2023 ASSESSMENT REPORT

EDN315123 ENGINEERING DESIGN 3

Introduction

Folios submitted this year varied greatly in quality and quantity though thankfully not in their approach and structure. Projects ranged from engineering designs that produced a physical prototype to engineering designs that produced an electronic or software-based prototype. Marking was at times challenging due to the unique nature and content of each folio.

As this is the first year of *Engineering Design*, there is much to cover and more points will also be raised during subsequent discussions, reflection and moderation and marker meetings.

Addressing the criteria throughout the folio

Criterion 1: apply critical and creative thinking to the design of a solution

Students that achieved a higher result were able to present a succinct problem to analyse and solve that was then incorporated into the design brief and throughout the rest of the folio.

Many of the less successful folios showed little evidence of being informed by the design brief and problem, and focused on producing a product or object rather than a prototype that was assessed against a set of success criteria and then re-iterated and modified.

The markers decided that Element 3 should be included for assessment (as the creation of a design brief is integral to the folio) and recommended that Element 4 be moved to Criterion 2 (as it has more in common with design production than designing a solution).

Award Outcomes for Criterion 1

Ratings Total				
Z	**T**	**C**	**B**	**A**
4	6	15	14	14

Criterion 2: apply an iterative design cycle to develop engineering design solutions

High achieving students demonstrated and clearly documented a progression of iterations (three to six variations) prior to the Final Engineered Design. Due to the variety of projects, some students undertook these iterations during the Design Development component (as sketches and models), others during Design Production (by modifying the electronic or physical prototype) and others a mixture.

This contrasted to students that seemed to demonstrate one idea and then made the prototype/product. These folios and projects did not achieve high awards.

Some of the assessed folios and projects illustrate that students are very fortunate that they have teachers, collaborators and available resources that allowed and assisted them to produce their project and to achieve the best possible outcome. It is recommended that students explore the available collaborators, expertise, skills, materials, equipment, software, hardware, workshops, processes and other resources so that they have a clear understanding of what they can produce or model in the time available. If necessary, they should reduce the scope of their proposed design to take this into account.

Award Outcomes for Criterion 2

Ratings Total				
Z	**T**	**C**	**B**	**A**
4	8	19	15	7

Criterion 4: use success criteria to review, reflect on and refine the design process

This criterion was possibly the second most difficult for students to successfully address. There were a few aspects that contributed to this.

Firstly, if students had not developed a comprehensive design brief, with its associated problem statement, client, aims and success criteria with an understanding of the constraints and limitations, there was a limited scope of factors that they could plan, test and analyse (Elements 1 and 2).

Secondly, students that chose too large or complex a project (or perhaps procrastinated excessively) and were unable to complete their prototypes in time were also unable to test and analyse their data against their success criteria (Elements 1 and 2) and then modify and optimise their solution (Elements 3 and 4).

Highly successful folios were able to complete their prototypes, test, analyse and modify their solutions and throughout demonstrate their optimisation by continuously referring back to the problem, aims and [measurable] success criteria.

Award Outcomes for Criterion 4

Ratings Total				
Z	**T**	**C**	**B**	**A**
5	14	12	14	8

Criterion 5: communicate for technical and non-technical audiences

High achieving students demonstrated a full suite of communication skills throughout their folio to explain their design and document the process. Lower achieving students may have been very text dense with few images, drawings or models to illustrate their points or relied heavily on illustrations but neglected to include explanatory annotations to explain their relevance to the Criteria being assessed.

There were a few issues with Academic Integrity that centred around students undertaking group projects and not clearly differentiating and identifying their own work and that of others in their submitted folios. It would be strongly advised that students not undertake group projects in the future.

As will be explained later, most students were clear as to the correct method for referencing external sources and did so.

Award Outcomes for Criterion 5

Ratings Total				
Z	**T**	**C**	**B**	**A**
4	8	10	19	12

Criterion 8: analyse the interrelationships between engineering projects and society

This criterion would seem to be the most difficult for students to comprehensively address.

Award Outcomes for Criterion 8

Ratings Total				
Z	**T**	**C**	**B**	**A**
4	8	19	14	8

General observations of the folios

It was readily apparent to markers that students must adhere to the specified folio structure and framework requirements as outlined in the external folio specifications. This specified structure allowed a degree of consistency and comparability when marking project folios despite the extreme breadth of topics and subjects covered by students.

Title Page

This was well undertaken with most being spartan in graphical design and containing the requisite information. A few managed to have a graphical theme that then also followed through the rest of the folio and tied the pages and folio together.

Design Brief

The best problem statements were open[ended] and easily addressed Criteria 8. Less successful folios were exemplified by the project focusing on a product or object as opposed to a problem, design challenge or issue.

Advice to students in following years would be to focus on the problem not the product. Students should aim to have a single sentence problem statement. They should make it succinct and then back it up by with an introductory context statement.

Students should ensure that the problem is able to clearly address all the required criteria and elements from the standards being assessed with the project topic that has been chosen. One of the greatest difficulties was that problems and the brief had to meet Criterion 8. This seems the most difficult for students to address successfully and effectively.

Good project folios addressed the problem all the way through and ended with a good ‘design folio’ (even if the product wasn’t totally complete or wasn’t totally resolved or didn’t quite ‘work’ yet). You could see throughout the following design process, production and evaluation/reflection stages that with more time, resources, skills and equipment that it would have worked, and it was on the right track.

Higher achieving folios also ensured that that they had a clearly defined ‘client’ (possibly theoretical) that the problem needed to be solved for, who had clear needs and wants. Students then carried out an in-depth discussion of the client’s (user’s) needs, providing a strong rationale and analysis. From these statements

students would generate their aims and the Design Brief, as the Brief should reflect the context of the user's needs.

Higher rating folios listed 4-6 aims that were practical and had a degree of sophistication. These were then related to clear and measurable success criteria that can be proven to have been achieved (through testing). Thereby students will then be able to 'prove' they have met the aims and thereby solved the problem (or part thereof) and reflect on where improvements could be made to optimise the solution.

Production Proposal

Highly successful students seemed to have returned to this component and updated key aspects that then reflected what they had undertaken in their design development and production components.

Advice from markers would be to choose a small to medium and manageable project that can be readily and safely made in the time and resources available. This will be informed by the research undertaken and may reinform the design development and lead to further iterations to meet the timeline. Limit the scope and carefully plan the sequence. Plan for redundancies in case of issues or delays.

Research Analysis Essay

The research analysis must pertain to the design brief. Less successful folios undertook research that was general in content and not explicitly related back to the problem and aims. Occasionally research was off topic and almost seemed as padding to complete a word count requirement. Students who included unrelated information did not improve marks but rather they fulfilled their wordcount.

Research essays should not exceed 2000 words and as stated only the first 2000 words will be assessed. They should also contain images and drawings to illustrate the research undertaken. Markers found it difficult to effectively wade through huge tracts of poorly formatted text in the time available. Images, diagrams, technical drawings and other illustrations across a range of mediums are required to meet the requirements of Criteria 2 (Element 1) and 5 (Elements 2 and 3).

High achieving students demonstrated research that was directly related to and informed the design process and solution. It was linked back to the aims and also discussed the success criteria. The research also clearly addressed Criteria 8 (Elements 1,2&3) as it related to the project and design(s). There were a few students that also recognised limitations in the original research and noted that they returned later to undertake further research to investigate solutions to unforeseen issues.

Design Development

High achieving students clearly presented at least three different iterations with annotations describing how they solved the problem(s) and addressed the aims and meet or exceed the success criteria. Some used the rating of 'Positive', 'Negative' and 'Interesting' and others colour codes or keys linked to the aims and success criteria. The iterations showed a progression of ideas and development towards the final design.

While most folios that had a physical project were able to undertake this aspect well, many electronically based projects did not. Much of their design development centred around producing a prototype and then modifying and improving them in that component (Design Production). This proved difficult to reconcile with the External Assessment Specifications and the associated elements assessed. Markers would recommend that students use this component to at least document their initial ideation (with annotations) to fulfil this assessment requirement and then further refine their designs throughout the next component.

Design Production

Most students were able to undertake and document the production of their prototype or product (even if it was only partially completed) and describe the process(es) and issues.

Higher achieving folios were able to successfully complete their prototype and document and demonstrate their testing and data that they use to articulate the refinement of their solution against the design brief and needs (previously stated aims and success criteria). Students were able to clearly show that they modified their prototype and went through several iterations with reasons and justifications to reach their Final Engineered Solution.

Less successful folios chose a medium to large project or one that had a high degree of complexity or resource-rich that were unable to be completed in the time available. This had the flow-on effect of not only an incomplete prototype but also not being able to test, collect and analyse data and then refine the solution/prototype. Students are advised to limit the scope and carefully plan the production sequence. They should plan for redundancies in case of issues or delays and adhere to achievement milestones set by their teacher or themselves.

Final Engineered Design

High achieving students were able to clearly document and present their final design solution, be that a physical prototype, digital product or, theoretical project (based on an idea or concept) that was successfully resolved to the best of their abilities against the problem and design brief (stated aims and success criteria). Presentation of images, diagrams, models, technical drawings and other illustrations across a range of mediums are required to meet the requirements of Criteria 4 (Element 4) and 5 (Elements 1, 2 and 3) with annotations explaining them.

Less successful folios presented a final design solution that demonstrated minimal resolution and/or was unable to successfully address the original problem and design brief (stated aims and success criteria) convincingly. Often their presentation lacked images, diagrams, models, technical drawings and other illustrations across a range of mediums required to meet the requirements of Criteria 4 and 5 with associated annotations.

Students should use the video to showcase their final design solution. This allows a demonstration of the functions and key aspects of the final prototype or product, especially digital products (e.g., games or software), that static images cannot. It has been recommended to TASC and the Years 9-12 Learning team that the video should not be compulsory but seen as an opportunity to demonstrate the prototyped solution in action. Not to submit a video is a lost opportunity. Without a good video it is hard to achieve the highest grades/marks

possible as it allows for students to demonstrate (through video) how an object 'functions'. Providing a video version that is the same as the folio power point and reading the contents is discouraged. Making a video of part of the folio's Power Point and voicing over it to explain in greater detail is appropriate. It was recommended that the video be a maximum of 3:30 minutes with no minimum time and no penalty for not submitting a video.[1]

Evaluation and Recommendations

High achieving folios clearly documented and articulated the evaluation of the solution against the problem and design brief (client's needs, aims and success criteria). The folios reflect on what has been achieved as well as where there were issues or problems. Students make suggestions and recommendations as to where redesigns and/or further testing, modelling or research could be undertaken to improve the design solution further.

Less successful folios often only addressed one or part of one of these aspects in a superficial manner. It is strongly suggested that students focus on this component especially if the project is not completed or does not work as planned or predicted. Students should offer reasons for why they were unable to complete the project and/or why it doesn't work as well as insights and reasons (not excuses) to improve the design solution further and make it successfully address the problem and brief.

References

Most students were very clear as to the correct method for referencing external sources. While intext referencing was successfully undertaken in most cases, there were still some students that were unsure how to proceed. It would be suggested that students be introduced to a referencing tool (such as 'Cite me') and use it consistently. It was also discussed amongst markers that numbering images and referring the numbers back to the references page was also acceptable.

Markers also agreed that all images should be clearly referenced so that there is no ambiguity as to whom took or constructed the image, model or video. Students should label all their own work as well (e.g., 'Author, 2023') to avoid confusion.

[1] This recommendation was discussed at the External Assessment Specifications Advisory Panel (EASAP) 2024 meeting and it was agreed that this should be implemented.

Appendix 1: Folio Proforma Example

Title Page

- TASC number

Note: Adapt pages (add, expand or condense) as required to best present and clearly communicate your engineered design and process. Consider graphical elements that will visually link pages and improve appearance and readability.

Note: While landscape is the preferred orientation of the finished product, students can use portrait orientation if it is more appropriate to their project needs.

Problem Statement

- Due to the…
- There is a problem with…
- Because of the…

Client/Stakeholder

- CONTEXT/BACKGROUND
- Needs/wants
- Restrictions and requirements (scope and limits)
- Contact and interactions.

Design Brief

To design and model/make a…… which will solve the issues outlined in

the problem statement.

Aims (4-6):

1. Safe…
2. Ethical use of materials…
3. Structurally sound
4. Easy and…
5. Minimise…

Research Analysis

Brainstorm – points to start discussing and looking:

- Keywords
- Concepts
- Ideas

Research Analysis

How does this proposal meet Criteria 8?

Is there enough scope and possible aspect to address the aspects outlined in Criteria 8?

Could you write a 1500-2000 word essay?

Can others assist you in broadening the scope of your research so that you can address all aspects of Criteria 8?

Research Analysis

Research and Investigating Ideas

- Other's Ideas,
- Existing products and solutions
- Variables – things you can modify and/or test

Design Developments

- Sketches
- Document ideation (modifications/ideas)
- At least 6 different sketches

Design Developments

Proposed solution (preliminary)

- Accurate 3D sketches and technical drawings (hand drawn)
- Accurate Orthographic and 3D drawings and/or CAD Model
- Function and Construction Diagrams and Details
- Annotations of how it works/functions
- How it meets and fulfils the aims
- Measurements and Annotations
- Enough information to make a prototype
    - Required resources (materials, costs, + time)
        - -> Gantt chart?
    - Processes and skills
        - -> RAMP?

Production Proposal

- Proposed product (indication of what, how and why)
- Required resources (materials, costs, + time)
    - -> Gantt chart
- Processes and skills
    - -> RAMP
- Planning – to get the ball rolling
    - -> sketch and very initial idea

Design Production

Manufacture and Project Management (Gantt chart inserted here)

- Planning (Material and Resources lists, Costing)
- Organising (Resources and Timeframes)
- Making Prototype/Working Model/Product and Safety
- Journal documenting& reflecting the process – list steps/stages (insert Lesson Log and Reflections here)

Design Production

- Variables to test (singular)
- Testing
- Collect, collate, present and analyse data
  - Include lists, tables, graphs, diagrams, videos to help explain…
- Issues that feed the need to change and modify?
  - List and refer them back to the AIMS

Design Production

- Possible Modifications – "keep the best and change the rest"
- Modify model, prototype, product
  - Repeat testing and modifying improvements and refining design
  - Cycle to maximise improvement to optimal outcome
- Use lists and sketches
  - Refer how they now meet the aims

Final Design

- Final solution after 'multiple' tests and modifications
- Accurate Orthographic and 3D drawings and/or CAD Model
- Function and Construction Diagrams and Details
- Annotations of how it works/functions
- How it meets and fulfils the aims
- Measurements and Annotations and material specifications

Evaluation and Recommendations

- How all the aims have been met by the solution
- 'Sell' your design and how it is the nest solution to the original problem.

References

- APA style references NOT Harvard
- Keep these updated all the way through – don't wait until the week before it is due…
- Ensure you have in-text referencing of all sources and illustrations.
- Reference your own images/videos (eg "Taken by Author, 2023")