



Generating a range of engineering solutions

Engineers create new products through a process of research and iterative development.

Research can include the analysis of products that may have similar solutions or even parts of them could be incorporated into a new idea.

The **brief** should be followed in all areas to ensure that solution and proposals meet the specific requirements of the task. If a specification is issued alongside the brief, then those points should also appear in annotation within the design process.

Sketches should be used to explore a range of ideas but should be fully supported by clear and detailed annotation. Where appropriate, links or references to a brief and specification should be present.

Development should be clearly annotated and form a part of an iterative process that clearly shows how the idea has progressed through to a final conclusion. Again, annotation and links to the specification and brief should clearly be evident.

CAD can be used to show clear development and is an excellent tool to make the iterative process clearer. Designs can be modified and saved in stages prior to presenting. It is also a good way of generating engineering drawings for the final solution. CAD also allows the production of high quality and realistic visuals.

Testing is used to support development of ideas and can focus on a number of areas:

- **Aesthetics:** seeing how the overall product looks from a visual sense.
- **Materials:** testing on materials to see if they are fit for purpose.
- **Ergonomics:** can be tested to see if the interface between product and user meets expectations.
- **Mechanical:** simple tests to check if mechanisms work in the way expected.
- **Electronic:** tests on circuits using breadboards or prototypes.

Developing ideas through to a conclusion

Ensuring that all aspects linked to the brief and design specification are addressed is a vital part of the designing stages. As a part of this process, evaluative methods such as a SWOT analysis should be undertaken against a small number of design ideas.

SWOT analysis looks at four key areas of selected design proposals:

1. **(S) Strengths:** these focus on the strengths of the design, what works well, what makes it better than the competitors' products, etc.
2. **(W) Weaknesses:** explore areas that need improving to ensure the design is successful.
3. **(O) Opportunities:** unexpected benefits from the design.
4. **(T) Threats:** looks at what could be problematic for the design, such as a better product being launched by a competitor.

Communicating design ideas

The information in design proposals needs to be relevant and use a suitable media to display the information. Sketches and CAD are the most common form of displaying ideas and development stages.

It's important that sketches have a logical structure so that the iterative nature of the development of ideas can be seen. Annotation should include appropriate terminology associated with design and engineering.

Ideas are often easier to explain when supported by models and detail sketches showing more complex sections in possibly enlarged details, exploded views or isometric.



Models, such as the above example (of a torch), can use a variety of materials including paper and card, foam, clay or other materials. They are not required to be fully detailed or functional but to be a visual aid to assist in the design process.