

A Level Design and Technology Insights 2024



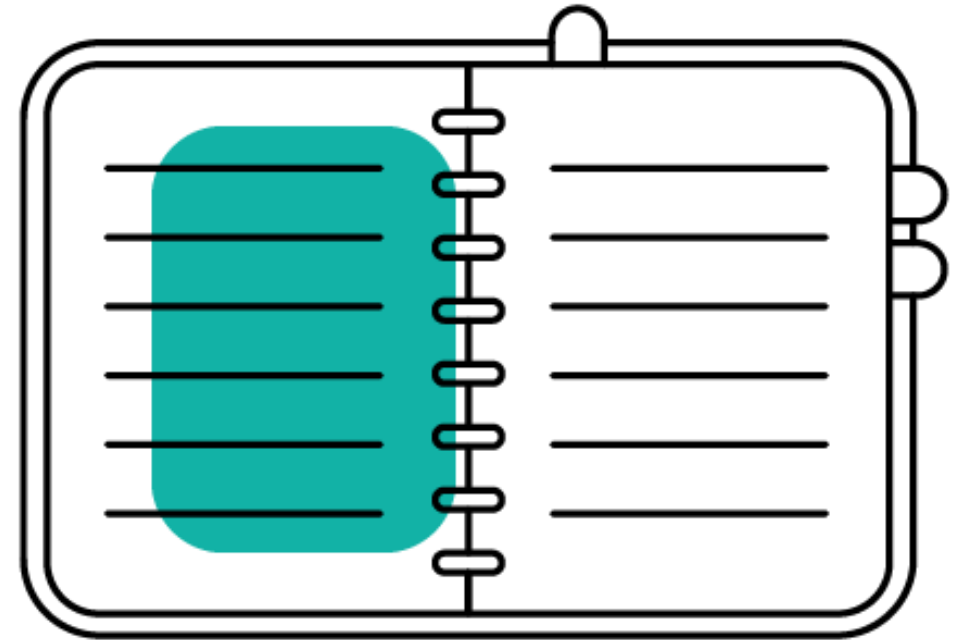
Agenda

Component 1: Examination

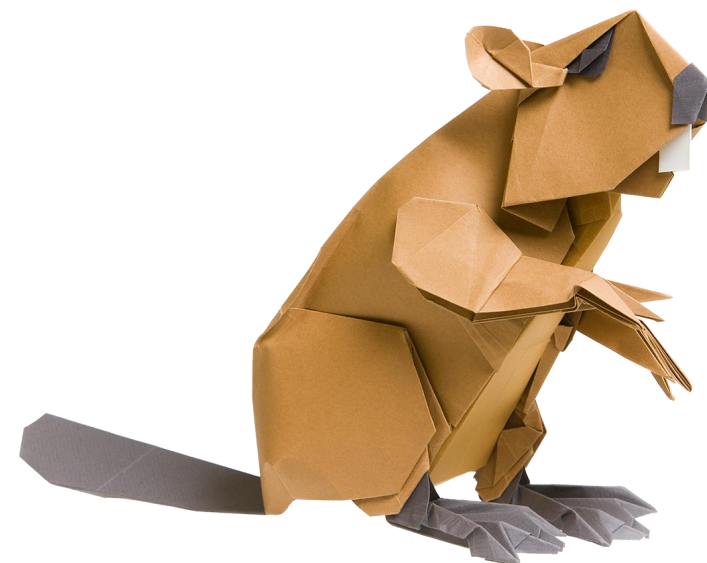
- Review the examiner report for the series.
- Highlight key areas of success and common misconceptions.
- Identify questions where students frequently lost marks.

Component 2: NEA

- Provide feedback on the moderation process.
- Focus on areas where candidates have not met the standard.
- Highlight common misconceptions and misunderstandings of the assessment criteria by students and/or teachers.



Module One Written Examination



Reporting for this series

Common exam mistakes:

- Inappropriate response to the demands of the command verb
- Ignoring the constraints posed by the context of the question
- Not responding to mathematics questions with the required degree of accuracy
- Plotting incorrect node/corner points in isometric drawings
- Using the examples from the stem of the question as their answer
- Being confused about the characteristics and philosophies of the design movements

Example Appropriate Response to 'Explain'

(b) The manufacturer embraces user centred design when developing new products.

User centred design considers user needs, wants and values.

Explain **two** other considerations of user centred design that help to ensure that products are fit for purpose.

(6)

- 1 User centred design can utilise focus groups drawn from potential stakeholders to gather a range of opinions and useful feedback because this will help the iterative design process and therefore improve the design of the product.

Command Verbs Used

Name

Give

Outline

Explain (two marks)

Explain (three marks)

Calculate

Describe using labelled sketches

Discuss

Draw

Evaluate

Mark Scheme

Any two explanations that include identification of a consideration (1) and linked explanations of that consideration (1) + (1).

1. Intended use of the product is central to the design (1) to ensure the product meets the specification (1) in order to fulfil user requirements in its intended use/environment (1)
2. The functionality of the product / what functions does it need to perform / how the user interacts with the product (1) the product needs to usefully perform to the specified level/use / have appropriate ergonomics / safety (1) in order to be effective in meeting user requirements (1)
3. Is the product innovative/a new approach to addressing a problem (1) by using new methods/materials/technologies/new approaches (1) to improve performance/cost/durability/ease of use (1)
4. Authentic design approach (1) so that all aspects of the design process are valued (1) and the user is the true focus of design (1)
5. Use of focus groups (1) to gather opinions and feedback (1) in order to drive design improvements (1)

Example Inappropriate Response to 'Explain'

(b) The manufacturer embraces user centred design when developing new products.

User centred design considers user needs, wants and values.

Explain **two** other considerations of user centred design that help to ensure that products are fit for purpose.

Identification
from MP2

Identification
from MP5

(6)
1 What function does the product need to perform. Use of focus groups. Is this a new approach to addressing the problem.

Identification
from MP3

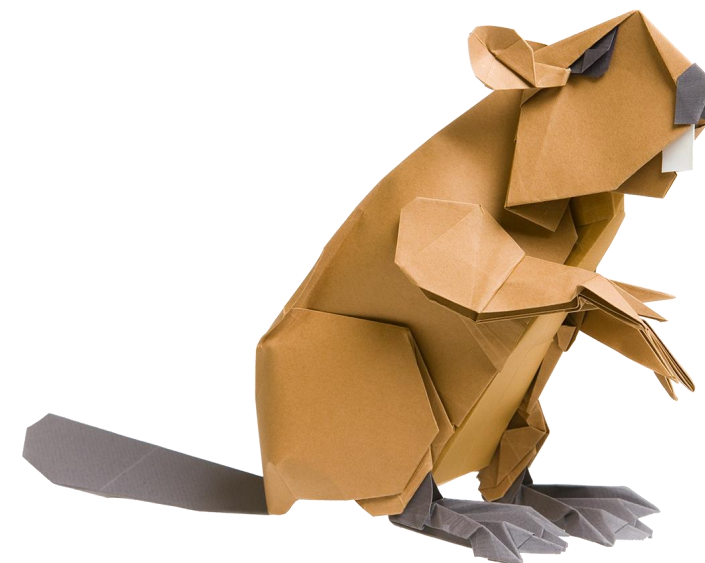
Areas of Success

- Examination performance is generally improving with an **increase in the mean score** this year.
- Candidates generally perform well in the **mathematics** questions.
- Candidates generally perform well on the **drawing** question.
- The final evaluation question provides appropriate challenge for candidates across the ability range, allowing candidates of all abilities to perform appropriately.

Poorly Answered Questions

- Question 1(b) reasons for using carbon steel for a chisel blade
- Question 6(d) about the parts of a risk assessment
- Question 9 about innovation management
- Question 10 about the benefits and drawbacks of reactive glass

NEA



Common Issues 2024 Insights

- The use of feedback throughout the portfolio – The iterative question
- Client led proposals
- Irrelevant Research
- Specifications
- Quality of design work
- Modelling and Architectural modelling
- Quality of manufacture

Insight 1: The Iterative question

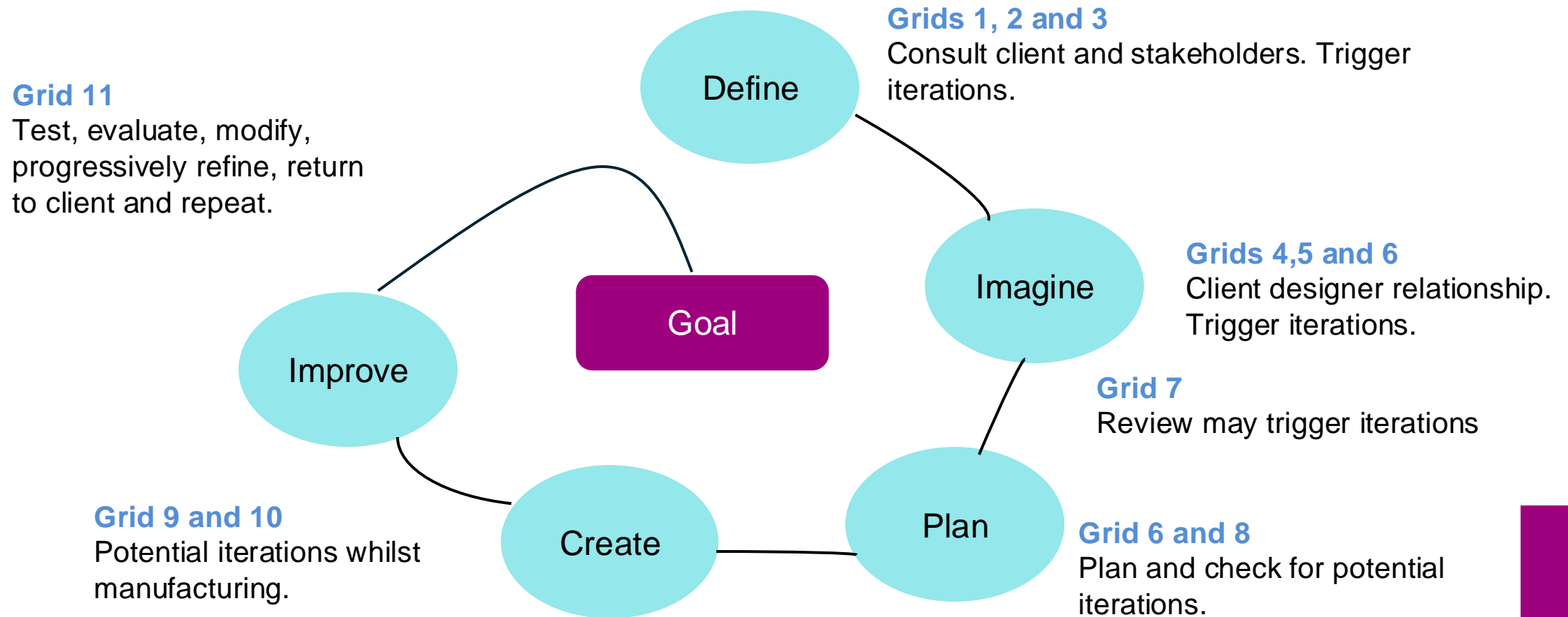
The qualification has at its heart the iterative design process. It is a fundamental objective of the qualification, and it underpinned the call for more rigour, both at GCSE and A level, when the qualifications were redeveloped in 2015/16.

Qualification aims and objectives

The aims and objectives of this qualification are, to enable students to:

- use creativity and imagination when applying iterative design processes to develop and modify designs, and to design and make prototypes that solve real world problems, considering their own and others' needs, wants, aspirations and values

The Iterative portfolio – iterative design process



Insight 2: Client led proposals

Grid One

This is the starting point of the portfolio and is therefore imperative.

Identification of a Design Possibility

- To work in a client centred/iterative way, candidates must identify the problems or needs (possibilities) of a client/user-group to develop a product that may fulfil those needs. The client/user-group could, for example, be a target market opportunity, a local business or organisation, or an individual client.
- Candidates can explore design possibilities, by undertaking market research, conducting identified user group interviews, or responding to a number of identified possibilities and justifying the choice of one.
- We expect that candidates will justify problem starting points from a range of positions. Some candidates will identify a range of problem starting points and others may focus on one and justify it. Working with the client they need to make a decision on the potential design possibility that they will be working on and then produce a preliminary design brief.
- Once candidates have identified the design possibility, they need a comprehensive investigation to identify the key information that needs to be researched to inform the design requirements.

Hose Holder exemplar



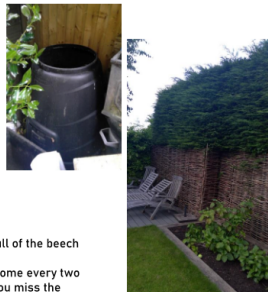
I talked with my client about problems in his life that might be helped by a product. He said that he has a lot of bikes in his garage and that his garage is a mess. He also needs some way of safely receiving his mail deliveries without them being stolen. He also has general property maintenance and household maintenance such as cleaning out his gutters and drainpipes, having hoses everywhere and struggling with storing them or moving them easily, cleaning the patio, treating wood, counsel given clippings bin overflows after cutting the bushes, watering plants, cleaning his car, and when cutting the hedges, it is difficult to reach the top of the hedge.



My client's patio gets dirty over time, and it is a hassle to get out all the proper equipment to clean it.

"It does require regular cleaning, but the problem is that it is next to glazed windows, the cleaning spray splashes on the windows. However, it doesn't get rid of all the algae and lichen. Also, it might damage grout due to high pressure of the water sprayer."

My client has an upright plastic cylindrical compost bin that regularly over fills and isn't as efficient as it could be



"This part of my garden is always untidy and because there are tall beech hedges next to it, the hedges shed their leaves at the end of spring and it's a big mess. Then they start rotting and clogging up drains and such."

How do you get rid of the leaves?

"Well to be honest I use to big boards like hands to scoop them up but as I get older, I won't be too keen on bending down all the time like that."

I could make a bike rack organizer that stores the bikes efficiently in the garage and stores anything that the bikes would need e.g., pumps, patches, or attachable lights. I could also make a seat that the mail deliveries can safely go into. I could have a quick way of having the hose be packed away so that it doesn't kink and is easy to take off the mounting system. I could have a compost/bin attachment so that the bin would be able to store more clippings. The gutter and drainpipes, I could make a tool that effectively cleans them better than the current tool used to clean it or I could make a product that helps with the cleaning of it. With the hedges I could make a product that helps you reach the top of the hedges that is easier to use than current market products



My client has trouble cutting the hedges due to their size and the ununiform nature of the ground in front of them.

"These are the hedges I have to cut periodically, at least once a year preferably twice, but I don't seem to have the time for it. Getting up high enough to cut and trim the bushes is a bit of a challenge, they must be approaching 4 meters high."

"Have you tried using a ladder to aid you reach the top?"

"No, at the bottom, it's not very stable and at the top, I've got a flower bed and other things in the way, and I usually do it on my own, so I haven't got someone to hold the ladder when I use it."

From this interview, I've narrowed it down to three main problems: the risk of the pet jumping out of the canoe, not being able to leave the canoe in various places, and the uncomfortable sitting position.



Client: "At the moment, we keep the pet secure by holding him tight in our thighs, however it's quite difficult to do because we go quite far, and our legs can get quite tired. He also wants to venture to the top of the canoe and look out, but he is not secure there, so we try and avoid him doing this."

Why It's a Problem: Paulas dog has fallen into cold water twice and has been wary of water ever since. It seems to have traumatized him and so my client wants to avoid this unnecessary event on her dog.

My Solution: An attachment of the dog onto the canoe. I will need to look at buoyancy aids in case the canoe flips over, and quick release systems so that the pet can be pulled out of the water if the canoe flips over. I will also look at current harnesses and options of how the attachment will work, and how the pet can move freely on the canoe.

Client Rating of Problem: High

Client: "At the moment, we can't dock wherever we want, and th
down the River Nidd and so it's picturesque, but we can't take ad
love to be able to dock the canoes at a shallow place about 10 mi

Why It's a Problem: Paula really enjoys open water swimming but

2. For how long would you use the canoe?
This will allow me to understand how long this includes comfort time.

My Solution: An anchoring system would attach to both the front and back of the canoe so that it can be docked on all terrain. They would be attached to the hook at the back. I will need to look at storage for the anchor a canoe a lot, as well as how the anchors will be taken up and lowered.

Client Rating of Problem: Moderate

Client: "At the moment, everyone that uses the canoes finds they going canoeing. At my age, this is a real problem as it could proba issues, as I tend to canoe most days as for about 2 miles at a time

Why It's a Problem: Paula is 53, as I mentioned in her introduction risk of certain health issues and suffers with a bad back. This makes uncomfortable for her and so a more supportive seat would really enjoy the experience more.

My Solution: A lightweight, transportable seat that can be pulled out of the car and used in the office. I need to look at similar products as inspiration and folding mechanical material testing to see what would be appropriate.

Client Rating of Problem: Low

8. Does sustainability of the decision to purchase certain products depend on the availability of information about the environmental impact of the products?

and where they could lead, I have decided on three product ideas to help solve my clients' problems:

Question: This would be a set of hooks on nylon string (the material that a dog lead is made of) that would slip into

same material that a dog lead is made of) that would clip into a long set of "train tracks" attached to either interior side of the canoe, to allow the pet to move freely up and down the canoe. This mechanism would allow the pet to be pulled out of the canoe if it did flip over.

Location: This product would be both built into the canoe and would be worn by the pet. This means that part of the product will be stored inside the main house and the other half will be stored already attached to the canoe.

Approximate Size: This product would have two dimensions as it has two aspects to it. The first aspect (the harness attachment) would be made to fit the pet, who is quite a small dog breed. The second aspect of the product (the hooks and 'train track' mechanism) would be fit for Duncan's canoe length.

Opportunities for Innovation: I am aware that no products are currently on the market for this problem currently, and so there is lots of possibility to innovate and design a completely new product to solve this unique problem. This would provide me with the most amount of innovation.

What to Investigate Next/Inspiration: Buoyancy aids, harnesses, attachment methods, 'train track' attachments, weight of all components, motorbike side cars, non-slip canoe mats

Solution Rating: High
Justification: Location is **optimum** as it can be kept where it's used and wouldn't need to be transported, the size wouldn't be too intrusive to my client, there are lots of **opportunities to innovate** as there are **no pre-existing similar products** and it would give me lots to investigate next.

Client Feedback

"I really like this idea, especially since it's not invasive to the whole canoeing experience, will blend in and will still keep my pet secure, also like that it could have some sort of floating aspect for extra security as I know that canoeing can be slightly risky for my pet, especially because he doesn't wear a life jacket. I don't know if I like that something would be semi-permanently attached to my canoe, would only be able to be used on one as my wife also prefers a certain canoe over the other and prefers having the pet over me."

Conclusion: From this exploration of design possibilities, I have discovered that there are many ways to solve the problem throughout the designing process as there is no existing solution to the problem.

Solution: This would be a lightweight, easily transportable, lightweight chair that could be inserted into the space. It should

...accommodate the pre-exis...
...ould originally be clipped in

Location: As this can be clipped to the canoe but stored inside a canoe, the cushions are suitable for use, up part of a cliff.

Approximate Size: The seat of the regular chair which is around 18" high would allow the 5th to 95th percentile male to sit comfortably. The seat of the chair would allow my client to sit comfortably.

opportunities for innovation in the market, but there are some lightweight, can be folded. There are already similar products, but you couldn't innovate as much as

What to investigate Next/
components, folding beach
sustainability

Resolution Rating: Low
Justification: The location was noisy and taken out when new management moved into the city. There is not much innovation. There is

[illegible]

ities for innovation and allow
that I design will be comp

1 "I often don't have my pet with me. I tend to hold the public more vertically because I find it easier. But when my pet's with me, I have to hold it a lot much higher and closer to my face. I have to be a little more aware to happen when my pet's with me, so I can quite strong for longer journeys."

2 "I tend to go for around a mile and a half, and I will take me around half an hour, but I will go for any I want to go for a shorter course, but I will usually go for around 15 minutes."

3 "When I cannot with my pet, I find that the canine is either side of me rather than around him. Also, because I hold him between my thighs when he can, the weight's more concentrated. The canine is either side of me, instead of my padding much, but when he's around me, he's more for the front. I find that I can't hold him in the back of my hand. I find I have to paddle much slower when he's at the front or he could fall in me easily and cause me to fall."

4 "Yes. Removing. I would be worried for the winter as we wouldn't be going canoeing as it'd be too cold. I would also like to be able to sit on him. I jump out so I can stay dry and I wouldn't be able to paddle. I would be able to paddle in the summer, but I wouldn't be able to paddle in the winter. I would be able to paddle in the summer, but I wouldn't be able to paddle in the winter."

5 "I sometimes put him on a lead, but I only needed when he sheds out. When he's out of his shadow and doesn't come back when called, I usually have to drag him back by his lead when he's out of his shadow."

6 "I have a budget of around £20 to £75 a month. I usually have a pet's share."

7. "I want your product to match my canoes, which are a white and blue tie-dye style pattern. I also want it to blend in as best as possible because I don't want my neighbours knowing what it is or being able to see it from the riverbank."

8. "This isn't a priority for me but I would prefer if the materials were sourced from a reputable place (e.g. FSC wood)."

9. "Yes, especially down at the bottom of my back and in my wrists."

10. "I don't think I would use general storage as we have a dock to leave bits and bobs on when we leave, and we don't take anything with us when we go out. My husband does like to take things, but we already have the watertight plastic bags to store it in. However, I don't enjoy carrying with my water jacket but I find that it always rolls around in the back and leaks all over the canoe. This is only a problem because I keep my dog towel here and so I can't dry my dog with a wet towel."

11. "I think this would be very useful, as there's not much available space anywhere in my house or outside really."

Map of Needs of the Prototype



Irrelevant Research

Investigation of needs and research

- Candidates should develop their understanding of the needs wants and values of the client/stakeholders
- Undertake relevant and focussed research as a result of a thorough dialogue with client/users/stakeholders
- The candidates will evidence an authentic link between the needs wants and values of the client, and the research undertaken
- The research will be perceptive, as a result of a close designer client relationship
- Candidates must avoid generic research, especially in terms of materials and processes

Insight 3: Rambling Research

Architectural design and style-modernism

I will be researching existing examples with a modern architectural style. I will include key components and an overview of this style.

Key components of modernism

- Components positioned at 90 degrees to each other and an emphasis on horizontal and vertical lines.
- The use of reinforced concrete and steel.
- Visual expression of the structure rather than hiding structural elements.
- Following the "machine aesthetic" in the use of materials produced by industrial processes.
- Rectangular, cylindrical and cubic shapes.
- Asymmetrical compositions.
- A lack of ornament or mouldings.
- Large windows set in horizontal bands.
- Open plan floors.
- White or cream facades.


Examples of modern buildings and things

Valencia

Iran

China

Walter Gropius and Le Corbusier



The history of modernism

There are many early sources for modernism's ideology. The English artist and writer William Morris, helped inspire the Arts and Crafts movement, by advocating that utility was an important an aesthetic, and that well-made handcrafted products were preferable to production-line, machine-made ones.

Another early source was the American architect Louis Sullivan, most famous for the phrase "form follows function". In principle, this meant the building should be designed so that the essential structure dictated the form, i.e., form fit useful purposes.

Two European architects emerged who, above all others, would be most widely associated with the new modernist style. One of these was Walter Gropius, the founder of the Bauhaus in Germany. Gropius taught artists to reject historical traditions and adapt the would create new designs of modernity.

Conclusion

In conclusion, I have researched and got an understanding on the modernism design. I think that using this design will be the best option for me to use with a using storage container as housing. People seeking housing want their house to be as modern as possible, as well as having complete my major project I will help provide the UK Of Man again.

It is somewhat difficult to understand what was learned from these two pieces of research.

Environment Research of my clients workplace



Here is my clients workspace he works in safe environment compliant with proper HSE training.

As you see my toolbox needs to have some sort of shape that allows it to be adapted and secured in the workplace.

Investigation of the work of others

With this product, I could potentially use the system in which is used as it has an automatic drop system of the feed which replaces a constant steady stream of feed. This could then be introduced into my product as it would have the features which I would need to place the feed on to the ground. A fault with this product that I may not have a fast enough dispensing system to release the feed on to the ground, so if I were to use this product, I would have to make sure the feed is dispensed quickly and that the feed can be turned on and off to reduce spillages of feed over certain areas and that some sort of birds don't get over feed.

This trailer could be interpreted in towards my product as it would be able to be pulled by the Polaris, if I was to design a spinner which would be able to be driven behind any vehicle with a tow hook. This would allow the product to have more freedom with which vehicle would be able to use it. It could also potentially mean that the feed could easily be placed on to the back of the trailer. This would mean large amounts of feed would be able to be stored within and loaded easily on to the trailer.

From this product, I can identify that the hopper on the back of this seed dropper has many aspects which I will be able to include into my design. We can see that the angle of the side walls of the hopper fit correctly meaning that all the feed will eventually travel down to the bottom of the trailer once the feed has been distributed. One design fault with this trailer might be accessibility, it would take a long time to remove the cover off the top of the hopper to fill it up with feed. This makes the practicality of this design less ergonomic and more difficult to use.

This linear feeder could also have the option to be a linear feed dropper. I would be potentially able to scale up this product and incorporate a different method which allows a variable amount of feed.

With this product, I can incorporate the design in which the product can be placed into the bed of a truck but scale it down so it can be fitted in to the back of the Polaris. One fault in which I can see from this product is that the feed, or ball which is used in this design, may not be able to turn freely down towards the feed spreader at the back when the spinner has been in use for a certain period of time.

From this product, I can see that there is a mechanism which is spinning out the feed over the crop. This design could be interpreted to my spinner as it would make sure the feed was spread out. One change I would make to it is to reduce the size so it will be able to fit to the Polaris and I would have to either increase or decrease the power of the spinner to make sure the distance is correct for the feed which is being spread.

The benefits to using static feeders is that it means there is no need to feed. The disadvantage with using them is that it means the wildlife is reliant on the food from the static feeders, and that they are not educated on what they have to do to scavenge for food and search for themselves.

Conclusion:

I would be able to incorporate different components from most of the products above. I would be able to use the hopper system which is on the top of the static spinner feeder. This would be large enough to fit all the feed needed in. From the trailer, I could potentially use it as a storage system to store the feed in. The tractor with the fertilizer spinner could be used due to the spinning disc which using the fertilizer out, the design of the linear feeder could be potentially used as it is a different option to consider the feed out over the track.

Whereas here we see relevant research with client input and focus.

Site analysis

As we can see from this photo there are crops surrounding the tracks where the feed needs to be spread and the type of terrain the Polaris will be travelling on.

As we can see from this photo there are large open fields which the Polaris will need to go over and endure to get to the feeding spots.

Here we have the typical spinner method. This involves a spinning disc, feed gates motor, deflector plates flow directors. The motor spins the spinner disc which has paddles on it. The feed gates and flow directors direct the feed from the hopper on to the spinner disc as it is spinning.

Here is a typical spinner disc sitting in place. You can see the paddles which chuck the feed out. You can also see the deflector paddles on the side which ensure the feed travels in the correct direction. With this there is a risk of things getting caught in the spinner. There could be extra shafts placed in on top and on the bottom to reduce the risk of being caught in the spinner. With this you would have to be careful as it could disrupt the flow of the feed as it is being spun out on to the ground.

Polaris Analysis

We can Analyse that there is a flatbed on the back of the Polaris. This is a place where the feed bags can be kept so they don't get damaged or thrown out. This means the feed can be transported with ease and no worry of losing the feed or damaging the feed for the birds and so he doesn't have to do more work.

As we can see from this photo, there is a front mounting position. This is a potential place in which the spinner could be mounted as there are already all the brackets and a balanced place for the offroad.

Here we can see there is a hitch which could be used to attach a trailer which could be another point in which the spinner could be attached to spread out the feed, or a trailer could be attached to store extra bags of feed to help transport it meaning that the user will not have to do extra trips to collect more feed for the pheasants.

Here are the bags which will need to be stored in the spinner's hopper and the back of the Polaris to allow the user to fill the spinner up and to fill up feeders as he is travelling around on his work. On every round he travels out, he requires 3 bags to sustain the spinner and to fill up the feeders as he is doing this rounds. Each bag weighs 30 kilograms meaning at maximum, the Polaris will have to withstand 70 kilograms worth of feed, so he does not have to do round trips to collect feed again.

Safety

Move divider towards bin

- Within the spinner there are some moving parts with the main one being the disc which spins the feed out.
- I would have to consider how the disc would have to be out of the way of fingers and stop fingers from being trapped.
- The weight of the spinner could potentially unstable the Polaris making it more prone to falling off or rolling the Polaris.
- If the weight proportions were to be incorrect, it could damage the occupancies of the Polaris.
- From the grain and feed there are quantities of dust which can be harmful to people as it contains bacteria and fungi.
- I would have to make sure the dust is blown away as it can irritate lungs in the short term and cause lung disease in the long term if inhaled constantly.

Sustainability

Sustainability in the material:

- The disc would be aluminium and the hopper too as they are very corrosion resistance and is a sustainable metal as it is in high supply and isn't single use.
- I would also use steel for the frame of the spinner. Steel is also a sustainable material as it is in plentiful supply and can be recycled every multiple times to cater for different products.

Sustainability in manufacture:

 - Making the product, there would be minimal wastage as the scrap pieces from the product or excess cut off pieces could be reused by someone else or myself to create another product or as extra pieces for the spinner such as a guard or spare part.

Sustainability in use:

 - The power supply for which the spinner disc would need to run off would be electricity as it is environmentally friendly and is a sustainable form of power as it would not produce any greenhouse gases which could pollute the air or the area in which the spinner is working.
 - The spinner would also be providing feed for the environment and the wildlife surrounding the area meaning that the ecosystem can run as it should without lack of food to be considered.

Sustainability in disposal:

 - All the parts on the spinner would be able to be recycled into new products. This is due to all the parts being recyclable. I would join all the metals together using nuts and welding meaning it can be reused.

Materials

- Steel could be a potential material for which the frame for the hopper and any additional solid parts within the product. Steel has a strong tensile strength which would mean the product would not easily be damaged as it is travelling off road and the steel is not elastic, meaning the moving parts would be held in place without much movement which could potentially damage the hopper or the spinner.
- Aluminium could be used for the spinner mechanism and any other guards which are surrounding the moving parts or places which could be damaged easily. This is due to aluminium having high corrosion resistance and being very light meaning it would not affect the balance of the spinner very much.

Methods of spreading

One method of spreading is the spinner method in which there is a disc with paddles which spins around at a high speed. The feed is then dropped on to the disc from a hopper above which sends the feed flying.

Another method of spreading the feed is having a shutter door which can be opened and closed which leaves a row or piles of feed over a certain area.

This is another potential method of spreading the feed on the ground, this involves a wide trailer which has small holes in the bottom of the hopper allowing feed to fall in a pattern over the width of the hopper.

Final design brief:

For my final design I will be solving the problem of dam McChary who is a game keeper. He has to Every morning and every evening travel out in his ATV which he fills with bags of pheasant and bird feed. He has to carry the bags by hand and fill feeders, such as the green one below. He also has to walk around and scatter the feed by hand to provide feed for them in other areas and educate them.

It is extremely time consuming for him which takes up his time to complete other jobs which are needed to be done. I will be creating a spinning device which will be off of the conventional spinning plate which will be spreading feed over a certain space for pheasants and the surrounding wildlife within the working space of my client dam McChary the game keeper. The spinner will be mounted on the Polaris allowing work to be done with the Polaris throughout the day without having to remove it every time after use, meaning he doesn't have to complete the work by hand. It would ensure that the surrounding ecosystem and wildlife would be able to thrive without having to scavenge for food or compete with other animals. The product would have a hopper well as the housing for the spinner disc on the bottom of the hopper. The hopper would be able to store 3 bags within it with 30kg worth of feed.

Insight 4: Specifications

The candidates often produced specifications that were generic/descriptive in nature or lacking in technical measurable points.

- A refined design brief and specification must be produced
- At best, these will reflect the research and analysis previously undertaken and consider changes or renegotiations that have taken place between stake holders/client and designer during the research
- This narrative is imperative if the candidate is to fully justify the performance requirements
- The specification must have **technical**, **measurable** and **realistic** points. The approach should mimic commercial activity
- The candidates would benefit from a test specification methodology

Exemplar Specifications

This is a top-level specification.

This example shows measurable elements here.

Specification: in this section, I will be summarizing and creating a criteria to compare my final product, prototypes and ideas against to create a successful final product. This will branch off from my research analysis.

1. Cost:

- The budget should not exceed 300USD (Tier 3) and an effort will be made to ensure the budget is between \$150 to \$200 (Tier 1,2), as agreed by both clients.
- A value added calculation (estimation) compared against potential competitors and customer & client response will determine the addition of new parts (to stay in budget). Extra features/parts might be discovered during the design and development process that should be discussed with my clients to weigh up the value.

2. Aesthetics

- The product must fit in with the surrounding environment to ensure it has a neutral aesthetic and doesn't look out of place.
- I will follow the qualities of Bauhaus - putting function first then form. As it is a highly functional machine where the focus is on the product.
- The design of the software must be minimal, spaced and not distracting. I will refer to Jakob Nielsen's heuristics 10 principles of user interface to test the software to ensure it is user friendly, easy to navigate and intuitive.

3. Ergonomics & Anthropometrics:

Design of the Machine:

- The angle of the screen should be between 30 to 45 degrees from horizontal, to ensure a universal viewing angle that all people can look at, regardless of if they are sitting or standing.
- An integrated power block/switch must be used to ensure the user can turn on/off the machine and to supply the varying voltages (5V & 12V) to the machine. This must allow for the power lead to be removable if broken or being transported to allow the user to easily repair/transport the RMM.
- The electronics must be easy to access via a screwable access panel so it can be unscrewed in the event of a repair - and screwed back on securely for safety to reduce the users access to the mains electric.

Design of the Software:

- The software of the product must use symbols to allow non English speakers to operate the machine.
- The software must have a consistent theme and menu system function buttons location to increase operator speed & the usability of the software.
- The screen must be able to be used with gloves (common PPE equipment) in a well lit environment with no glare (to allow the screen to be visible at all angles in case of an emergency).
- The user must receive some sort of feedback, for confirmation of action execution, and utilize shortcuts to increase the speed of operations.
- The software must include educational information about each parameter through the use of "i" help icons to allow the RMM to be used independently.
- The software must include the option to select predefined values for specific moulding materials while giving the user full & live control over the machine to appeal to both beginner and expert rotocasters.
- The information should only show relevant/essential information. The information should be as accurate (1dp or 2 sf) as required for the user to make a decision. It should be displayed in a simple, understandable form that can be used by the user.

Design of the control panel:

- The controls should use the "preferred method of control" and the "expected effect must relate to the type of control" to reduce the learning curve of using the control panel. (From page 12)
- Any buttons used must not be smaller than 16.7mm in diameter to allow users with larger fingers, or gloves on, to easily interact with the controls.

4. Transportation

- The machine [Packaged] must not exceed 2000mm by 807mm (smallest), to ensure the machine can fit inside a standard door.
- The machine should not exceed 17.7 kgf in weight to allow the user to easily pick up the machine and transport it between storage & use.

- The machine should have a simplified assembly that will allow it to be shipped in a small volume to reduce the overall cost of the machine and environmental impact.
- Should have a minimum mold size of 240mm x 240mm x 240mm. The footprint should not exceed 750mm x 750mm (LxW) (depth of table in Educational workshop + art).
- The dimensions of the various standard components (Nema 17, potentiometer, etc) will be used in the design of the electronic housing.

5. Safety and Product Testing:

- A risk test should firstly be taken of the prototypes/final product and an effort should be made to reduce the overall risk. When designing the product, the following safety standards will be taken into consideration:
 - ISO 12100:2010 Safety of machinery - Risk assessment and risk reduction
 - ISO EN 5008 - Product Labeling and Electrical Requirements
 - ISO 14120:2015 - Safety of machinery
 - ISO 13854, Safety of machinery - Minimum gaps to avoid crushing of parts of the human body.
 - ISO 11429, Ergonomics - System of auditory and visual danger and information signals. The labels and signals used to display errors/danger should surpass ISO 11429.
 - ISO 13850:2006, Safety of machinery - Emergency stop.

6. Social, Cultural and Environmental Impact - Page 12:

- An effort should be made to reduce the power usage of the machine when moulding to reduce the effect it has on the environment.
- An effort will be made to allow the machine to mold renewable materials such as wasted 3d prints [Tier 3].
- The machine must be able to be easily repaired & maintained and should use accessible standard components to extend the product life.
- The machine must be able to be flat packed and shipped to decrease the carbon footprint of the product as less units can be shipped with less fuel.

7. Material Properties:

- When choosing the material for the body of the RMM, I will make sure the material has the following properties:
 - Can be easily accessed in the workshop and not exceed the material budget.
 - Light weight - reduce the torque needed to turn the inner cores & stress on shafts.
 - Easy to machine/work with - The material should be able to be used in the workshop, with workshop tools.
 - Stiff & hard - should not deform under the weight of the mold & temperature [Tier 3].
 - Strong in compression (to hold its own weight and he weight of the mold) and in tensile force (to ensure the material does not fracture or stretch under the load of the mold).

- When choosing the material for the axes of the RMM, I will make sure the material has the following properties:

- Can be easily accessed in the workshop and not exceed the material budget.
- Rigid & stiff - to ensure the shaft does not bend and can support the weight of the mold + axis
- High strength-to-weight ratio - the lighter a component is the less torque/stress applied to the machine, gears and motors.
- Easy to machine and work with - should be able to be used on the lathe or other machines used in the workshop.

- When choosing the material for any gears for the RMM, I will make sure the material has the following properties:
 - Can be easily accessed in the workshop and not exceed the material budget.
 - Tough - to withstand the grinding force of the opposing gear.
 - Low coefficient of friction - to reduce wasted energy and allow the cores to spin with ease.
 - Good resistance wear - The more durable the gears are, the longer the

- machine can function for.
- High strength-to-weight ratio - the lighter a component is the less torque/stress applied to the machine, gears and motors.
- High tensile strength - allows heavier molds to be used, as motors can turn with a higher torque and the gears will not fracture.

9. Capacity:

- Below is a list of components that must be included in the final product:
 - [Tier 1] Bearings must be used between shafts and the carcass; Shafts; either Toothed Belt with a Driver Pulley GT2 and/or Bevel Gears
 - [Tier 2] Nema 17 with either A4988 or L298; a 120mm PC fan; a TFT 1.8 inch for output; Potentiometer + Button for input; ON/OFF switch + Emergency stop; 12 Volt Power Supply & a Lead for a house hold wall socket; Arduino UNO/Mega and 100uF Capacitors
 - [Tier 3] Either a heat gun or Induction heater as the heating element, a 120mm PC fan for cooling and relays for control of mains voltage components.

10. Function & Machine (CONSUMER WANTS, NEEDS & VALUES):

10A. Primary Function of the Machine - Rotary mold hollow parts

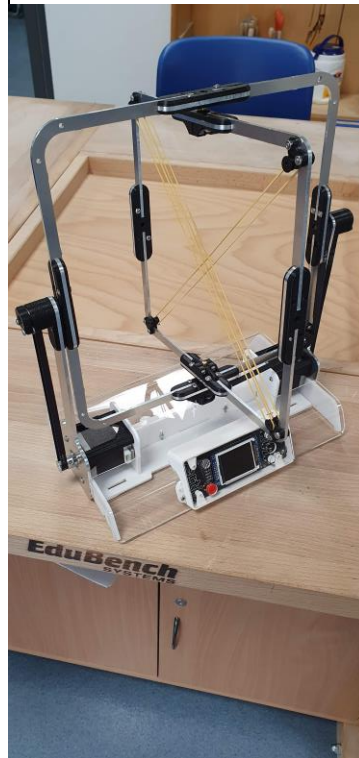
- The user must be able to easily fit, and center, a variety of molds into the machine.
- The user must be able to, by themselves, navigate through the menu systems to get to various molding parameters, information pages and settings to have full control over the machine [Tier 2]. This includes:
 - X axis speed, Y axis speed, X & Y spin ratio, Molding time
 - [Tier 3] Heating temperature, Heating cycle time, Cooling cycle time
- The user must be able to cold cast repeatable hollow parts & polymer parts in Tier 3. [Page 11 - Performance]
- The machine must be able to reach and maintain a min & max speed of 2 to 20 RPM for 10 minutes to 8 hours to allow users to cast a variety of materials and use varying rates. [Page 11 - Performance]
- The machine must be able to use one or multiple ratios when moulding to allow users to cast a variety of shapes [Page 11 - Performance]
- [Tier 3] The machine must be able to heat up the polymer granules in the mold and rotary cast at a consistent temperature of (minimum) 160°C
- The machine must be able to offer predefined values for common molding materials (plaster, easy flow 120, 2 part resin) to allows less experienced users to cast. The values, however, should be able to be changed for more experienced casters.
- The mounting system must accommodate for both steel/metal molds, ceramic/resin molds and vacuum formed polymer molds to suffice for all mold creation techniques.

10B. Secondary Function of the Machine - Educational device

- The user, in their time interacting with the product, must be educated about Rotary Molding and what the various parameters are and how they relate to the mold produced to allow the user to They must be able to adequately use the machine to transform raw material into a hollow part - on their own in a safe manner.

Client Comments: [ART] Overall I'm pleased with the direction the product is taking - I'm glad there is a great focus on making the product intuitive and user friendly. [EDUCATOR] I am glad that Jack has included Tier 2 & 3 spec points. However, I would like to see a greater emphasis on safe use of the machine and the educational value gained.

Developed Design Brief: I'm going to design and manufacture an RMM for the educational market. Initially focused on D&T & ART teachers, capable of moulding cold resins, foodstuffs, plaster of Paris. It is to be part self-assembled by the user to be sold at a cost of no more than 200 USD which must be capable of moulding for 1 minute to 8 hours with a rotational speed variation of 2 to 20 RPM with infinite options of variable cycle rates. It must conform to current BS standards with an intuitive user interface and preselected moulding menus that can be fully customised by the user.



14

The candidate looked at design styles and discussed this with the client, in the research section. They looked at the Deco style and a link to 'Smokey Jazz', including the styling and fashion. The discussion led to a high-quality specification point.

SPEC POINT

The proposal should develop the Deco theme and its connection to 1920's Jazz, measurable against other designs of this period.

SHOWS THOUGHTFUL USE OF THE RESEARCH, A DISCUSSION WITH THE CLIENT AND A MEASURABLE OUTCOME.



More measurable elements here for example.

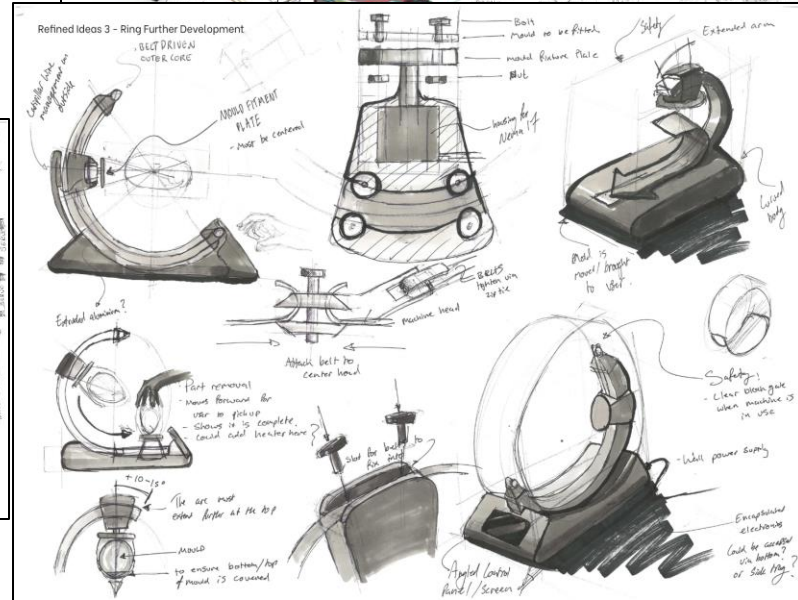
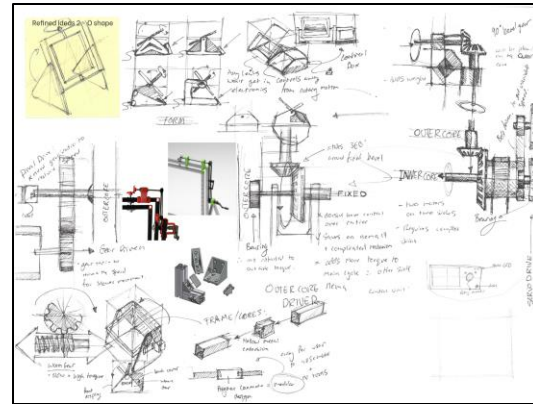
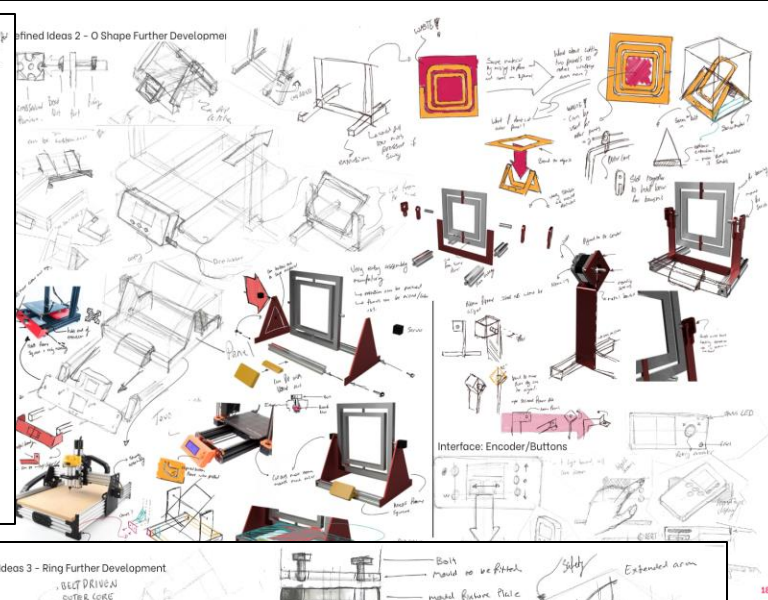
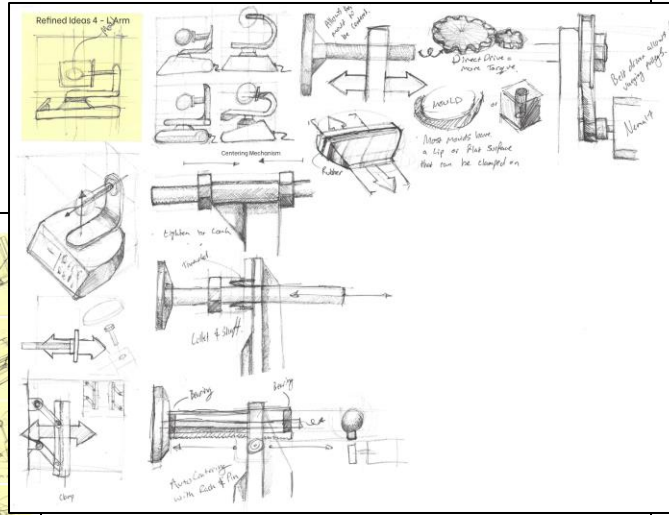
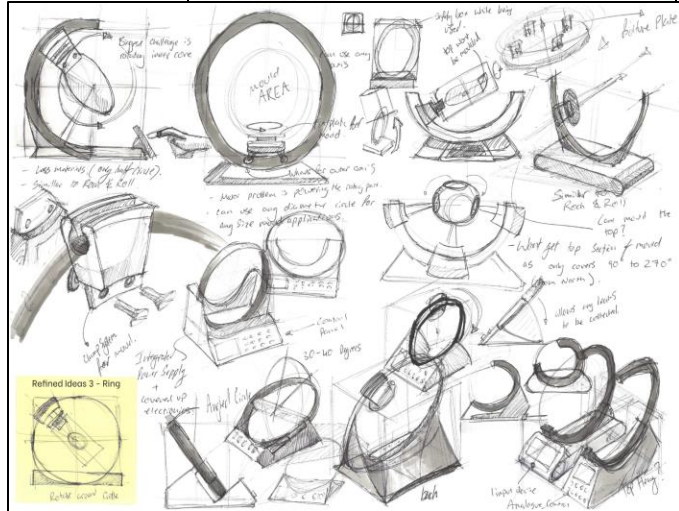
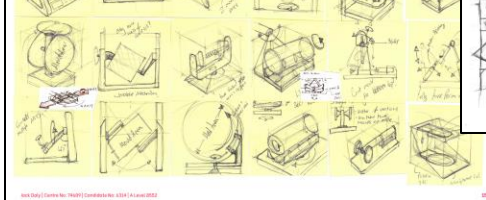
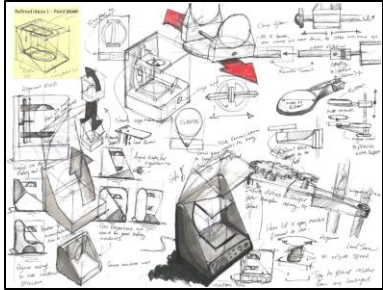
Here we see a re-worked brief, which draws on the research and client requirements.

Insight 5: Quality of Design Work

Design Ideas

- In this section it is expected that a range of design strategies are used to produce a range of design ideas, that address the specification criteria from the previous section.
- Design strategies include drawn elements such as 2D, 3D, and subsystem details. Other strategies might include inspiration materials, work of other designers and cultural/historical influences where relevant.
- Candidates should be thinking like a commercial designer and apply their knowledge of technical skills and materials and back it up with the research they have carried out previously, plus any additional research that is required.
- It should be obvious that the work has considered the needs established prior to this section.
- Annotation should illustrate the candidate's knowledge and understanding of technical elements such as materials, processes and techniques that are relevant to the identified design area.
- Iteration should/could occur in this section – and beyond (you may see linear or cyclical designing.) However, the client/stakeholder input should be apparent.

Insight 5



This is a superb example of fluid design work. The candidate has a sketching style that exudes confidence. The annotation shows a knowledgeable grasp of the important theoretical elements that are relevant to the design sketches. This is a top-level example of this assessment criterion.

Insight 6: Modelling and Architectural Modelling

Concept Modelling and Architectural modelling is an acceptable approach to use as a submission

However, these rules apply to both:

- The models must be produced accurately and to scale
- They must use an appropriate selection/range of materials, fixtures, components and fittings
- They must use a range of skilful, accomplished making skills/processes
- They should display A level demand and rigor

Insight 7: Quality of Manufacture Tools and Equipment

This assessment criterion can produce polarised outcomes, with very good performances at one end, or a lack of demanding A level processes at the other. Where candidates had modelled products, they were often at a low level, and on occasion, relied heavily on a CAM output, with limited interlocking parts. That said good quality modelling can allow access to the higher mark levels.

Positive

- ✓ Candidates should undertake real client dialogue
- ✓ Candidates should utilise demanding A level skills
- ✓ Candidates should select processes and tools that show sound technical understanding that are relevant to the design proposal

Negative

- ✗ Candidates should be advised against submitting simplistic outcomes, using limited skills and processes
- ✗ Candidates should aim to avoid work wholly CAM produced without complexity

Insight 7: Quality of Manufacture Quality and Accuracy

This section should be characterised by demonstrating high level making skills that evidence accuracy, leading to a quality artefact, that is a fully functioning prototype that meets the end user needs, identified in the specification. We should also see candidates being confident enough to consult with the interested parties and amend the design during the manufacturing as a result of this consultation, or indeed in response to issues during the manufacturing process, therefore evidencing an iterative approach during making.

Positive

- ✓ Candidates should undertake real client dialogue, illustrate an iterative process.
- ✓ Candidates should undertake A level demanding manufacturing techniques and making skills.
- ✓ Candidates should produce an accurate prototype that is well executed and finished.

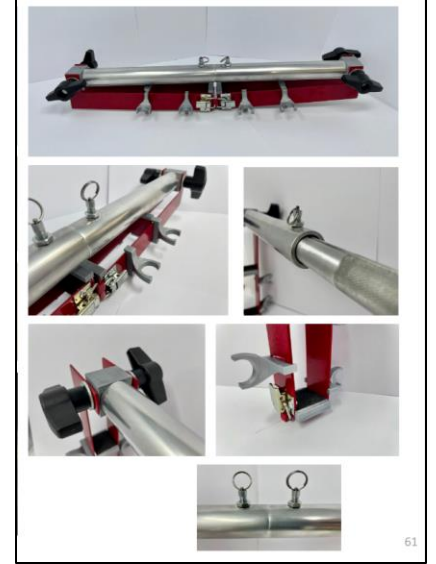
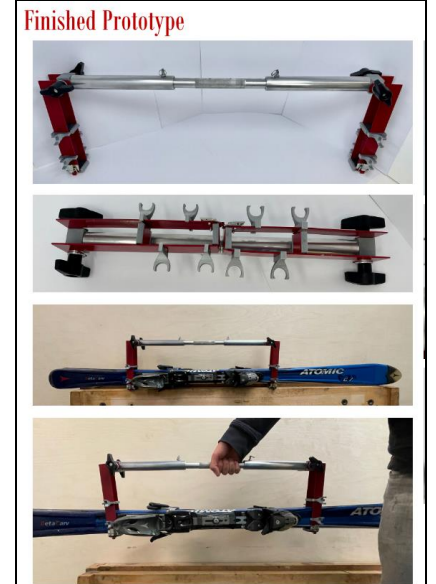
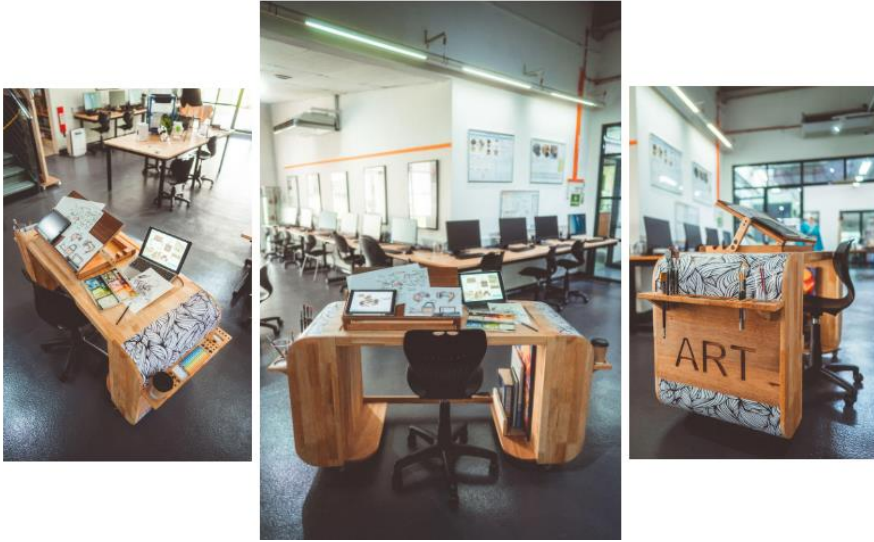
Negative

- ✗ Candidates should avoid submitting simple outcomes.
- ✗ Candidates should avoid submitting inaccurate scale models

Insight 7: Quality of Manufacture

A range of high-quality products.

FINAL PRODUCT

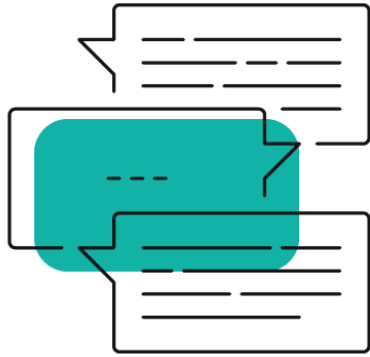


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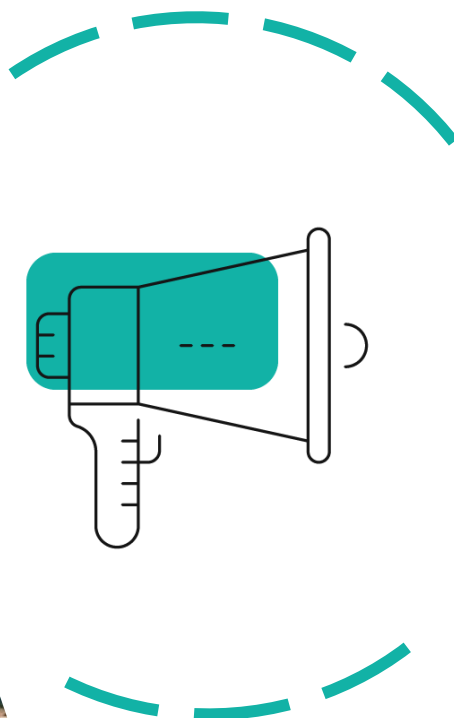
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