Unit title: Project for Applied Science

Unit code: **J/601/0221**

QCF level: **5**

Credit value: **20**

Aim

This unit enables learners to integrate acquired knowledge, understanding and skills and display a significant degree of autonomy applying them in an individual practically-based study.

Unit abstract

Development of knowledge and skills within higher level qualifications is sometimes limited by the modular structure of the programme. In employment, however, learners are frequently required to use knowledge and skills across a range of subject disciplines and apply them in unfamiliar situations. It is essential therefore that they are able to apply planning, research and analytical skills, in addition to being able to identify, access and use a variety of information sources. They must work safely and accurately, keep detailed records and process information and data precisely, as well as communicating their results in a variety of ways suited to a target audience.

The project topic can be drawn from a wide variety of activities appropriate to the programme of study but learners must be actively involved in the selection and development of the project proposal. Learners must take responsibility for producing a project plan that should be agreed with the assessor. The work should be carried out logically, based on the application of scientific method. The results of the investigation should be evaluated and presented in the form of a scientific report.

Learning outcomes

On successful completion of this unit a learner will:

1 Be able to plan a project

2 Be able to implement the project plan

3 Be able to evaluate the project outcomes

4 Be able to communicate the project investigation and its results.

Unit content

1 **Be able to plan a project**

Project specification: practical and literature based; scope and purpose of the investigation; intended outcomes; methods of approach; resource requirements

Review key information: background theory; supporting data; published methods; identification and acquisition of sources; use of texts, journals and internet

Experimental design: standard published methods; reported alternative procedures; existing equipment and materials; sources and access to other equipment; achievable timescales; criteria for success; identified monitoring points and procedures

Amend schedule: agreed amendments relating to project specification, timescales etc following discussions with supervisor

2 **Be able to implement the project plan**

Investigation: experimental work; operating methods and procedures; acquisition of equipment and materials; methods of data collection and recording; accuracy and precision; quality standards; minimisation of errors; use of statistical techniques

Safety: potential hazards eg risk assessment, COSHH analysis

Logbook: dated entries; tables and records of results; correct use of units; error analysis; own versus group results; schedule amendment eg significant or unexpected events, deviations from expected data and results, progress made relative to original plan; agree proposed amendments

3 **Be able to evaluate the project outcomes**

Analyse: analysis of data and experimental observations; draw conclusions based on analysis of results

Evaluate the study: appropriate evaluation methods set against formulated criteria for success; use of correct statistical techniques; identification of sources of error; confidence limits for results

Further investigations: suggestions for further study relating to minimising errors; extending topic area; confirming or supporting conclusions

Conclusions: conclusions from analysis of data and experimental observations justified in terms of original specifications

4 **Be able to communicate the project investigation and its results**

Scientific report: abstract; introduction and objectives; literature survey; fully processed results (raw data; spectra etc may be included as an appendix); experimental work; critical discussion; suggestions for further investigation; appendices; bibliography

Format: conform to accepted scientific format relating to abstract; literature survey; tabulated results; in-text referencing and bibliography; written in third person past tense; use of spreadsheets, presentation packages and scientific software as appropriate

Project specification: practical and literature based; scope and purpose of the investigation; intended outcomes; methods of approach; resource requirements

Presentation: appropriate media; delivery suited to target audience; clear explanations of scope and results; justify conclusions

Learning outcomes and assessment criteria

Learning outcomes On successful completion of this unit a learner will:	**Assessment criteria for pass** The learner can:
LO1 Be able to plan a project	1.1 establish a project specification from consideration of the scope and purpose of an appropriate topic 1.2 undertake a review of key information that supports the work 1.3 produce an experimental design for the study 1.4 amend the schedule as appropriate following discussions with supervisor
LO2 Be able to implement the project plan	2.1 record all safety requirements 2.2 undertake the investigation according to the agreed specification and safety codes of practice 2.3 compile a logbook documenting all observations and results
LO3 Be able to evaluate the project outcomes	3.1 analyse results in terms of original specifications 3.2 use appropriate methodology to evaluate the study 3.3 propose areas of further investigation that could lead to improvement of the project outcomes 3.4 justify both the conclusions drawn from the study and the proposals for further investigation
LO4 Be able to communicate the project investigation and its results	4.1 produce a scientific report in an accepted format 4.2 identify the extent to which the project specification has been met 4.3 prepare a presentation summarising the project investigation

Guidance

Links

This unit has particular links with the following units within this qualification:

- *Unit reference number F/601/0220: Analysis of Scientific Data and Information*
- *Unit reference number R/601/0223: Work-based Investigation*
- *Unit reference number L/601/0222: Laboratory Management*
- *Unit reference number J/601/0297: Statistics for Experimental Design.*

This unit also links with the following NOS:

- NVQ L4 Laboratory and Associated Technical Activities (LATA).

Essential requirements

Delivery

This unit differs from *Unit R/601/0223: Work-based Investigation* in that the latter must be carried out in the workplace and gives credit for work-based activity. The *Project for Applied Science* unit is developed and planned within the centre of learning but some or exceptionally all of the practical work could be carried out in the workplace or elsewhere if that is where any specialist equipment is located. This unit requires coverage of broader topics and a greater learner input into topic selection, development and evaluation than is required for Unit 8. The work used for this unit must not be used for *Unit R/601/0223: Work-based Investigation*.

The project topic can be drawn from a wide range of activities appropriate to the programme of study but must have a significant practical investigation. It may be carried out individually or as a component of a team investigation. Where teamwork is involved sufficient documentation must be kept to demonstrate the individual efforts of each learner. Logbooks must distinguish clearly between team results and observations and work undertaken by the individual. Learners must display a significant amount of autonomy and apply their initiative and judgement in the selection and development of the project topic together with its execution and evaluation.

To ensure safe work practices, learners must be briefed thoroughly on project work methodology. All project specifications and schedules must be scrutinised and agreed by supervisors before learners start work and regular meetings between learners and supervisors should be scheduled to monitor progress. This support should not prevent learners from achieving the higher grades providing individuals make a significant contribution to the development of the plan, and their suggestions and actions are reasonable within their level of experience. Supervisor support should be available at all times during the project and detailed records kept of the extent of the support individuals required. This information should be used in making decisions on grading. Learners must be allowed to make their own decisions during the implementation phase and supervisors should normally intervene only when safety is likely to be compromised. A lot can be learned from negative results and failed experiments. Supervisors should not attempt to prevent this providing the learner's actions and decisions are reasonable and fall within the agreed plan. Results and achievements must be evaluated against the aims and criteria in the project plan.

Assessment

Projects may be carried out individually or in small teams. In the case of team projects the supervisor must document individual contributions in sufficient detail to enable accurate grading and verification to take place. The interaction of team members should be considered, along with learner autonomy in completing the project, when looking at higher grading.

In all cases, planning for learning outcome 1 must be completed and agreed before learners start their practical work. The supervisor should also receive a draft report of the literature review and experimental design before the discussion stage in learning outcome 1. For learning outcomes 2 and 3, the supervisor needs to monitor the early stages of the work and the logbook and, providing learners are competent in safe working practices, progressively reduce the amount of supervision relating to the direction and management of the project.

The format of the final report for learning outcome 4 must be determined at the planning stage. Supervisors should set a deadline to see a draft version of the early sections (not the whole report), and provide feedback. Amendment and completion of the final scientific report should then take place without further assistance or comment from the supervisor. The presentation must be made to supervisors and fellow learners and may or may not include peer assessment. If the presentation is to be used to meet the higher grading criteria then minimum guidance should be given.

Resources

This project unit will be developed and planned within the centre but some, or exceptionally all, of the practical work could be carried out in the workplace or elsewhere if this is where any essential specialist equipment can be located. Required resources will vary significantly with the nature of the project. The identification of equipment and materials, and establishment of their availability, is a vital part of the planning phase.

Tutors should ensure that learners do not start work that cannot succeed because of lack of access to the required resources. Use of specialised equipment outside the centre is acceptable, however, agreement on access must be reached before work begins. Learners will require access to computer and appropriate software packages in order to produce their report.

Employer engagement and vocational contexts

Ideally, the project topic should have a vocational context. Where this is the case learners will benefit from visits to related industries to observe industrial aspects of their study area. In particular, where analytical procedures form a significant part of the project, a visit to a local company or hospital to see automated analytical procedures in action would be advantageous.

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