvements, and considering any constraints.</p>	<ul style="list-style-type: none"> <li>• Web page/blog.</li> <li>• Presentation.</li> <li>• Report.</li> <li>• Interview.</li> </ul>



# Unit 23: Computer Systems Support in Practice

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

Computer systems, such as digital TV, digital travel systems (like Transport for London's Oyster card), office-based networks and automated production lines, are essential to everyday activities and we have come to rely on them. These systems need to be supported over the system's life cycle to ensure that they are working quickly and without issues/faults. In a similar way, preventive maintenance is essential to increase a system's longevity and performance. In addition, for systems to be sustainable, their environmental impact needs to be managed and minimised.

In this unit, you will develop the practical skills and understanding to help you in a computer system's support job. There is a wide range of roles available, including an IT support technician and network support engineer. You will also gain valuable skills for employment, such as planning, communication, and problem-solving skills.

You will investigate how common system support issues and faults vary over the system's life cycle. You will then explore the incident diagnostic process and investigate some of the common issue/fault remedies. For an operational system you will explore approaches to evaluating the system, such as to determine customer satisfaction and the environmental impact. Increasingly, support systems use software and a database to collect and evaluate information about the system.

Based on a brief, you will plan the support for a computer system over the life cycle. You will then implement the plan, where feasible to do so, to provide support for an operational computer system. For instance, you will log system issues/faults, diagnose and rectify problems, and provide feedback to system users. Further, you will analyse operational data to improve the system. Finally, you will review the outcome of the activities taken to support a computer system.

In particular, this unit develops skills from *Unit 1: The Online World*, *Unit 2: Technology Systems*, *Unit 10: Database Development*, *Unit 11: Computer Networks*, *Unit 14: Installing and Maintaining Computer Hardware*, *Unit 15: Installing and Maintaining Computer Software*, *Unit 20: Building a Personal Computer* and *Unit 22: Computer Security in Practice*.

## Learning aims

In this unit you will:

- A understand how support needs vary over the computer system's life cycle
- B investigate the incident diagnostic processes, common system remedies and how to evaluate a support service
- C plan the support for a computer system over the system's life cycle
- D provide operational support for a computer system and review the outcome.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand how support needs vary over the computer system's life cycle</b></p> <p><b>Computer devices and technology systems (also known as computer systems)</b></p> <p>Understand that:</p> <ul style="list-style-type: none"> <li>• a computer is a device/machine, e.g. a server, personal computer, laptop, tablet or smartphone, that processes digital data (input–process–output from storage or via a network)</li> <li>• a technology system is the complete collection of at least two computer devices and components, e.g. hardware (such as a router, wireless access point or switch), software, peripherals, power supplies, communication links, and input and output devices.</li> </ul> <p>Technology systems (or computer systems) include digital TV, digital travel systems (like Transport for London's Oyster card), internet banking and automated production lines (such as car production lines).</p> <p>Know that:</p> <ul style="list-style-type: none"> <li>• an issue prevents the intended use or operation of a computer/technology system, or infringes the rule of law or an organisation's policies, e.g. forgotten login details, privacy and copyright, and insufficient user training</li> <li>• a fault is a defect in either hardware or software, which prevents the intended use or operation of a computer/technology system.</li> </ul> <p><b>System's life cycle</b></p> <p>Understand the system's life cycle stages of:</p> <ul style="list-style-type: none"> <li>• design and build</li> <li>• operate</li> <li>• decommission.</li> </ul> <p><b>Types of support required across the system's life cycle</b></p> <p>Understand the support required for:</p> <ul style="list-style-type: none"> <li>• design and build stage:             <ul style="list-style-type: none"> <li>◦ process design and documentation, e.g. system requirements, security requirements</li> <li>◦ configure systems, e.g. user requirements</li> <li>◦ key performance measures, e.g. downtime/uptime/high availability</li> <li>◦ environmental policies, e.g. manufacturing and disposal of hardware</li> <li>◦ training, e.g. hardware and software functions and features, business processes</li> </ul> </li> <li>• operate stage, including common computer system issues/faults, e.g.:             <ul style="list-style-type: none"> <li>◦ internet connectivity</li> <li>◦ retrieving and saving files</li> <li>◦ software errors</li> <li>◦ environmental and sustainability</li> <li>◦ unauthorised access</li> </ul> </li> </ul> <p style="text-align: right;"><i>continued</i></p>

**What needs to be learnt**

- decommission stage:
  - archive and migrate system data, e.g. database records
  - shut down systems, e.g. system downtime
  - recycle hardware, e.g. monitors, keyboards, memory, desktop case.

Understand how support changes with time. For example, at the beginning of the life cycle (i.e. more investment is required to train users) and at the end of the life cycle (i.e. less investment will be made in any systems which are being decommissioned).

**Providing support to system users**

Understand the impact of providing support to system users across the system's life cycle, e.g. system downtime could reduce or limit a user's productivity.

Understand that the level of systems support is a compromise between cost, the resources provided and the environmental impact, e.g. energy consumption. Support resources include human, number and type of software licences, number and type of hardware devices, capacity requirements (e.g. size of hard disk drive and network bandwidth) and operational availability of the system.

**What needs to be learnt****Learning aim B: Investigate the incident diagnostic processes, common system remedies and how to evaluate a support service****Incident diagnostic processes and levels of support**

Understand that the incident diagnostic processes involve:

- recording information about the issue/fault, e.g. date, name of person, location of issue/fault, type of device, location of device, error code, parts used, description, symptom(s)
- information sources, e.g. automatic error messages, helpdesk records, questioning the user, technical manuals
- specific issue/fault identification procedures, e.g. using flow charts, issue/fault validation, minimising disruption, escalation (to prioritise issues/faults)
- communicating with user, e.g. estimated time for repair, estimated cost, tone of voice
- action taken, e.g. issue/fault history, record of work carried out.

Understand the levels of support available:

- level 1 support, e.g. the initial support where the technician gathers the issue/fault details and offers possible basic solutions
- level 2 support, e.g. more in-depth technical support with a more experienced and knowledgeable technician, or desktop support
- level 3 support, e.g. a specialist technician handles most difficult or advanced specific back-end issues/faults.

Understand how the incident diagnostic processes and levels of support could affect the support provided, e.g. accurate recording of information will provide an effective diagnostic process and analysis as well as helpdesk records improving customer service and issue/fault diagnostics and reducing downtime.

**Technology system remedies**

Be aware of common remedies for technology system issues/faults, e.g.:

- user errors, e.g. training, providing progress reports, verbal/written feedback, escalation of problem (to prioritise issues/faults)
- hardware errors, e.g. repair, replace, upgrades, drive mappings, work-around solutions
- software errors, e.g. installing software, reconfiguring software, upgrading software, work-around solutions
- advice and guidance on using software applications, e.g. use of spellchecker, saving files, application features, retrieving files, work-around solutions
- sources of information available, e.g. reference manuals, specifications, frequently asked questions, websites, issue/fault resolution flow charts
- on-site visit or help via telephone, e.g. electronic mail, text or instant messaging, online chat
- remote desktop control, e.g. Netviewer Support, LogMeIn.

*continued*

**What needs to be learnt**

Understand how different types of system issues/faults could impact the technology system, e.g. a faulty network interface card will prevent the technology system connecting with a computer network.

**Support service evaluation**

Understand that support service evaluation involves investigating service trends over time. For example:

- a system's performance, e.g. amount of downtime, application monitoring, system monitoring software
- customer satisfaction, e.g. customer feedback
- environmental impact, e.g. energy consumption, paper consumption.

Be able to recommend improvements to the support service, including:

- the performance of the system, e.g. reduce downtime, preventative maintenance of system and printers
- customer satisfaction, e.g. through training, uploading software patches, supporting documentation
- environmental (green issues), e.g. computers and monitors set to hibernate mode, use laptops or energy-saving PC and recycling hardware.

**What needs to be learnt****Learning aim C: Plan the support for a computer system over the system's life cycle****Plan the support for a computer system**

Be able to produce a system's support plan focusing on the operational stage of the life cycle, including:

- purpose
- details of the computer system (including the computers)
- design and build stage:
  - user requirements, e.g. system requirements, business requirements, hardware and/or software requirements
  - disaster recovery, e.g. planned and unplanned downtime, natural disaster, back-up of data, hardware maintenance, software support, system restore and test
  - capacity planning, e.g. determine the requirements and build the system accordingly
- operate stage:
  - disaster recovery, e.g. apply and monitor procedures of disaster recovery to sustain business continuity for organisations
  - capacity planning, e.g. apply and monitor procedures for capacity, including analysing the importance of usage trending over time, monitoring disk, memory and CPU requirements to sustain ongoing preventative maintenance
  - security planning, e.g. apply and monitor procedures for security, including access controls, malware protection, data protection, internet and email protection, encryption, audit trails
  - ergonomics, e.g. workstation layout, positioning of equipment, health and safety issues, including repetitive strain injury, eye strain, electrical equipment safety, trailing cables, portable appliance testing
  - floor plans to show the positioning of office furniture (e.g. desks, cabinets) and positioning of IT equipment (e.g. workstations, cabling, servers, printers, lighting, air conditioning)
  - other requirements (e.g. sensitivity and risk profile of the intended data to be held on the system)
  - constraints e.g. availability of resources
- decommissioning stage:
  - remove user access, e.g. disable user accounts and passwords
  - delete sensitive files using software programs
  - format hard drives
  - initial plan ideas and alternative solutions to providing support for a computer system.

**What needs to be learnt****Learning aim D: Provide operational support for a computer system and review the outcome****Operational support for a computer system**

Be able to provide operational support, which resolves common technology system issues/faults. Examples include:

- replacing a faulty DVD-ROM drive or any other suitable internal component
- providing training to users
- installing new hardware and/or software to meet a user or business requirement, troubleshoot and remedy error beeps.

Understand the different operational support methods:

- communicating information, e.g.:
  - good practice, e.g. being supportive, dealing with stressed individuals, being calm
  - providing progress reports
  - verbal and written feedback
  - escalation of problem, e.g. irregular requests, outside responsibility, levels of support (1, 2 and 3)
  - archiving requests and responses, e.g. use of computerised databases
- advice and guidance, e.g.:
  - basic operating functions, e.g. of hardware, software, networking features
  - maintenance procedures, e.g. cleaning CD/DVD readers, printer head cleaner utilities, running diagnostic software
  - troubleshooting advice, e.g. replacing broken equipment, running testing applications, identification of an upgrade/replacement needed
- procedures, e.g.:
  - recording end-user requests
  - issue/fault-finding
  - recording problems, e.g. time constraints
  - using sources of information, e.g. reference manuals, specifications, frequently asked questions, websites
  - issue/fault resolution flow charts.

Understand trends in operational support, e.g. reoccurrences of the same issues/faults across multiple computer systems/users and identifying what the most effective solution would be, or environmental considerations such as power and paper consumption.

Be able to consider capacity planning in terms of sustaining ongoing preventative maintenance of a computer system, thereby reducing the likelihood of issues/faults occurring in the future.

Be able to consider disaster recovery in terms of what methods you would put in place in the event of a disaster, e.g. data recovery via cloud back-up.

*continued*

**What needs to be learnt****System review methods**

Be able to review the operational support for the modified computer system, against the:

- original requirements
- purpose
- users' and if possible administrator's experience, e.g. systems performance, system availability and use of resources
- constraints, e.g. hardware and software availability
- resolution of the system issues/faults.

Be able to make recommendations for further operational support improvements, e.g. hardware and software configuration and settings and environmental impact.



## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand how support needs vary over the computer system's life cycle</b>			
1A.1 Identify the support required across at least <b>one</b> stage of the system's life cycle.	2A.P1 Explain the types of support required across the system's life cycle.	2A.M1 Review the types of support required across the system's life cycle, explaining why the support changes over time.	2A.D1 Discuss the impact of and compromises in providing systems support.
<b>Learning aim B: Investigate the incident diagnostic processes, common system remedies and how to evaluate a support service</b>			
1B.2 Identify at least <b>two</b> incident diagnostic processes.	2B.P2 Explain the incident diagnostic processes and the levels of support available.	2B.M2 Review the impact of the incident diagnostic processes and the levels of support available.	2B.D2 Evaluate the strengths and weaknesses of the support service and make recommendations for further improvement.
1B.3 Identify at least <b>two</b> types of common technology system issues/faults.	2B.P3 Explain the different types of common technology system issues/faults and the remedies.	2B.M3 Review the impact of different types of common technology system issues/faults.	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Plan the support for a computer system over the system's life cycle</b>			
1C.4 Identify the purpose and 'client' requirements for the support of a computer system over the life cycle.	2C.P4 Describe the purpose and 'client' requirements for the support of a computer system over the life cycle.	2C.M4 Produce a detailed support plan, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• considerations for disaster recovery and capacity planning</li> <li>• considerations for security planning.</li> </ul>	2C.D3 Justify final decisions, explaining: <ul style="list-style-type: none"> <li>• how the plan will fulfil the stated purpose and 'client' requirements</li> <li>• any constraints on the plan.</li> </ul>
1C.5 Produce a support plan for at least <b>two</b> computers over the system's life cycle, with guidance, including: <ul style="list-style-type: none"> <li>• a list of hardware and software to be supported</li> <li>• an outline of the types of support required.</li> </ul>	2C.P5 Produce a support plan for at least <b>two</b> computers over the system's life cycle, including a description of: <ul style="list-style-type: none"> <li>• the hardware and software to be supported</li> <li>• the types of support required</li> <li>• the incident diagnostic process</li> <li>• how the support service will be evaluated.</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Provide operational support for a computer system and review the outcome</b>			
1D.6 Provide operational support for a computer system, with guidance, that includes the reporting and resolution of at least <b>three</b> different system issues/faults.	2D.P6 Provide operational support for a computer system, including the reporting and resolution of at least <b>five</b> different system issues/faults.	2D.M5 Review trends in operational support of a system, demonstrating awareness of capacity planning and putting in place disaster recovery measures.	2D.D4 Refine operational support for a computer system, based on an evaluation of trends.
1D.7 Identify whether the operational support was suitable for the intended purpose and original requirements.	2D.P7 Explain whether the operational support was suitable for the intended purpose and original requirements.	2D.M6 Review the extent to which the operational support meets the original requirements, considering feedback from others and any constraints.	2D.D5 Evaluate the initial plan to support an operational computer system against the final outcome and justify any changes that were made, making recommendations for further improvement.

## Teacher guidance

### Resources

Hardware and software resources will be needed for the practical aspects of the unit. As a minimum, each learner will need access to a computer system and the appropriate tools and resources to identify, troubleshoot and remedy a range of issues/faults – for example, access to system diagnostic tools, remote access software, anti-virus software and operating systems.

Learners can use simulators or multi-media tools to gain experience before handling 'live' resources. It is recommended that free resources are obtained for the practical activities.

The practical activities should take place in a workshop with appropriate tools and take account of health and safety requirements.

Learners need access to a brief. The brief can either be created by the centre or be generated by the learner and approved by the centre.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Learners should include evidence from this unit as part of their digital portfolio (*Unit 3: A Digital Portfolio*).

### Learning aim A

Learners will understand how support needs vary over the system's life cycle and investigate common operational support issues/faults and remedies. Learners should first identify the stages of the system's life cycle – design and build, operate and decommission stages – then review the support required at each stage. Learners must keep in mind that although requirements capture is not specifically covered as part of the system's life cycle, they will be provided with the requirements as part of the 'client' brief.

**For 2A.P1:** learners should explain the types of support required across the system's life cycle. For example, during the design and build phase there should be support documentation produced and environmental considerations for decommissioning the system. They should also explain common computer system issues/faults of the operation phase (e.g. internet access, hardware failure) and the decommission phase of archiving and migrating system data (e.g. database records).

*For level 1, as a minimum, learners should identify the support required across **one** stage of the system's life cycle. However, it is likely to be a brief description – for example, operational security requirements for a new information system.*

**For 2A.M1:** learners should review the types of support required across the system's life cycle, explaining why the support changes over time. For example, during the design and build stage they should review the process design and documentation to ensure the system can be used as intended, e.g. identify further system or user requirements that could support the process. They should also review common computer system issues/faults of the operation phase, e.g. internet access, hardware failure. Plus, they should review the decommission stage of archiving and migrating system data (e.g. database records).

**For 2A.D1:** learners should evaluate the impact of providing support across the system's life cycle. For example, a server 'crash' during working hours will affect the organisation's ability to access operational data to support business processes, or unauthorised access to files and folders could result in malicious damage. Learners should also consider the compromises in providing systems support, such as the operational availability of the service and the increased cost and environmental impact.

### Learning aim B

Learners will investigate the incident diagnostic processes in terms of selecting the most appropriate method to use when diagnosing a range of issues/faults. They will understand the different levels of support and how these can be used in conjunction with the processes to provide the most effective support. Learners will become aware of the different types of technology system issues/faults and their remedies. They will also understand how to analyse a support service.

**For 2B.P2:** learners should explain the incident diagnostic processes and the levels of support available. For example, they could explain why it is important to record information about the issue/fault, including the date, name of person, location of issue/fault, type of device, location of device, error code, parts used, problem description and symptom. They will also need to explain the levels of support available. For example, level 1 support is known as the initial support, which is where the technician gathers the issue/fault details and offers possible basic solutions to the system user.

*For level 1, as a minimum, learners should identify at least two incident diagnostic processes – for example, recording information and communicating with the system user. They are likely to have listed at least **two** of the incident diagnostic processes with some description.*

**For 2B.P3:** learners should explain the different types of common technology system issues/faults and remedies, such as user issues, or hardware and software faults, and what the remedies are likely to be.

*For level 1, as a minimum, learners should identify and give examples of at least **two** types of common technology system issues/faults, such as:*

- *user, e.g. password problems, unable to locate files*
- *hardware, e.g. component failure*
- *software, e.g. unable to use software, software running slowly.*

**For 2B.M2:** learners should review how the incident diagnostic processes and the levels of support available could impact the support provided. For example, the consequences of not recording the issue/fault information accurately and instigating the appropriate level of support due to the severity of the problem.

Other examples include:

- specific issue/fault identification procedures allows for effective issue/fault diagnostics
- good user communications can reduce the time for repair and corresponding cost
- scheduled routine maintenance and hardware and software upgrades have a positive impact on business continuity.

**For 2B.M3:** learners should review how different types of common computer system issues/faults could impact the technology system. For instance, not having genuine licence keys for software will limit its functionality, along with that of other software with which it has associations, or an operating system which fails to load means the technology system cannot be used.

**For 2B.D2:** learners should evaluate the strengths and weaknesses of the support service and make recommendations for further improvement. As a minimum the evaluation should cover the system's performance, customer satisfaction and environmental aspects of the service. For example, the advantage of accurately recording the work carried out means that the problem can be rectified more efficiently if it occurs again in the future. A disadvantage is that not providing the appropriate level of support would mean that the problem is not rectified quickly, therefore resulting in increased system downtime. Recommendations for further improvement could include writing a training manual on how to use a new software program.

### Learning aim C

Learners will plan the support for a computer system containing at least **two** computers (depending on hardware and software availability) which fulfils the brief over the system's life cycle. The focus for the plan should be on the operational stage of the system's life cycle, while covering the other stages in less detail.

Learners should have access to a suitable assessment brief, which contains the user requirements for the support of a computer system, including:

- the purpose of the support
- the 'client' requirements.

**For 2C.P4:** learners should describe the 'client' requirements and purpose of the support for a computer system.

*For level 1, as a minimum, learners should identify the 'client' requirements and the purpose of the support for a computer system.*

**For 2C.P5:** learners should produce a support plan to focus on the operational stage of the system's life cycle while covering the other stages in less detail. The support plan should include a specification of the support to be provided, covering:

- the hardware and software to be supported
- the types of support required
- the incident diagnostic process
- how the support service will be evaluated.

*For level 1, as a minimum, learners should produce a support plan to cover each stage of the system's life cycle, including a list of hardware and software to be supported, and an outline of the types of support required.*

**For 2C.M4:** learners should produce a detailed support plan, including:

- alternative solutions
- considerations for disaster recovery and capacity planning
- considerations for security planning.

Learners need to think about how the requirements can be achieved using alternative solutions for elements within the support service, rather than creating whole new solutions. These should be briefly described. Learners are not prevented from a describing a whole new solution should they want to.

They also need to consider disaster recovery, in terms of how the business will sustain continuity in the event of a systems disaster, e.g. fire, earthquake. They must consider capacity planning in terms of how they would monitor systems over time, including disk, memory and CPU monitoring. Security is a very important aspect in support planning, and learners should consider how security will be applied and monitored, particularly with data.

**For 2C.D3:** learners should justify their final decisions, explaining how the plan will fulfil the stated purpose and 'client' requirements, describing the impact and any constraints on the support plan, such as the process of the removal of sensitive data or system constraints.

### Learning aim D

Learners will provide operational support for the computer systems and review the outcome.

**For 2D.P6:** learners must provide operational support for a computer system, including the reporting and resolution of at least **five** different system issues/faults. These may be a combination of any user, hardware and software issues/faults (e.g. replacing a faulty keyboard or mouse). Learners should provide operational support for a mixture of different issues and faults.

*For level 1, as a minimum, learners should provide operational support for a computer system that includes the reporting and resolution of at least **three** different system issues/faults. Learners should provide operational support for a mixture of different issues and faults.*

**For 2D.M5:** learners will review trends in operational support of a system, demonstrating awareness of capacity planning and putting in place disaster recovery measures. For example, they will identify what could potentially be a common problem and how capacity planning and disaster recovery techniques can be applied to prevent significant damage to systems.

**For 2D.D4:** learners should refine the operational support provided for a computer system based on the evaluation of trends – for example, if a trend suggests that a common virus is affecting many computer systems – technicians could simplify the process of finding and removing the virus by using remote desktop software instead of visiting each computer system and removing the virus individually.

**For 2D.P7:** learners should explain whether the operational support was suitable for the intended purpose and the original requirements.

*For level 1, as a minimum, learners should identify whether the operational support was suitable for the intended purpose and original requirements.*

**For 2D.M6:** learners should build on the explanation for level 1 and review how well the 'client' requirements and purpose have been met, and should include details of how constraints have affected the support provided. They should also seek feedback from the 'user' about the support provided. An interview would be an ideal way of discussing the support provided and recording the feedback. Learners should consider any constraints that they have had to deal with when providing the support for the system.

**For 2D.D5:** learners should evaluate their initial plans to support a computer system against the final outcome. They should justify any changes that were made and explain the rationale for those changes. They should also give recommendations for at least three operational support improvements, but do not need to implement them.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Computer System's Life Cycle Support Needs	<p>You have been invited to attend an interview for an apprentice position at a local company. You have been asked to prepare a web page or presentation on how support needs vary over the computer system's life cycle.</p> <p>You should explain and review the types of support required over the system's life cycle before evaluating the impact of providing support to systems users.</p> <p>Prepare the web page or presentation for your interview.</p>	<ul style="list-style-type: none"> <li>• Web page.</li> <li>• Presentation.</li> </ul>



Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.P3, 2B.M2, 2B.M3, 2B.D2	Systems Life Cycle Support	<p>You were successful in your interview and the company would like you to join them as an apprentice to help support a system.</p> <p>They have asked you to produce a report that:</p> <ul style="list-style-type: none"> <li>explains the incident diagnostic processes and the levels of support available</li> <li>explains the different types of common technology system issues/faults and the remedies</li> <li>reviews the impact of the incident diagnostic processes and the levels of support available</li> <li>reviews the impact of different types of common technology system issues/faults</li> <li>evaluates the strength and weaknesses of the support service</li> <li>makes recommendations for further improvements.</li> </ul>	<ul style="list-style-type: none"> <li>Report.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.P5, 2C.M4, 2C.D3	Support Plan	<p>You have been asked to plan the support for a computer system over the system's lifecycle.</p> <p>Describe the purpose and 'client' requirements for the support of a computer system.</p> <p>Produce a detailed support plan for at least two computers over the system's life cycle, including:</p> <ul style="list-style-type: none"> <li>• a description of the hardware and software to be supported</li> <li>• a description of the types of support required</li> <li>• a description of the incident diagnostic process</li> <li>• a description of how the support service will be evaluated</li> <li>• alternative solutions</li> <li>• considerations for disaster recovery and capacity planning</li> <li>• considerations for security planning.</li> </ul> <p>Explain how the support plan will fulfil the intended purpose and 'client' requirements and any constraints on the plan.</p>	<ul style="list-style-type: none"> <li>• Plan.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1D.6, 1D.7 2D.P6, 2D.P7, 2D.M5, 2D.M6, 2D.D4, 2D.D5	Operational Support and Review	<p>The support plan for the system's life cycle was approved and you have been asked to implement the operational stage of the plan.</p> <p>For the operational system:</p> <ul style="list-style-type: none"> <li>• provide support, including the reporting and resolution of five different issues/faults</li> <li>• review system support trends, demonstrating awareness of capacity planning and putting in place disaster recovery measures</li> <li>• refine the operational support for a system to reduce downtime while considering trends.</li> </ul> <p>Gather some feedback and review how the operational support is suitable for the intended purpose and original requirements, while considering any constraints.</p> <p>Make recommendations for further improvement.</p>	<ul style="list-style-type: none"> <li>• A video diary</li> <li>• Witness statements</li> <li>• Observation records</li> <li>• Web pages/blogs</li> <li>• Report.</li> </ul>



# Unit 24: Software Systems Development

Level: **1 and 2**

Unit type: **Mandatory or Optional specialist**

Guided learning hours: **60**

Assessment type: **Internal**

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## Unit introduction

This unit is about integrating two or more technologies to create a larger software system. For example, a complex commercial system many people use is a social networking site, such as Twitter or Facebook. The site integrates a database for storing users' personal details and a web-based software application for accessing the data and user interaction. Other examples of integrated software systems include multi-player games and photo-sharing applications like Instagram.

In this unit, you will investigate a range of uses of existing software systems and learn about the importance of testing to quality assure software programs and software systems. You will be able to apply some of your findings when creating your own software system.

You will integrate at least two technology-based products or systems. Technologies you choose to include could be databases, websites, automated systems and multimedia. To integrate these technologies you will need to write a software program.

You are likely to begin this unit early on in the course because you will need to start the design of the software system prior to completing other products or systems, such as a website and a database, which will be integrated in this unit to make the software system. The system will be based on a brief, from which you will design, develop, system test and then review your own software system.

There are many software developer job roles which relate to websites, databases and automated device technologies. These include jobs in SQL programming, and as ASP developers, PHP developers, JavaScript programmers and more. All of these jobs/technologies and others are highly sought after. You will also learn important skills for employment, such as problem solving and self-management.

In particular, this unit develops skills from *Unit 8: Mobile Apps Development*, *Unit 10: Database Development*, *Unit 12: Software Development*, *Unit 13: Website Development*, *Unit 16: Automated Computer Systems*, *Unit 17: Multimedia Products Development* and *Unit 22: Computer Security in Practice*.

This unit is mandatory in the Computer Science pathway.

## Learning aims

In this unit you will:

- A understand the uses of software systems and the quality assurance of software programs
- B design a software system
- C develop the software system and undertake system testing
- D review the finished software system.

## Learning aims and unit content

What needs to be learnt
<p><b>Learning aim A: Understand the uses of software systems and the quality assurance of software programs</b></p> <p><b>The purpose of a software system</b></p> <p>A software system is the integration of at least two different technology-based products or systems. The integration of the products, e.g. a website and/or systems, a network or automated device is achieved using a software program. Examples of different software systems include:</p> <ul style="list-style-type: none"> <li>• a website with a database, e.g. an e-commerce shopping website</li> <li>• a software program connected to a database, e.g. a multi-player computer game</li> <li>• automated devices with a website to control lighting, sound and heating</li> <li>• an automated device which controls a wind turbine using sensors to measure wind speed and direction, and actuators to switch the turbine on and off via a website</li> <li>• a software program which uses location-based technologies such as GPS (Global Positioning System) on a mobile phone to provide proximity marketing</li> <li>• a mobile app connected to a database or website, e.g. a telephone directory or address book.</li> </ul> <p><b>Typical uses of software systems</b></p> <p>Uses and purpose of software systems, including:</p> <ul style="list-style-type: none"> <li>• real-time information, e.g. train timetables, news services, traffic reports, flight status updates, weather, automated production lines and aero engine monitoring</li> <li>• commerce, e.g. internet banking, online auction websites, retail sales, publishing</li> <li>• government, e.g. online tax returns, revenue collection</li> <li>• education, e.g. online testing and virtual learning environments (VLEs), Wikipedia</li> <li>• business, e.g. enterprise resource planning, customer relationship management software systems</li> <li>• entertainment and social networking sites, e.g. multi-user games, radio players, Facebook, YouTube</li> <li>• upload and download services, e.g. music, film, upgrades, software, file/media sharing, cloud computing, TV on demand.</li> </ul> <p style="text-align: right;"><i>continued</i></p>

## What needs to be learnt

### Quality assurance of software programs

Software testing is an important technique to ensure that finished software programs are quality assured.

Know that the quality characteristics of a software program are:

- correctness, e.g. the software program should meet all the requirements set out by the client and expected by the customer
- efficiency and performance, e.g. the amount of system resources a software program consumes (processor time, memory space, accessing storage media)
- maintainability, e.g. the ease with which a software program can be modified by its present or future developers in order to carry out corrective (diagnose and fix errors), perfective (implement new requirements), adaptive (modify the program and system to cope with changes in the software environment) and preventative (increase software maintainability to prevent future problems) alterations to the code
- portability, e.g. the range of computer hardware and operating system platforms on which the source code of a software program can be interpreted, compiled and executed
- reliability, e.g. the accuracy of its outputs under a range of inputs and conditions
- robustness, e.g. the quality of the coding that ensures the extreme data can be processed without causing the software program to crash
- usability, e.g. the ease with which an end user can use the software program for its intended purpose or, in some cases, even unanticipated purposes
- security, e.g. the actions needed to keep data secure from external and internal threats.

Know that there are different types of testing used to quality assure software programs, including:

- functional tests designed to ensure that specific actions or functions of the program work as intended
- usability tests designed to check that the user interface is easy to use and understand
- load tests used to check that a system can continue to operate under a specific load, such as large quantities of data or a large number of users
- compatibility tests designed to test that a new software program works on different types of operating systems and hardware devices such as PCs and mobile computers.

Understand that there are different levels of testing for software systems:

- unit tests verify the functionality of a specific section of code and are usually completed by the programmer as they write the code.
- integration tests are any type of software testing that seeks to verify the interfaces and functionality of a software program. Individual modules (or units) are tested as a group.
- system tests test a completely integrated software system to verify that it meets the original requirements and is functional.

*continued*

**What needs to be learnt**

Understand that testing involves compromise between quality assurance of a software program and the cost and time involved in testing. This is because:

- it is not possible to test a program for every type of defect (e.g. functional fault or missing requirement)
- tests are usually targeted to assess one or two quality characteristics at a time
- generally the earlier a defect is discovered in the development process, the easier and cheaper it is to fix.



**What needs to be learnt****Learning aim B: Design a software system****Design documentation**

A project plan for developing a software system should include:

- project milestones
- dates and times allocated to tasks
- concurrent and parallel tasks, e.g. a Gantt chart
- contingency planning.

Know that the system design includes:

- intended purpose and 'client' requirements (as defined in a brief)
- a problem definition statement
- a proposed solution using design tools, e.g.:
  - an explanation of how at least two different technologies will combine to produce a final software system
  - a schematic of the software system describing:
    - the main program tasks in an input and output format between the main technologies used
    - interrelationships, interdependencies and feedback between the technologies
    - navigation
  - algorithms with a description of the method of solution, e.g. flow charts, pseudo-code and events
  - hardware components, e.g. smartphones, tablet PCs, sensors and actuators
  - software components, e.g. applications, operating systems, programming languages
  - if required, network design to connect hardware devices, including:
    - hardware components, e.g. wireless cards, servers, routers, network cabling
    - software components, e.g. applications, operating systems
- a brief outline of alternative design solutions for the intended software system, e.g. for interrelationships, interdependencies, algorithms and navigation
- a list of any predefined programs and/or code snippets, digital assets and their sources
- a system test plan with test data (normal, extreme and abnormal data), e.g. testing the inputs and expected outputs and compilation of the code
- constraints, e.g. device capabilities, including connectivity, memory storage, technology availability or programming language.

**What needs to be learnt****Learning aim C: Develop the software system and undertake system testing****Developing a software system**

Develop the software system using suitable constructs and techniques, e.g.:

- comments
- constants
- operators
- reserved words
- input and output commands
- variables
- assignments
- sequences
- counter-controlled and conditional loops
- iterations
- sequential statements
- recursions
- sub-routines
- data types.

Other constructs and techniques should be used where appropriate to the technologies used in the software system, including:

- query databases managed on a web server, or local hosts to perform simple functions, e.g. write/read from a database and search for information
- use a programming language with database connectivity to add, delete, amend and search records using appropriate connection methods, e.g.:
  - Open Database Connectivity (ODBC)
  - Data Control Objects (DCO)
  - Structured Query Language (SQL)
- use forms to handle data input, processing, output and validation
- use server-side and/or client-side scripting, e.g. Active Server Pages (ASP), Hypertext Pre-processor (PHP), JavaScript
- use Extensible Mark-up Language (XML), e.g. generating orders
- integrate resources, e.g. connecting outputs from one system to act as inputs for another
- customise web pages to display appropriately on mobile devices
- implement security features, e.g. encryption, password protection, read/write access
- consider automated devices, e.g. programmable devices which can be used as controllers (such as Raspberry Pi, Lego RCX/NXT/Mindstorms, Arduino, PIC), input devices (like light-dependent resistors, touch sensors, switches) and output devices (LEDs and LED arrays, lights, motors, actuators).

*continued*

## What needs to be learnt

### System testing

Be able to use suitable test methods appropriate to the types of technologies used to create the software system.

Be able to test the software system solution:

- for functionality against the test plan with the test data
- by reviewing the quality (correctness, reliability, usability, efficiency and performance, maintainability, portability, robustness and security) of the software system
- by gathering feedback from others on the usability of the solution.

Document any changes to the design, including changes to the source table for predefined programs and/or code snippets, and/or digital assets.

### Refining the software system

Improvements and/or refinements to the system to improve the quality of the software, including:

- diagnosing and fixing errors
- implementing new requirements
- increasing software maintainability to prevent future problems
- the constituent technologies, e.g.:
  - website product, e.g. text, navigation methods, embedded multimedia
  - database development, e.g. validation rules, input masks and indexing
- automated devices, e.g. input and output commands and sub-routines, limitations of sensors and actuators, accuracy of readings from sensors and precision available to control motors.

**What needs to be learnt****Learning aim D: Review the finished software system****Review the finished software system**

Review the finished software system for:

- fitness for purpose and against the original requirements
- constraints, e.g. programming language, hardware, time, device capabilities
- quality of the software system, e.g. correctness, reliability, usability, efficiency/performance, maintainability, portability, robustness and security
- strengths and improvements.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Understand the uses of software systems and the quality assurance of software programs</b>			
1A.1 Identify the uses of at least <b>two</b> different software systems and the different quality characteristics of software programs.	2A.P1 Explain the uses of at least <b>two</b> different software systems and how the quality characteristics of software programs vary.	2A.M1 Review the types of tests used to quality assure different characteristics of software programs.	2A.D1 Discuss why different tests are commonly completed at different levels within the development process and the compromises involved with testing software programs.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Design a software system</b>			
1B.2 Identify the purpose and 'client' requirements for a software system that combines at least <b>two</b> different technologies.	2B.P2 Describe the purpose and 'client' requirements for a software system that combines at least <b>two</b> different technologies.	2B.M2 Produce a detailed design for the software system, including: <ul style="list-style-type: none"> <li>• alternative solutions</li> <li>• a detailed proposed solution including algorithms</li> <li>• system test data.*</li> </ul>	2B.D2 Justify the design decisions, including: <ul style="list-style-type: none"> <li>• how they will fulfil the stated purpose and the 'client' requirements</li> <li>• any design constraints.</li> </ul>
1B.3 Produce a design for the software system that combines at least <b>two</b> different technologies, with guidance, including: <ul style="list-style-type: none"> <li>• a project plan</li> <li>• a problem definition statement</li> <li>• an outline of the proposed solution.</li> </ul>	2B.P3 Produce a design for the software system that combines at least <b>two</b> different technologies, including: <ul style="list-style-type: none"> <li>• a project plan</li> <li>• a problem definition statement</li> <li>• an explanation of the proposed solution and a system schematic</li> <li>• hardware and software components</li> <li>• if required, network components and network design</li> <li>• a list of any predefined programs and/or sub-routines and their sources</li> <li>• a system test plan.*</li> </ul>		

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim C: Develop the software system and undertake system testing</b>			
1C.4 With guidance, develop a software system that combines at least <b>two</b> different types of technology, including: <ul style="list-style-type: none"> <li>• a user interface (input and output)</li> <li>• constructs / techniques.*</li> </ul>	2C.P4 Develop a software system that combines at least <b>two</b> different types of technology for a given brief, including: <ul style="list-style-type: none"> <li>• a user interface (input and output)</li> <li>• constructs / techniques</li> <li>• commentary throughout the code.*</li> </ul>	2C.M3 Develop a functional software system that meets the given brief.*	2C.D3 Refine the software system, undertaking further testing to take account of the quality of the software and user feedback.*
1C.5 With guidance, test the software system for functionality and against the original requirements and repair any faults.	2C.P5 Undertake system testing for functionality using the test plan and against the original requirements and repair any faults.	2C.M4 Undertake system testing using the test data, gathering feedback from others on the usability, and repair any faults.	

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim D: Review the finished software system</b>			
1D.6 Identify how the final software system is suitable for purpose and the original requirements.	2D.P6 Explain how the final software system is suitable for the original requirements and purpose.	2D.M5 Review the extent to which the software system meets the original requirements, considering feedback from others and any constraints.	2D.D4 Evaluate the final software system against the initial designs and the quality of the code, and justify any changes made, making recommendations for further improvement.

\*Opportunity to assess mathematical skills



## Teacher guidance

### Resources

Centres should carefully consider which resources are appropriate to the types of technologies that learners will use to create a software system. These resources must be available for learners before attempting to deliver this unit.

For further guidance, please visit the relevant units in the specification for recommended resources applicable to the types of technologies which are intended to be used in this unit. For example, *Unit 16: Automated Computer Systems* will recommend programmable devices/controllers and input and output devices as suitable resources to use. Therefore, you should consider using the same resources as part of the design and development of a software system.

Centres should also carefully consider which programming language(s) and technology development environment(s) they are going to use, and whether the tool(s) will allow learners to meet all the assessment criteria for this unit.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

It is advised that learners begin this unit early on in the course because they will need to start the design of the software system prior to completing other products or systems from other units. Learners are expected to use the skills gained from *Unit 12: Software Development* and at least one other unit specific to a technology to support them with the development of a software system, e.g. *Unit 13: Website Development* or *Unit 16: Automated Computer Systems*.

Evidence for this unit requires learners to show that they understand the uses of software systems and the quality assurance of software programs. They also need to demonstrate practical skills when designing, developing, testing and reviewing a software system of their own to meet a given brief.

Learners will have to understand the requirements of a brief, which is likely to be set by the teacher. However, learners are also encouraged to think of their own ideas for a software system and produce their own brief. If they do, the brief must be agreed by the teacher before continuing with the assessment.

To achieve all grading criteria, learners should have access to existing software system products.

Centres are encouraged to use evidence from the development of the software system as part of the learner's digital portfolio (*Unit 3: A Digital Portfolio*).

### Learning aim A

Learners should investigate at least **two** different existing software systems and identify their uses. Separately, they should also identify different quality characteristics of software programs, e.g. correctness, efficiency and performance, and maintainability. Learners should be encouraged to investigate different types of software systems, such as those used in communication, commerce, government or business.

**For 2A.P1:** learners are required to review at least **two** different software systems created by others. Learners should explain the uses of the systems. Learners should also explain how the quality characteristics of software programs vary. The two software systems should be designed for different purposes.

*For level 1, as a minimum, learners should identify the uses of at least two different software systems and the different quality characteristics of software programs or software systems.*

**For 2A.M1:** learners should review the types of tests used to quality assure different characteristics of software programs or software systems, i.e. compatibility tests, functional tests, usability tests and load tests.

**For 2A.D1:** learners should discuss why different tests are commonly completed at different levels within the development process and the compromise involved with testing software programs. This should include unit, integration and system testing.

### Learning aim B

Learners should have access to a suitable assessment brief, which contains the 'client' requirements of the software system, including:

- the purpose of the software system
- an outline of at least **two** different technologies which will be used to create the software system
- the task(s) the software system must perform
- what the required user inputs and outputs are
- an outline of any processing/functions required.

It is intended that the design and development of constituent technologies are completed as part of the other units in the course.

Examples of software systems could include:

- an online telephone directory, which displays contact details for people
- an online ticketing system, which displays available seats and allows people to book seats
- an appointment system for a vet/doctor/dentist/hairdresser
- an online system to display location of buses using sensors
- an online system to remotely view energy consumption in the house
- an online leader board for a game.

**For 2B.P2:** learners should describe the purpose and 'client' requirements of a software system that combines at least two different technologies for their designs.

*For level 1, as a minimum, learners should identify the user requirements and the purpose of a software system that combines at least two different technologies for their designs.*

**For 2B.P3:** learners should outline their proposed solution for a given problem contained in a brief. The design documentation should include:

- a project plan including project milestones, dates and times allocated to tasks, concurrent and parallel tasks and contingency planning. This could be presented as a Gantt chart
- a problem definition statement
- an explanation of how at least **two** different technologies will combine to create the proposed software system
- a system schematic outlining a proposed solution, which are appropriate to the types of technologies being used, to create the proposed software system, including:
  - a description of the main software system tasks (e.g. data input and output format)
  - screen layouts and navigation

- simple data structures
- algorithms or descriptions of the solution method
- hardware and software components
- if required, network components and network design, e.g. network diagrams, plans
- a list of any predefined programs and/or sub-routines and their sources
- a system test plan (to test for the logic and functionality).

*For level 1, as a minimum, learners should identify the purpose and 'client' requirements for the proposed software system. The outline of a proposed solution will contain:*

- *a project plan*
- *a problem definition statement*
- *an outline of the proposed solution, including:*
  - *a description of the main software system tasks – input and output*
  - *a description of how at least two different technologies will combine to create the proposed software system*
  - *screen layouts (input and output) – templates or design sheets can be used to help learners with their design.*

**For 2B.M2:** in addition to the requirements for the Pass grade, learners should produce:

- a detailed proposed solution using a range of suitable tools (in addition to those used at Pass level), which, when combined with those suggested for different types of technologies, will provide a more detailed picture of how the proposed software system will be developed
- a brief outline of any alternative solutions for the intended software system
- system test data.

**For 2B.D2:** learners are expected to be able to justify their design decisions and how the chosen design fulfils the stated purpose and user requirements for the given brief. They should consider the suitability for the end user and the quality and thoroughness of their design work. Learners need to consider their design in light of any constraints arising from the software system development – for example, technology and language used, and the device capabilities (such as memory) in terms of the quality of the user interface, manipulation and storage of data, and ease of use. Learners should explain why alternative designs were rejected.

### Learning aim C

Learners will develop a software system and undertake system testing for a given brief.

**For 2C.P4:** learners should develop their solution to the given brief by implementing their design. Some learners will find that their designs do not allow them to implement a solution. In this case, learners should amend their software system but should not revisit the design work at this stage. Learners should ensure that they are developing solutions using an appropriate range of constructs/techniques and development environment(s) relevant to the technologies being combined to create the software system. The software system should also include commentary built into the software system and have a user interface with both input and output facilities.

Learners will not produce a solution which fully meets the brief. However, they should ensure that what they produce is functional.

*For level 1, as a minimum, learners should use their designs and their understanding to create a simple software system to solve the given problem. The solution will not meet the brief and may not function correctly in some situations. In addition, the range of constructs and techniques is likely to be limited.*

**For 2C.M3:** at this level, learners will produce a functional software system that satisfies the brief. Learners are likely to need to adapt their designs to create a fully functioning software system solution.

**For 2C.P5:** learners should use appropriate testing methods relevant to the chosen technologies and test their software system solution using their test plan. During the testing process, they should keep evidence of any changes made (e.g. code) and repair any faults.

Learners should test that their software system meets the original requirements from the brief.

*For level 1, as a minimum, learners should use appropriate testing methods relevant to the chosen technologies and test the main functions of their software system, e.g. that data can be input.*

**For 2C.M4:** learners should use appropriate test methods relevant to the chosen technologies and test their software system using the test data. They should correct any faults or errors found during the process and produce evidence to show any changes made to the software system. Learners should work with others to obtain feedback on the quality and functionality of their program.

**For 2C.D3:** learners should recognise that the process of developing and testing software systems is an iterative one. When making refinements to their software system, learners should take into account their test results and user feedback. Learners should refine the software system, taking account of user feedback and the quality of the product, e.g. correctness, efficiency and performance. All the ideas from testing, feedback and reviewing the software system should have been considered when refining the program.

### **Learning aim D**

**For 2D.P6:** learners should review their software system in light of the results of their testing and should explain how their software system meets the original requirements and is fit for purpose.

*For level 1, as a minimum, learners should identify how their software system meets the purpose and the original requirements.*

**For 2D.M5:** learners should consider the outcomes of their testing and should review the extent to which the software system solves the given problem. Learners should gather feedback from others and consider changes they would like to make in the light of this feedback.

**For 2D.D4:** learners should evaluate their initial designs and the completed software system. They should identify any changes made from the design stage and justify these changes in terms of the requirements and the features of the technology development environment(s) used, and any other constraints.

Learners should make at least **three** specific suggestions for improving the complete software system to ensure it is fully functional, well developed and fit for purpose.

Learners do not need to implement the enhancements.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

### Scenario

Develop a software system that allows players to participate in an online quiz. The questions and answers are stored on a database. A website will interact with the database so that questions are randomly presented to players, and answers are automatically scored when they are checked against. The player's details and their scores will be stored in the same database. A range of digital assets should be embedded into the website (e.g. audio, animation, video and graphics) to provide some interaction.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1 2A.P1, 2A.M1, 2A.D1	Research Software Systems	<p>You are a programmer working for a software development company.</p> <p>Your line manager is about to set you a project, which involves combining different technologies to create a software system. Before they do, you have been asked to conduct some research on software systems that are used currently.</p> <p>Review at least two different software systems and explain their use.</p> <p>Explain the different quality characteristics of software programs, e.g. correctness, efficiency and performance and maintainability.</p> <p>Review the types of tests (compatibility, functional, usability and load) used to quality assure different characteristics of software programs.</p> <p>Discuss different tests commonly completed at different levels (unit, integration and system) within the development process and the compromises involved with testing software programs.</p>	<ul style="list-style-type: none"> <li>• Web page/blog.</li> <li>• Report.</li> <li>• Presentation.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1B.2, 1B.3 2B.P2, 2B.P3, 2B.M2, 2B.D2	Design a Software System	<p>You should explain how your design meets the 'client' requirements when addressing the problem.</p> <p>You will need to design a software system that meets the 'client' requirements and purpose, and include in your design:</p> <ul style="list-style-type: none"> <li>• a project plan</li> <li>• a problem definition statement</li> <li>• an explanation of how the technologies will be combined to create the proposed software system, i.e. website, database (and programming)</li> <li>• a system schematic explaining the proposed solution, which are appropriate to the types of technologies being used to create the proposed software system, including a description of the main software system tasks, screen layouts and navigation, simple data structure, and algorithms or descriptions of the method of solution</li> <li>• hardware and software components</li> <li>• a list of any predefined programs and/or sub-routines and/or including their sources</li> <li>• a system test plan.</li> </ul>	<ul style="list-style-type: none"> <li>• Design documentation.</li> <li>• Report.</li> <li>• Screens (input and output).</li> <li>• Sources table.</li> <li>• Test plan.</li> </ul>

Criteria covered	Assignment	Scenario	Assessment evidence
1C.4, 1C.5 2C.P4, 2C.M3, 2C.P5, 2C.M4, 2C.D3	Develop and Test a Software System	<p>Develop the software system, including commentary within the code.</p> <p>Test the software system against the test plan, checking the 'client' requirements are still being met and documenting any changes to the software system.</p> <p>Fix any faults in the software system.</p> <p>Gather feedback on the software system from one other person, including how easy it is to use and the quality of the code.</p> <p>Review and refine your software system in the light of feedback.</p>	<ul style="list-style-type: none"> <li>• Annotated code.</li> <li>• Annotated design.</li> <li>• User feedback.</li> <li>• Functional software system.</li> <li>• Test plans and data.</li> </ul>
1D.6 2D.P6, 2D.M5, 2D.D4	Review the Software System	<p>How could the software system be improved?</p> <p>Review the software system against original requirements and purpose. Does it meet the requirements?</p> <p>Include strengths and points you could improve. List the constraints of the software system.</p> <p>Justify where your design has changed during the development, including what has changed following feedback, and explain how you would improve the software system further.</p>	<ul style="list-style-type: none"> <li>• Annotated code.</li> <li>• Annotated design.</li> <li>• User feedback.</li> <li>• Evaluation report.</li> </ul>





# Unit 25: IT Work Experience

Level: **1 and 2**

Unit type: **Optional specialist**

Guided learning hours: **30**

Assessment type: **Internal**

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## Unit introduction

Does gaining IT work experience in the IT sector or the creative computing industries appeal to you? You could mix with IT/computing professionals to gain invaluable experience and network with like-minded people, which will help you in your course and career.

Potential employers value work experience because it shows that you have initiative and are truly interested in the sector, and it gives them an opportunity to spot young, talented people. Also, it gives you first-hand experience of what is expected from potential employees, gives you experience of real job situations and will allow you to apply some of what you have learnt on your Pearson BTEC Level 1/Level 2 Firsts in Information and Creative Technology.

In this unit, you will prepare for and secure your IT work experience by learning how to find and apply for a suitable vacancy. You will be supported by your teacher, who will assist you in finding a suitable work placement that closely matches your skills and interests. This may include contacting one of the various organisations that support learners who are looking for suitable work experience.

You will look at work-based health and safety issues, and learn more about the workplace, gaining knowledge, skills and understanding to help you to progress in a career. Through your work experience, you will investigate and use employability skills that are needed in the workplace, and you will gain first-hand experience of the IT sector or creative computing industry.

This unit will also give you the opportunity to review your IT work experience and to consider how it will help you achieve your personal career aims, for example by reviewing what worked well and what you could improve next time.

## Learning aims

In this unit you will:

- A prepare for and secure your IT work experience
- B use technical and employability skills during your IT work experience
- C review your IT work experience.

## Learning aims and unit content

### What needs to be learnt

#### Learning aim A: Prepare for and secure your IT work experience

Work experience is about being employed in an organisation full time, for example for 2–12 weeks, or part time, for example one day a week over 12 weeks. The work experience could be paid or unpaid and should last for a minimum of 10 working days.

#### **Search for work experience in the IT sector and/or creative computing industries**

This includes:

- places to search for IT/computing work experience, e.g. employment websites, company websites, publications, job centres, noticeboards, personal networks
- criteria to use when searching for IT/computing jobs
- understanding the features of a job advertisement
- technical skills, e.g. programming, computer networking skills
- personal characteristics, e.g. communication and literacy, self-management, teamworking
- matching personal and technical skills to those advertised
- recognising suitable opportunities.

Apply for IT/computing job roles, including:

- speculative applications
- the process once a suitable job advert has been found
- requesting an application form and/or more information about the role
- online versus paper-based applications
- using your digital portfolio as part of the application process
- the process once the application has been submitted.

Application for IT/computing job roles, including:

- documents used in applications and their structure, length and formatting, e.g. covering letter, curriculum vitae, application form
- outlining relevant education, skills and interests
- how to meet employers' expectations
- evidencing technical skills and abilities
- detailing achievements to date, e.g. school or college awards, sporting achievements, voluntary work
- how any gaps can be addressed, e.g. on-the-job training, further reading, course completion
- presentation of application, e.g. form filled out correctly, spelling, formal language, format and structure
- checking accuracy of application, e.g. no embellishments, facts are correct.

*continued*

### What needs to be learnt

Interview skills:

- using communication skills, both verbal (listening, speaking) and non-verbal (body language, facial expressions)
- presentation of self, appearance, clothing, cleanliness
- asking questions about workplace, e.g. uniform or dress code requirements, working hours, key contact at workplace, and asking questions about the work experience, e.g. what the role and responsibilities would be
- asking for clarification or further information when necessary
- preparing answers to common questions, e.g. reason(s) for applying for the role, skills and knowledge to carry out role(s) in the IT sector/creative computing industries, current sector-specific issues
- demonstrating confidence
- demonstrating professionalism.

Know what technical IT/computing skills and employability skills (as outlined in learning aim B) are valued in particular IT work experience placements. For example, providing computer systems support requires technical IT/computing skills, e.g. diagnosing and repairing computer hardware faults, and employability skills, e.g. communication skills to provide advice and guidance to system users.

### Health and safety considerations in the workplace

Measures to ensure personal health and safety in the workplace, e.g. Criminal Records Bureau (CRB) check, posture and screen position when using a computer, frequent breaks, personal protective equipment (PPE), safe manual handling procedures.

Measures to ensure health and safety of others, e.g. working in a safe manner individually, CRB check, keeping fire exits clear, safe operation of electrical equipment.

Current and relevant legislation, e.g. Health and Safety at Work Act, Control of Substances Hazardous to Health (COSHH) Regulations.

Potential health and safety risks of using technology in the workplace and methods to reduce those risks, e.g.:

- repetitive strain injury (RSI) risks can be reduced by the ergonomic set-up of workstations
- back injury risks can be reduced by using appropriate machinery and methods for handling equipment
- electrical shock risks can be reduced by isolating electrical equipment prior to carrying out maintenance.

## What needs to be learnt

### Learning aim B: Use technical and employability skills during your IT work experience

Work-related technical IT/computing skills could include:

- providing computer systems support to system users
- using database and spreadsheet software
- developing creative products (audio, graphics, animation and video)
- developing/maintaining websites
- developing/amending basic software programs or mobile apps.

Employability skills valued in the workplace:

- communication and literacy, i.e. ability to produce clear, structured written work and oral literacy, including listening and questioning and non-verbal communication (body language)
- self-management, i.e. being responsible, flexible and reliable, demonstrating time-management skills, integrity and a readiness to improve own performance, and the ability to maintain a positive attitude
- teamworking, i.e. respecting others, cooperating, negotiating, persuading and contributing to discussions
- problem solving, i.e. analysing facts and circumstances and applying creative thinking (including artistic appeal) to develop appropriate solutions
- application of IT or digital literacy, i.e. the general ability/skills to use computers to support learning, working and leisure activities (e.g. word processing, presentation software and file-management skills)
- application of numeracy, i.e. the manipulation of numbers, general mathematical awareness and its application in practical contexts
- business and customer awareness, i.e. the basic understanding of the key drivers for business success (e.g. cash flow) and the need to provide customer satisfaction to appropriately meet the needs of customers
- leadership and organisation, including managing projects, being decisive and inspiring others.

Know that personal characteristics are a combination of technical and employability skills (as defined in Unit 19: Computing in the Workplace).

Understand why these employability skills are valued in the workplace, such as communication skills, including:

- sharing ideas, concepts and other information with colleagues
- sharing information and socialising with suppliers and customers
- undertaking work as part of a team
- reducing the likelihood of errors.

Employability skills include:

- communicating with others, e.g. manager, colleagues, customers/clients
- working with others, including colleagues
- completing tasks within agreed timescales.

*continued*

**What needs to be learnt**

Advanced employability skills include:

- working with autonomy
- demonstrating leadership skills (when working with others)
- managing a team/persuading others to commit to your ideas
- problem solving, e.g. finding a new way to complete tasks by using technology, like social media, to complete tasks more efficiently or to organise projects.

**What needs to be learnt****Learning aim C: Review your IT work experience**

Contributing to the organisation:

- completing technical IT/computing-related tasks, e.g. writing a macro in Excel or a database report query and supporting users on a helpdesk
- communicating with colleagues, e.g. attending and participating in meetings, or using email systems.

Benefits of IT work experience, e.g.:

- employability skills developed
- technical IT and computing skills developed (reinforcing and expanding on the knowledge, understanding and skills gained from the BTEC course)
- networking and relationship building with like-minded individuals
- employer reference for future employment
- confirming and reviewing the learner's preconceptions and interest in the IT sector or creative computing industry.

Collecting feedback during the IT work experience:

- from colleagues and supervisor(s)
- types of feedback, e.g. verbal, comment cards, questionnaires, video diaries
- the technical and employability skills and knowledge needed to be successful in the full-time equivalent role
- evaluate self, including feedback from others, e.g. using a SWOT (strengths, weaknesses, opportunities and threats) analysis by contribution of technical and employability skills.

Areas for improvement, e.g. to meet planned goals on time, to communicate more effectively or to learn new scripting/programming constructs and techniques.

Recommendations for career development, e.g.:

- further education
- relevant part-time or voluntary work/work experience
- research other sectors, including speaking to careers adviser and colleagues working in the sector
- identify potential job roles of interest, including the required technical and employability skills
- qualifications (e.g. maths, English, IT/computing).

Planning short-term and long-term career aspirations over time, e.g. within next six months, a year, three years.

## Assessment criteria

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim A: Prepare for and secure your IT work experience</b>			
1A.1 Use job-searching techniques, with guidance, to find IT work experience.	2A.P1 Use job-searching techniques to find at least <b>three</b> suitable opportunities for IT work experience.	2A.M1 Enhance your applications by including at least <b>two</b> of the following: <ul style="list-style-type: none"> <li>• an application form</li> <li>• a technical and employability skills review</li> <li>• a digital portfolio.#</li> </ul>	2A.D1 Refine your job applications to meet employers' expectations, taking into account feedback from others.#
1A.2 Prepare, with guidance, and apply for at least <b>one</b> job role in the IT and/or creative computing industries, by including: <ul style="list-style-type: none"> <li>• a covering letter</li> <li>• a tailored two-page curriculum vitae</li> <li>• completing an interview.#</li> </ul>	2A.P2 Prepare and apply for at least <b>three</b> job roles in the IT and/or creative computing industries, by including: <ul style="list-style-type: none"> <li>• a covering letter</li> <li>• a tailored two-page curriculum vitae</li> <li>• completing an interview with confidence.#</li> </ul>		
1A.3 Identify health and safety considerations to ensure personal safety in the workplace.	2A.P3 Explain health and safety considerations that ensure the safety of self and others in the workplace.	2A.M2 Identify and explain at least <b>three</b> potential health and safety risks that could occur during your IT work experience.	2A.D2 Discuss measures to reduce the potential risks during your IT work experience.

Level 1	Level 2 Pass	Level 2 Merit	Level 2 Distinction
<b>Learning aim B: Use technical and employability skills during your IT work experience</b>			
1B.4 Demonstrate technical skills and employability skills.	2B.P4 Demonstrate technical skills and employability skills, of which at least <b>one</b> should be an advanced skill.	2B.M3 Explain why certain technical and employability skills are valued by the employer, having consulted with colleagues.	2B.D3 Evaluate your technical and employability skills from undertaking the IT work experience.
<b>Learning aim C: Review your IT work experience</b>			
1C.5 Identify your contribution to the organisation.	2C.P5 Describe your contribution to the organisation.	2C.M4 Explain your contribution to the organisation, making recommendations for improvement and describe how this has affected your career aspirations.	2C.D4 Evaluate your contribution to the organisation and make recommendations for your career development over time.
1C.6 Identify the benefits of undertaking IT work experience and identify your career aspirations.	2C.P6 Describe the benefits of undertaking IT work experience and describe your career aspirations.		

#Opportunity to assess English skills



## Teacher guidance

### Resources

This unit focuses on learners gaining work experience in the IT sector or in a creative computing industry. Learners should be given background knowledge, and an understanding about the job market and the skills required when applying for work and working in a competitive vocational environment.

Centres are encouraged to develop links with a wide cross-section of organisations with diverse roles in the IT sector or creative computing industries.

Visits by staff from companies offering potential work experience placements would add context and realism to the preparation process – for example, allowing the staff to contribute towards learners' background knowledge.

Links could be established with the local careers service and/or job centres, which could provide advice on the job market as well as the skills needed when applying for a job in this sector.

### Assessment guidance

This unit is assessed internally by the centre and externally verified by Pearson. Please read this guidance in conjunction with *Section 8 Internal assessment*.

Learners will prepare for and secure IT work experience with an organisation by applying for suitable opportunities. When successful, learners will undertake their work experience and demonstrate appropriate technical and employability skills throughout. Finally, learners will review their work experience by reflecting upon their contribution to the organisation and making recommendations for their career development over time.

Learners should be clear about the practical tasks they are expected to perform. They should also be responsive to broader issues, such as timekeeping and health and safety issues, during their work experience.

The centre needs to take responsibility for ensuring that all aspects of safeguarding learners on work experience have been covered. This includes CRB checks (where applicable) and risk assessments.

It is recommended that learners complete a minimum of 10 days' work experience in the IT sector or in a creative computing industry. Evidence from simulated work experience is not acceptable.

Evidence generated and/or demonstrated during the work experience must be authenticated by a workplace supervisor or manager, or a visiting teacher. Centres are responsible for verifying evidence and should be confident that those who sign witness statements and observation records in a workplace are sufficiently competent to do so.

Observation records must clearly show learner's achievement against the target criteria. Signed witness statements, observation records and supporting learner evidence should be retained by the centre for quality assurance purposes.

Learners should include evidence from this unit as part of their digital portfolio (*Unit 3: A Digital Portfolio*).

## Learning aim A

Learners will prepare for and secure their IT work experience by searching, preparing and applying for at least **three** suitable work experience opportunities. Learners will prepare and apply for these job roles by producing a covering letter and curriculum vitae, and at least **two** of the following:

- an application form
- a technical and employability skills review (e.g. teamworking, problem solving)
- a digital portfolio.

They will have the opportunity to gather some feedback and refine their job applications to meet employers' expectations.

Learners are expected to submit their applications to their chosen employers. Learners will also be required to consider health and safety, and the possible risks that could occur during their IT work experience.

**For 2A.P1:** learners should use job-searching techniques to find at least **three** suitable opportunities for IT work experience. Examples could include employment websites, company websites or job centres.

*For level 1, as a minimum, learners should use job-searching techniques, to find IT work experience.*

**For 2A.P2:** learners should prepare an application for at least **three** job roles in the IT and/or creative computing industries by producing a covering letter and a two-page curriculum vitae tailored for the job roles. The interviews may be simulated if there is no employer available, but learners should be encouraged to consider this process as a realistic preparation for their work experience.

*For level 1, as a minimum, learners should prepare an application for at least **one** job role in the IT and/or creative computing industries by producing a covering letter and a one-page curriculum vitae. Learners must be successful with a job role before completing an interview. The curriculum vitae can be generic, which is suitable for applying to most IT and/or creative computing job roles. The interview is likely to be a short conversation demonstrating little confidence.*

**For 2A.M1:** learners should enhance their job applications by including at least **two** of the following:

- a detailed application form
- a technical and employability skills review
- a digital portfolio (from *Unit 3: A Digital Portfolio*) that showcases their talents.

**For 2A.D1:** learners should refine the content of their job applications by making them more attractive to employers. They should also gather feedback from others, such as their teacher, head of department or their peers, and make improvements, which should be grammatically accurate, concise, tailored to the job adverts and error free. Other refinements may include improving the presentation of the applications.

**For 2A.P3:** learners should explain health and safety considerations that ensure the safety of self and others in the workplace, for example explaining the importance of CRB checks within organisations.

*For level 1, as a minimum, learners should identify health and safety considerations to ensure personal safety in the workplace.*

**For 2A.M2:** learners should identify and explain at least three potential health and safety risks that could occur during their IT work experience – for example, trip hazards with trailing cables or toxic chemicals in computer screen/keyboard cleaning fluid products.

**For 2A.D2:** learners should expand upon their explanation by discussing the measures to reduce the potential risks during their IT work experience – for example, reporting any potential risks to the health and safety officer and working with them to minimise those risks to self and others.

### Learning aim B

If learners are offered more than one job role, it is advised that they discuss their options with their teacher before accepting a position.

Learners will undertake their IT work experience and demonstrate technical and employability skills throughout their time at their chosen organisation.

**For 2B.P4:** learners should demonstrate their technical skills and employability skills, of which at least **one** should be an advanced employability skill, during their IT work experience. The technical skills will vary depending on the nature of the work experience and what is expected of the learner. Examples of advanced employability skills could include managing a project and working with others to achieve specific objectives.

*For level 1, as a minimum, learners should demonstrate their technical skills and basic employability skills during their IT work experience. Examples could include following instructions or adhering to health and safety practices, or adapting communication methods and skills for different tasks and people.*

**For 2B.M3:** learners should explain why certain technical and employability skills are valued by the employer, having consulted with colleagues within the organisation. They should identify their technical and employability skills, which they have used throughout the IT work experience, and give examples of why they are valued by the employer. For example, using problem-solving skills helped towards resolving problems, which subsequently led to contributing towards the goals of the organisation.

**For 2B.D3:** learners should evaluate their technical and employability skills from undertaking the IT work experience, especially those which were valued by the employer. They could explain which skills they have and which they have yet to develop or could develop further, and suggest how they might do that. They could also explain how they know they have the skills, giving examples of when they have used them. This will be useful for learning aim C where they will review their IT work experience.

### Learning aim C

Upon completion, learners should review their IT work experience by explaining how they have contributed towards the organisation and making recommendations for improvement.

**For 2C.P5:** learners should describe their contribution to the organisation – for example, providing computer systems support to system users and helping them to resolve problems, e.g. resetting a network password.

*For level 1, as a minimum, learners should identify their contribution to the organisation without giving any further description or examples.*

**For 2C.P6:** learners should describe the benefits of undertaking IT work experience, e.g. learning valuable skills and knowledge of working with IT systems in a real workplace environment, which will help them choose a particular career path. They should also describe their career aspirations, e.g. pursue a career as a network manager, giving reasons as to why they want this type of career.

*For level 1, as a minimum, learners should identify the benefits of undertaking IT work experience, e.g. supporting users from an IT helpdesk. They should also identify their career aspirations, e.g. a animation designer. They will not give any further description.*

**For 2C.M4:** learners should explain their contribution to the organisation while making recommendations for improvement – for example, providing computer systems support to system users and helping them to resolve problems, e.g. delivering training on how to use an email application. A recommendation could be to identify whether any other systems users share a similar training need, and to deliver training sessions to a group of users on how to use an email application.

Learners should also describe how their IT work experience has affected their career aspirations. For example, they might find that they enjoyed providing computer systems support to system users and feel the need to develop in this area of IT.

**For 2C.D4:** learners should expand upon their explanation by evaluating their contribution to the organisation, recognising what went well and what did not go so well. Learners should also give recommendations of how they could develop in their future careers. For example, studying a computer networking course will help give them a greater understanding of managing computer networks, especially when it ties in so well with computer systems support.

## Suggested assignment outlines

The table below shows a programme of suggested assignment outlines that covers the assessment criteria. This is guidance and it is recommended that centres either write their own assignments or adapt any assignments we provide to meet local needs and resources.

Criteria covered	Assignment	Scenario	Assessment evidence
1A.1, 1A.2, 1A.3 2A.P1, 2A.P2, 2A.P3, 2A.M1, 2A.M2, 2A.D1, 2A.D2	Preparation for my IT work experience	Prepare for employment by searching for suitable work experience opportunities in the IT sector or creative computing industries, completing job applications and using interview skills, and researching the health and safety requirements.  Following a successful application, undertake an interview, showing confidence, professionalism and evidence of preparation.	<ul style="list-style-type: none"> <li>• List of suitable vacancies.</li> <li>• Job application(s).</li> <li>• Signed observation record of interview with relevant skills demonstrated.</li> <li>• Report detailing health and safety requirements.</li> </ul>
1B.4, 1C.5, 1C.6 2B.P4, 2C.P5, 2C.P6, 2B.M3, 2C.M4, 2B.D3, 2C.D4	IT work experience and review	During your IT work experience, you must demonstrate technical skills and employability skills, of which at least one should be an advanced employability skill.  Review your IT work experience by describing the benefits of undertaking work experience and describing your career aspirations. For example, include details of how things go, what you learn from the experience, and how you could use the experience to benefit your career development.	<ul style="list-style-type: none"> <li>• Signed witness statement(s) from work placement organisation.</li> <li>• Presentation reflecting on the work experience and supporting notes.</li> <li>• Observation record(s).</li> </ul>



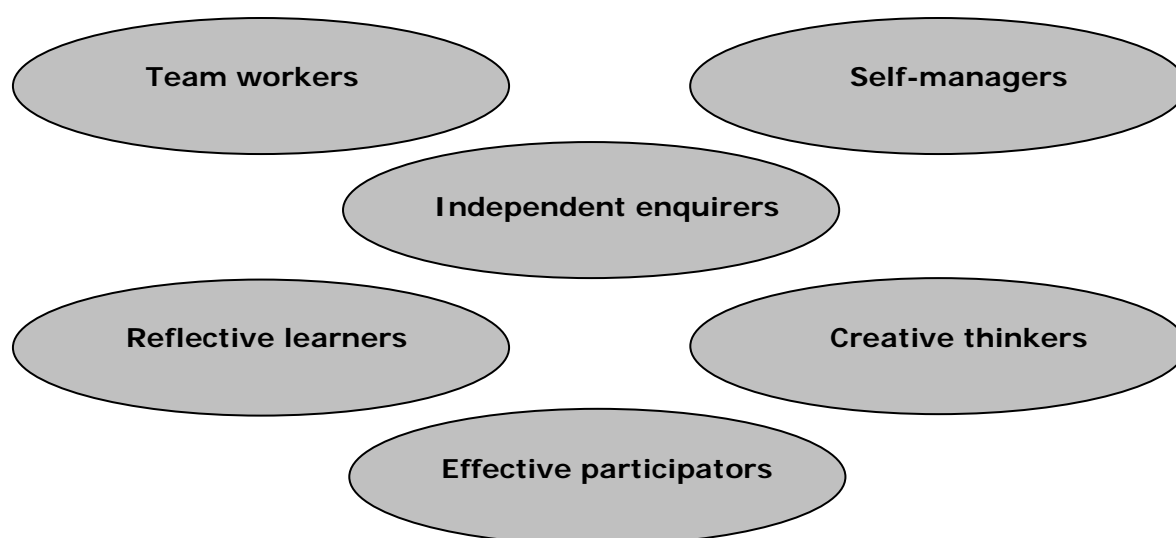
# Annexe A

## Personal, learning and thinking skills

### A FRAMEWORK OF PERSONAL, LEARNING AND THINKING SKILLS 11–19 IN ENGLAND

The framework comprises six groups of skills that are essential to success in learning, life and work. In essence, the framework captures the essential skills of: managing self; managing relationships with others; and managing own learning, performance and work. It is these skills that will enable young people to enter work and adult life confident and capable.

The titles of the six groups of skills are set out below.



For each group, there is a focus statement that sums up the range of skills. This is followed by a set of outcome statements that is indicative of the skills, behaviours and personal qualities associated with each group.

Each group is distinctive and coherent. The groups are also interconnected. Young people are likely to encounter skills from several groups in any one learning experience. For example, an independent enquirer would set goals for their research with clear success criteria (reflective learner) and organise and manage their time and resources effectively to achieve these (self-manager). In order to acquire and develop fundamental concepts such as organising oneself, managing change, taking responsibility and perseverance, learners will need to apply skills from all six groups in a wide range of learning contexts.

## The skills

### Independent enquirers

**Focus:**

Young people process and evaluate information in their investigations, planning what to do and how to go about it. They take informed and well-reasoned decisions, recognising that others have different beliefs and attitudes.

**Young people:**

- identify questions to answer and problems to resolve
- plan and carry out research, appreciating the consequences of decisions
- explore issues, events or problems from different perspectives
- analyse and evaluate information, judging its relevance and value
- consider the influence of circumstances, beliefs and feelings on decisions and events
- support conclusions, using reasoned arguments and evidence.

### Creative thinkers

**Focus:**

Young people think creatively by generating and exploring ideas, making original connections. They try different ways to tackle a problem, working with others to find imaginative solutions and outcomes that are of value.

**Young people:**

- generate ideas and explore possibilities
- ask questions to extend their thinking
- connect their own and others' ideas and experiences in inventive ways
- question their own and others' assumptions
- try out alternatives or new solutions and follow ideas through
- adapt ideas as circumstances change.

### Reflective learners

**Focus:**

Young people evaluate their strengths and limitations, setting themselves realistic goals with criteria for success. They monitor their own performance and progress, inviting feedback from others and making changes to further their learning.

**Young people:**

- assess themselves and others, identifying opportunities and achievements
- set goals with success criteria for their development and work
- review progress, acting on the outcomes
- invite feedback and deal positively with praise, setbacks and criticism
- evaluate experiences and learning to inform future progress
- communicate their learning in relevant ways for different audiences.



### Team workers

#### Focus:

Young people work confidently with others, adapting to different contexts and taking responsibility for their own part. They listen to and take account of different views. They form collaborative relationships, resolving issues to reach agreed outcomes.

#### Young people:

- collaborate with others to work towards common goals
- reach agreements, managing discussions to achieve results
- adapt behaviour to suit different roles and situations, including leadership roles
- show fairness and consideration to others
- take responsibility, showing confidence in themselves and their contribution
- provide constructive support and feedback to others.

### Self-managers

#### Focus:

Young people organise themselves, showing personal responsibility, initiative, creativity and enterprise with a commitment to learning and self-improvement. They actively embrace change, responding positively to new priorities, coping with challenges and looking for opportunities.

#### Young people:

- seek out challenges or new responsibilities and show flexibility when priorities change
- work towards goals, showing initiative, commitment and perseverance
- organise time and resources, prioritising actions
- anticipate, take and manage risks
- deal with competing pressures, including personal and work-related demands
- respond positively to change, seeking advice and support when needed.

### Effective participators

#### Focus:

Young people actively engage with issues that affect them and those around them. They play a full part in the life of their school, college, workplace or wider community by taking responsible action to bring improvements for others as well as themselves.

#### Young people:

- discuss issues of concern, seeking resolution where needed
- present a persuasive case for action
- propose practical ways forward, breaking these down into manageable steps
- identify improvements that would benefit others as well as themselves
- try to influence others, negotiating and balancing diverse views to reach workable solutions
- act as an advocate for views and beliefs that may differ from their own.

### Summary of the PLTS coverage throughout the programme

This table shows where units support the development of personal, learning and thinking skills.

#### Key:

✓ indicates opportunities for development

a blank space indicates no opportunities for development

Unit	Personal, learning and thinking skills					
	Independent enquirers	Creative thinkers	Reflective learners	Team workers	Self-managers	Effective participators
1	✓	✓				
2	✓	✓				
3	✓	✓	✓		✓	
4	✓	✓	✓		✓	
5	✓	✓	✓		✓	
6	✓	✓	✓		✓	
7	✓	✓	✓		✓	
8	✓	✓	✓		✓	
9	✓	✓	✓		✓	
10	✓	✓	✓		✓	
11	✓	✓	✓		✓	
12	✓	✓	✓		✓	
13	✓	✓	✓		✓	
14	✓	✓	✓		✓	
15	✓	✓	✓		✓	
16	✓	✓	✓		✓	
17	✓	✓	✓		✓	
18	✓	✓	✓		✓	
19	✓	✓	✓	✓	✓	✓
20	✓	✓	✓	✓	✓	✓
21	✓	✓	✓		✓	✓
22	✓	✓	✓	✓	✓	✓
23	✓	✓	✓		✓	✓
24	✓	✓	✓	✓	✓	
25	✓	✓	✓	✓	✓	✓

# Annexe B

## Level 2 Functional Skills

### Functional Skills standards for English Level 2

<b>Speaking, listening and communication</b>
Make a range of contributions to discussions in a range of contexts, including those that are unfamiliar, and make effective presentations
<b>Reading</b>
Select, read, understand and compare texts and use them to gather information, ideas, arguments and opinions
<b>Writing</b>
Write a range of texts, including extended written documents, communicating information, ideas and opinions, effectively and persuasively

### Functional Skills standards for mathematics Level 2

<b>Representing</b>
<ol style="list-style-type: none"> <li>1. Understand routine and non-routine problems in familiar and unfamiliar contexts and situations</li> <li>2. Identify the situation or problems and identify the mathematical methods needed to solve them</li> <li>3. Select a range of mathematics to find solutions</li> </ol>
<b>Analysing</b>
<ol style="list-style-type: none"> <li>1. Apply a range of mathematics to find solutions</li> </ol> <p>Use appropriate checking procedures and evaluate their effectiveness at each stage</p>
<b>Interpreting</b>
<p>Interpret and communicate solutions to multistage practical problems in familiar and unfamiliar contexts and situations</p> <p>Draw conclusions and provide mathematical justifications</p>

## Functional Skills standards for ICT Level 2

<b>Using ICT</b>
<ol style="list-style-type: none"> <li>1. Plan solutions to complex tasks by analysing the necessary stages</li> <li>2. Select, interact with and use ICT systems safely and securely for a complex task in non-routine and unfamiliar contexts</li> <li>3. Manage information storage to enable efficient retrieval</li> </ol>
<b>Finding and selecting information</b>
<ol style="list-style-type: none"> <li>1. Use appropriate search techniques to locate and select relevant information</li> <li>2. Select information from a variety of sources to meet requirements of a complex task</li> </ol>
<b>Developing, presenting and communicating information</b>
<ol style="list-style-type: none"> <li>1. Enter, develop and refine information using appropriate software to meet requirements of a complex task</li> <li>2. Use appropriate software to meet the requirements of a complex data-handling task</li> <li>3. Use communications software to meet requirements of a complex task</li> <li>4. Combine and present information in ways that are fit for purpose and audience</li> <li>5. Evaluate the selection, use and effectiveness of ICT tools and facilities used to present information</li> </ol>

## Mapping to Level 2 Functional Skills

This table shows where a **learning aim** in a unit is of particular relevance for learners being prepared for assessment in Functional Skills in English, mathematics and/or ICT at Level 2. Centres may identify further opportunities arising in their own programmes in addition to those identified below, for example group work, research, employment-related activities and work experience.

**Key:** a letter, e.g. A, indicates the learning aim where there are opportunities for development; a blank space indicates no opportunities for development

Unit	English			Mathematics			ICT		
	Speaking, listening and communication	Reading	Writing	Representing	Analysing	Interpreting	Using ICT	Finding and selecting information	Developing, presenting and communicating information
1	A B C	A B C	A B C				A B C	A B C	A B C
2	A B C	A B C	A B C	C	C	C	A B C	A B C	A B C
3							A B	B	B C
4		A	A				B C	B C	B C
5		A	A				B C	B C	B C
6		A	A				B C	B C	B C
7		A	A				B C	B C	B C
8		A	A		C		B C	B C	B C D
9		A	A	C	C	C	B C	B C	B C D
10		A	A				B C	B C	B C D
11		A	A				B		
12		A	A		C		B C	B C	B C D

Unit	English			Mathematics			ICT		
	Speaking, listening and communication	Reading	Writing	Representing	Analysing	Interpreting	Using ICT	Finding and selecting information	Developing, presenting and communicating information
13		A	A				B C	B C	B C D
14		A	A				B		
15		A	A				B		
16		A	A		C		B		
17		A	A				B C	B C	B C D
18				A B C	A B C	A B C	B C		B C
19	D	A C	A B C D				D	D	D
20		A	A				B	B C	B C
21	D	A B C D	A B C D	C	C D	C D	B C	B	C D
22		A	A				B		
23		A B	A B				C		
24		A	A		C		B C	B C	B C D
25	A	B	A				A B	A	

## Annexe C

### Synoptic assessment

Synoptic assessment in these qualifications is embedded throughout the assessment criteria across the units of study. The mandatory units provide the essential knowledge, understanding and skills required in the information and creative technology sector and underpin the content of the optional specialist units.

In addition, there are further mandatory units in the Diploma specifically designed to allow learners to draw together all the themes and skills gained from other units of study and apply them to planning and carrying out a project.

Learners studying these qualifications are able to demonstrate a number of synoptic approaches towards meeting the assessment criteria. These include:

- showing links and holistic understanding/approaches to units of study from the specification
- being able to interrelate overarching concepts and issues, bringing together their knowledge of the information and creative technology sector
- drawing together and integrating knowledge, understanding and skills across different units, in order to develop an appreciation of how topics relate to one another, and how each may contribute to different information and creative technology context or situations
- making and applying connections to particular information and creative technology contexts or situations
- demonstrating their ability to use and apply a range of different methods and/or techniques
- being able to put forward different perspectives and/or explanations to support decisions they have made or evidence they have presented
- being able to suggest or apply different approaches to information and creative technology contexts or situations
- synthesising information gained from studying a number of different information and creative technology activities
- applying knowledge, skills and understanding from across different units to a particular information and creative technology situation, issue or case study
- using specialist information and creative technology terminology where appropriate
- demonstrating analytical and interpretation skills (of evidence and/or results) and the ability to formulate valid well-argued responses
- evaluating and justifying their decisions, choices and recommendations.





## Annexe D

### Summary of units in the BTEC Level 1/Level 2 First in Information and Creative Technology

The BTEC First suite in Information and Creative Technology contains four qualifications:

**Award (120 GLH), Certificate (240 GLH), Extended Certificate (360 GLH) and Diploma (480 GLH).**

The smaller qualifications are 'nested' within the larger qualifications, which means that learners may take a smaller-sized qualification, then top up to a larger size without repeating the units already achieved in the smaller size.

This table lists each unit in the suite and how it is used within individual qualifications, i.e. is the unit mandatory (Mand), optional specialist (Opt) or not included (—).

**Key:** Mand – Mandatory; Opt – Optional specialist; — indicates where the unit does not appear in the qualification

Unit	Unit title	GLH	Qualifications			
			Award	Certificate	Extended Certificate	Diploma
1	The Online World (externally assessed)	30	Mand	Mand	Mand	Mand
2	Technology Systems (externally assessed)	30	—	Mand	Mand	Mand
3	A Digital Portfolio	30	Mand	Mand	Mand	Mand
4	Creating Digital Animation	30	Opt	Opt	Opt	Opt
5	Creating Digital Audio	30	Opt	Opt	Opt	Opt
6	Creating Digital Graphics	30	Opt	Opt	Opt	Opt
7	Creating Digital Video	30	Opt	Opt	Opt	Opt
8	Mobile Apps Development	30	—	Opt	Opt	Opt
9	Spreadsheet Development	30	Opt	Opt	Opt	Opt
10	Database Development	60	Opt	Opt	Opt	Opt
11	Computer Networks	60	—	Opt	Opt	Opt

Unit	Unit title	GLH	Qualifications			
			Award	Certificate	Extended Certificate	Diploma
12	Software Development	60	–	Opt	Opt	Opt
13	Website Development	60	Opt	Opt	Opt	Opt
14	Installing and Maintaining Computer Hardware	60	—	Opt	Opt	Opt
15	Installing and Maintaining Computer Software	60	—	Opt	Opt	Opt
16	Automated Computer Systems	60	—	Opt	Opt	Opt
17	Multimedia Products Development	60	—	Opt	Opt	Mand
18	Computational Thinking	30	—	Opt	Opt	Mand
19	Computing in the Workplace	60	—	Opt	Opt	Mand
20	Building a Personal Computer	30	—	Opt	Opt	Opt
21	A Technology Business	60	—	Opt	Opt	Opt
22	Computer Security in Practice	60	—	Opt	Opt	Opt
23	Computer Systems Support in Practice	60	—	Opt	Opt	Opt
24	Software Systems Development	60	—	Opt	Opt	Opt
25	IT Work Experience	30	—	Opt	Opt	Opt

## Annexe E

### Structure: Pearson BTEC Level 1/Level 2 First Award in Information and Creative Technology

The Pearson BTEC Level 1/Level 2 First Award in Information and Creative Technology is taught over 120 guided learning hours (GLH). It has mandatory and optional specialist units.

Learners must complete unit 1 and unit 3 and a choice of optional units to reach a total of 120 GLH.

Pearson BTEC Level 1/Level 2 First Award in Information and Creative Technology			
Unit	Mandatory units	Assessment method	GLH
1	The Online World	External	30
3	A Digital Portfolio	Internal	30
<b>Optional specialist units</b>			
4	Creating Digital Animation	Internal	30
5	Creating Digital Audio	Internal	30
6	Creating Digital Graphics	Internal	30
7	Creating Digital Video	Internal	30
8	Mobile Apps Development	Internal	30
9	Spreadsheet Development	Internal	30
10	Database Development	Internal	60
13	Website Development	Internal	60

# Specification

## BTEC FIRST INFORMATION AND CREATIVE TECHNOLOGY

**Certificate**  
**Extended Certificate**  
**Diploma**

For more information about Edexcel, BTEC or LCCI qualifications  
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