Design and Technology Curriculum

Learning Guide

CONTENTS: THE DESIGN PROCESS

SAMOA

DESIGN AND TECHNOLOGY

"The Design Process"

Part 1: Teacher Notes

These notes have been prepared to help teachers and students understand the importance of the Designing Process in the development of teaching programs and the use of student projects to develop skills of thinking about projects as well as producing them. The Designing Process provides a more sustainable learning outcome for students as it seeks to provide skills and attitudes for students that will sustain their ongoing learning after school.

TEACHING PROGRAMS — DEVELOPING SKILLS

Design Technology is about generating ideas to solve problems that results in a product:

The product may be new

or

The product may be in need of repair

To develop skills in making or repairing products teachers will be required to design teaching programs that will give students an opportunity to be trained in the required skills. The skills that need to be developed relate to the design process.

Skills of investigation
Skills of designing solutions to problems
Skills of producing (or repairing) products
Skills in evaluating products (their own or of others)

The skills needed by students can be seen firstly as **Technical Skills** relating to the materials, tools to be used and the associated processes or procedures. These skills relate to the **Producing** (or Making) stage. This could be called the *applied learning stage.*

Secondly the skills needed by students are associated with the designing process. The skills that need to be developed include:

Design Skills relating to **Investigating, Designing** and **Evaluating** - the *thinking stage*.

STUDENT PROJECTS

Completed projects designed and specified by the teacher (or the student) are the main tangible outcomes for the students, and the projects also provide the planning structure for teachers.

The projects are mainly developed and designed by the teachers in years 9 and 10 and in years 11 and 12 and 13 increasingly the students have a role in developing them. The projects then become the framework for the construction of the annual teaching program. The projects meet several important teaching requirements

- The projects connect the intended learning to a real context or problem to be solved.
- The projects enable particular skills to be developed in a deliberate and planned way
- The projects integrate the Design and Technology Strands
- Students can readily communicate their 'project' learning in oral and written form
- Teachers can conduct skills training lessons that are required for the students to complete the project.-such training will also include skills of investigating, devising and evaluating as well as technical or making skills

At the centre of this course is the Design Brief, which brings together all the skills and the learning from all the strands. The Design Brief is a short paragraph describing the problem to be solved, establishing the need for the product, and then setting out the specifications within which the product is to be developed.

The specifications will challenge the student's skills of:

Investigation
Designing
Production (or making)

and

Evaluation

So in planning and annual teaching program, the projects will be carefully selected by the teacher across the 3 terms to develop skills in a progressive and planned way integrating the strands. Sometimes two strands will be used, sometimes three, but eventually all strands and achievement objectives will be covered over the annual program

As students reach higher grade levels there will be increasing opportunity to undertake more complex projects and to design their own. In many cases they will work collaboratively in 'industry teams' mirroring what might happen in the workplace. As projects become more complex, cost may become a factor and students may develop models or prototypes and only develop certain components of the final product to full size to demonstrate their making skills and keep cost to a minimum

The program-planning task for the teacher is to design interesting projects, analyse the skills required to complete the project, and what achievement objectives will be covered.

This can be an interesting and challenging course for students developed by creative teachers *using available resources*.

There will never be sufficient time to teach all the technical skills required for every possible trade or occupation that might be needed in a lifetime, but this course can teach students a Design Process to think through problems, when coupled with an expectation of high quality outcomes will last a lifetime.

DESIGNING PROCESSES

Designing in technology is purposeful, systematic, and creative, with many possible solutions. While it is recognised that students' prior learning has equipped them with an ability to identify, manage, and resolve problems, a four part designing model: *investigating, designing, producing and evaluating*, is provided as a model that can be used.

Design and Technology involves working within Design Briefs or requirements to satisfy human needs and wants for a client or customer. It is an interactive decision-making process involving thinking, investigating, creating, and devising with continuous evaluation and, often, modification as a result of this evaluation.

Investigating

Investigating can include activities such as:

- specifying plans and purposes from a need analysis, and identifying tasks;
- establishing outcomes;
- researching, analysing, and communicating information;
- searching for solutions;
- critical analysis of a product's structural characteristics.

Designing

Designing can include activities such as;

- devising flexible, imaginative, innovative and enterprising outcomes;
- preparing sketches, concept drawings, and working drawings;
- testing, modifying, and validating ideas;
- selecting appropriate solutions.

Producing

Producing can include activities such as:

- making articles to chosen standards and specifications;
- developing skills and applying them to new situations;
- controlling quality, reliability, safety, and cost;
- devising and using procedures, processes, or sequences;
- working alone or collaboratively;
- using resources, equipment, or materials.

Evaluating

Evaluating can include activities such as:

- evaluating how well the requirements of the design brief have been met;
- redeveloping or improving plans, ideas, or procedures;
- preparing reports on outcomes;
- considering personal achievement and learning against criteria;
- involving other people in the evaluation process;
- communicating with people about outcomes and expectations;
- critiquing outcomes of prototypes against similar retail products;
- taking action based on what has been learned.

INVESTIGATING

- Investigate the design brief:
  - Clarify the problem
  - Note the specifications required by the 'customer'
  - Explore issues about the problem
- Investigate ideas for solutions
- Find information about ideas
- Evaluate and document.

DESIGNING

- Identify the most likely idea
- Develop and refine the idea
- Devise the proposed solution
- Model or trial the proposal
- Evaluate and document.

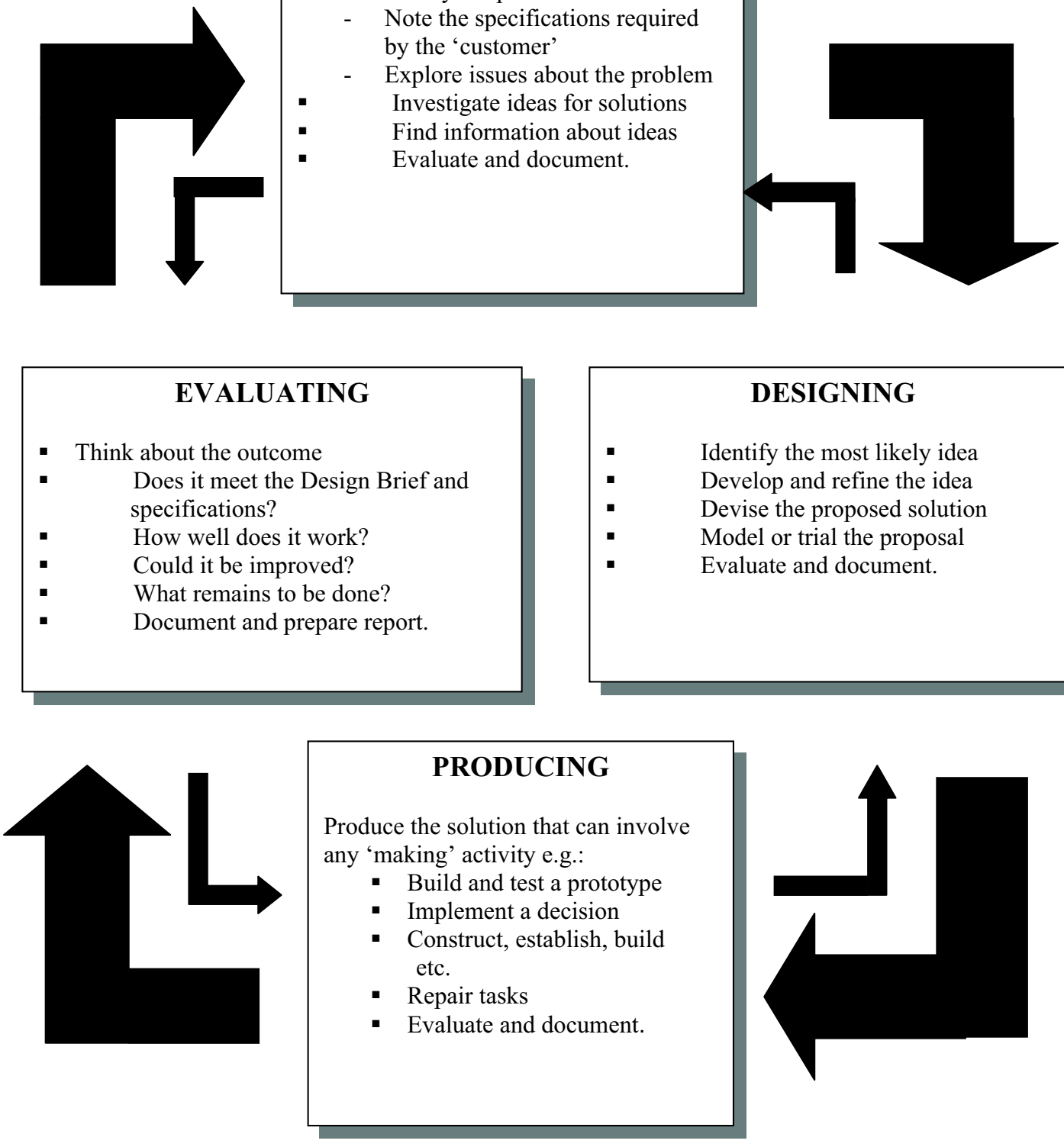
PRODUCING

Produce the solution that can involve any 'making' activity e.g.:

- Build and test a prototype
- Implement a decision
- Construct, establish, build etc.
- Repair tasks
- Evaluate and document.

EVALUATING

- Think about the outcome
- Does it meet the Design Brief and specifications?
- How well does it work?
- Could it be improved?
- What remains to be done?
- Document and prepare report.



THE DESIGN PROCESS

The large arrows indicate the main direction of activities in the process.

The small arrows indicate the usual and expected movement backwards and forwards between the stages.

Note:
At Year 13 the 2 Stages of *Investigating* and *Designing* are combined into <u>one</u> stage called *Designing*.

Design and Technology is the means by which people turn ideas into reality. It involves the application of knowledge and processes to develop systems and products that solve problems and extend human capabilities

The power of ideas, innovation and enterprise are central to the design and development of sustainable, socially responsible, and preferred future.

Design and Technology seeks to empower and energise learners to participate actively in:

- creating opportunities for innovation
- fostering the power of ideas
- recognizing and capitalizing on opportunities
- designing solutions to meet human needs
- enhancing practical knowledge and capabilities
- critiquing past, present and emerging technologies
- developing appropriate products
- evaluating and embedding values for environmental sustainability

Design and Technology is then, about generating ideas to solve problems that result in a product.

Students who do well in Technology will be observant of the world in which they live. They will see the 'made' world. They will see examples of good design, good workmanship, clever use of available materials and they will also see poor design, poor workmanship and poor use of materials. They will see products as a response to a need. The need may be quite basic or it might be quite complex. It might serve a personal need or it might serve a need expressed by others – family or community.

Students learn to use, manage, assess, and understand technology. They will recognise their social responsibility for the resources and materials being used, including recycling, waste disposal, and effects on the environment. A technologically literate student is empowered to interact with innovations and ideas developed through other disciplines. This is achieved through the ability to reflect and make informed judgements, the enhancement of manipulative skills, and the ability to realise designs through applied problem-solving.

SAMOA

DESIGN AND TECHNOLOGY

"The Design Process"

Part 2: Student Notes

These notes have been prepared to help students with the designing components of the Design and Technology Curriculum Statement, for the Samoan Ministry of Education.

The model set out in these notes will be useful in all Design Technology designing tasks, whether they be simple or demanding, or related to materials, information, or processes.

Checklists are provided to help students with each stage of the process, which could form the basis of Internal Assessment mark schemes.

THE DESIGNING PROCESS

Why is designing important?

Few things around us stay the same for long. Our world is changing so that it is impossible for any of us to know everything or be able to do everything. There are few ready-made solutions that we can use for all future situations.

It is therefore important to develop a process to help us *know how to know or learn how to learn*. This process is important in our personal lives, for future learning in the workplace or for when we return to our village.

This process is called the designing or problem-solving process. It involves working through a series of linked steps that lead to solving a problem or satisfy a need.

Developing skills with this designing process takes practice. You will gain confidence and success with the process by using it often and in many different situations. Most people get a lot of enjoyment from designing and making something useful, or solving a problem or reaching a decision about a difficult situation.

The designing process is seen by many as a constant search for better solutions to our needs. For example, good industry employers constantly use the designing process as they try to improve products and processes.

Are designing and problem-solving the same?

They both use the same designing strategy or process to reach a solution.

The designing process usually results in an actual product or process involving materials and information.

Problem-solving uses the designing process to lead to a decision or solution. This may not involve a product. *Problem-solving or decision- making* is not always concerned with technology and is useful in situations such as:

Buying a tool
Planning a party or festival
Choosing a study program
Planning a holiday or trip
Making choices (e.g. which brand to buy)
Finding an engine problem
Working out how to do something.

In these examples, the outcomes do not involve the production of a final product or process.

Technicians in the appliance service and automotive industries are very involved in *problem-solving*, but less so in *designing*.

SUMMARY

Designing usually leads to an actual product.

Problem-solving uses the designing process to find a solution or decision that may not involve a product.

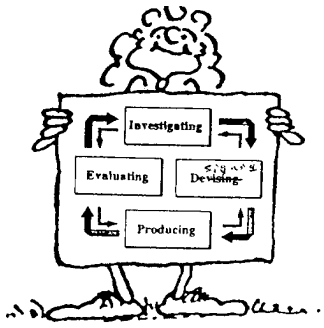
Why is it important to use a designing process?

Solutions to designing tasks are rarely reached in a disorganised way. You rarely find good solutions by chance.

The use of an orderly process always leads to better decisions or solutions. This process helps ensure that important things are not overlooked.

Designers are more likely to produce better results as they develop confidence, experience, and practice skills with the designing process.

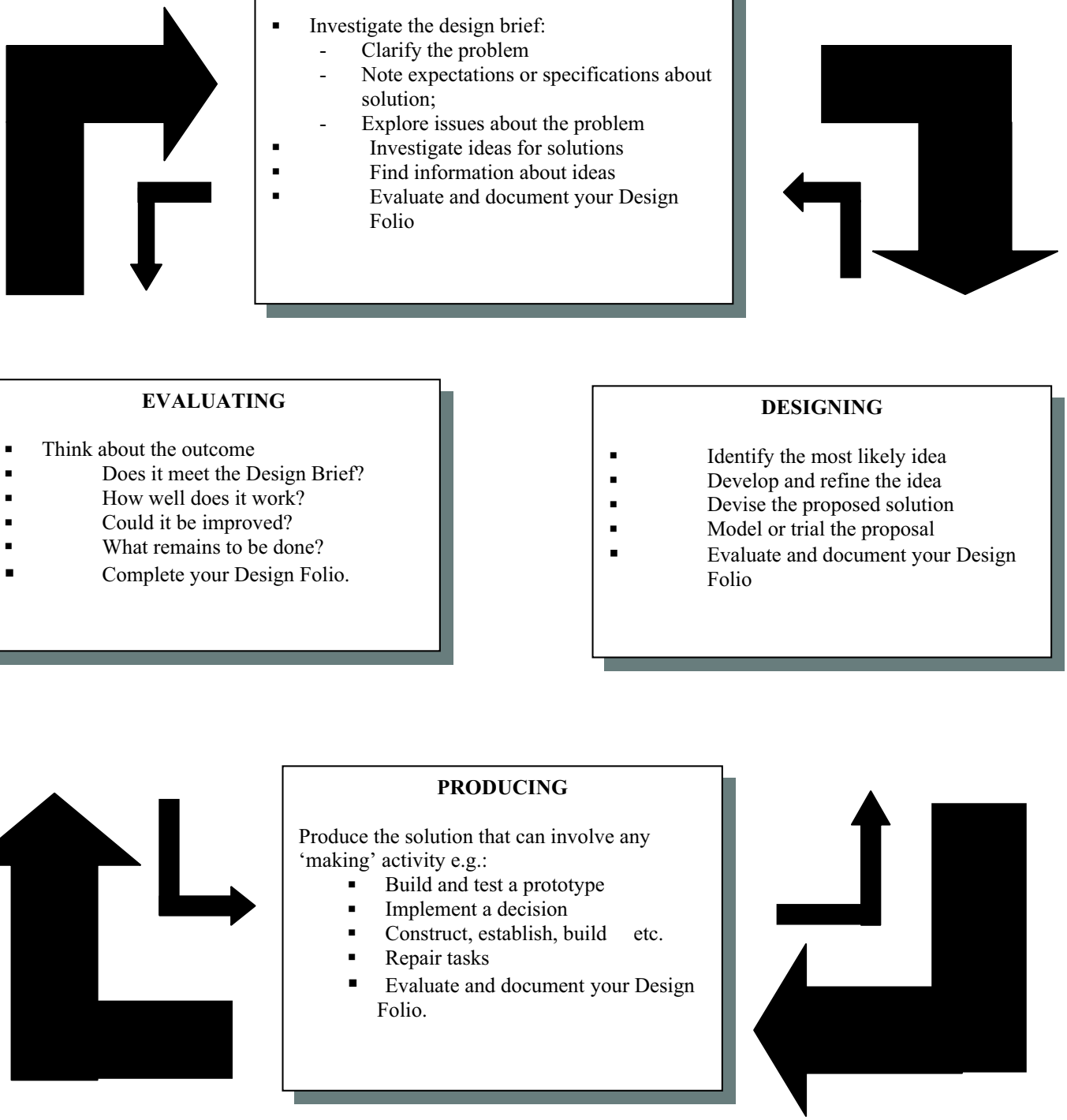
What is the designing process?



The designing process involves four linked main stages:

- **Investigating** the problem, ideas for solutions, and information about ideas.
- **Designing** solutions.
- **Producing** the final solution.
- **Evaluating** the outcomes.

You can use this process for most designing tasks, no matter how complex. **Some designing tasks are relatively quick and simple – others can be complex and difficult**.



THE DESIGN PROCESS

To use the process the designer has to work through the parts of each stage.

The large arrows in the diagram show the main flow of the designing process. This is the ideal process, which hardly ever happens, as the stages do not always follow each other in such a simple way.

The small arrows indicate the revisiting of stages that is normal and expected in the process.

At any stage, unexpected opportunities or problems may make it necessary to move backwards and forwards through the stages before you find a solution. In fact, many more small feedback arrows could be drawn leading to all parts of the diagram, as the designer goes back to earlier stages. This is the result of the continual process of evaluation or review that is necessary throughout the process.

A large designing task can have many small designing tasks embedded in it. For example, the process of designing a car or a building can have hundreds of smaller design tasks, for various parts, within the main task.

Designing is much more than simply drawing plans, shaping, styling or decorating. These activities are important, but they are only a small part of the designing process.

Are all stages of the process necessary?

All stages of the designing process are important, and each stage must be included in any designing task. For some tasks you may need to spend more time on one stage of the designing process than others. For example, an electric security lock on a door could take a lot of planning and development work, but the final solution may be quite easy to build.

Other tasks, such as establishing a paved are for a shelter may need less planning, but involve more 'producing' or 'doing'.

Where does the process start?

All designing or problem-solving tasks start with a need. However, different tasks may require the designer to enter the designing process at different points.

For example, a designer can start with a new design brief, and move through the *investigating – devising – producing – evaluating* process. Another situation may start with an existing product that needs to be repaired, modified or improved. In this case, the designing process is *evaluating – investigating – devising – producing – evaluating*.

Review progress at each stage

At each stage of the process, you have to make many judgements and decisions. It is important that you evaluate your progress and the decisions made at each stage. Do not wait for the final evaluation stage.

Working with others

Wherever possible, work with others throughout the designing process. Discussion and cooperative activity will normally produce better results than when you work alone – this is how industry works.

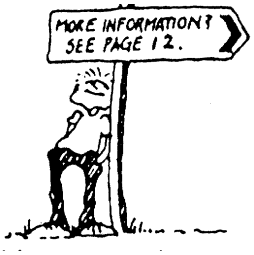
When working with others you will need to share decisions or sometimes settle conflicts as the group works through the process.

Documentation

Keep records of all stages in the designing process. Do not throw anything away, even rough 'ideas' sketches, brainstorming notes, or results of tests or experiments made. Often, you will have to submit this development material in your Design Folio for assessment as evidence of the process used.

The type of documentation needed will depend upon the task and the audience or 'client'. This will be clear at the design brief stage. For some tasks you may only have to document certain stages. For other tasks you will need a Design Folio covering the total process.

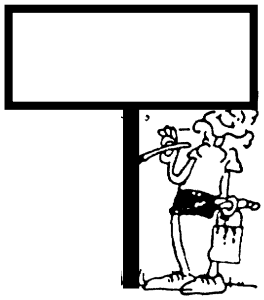
If you have to make an oral presentation about the proposed solution, you may need different material, such as charts or pictures.



Graphics are an important part of the designing process. The type of graphic used must suit the task and the stage of the design process. At the investigating and designing stages, for example, you may only need 'thumbnail' concept sketches or flow charts.

At other stages, you will need detailed technical drawings and other graphics (e.g. printed circuit board artwork), before you can produce the final product.

CAD/computer graphics can be very useful at all stages of the process, if you have access to this technology.



Your final drawings must comply with normal drawing conventions – ask your teacher about drawing conventions.

INVESTIGATING THE DESIGN BRIEF

The design brief is a statement about the need or problem and any expectations or specifications required for the solution. A design brief is like a contract, because it sets out all of the conditions and specifications that apply to a situation.

The design brief outlines:

- The problem or the need;
- The task expected to be undertaken;
- Any specifications for the solution, and any special conditions.

The designing task is easier to tackle if the design brief is clear and precise. If the brief is not clear, design work may be misdirected.

In some cases, the design brief will list some essential outcomes that must be met. It may also list some desirable outcomes. These are not absolutely essential.

Clarify the problem or the need

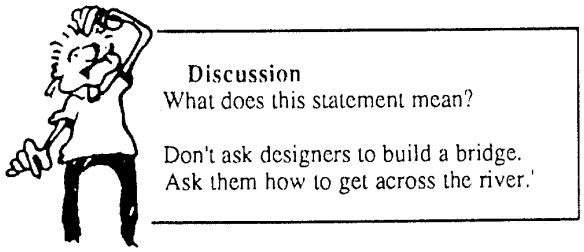
Investigating and clarifying the problem is the first important step along the path to a solution. For this you need to think about and discuss the problem, and perhaps do some background reading. You may do a 'needs analysis'. Some industrial designers undertake market research activities before starting design work.

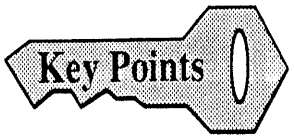
Specifications and limitations

In designing tasks, some factors are 'set', and beyond the designer's control. These will place limits on the designing process. These could include:

- Time: the solution may be needed by a certain date.
- Processes: the equipment available may influence the processes to be used.
- Materials: the choice of materials may be defined, or be limited to those available.
- Cost: there may be a limited budget.
- Performance specifications: the solution may have to satisfy some performance requirements.
- Operational requirements: where and how the solution will be used.
- Legal requirements: building, safety regulations, or Samoan building standards may have to be considered.

You may also have to keep in mind issues such as ethical considerations, energy use, operational efficiency, maintenance, operating costs, security, mobility, appearance, aesthetic appeal, ergonomics and environmental impact.





The design brief is a statement about the designing task. It describes the need for the problem to be solved, and any specifications required to be followed in designing the solution.

Are all design briefs the same?

Design briefs can vary. Some are 'open design briefs' which state the problem and do not suggest a possible solution. For open design briefs the designer has to develop or negotiate the detailed design brief and may be able to explore creative and innovative solutions.

Other design briefs can be closed and contain exact specifications that must be met by the solution.

Consider the differences between the following design briefs.

Example A – an open brief

The problem – a new office building has parking for tenants' cars. Other motorists are using the parking spaces illegally, which is upsetting the tenants.
The task – design a way to allow only tenants' cars into the parking area.

This brief leaves the designer plenty of scope, as there are no expectations or limitations stated. It gives few clues about a solution. The designer must investigate and analyse the problem and establish a set of outcome expectations. This can involve discussion and negotiation with the 'client'. In other words, the designer establishes a detailed design brief from the original open brief.

Example B — a structured design brief

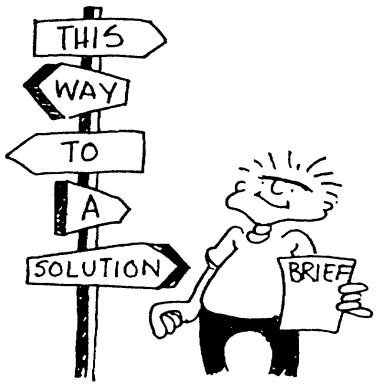
The problem – a new office building has parking for tenants' cars. Other motorists are using the parking spaces illegally, which is upsetting the tenants.

The task – devise a way to only allow tenants' cars in the parking area.

Specifications – the parking area must be enclosed with a mesh security fence, leaving one entry point for cars. The system must include a hinged boom gate operated by a remote controller unit provided to each tenant.

This design brief sets out expectations that must be met. Most of the designing decisions have been made.

The 'customer's' expectations about the outcomes may limit the solution that a creative designer could develop. For example, the mesh fence requested has ruled out a potentially attractive and cheaper garden border, and the remote controller may be more expensive and less reliable than a metal key, or numeric keypad and PIN number for each user.



CHECKLIST - THE DESIGN BRIEF

The designing task

- Do you know what is expected of you?
- Details about the folio required?
- Are requirements about the task clear?
- Due dates for drafts and final report.

'Open' design briefs

- Is there a statement about the problem?
- Why is it a problem?
- Will you prepare a detailed design brief?

'Closed' design briefs

- Is the design brief clear?
- Has the need or problem been described?
- Do you need to investigate the problem further?
- Are specifications about the solution clear?

Physical specifications, for example:

- Cost
- Colour, texture
- Size, weight
- Style, shape
- Strength
- Durability
- Stability.

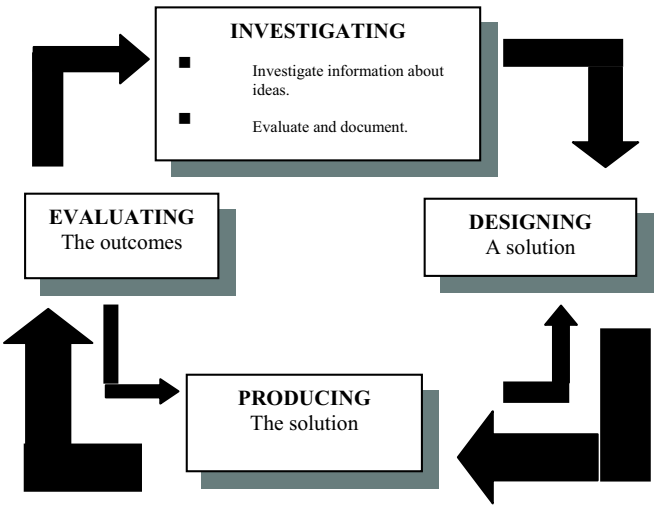
Performance specifications, for example:

- Essential requirements
- Other requirements
- Are there requirements for reliability, efficiency, operating costs?

The solution in use

- Who will use the product?
- Where will the product be used?

INVESTIGATING IDEAS



The 'investigating ideas' stage of the designing process is vital. Good solutions depend upon good ideas.

Some background reading or discussion with others may help you with understanding the problem set out in the design brief. Encyclopaedias, CDs, dictionaries, magazines, and textbooks can be useful.

A range of ideas gives the designer many options for possible solutions to the problem. You should investigate a lot of ideas, no matter how unlikely they may seem. Often, these ideas can lead to surprising and creative solutions. Work with others wherever possible, and discuss as many ideas as you can think of.

Good designers try to be creative

The easiest way to get ideas is from our own background and this will improve with experience and confidence. There are many ways to get new or better ideas.

Successful designers try to think creatively about problems. They question the obvious or traditional ways of dealing with things, and try to look at situations from different angles. They don't limit their thinking by using traditional solutions. They take some risks and go beyond the usual approach.

Good designers try to be imaginative, and approach their work with a sense of fun.

Designers are always looking for better ideas and solutions that are simple, elegant and effective. Effective designers are hardly ever satisfied with their first ideas, and search for better ideas.

Brainstorming is a useful and enjoyable way to produce creative ideas. Usually it involves a group, where everybody contributes ideas.

Every member of the group writes down a list of ideas about the problem. Each person, in turn, reads out an idea which is written onto a board or sheet of paper that everyone can see. As ideas are read out, new ideas will emerge. People can add new ideas to their list and read them out when their turn comes. All ideas are allowed. The crazier ones may suggest a new approach by triggering other ideas.

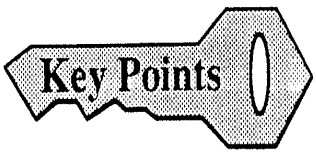
It is important that no one criticises anyone else's ideas. Being criticised may make people reluctant to offer any more ideas.

How have others solved this problem?

It is likely that this problem has occurred somewhere else and that a solution has been found. You may adapt ideas from other solutions.

Some designers claim that good design is more about adapting ideas than inventing new ones. However, adapting an idea from somewhere else is not always the best solution.

INVESTIGATING IDEAS



1. ideas are starting points for solutions.
2. ideas are vital to the designer.
3. look for a range of good, creative and fresh ideas.

CHECKLIST - INVESTIGATING IDEAS

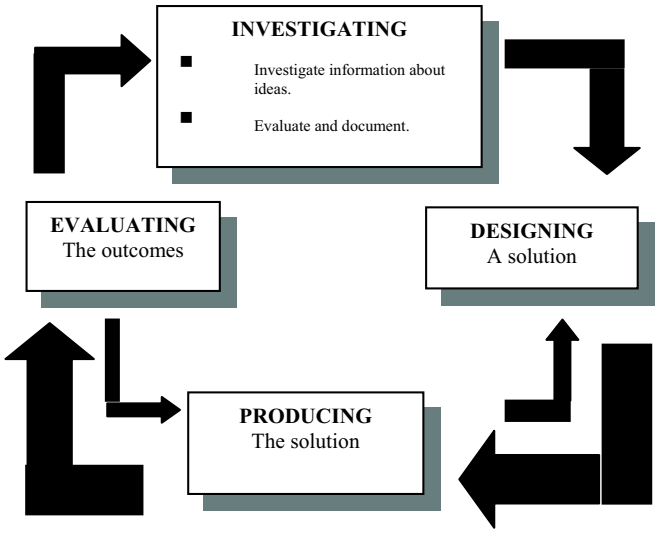
Before proceeding with your investigation, check:

- Is the design brief clear?
- Is the task clear?
- How will you find good ideas?
- How will you find creative ideas?
- Will you contact or interview resource people for ideas? (who?)
- Will you use a range of resources to get ideas?
- How have others handled this problem? Are there any existing ideas or solutions that could help you with the task?

Evaluation of the 'Investigating ideas' stage

- Have you found a useful range of ideas?
- Have you found several creative ideas?
- Have you found several ideas that appear to be likely solutions?
- Have other people been involved in developing ideas?
- Have you discussed the ideas with others? Have you made notes and sketches about the ideas?

INVESTIGATING INFORMATION ABOUT IDEAS



An idea is only a starting point or option for a solution. Before you can consider an idea to be likely solution, you usually need to know more about it. For example, before using an idea involving a certain material, you may need information about costs, sizes, availability, and properties. These are factors to help in analysis.

The investigating ideas stage and the investigating information about ideas stage are closely linked, and you may need to move backwards and forwards between the two stages many times – as you make decisions about information you are analysing.

Sometimes, you may need to reject an idea because of the information found; it may be too costly, material may not be available in the size needed, or the idea may be unrealistic or not practical. This is the analysis stage or thinking stage.

You can gather information by talking, listening and observing, and by reading reference material. The more literature there is available, the more important it is to know where and how to find useful information. Often the information you find can lead to new ideas.

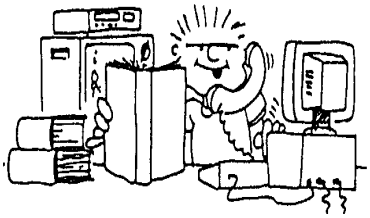
Be careful to get information at the right level for the task (e.g. if you need information on a transistor for a simple sensing circuit, you do not have to read a scientific textbook on electronics).

It is important to be selective when using resources. There will not be time to use them all, so skills such as skim reading the table of contents, index, and conclusions will help you to spot valuable information quickly. Make sure that the information is related to the task!

It is important that information is up-to-date. Some texts and reference books may be out of date, and recent magazines and brochures information may have more up-to-date information.

Where to find information

Resource centre/libraries may have:
Handbooks and manuals
References, texts and encyclopaedias, videos
Product brochures and catalogues
CDROMS
Magazine and journal articles
Various research reports
Internet



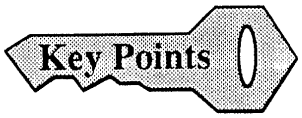
Businesses, specialist people and organisations in the community can be an excellent source of information. Contact manufacturers, specialist people, industry employers.

What factors can be used to assist in analysing materials, processes, tools and equipment. When ideas are generated decisions have to be made to help determine the 'quality' of the idea. Certain ideas may be very expensive, some cheap, others may be environmentally sensitive, others perhaps wasteful of resources. This task for designers is to make careful and calculated decisions using a set of factors to judge the decisions. The set of factors will

change from project to project but will be guided by the design brief.
Factors for analysing materials could include:
Cost, availability, durability, ease of use, environmentally sustainable, attractiveness.

Factors for analysing tools could include:
Availability, ease of maintenance, cost, appropriateness, simple, skills required, elaborate skills required.

Factors for analysing processes could include:
Efficiency, industry standard, practical, simple, complex, fast, slow.



1. you need information about an idea before you can consider it to be a likely solution.
2. the information must be up-to-date and accurate.
3. the information must be analysed and sorted using the design brief specifications.

CHECKLIST – INVESTIGATING INFORMATION ABOUT IDEAS

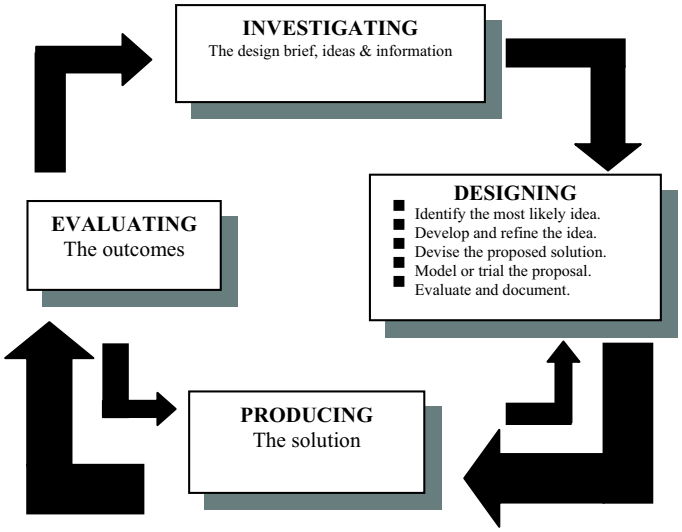
Before proceeding with this stage, check:

- Have you identified your promising ideas?
- What information do you need about these ideas?
- What sources of information will you explore?
- Have you thought about what factors you can use to analyse the ideas?

Evaluation of the investigating information stage

- Have you got all the information you need?
- Was enough information available for you to make decisions about using the idea?
- Is the information opinion or fact?
- Is the information detailed enough?
- Have you cross-checked important information?
- Do you need more information?
- Is the information useful?
- What evidence supports the information?
- Is the information up-to-date?
- Have you used a variety of sources?
- Has the information found led you to reject some ideas?
- Have you selected a range of factors to help in analysis?

DESIGNING THE MOST LIKELY SOLUTION



At this stage of the designing process you have to sort out likely solutions and make some careful judgements.

By now, you should have considered many ideas, and gathered information about all ideas that could be likely solutions.

You must choose the 'idea' that seems most likely to be successful. The designer has to predict the way this idea will work, or how it will look.

You may have to choose the best of several potentially good solutions. It may be that none of the ideas may be ideal, but choose the best at this stage, unless you consider it to be unsatisfactory because it does not meet the design brief.

At this stage, you need to develop and refine the idea, taking it from an 'idea' stage to a more detailed proposal. You may need to test the proposed solution (e.g. building a model or 'mock-up'). You can assemble and test electronic solutions on test boards.

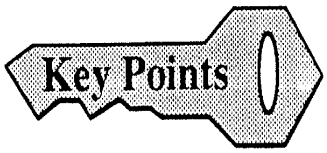
You may need to test materials and construction ideas. In some cases, you may need to carry out more development work, and develop new skills or processes. For some task you may need an in-depth understanding of materials and processes. This could involve further reading, practise, and experimentation. Larger designing tasks could involve considerable development work or pilot studies.

Sometimes, the designer may be asked to justify decisions or provide documented evidence to support the decisions made.

Preparing for the producing stage

It is important that you complete the drawings and notes that will enable the actual production of the solution to proceed.

Where the end product is a document or a piece of graphics or craftwork, you may only need to do an outline sketch of the result at this stage.



1. Choose the best idea from the range of ideas available, and ensure you get all the information you need about the idea. This is end of your analysis and is the 'thinking' stage.
2. Develop and test the proposal until you are sure it is a good solution.
3. Test the proposed solution to ensure that it meets the design brief.

CHECKLIST — DESIGNING THE MOST LIKELY SOLUTION

Before proceeding with this stage, check:

- Which ideas have most potential?
- Is all of the required information available to enable you to make decisions?

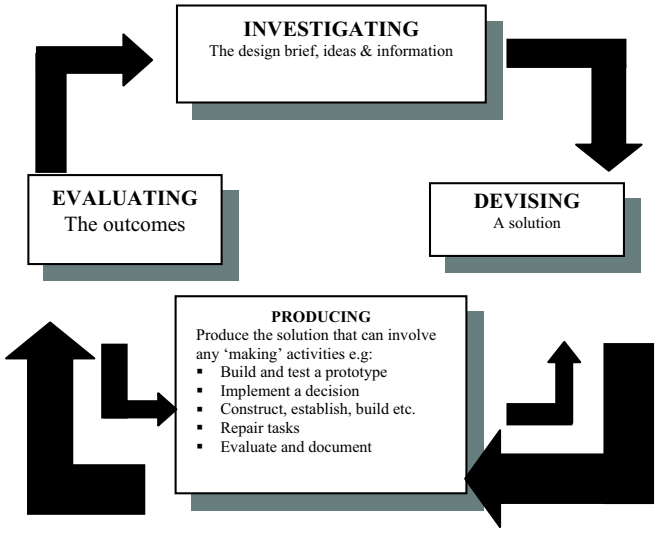
Evaluating the proposed solution

- Does the proposed solution meet the design brief?
- Why have you selected this solution?
- Have you tested, modelled, or simulated the proposed solution?
- What were the results of these tests?
- Were any changes required?
- How readily can the solution be produced?
- Have you selected the most suitable materials?
- Have you considered the properties and appearance of materials?
- Is the cost of materials acceptable?
- Does the solution need packaging or labels?
- Are there any dangerous parts?
- What will happen if the product breaks?
- Can the product be stored properly?
- Does it pass the SAFE test?
  Simple
  Appropriate
  Functional
  Efficient

Devising the 'production' stage

- Are any new techniques needed?
- Is there enough time to make the solution?
- Is the available equipment adequate?
- Are the materials needed, available?
- Are any special materials needed?
- Are any special fittings needed?
- Have you prepared the necessary documentation, i.e. production drawings and notes?

PRODUCING THE SOLUTION



The important producing stage is a rewarding part of the designing process. It is the result of the planning stages. It is the real 'doing' stage that results in the product or solution sought by the design brief.
The producing stage can involve many activities, depending on the type of task, for example:

- Building a piece of furniture
- Implementing a production system
- Producing a piece of artwork
- Repairing an engine
- Producing a special photograph.

By now, the designer has decided on the solution and the materials and processes to be used. You may have to develop and practise new skills and processes, especially with new materials. You may also have to overcome production difficulties.

Work out a list of materials so you can order what you need and calculate final costs.

A prototype of the solution is useful

A prototype is a full-scale operational product that gives the designer a chance to check, test, and perhaps, modify, the solution before final production begins. The prototype must be well built so that it gives a correct impression of the final product.

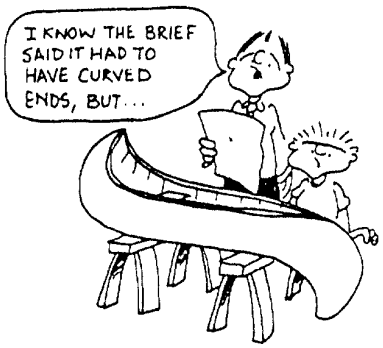
For some tasks, you may need to make various jigs, templates, or tools so that production is easier and you can maintain a consistent standard. For example, you may have to make a jig so that parts can be cut to the correct lengths, be pre-drilled identically, and fastened together at a certain angle. Similarly, you may need to prepare a page layout template for a document production task.

For more detailed or complex tasks a 'production procedure' may be needed. This should describe the way in which the product will be produced. Use production methods that minimise costs and waste.

You may have to carry out many small designing tasks within the main task. For example, the production of an assembly jig may involve several minor designing tasks. You may need to do some problem-solving to overcome production difficulties.

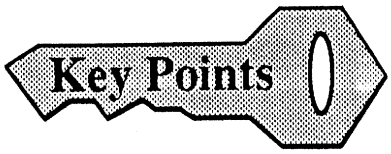
With larger construction projects because of cost, a prototype may be the final product because of limited resources. In some cases only certain parts of the project will be built to full size. If the project is a team task, each member of the team may be required to become a 'specialist' in certain tasks.

Ongoing appraisal of your work is important, for no matter how carefully you have planned, unexpected situations may arise that need attention.



For successful outcomes at the producing stage you usually have to use the correct tools and equipment. If you use high standards in the various processes you will be able to achieve near-commercial standards of quality, performance, and presentation.

The producing stage also involves managing time and resources. Plan carefully and keep to a timetable.



1. At this stage, the solution that has been devised is produced.
2. Work in a careful and logical way. Strive for excellence.
3. You should build and test a prototype before implementation or production.

CHECKLIST - PRODUCING THE SOLUTION

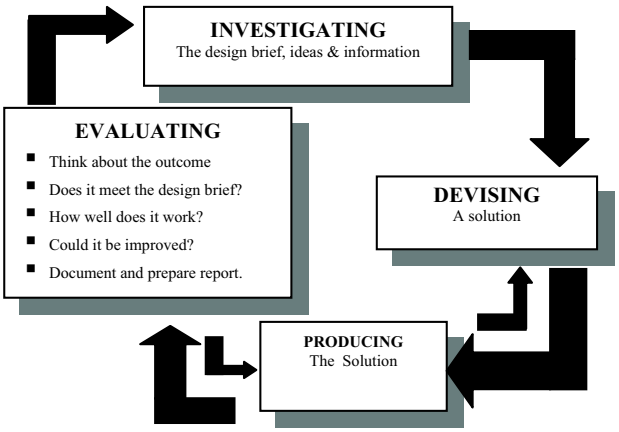
Before proceeding with the stage, check:

- Have you built and tested a prototype?
- What were the outcomes of the tests?
- Were any changes needed?
- Are any new materials or processes needed?
- Are the necessary tools and equipment available?
- Are any jigs or special tools needed during the producing stage?
- Are any new skills needed to produce high standard outcomes?
- Are the necessary materials available?
- Are the necessary systems available?
- Are the processes effective and safe?
- Is everything ready for production to start?

Evaluation of the producing stage

- Has the producing stage been successful?
- What comments can you make about:
- Materials used?
- Processes used?
- Techniques used?
- The time taken?
- Standards reached?
- Quality control?
- Waste management?

EVALUATING THE OUTCOME



How successful is the outcome?
This is the basic question that you have to answer when you have produced or implemented the 'solution'.

You need to consider three things:

1. does it work?
2. does if fully meet the design brief?
3. will modification improve its performance?

The answers to the first two questions ought to be 'yes' if you have followed the designing process.

If the answer to these questions is 'no' or 'maybe', you may have to go back to an earlier stage of the designing process to reconsider or redevelop some part of the solution.

When you are thinking about the success of the outcomes, it is important that you consider both the processes used and the product. For example, a disappointing end product may be due to inadequate ideas, incomplete information about the ideas, wrong materials selected or poor processes.

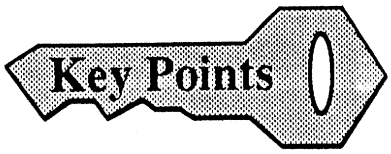
In some cases, the solution may create new and unexpected problems. You may have to go back to the investigating, devising, and producing stages to adjust the solution.

Wherever possible, involve others in the evaluation or review process. Discussion with other people may identify factors that you have not considered.

It is important to be sensitive about the ways technology affects other people and the environment. Some designing solutions can have unexpected and unwanted side effects that can damage the environment, or offend or disadvantage some people in our community. The evaluation stage in the designing process must ensure that unwanted outcomes are found and remedied.

If the designing task is being undertaken for somebody else, they may want to carry out their own evaluation to ensure that the proposed solution meets their expectations.

Important note:
The designer must appraise or evaluate decisions and progress throughout the designing process. Evaluation is not something that happens only at the end of the process.



1. Evaluating involves thinking carefully about the outcomes of the designing process.
2. How well does the solution work?
3. Does the solution satisfy all parts of the design brief?

CHECKLIST - EVALUATION OF THE OUTCOME

Evaluation of the solution

- Did the solution fully meet the brief?
- How well did the solution work?
- How do others feel about the outcomes?
- What is the best feature of the solution?
- What is the least satisfactory feature?
- Are there any parts that can be improved?
- What improvements could be made?
- Are there any unexpected problems?
- Are there any unexpected benefits?

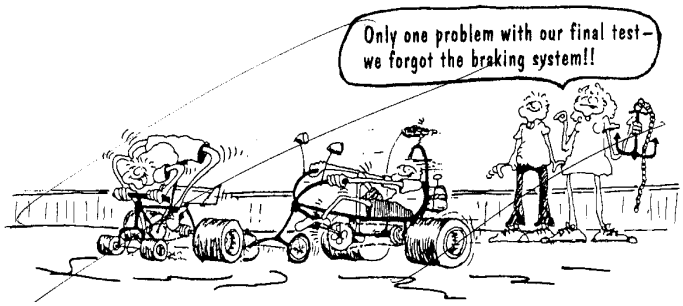
- Can you think of a better solution now?
- Could it offend anybody in society?
- Is the solution cost-effective?

The solution in use

- Is the solution environmentally friendly?
- Is the solution aesthetically pleasing?
- Is the solution ergonomically sound?
- Will users need training or instructions?
- Is the solution safe to use?
- Could a malfunction be dangerous?
- What maintenance could be required?

Evaluation of the designing process

- What things have helped in the process?
- What things have hindered the process?
- Were there unexpected problems?
- Would you do it this way again?
- Was any 'backtracking' needed? Why?
- Were there any problems with materials?
- Were there problems with the systems used?
- Have any compromises been necessary?
- What new learning has occurred?
  - About materials?
  - About processes?
  - About the designing process?
  - Other?



SAMOA

DESIGN AND TECHNOLOGY

"The Design Process"

Part 3: The Design Folio

When students design solutions to problems and make or repair products using the Designing Process it is necessary to provide some documentation to show the thinking that has been used by the student. In the workplace this may be in the form of notes following discussions with the client, or notes about materials chosen or not chosen, sketches of ideas, costings worked out and reminders about things that did not work as expected. In the classroom we call this notebook, the Design Folio. The Design Folio is a place where you record these ideas – sometimes you will use only part of the folio as you practice your Designing skills – other times you will use all parts of the Design Folio.

DESIGN AND TECHNOLOGY PROJECT — DESIGN FOLIO

Student Name: _____

INVESTIGATING THE DESIGN BRIEF — DESCRIBING THE PROBLEM TO BE SOLVED

Section 1 — Clarify the Problem

You have been given a problem to solve. State the problem in your own words.

Section 2 — Note Specifications required for the solution

State the design specifications you have been given. Re-write them in your own words in the form of a list, explaining what each one means.

Section 3 — Explore issues about the problem

Explain why this problem needs to be solved for your client.

INVESTIGATING IDEAS AND INVESTIGATING INFORMATION ABOUT IDEAS

'PROBLEM ANALYSIS'

Section 4 — Investigate ideas for solutions

Go to your list of design specifications. For each specification:
Write it out
Investigate to find as much as you can about the specifications
For each investigation, write a brief report.

Specification 1

Investigation (what I researched)

Report (what I found out)

Specification 2

Investigation (what I researched)

Report (what I found out)

Specification 3

Investigation (what I researched)

Report (what I found out)

Specification 4

Investigation (what I researched)

Report (what I found out)

Specification 5

Investigation (what I researched)

Report (what I found out)

Specification 6

Investigation (what I researched)

Report (what I found out)

Section 5 — List of materials and equipment

Make a list of materials you are considering for use.

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Make a list of all the equipment you might possibly use.

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*Section 6 —**ANALYSING FACTORS***

Analyse materials and equipment needed by completing the grid below. Write the names of the materials and equipment and procedures you have chosen/used in the left hand column. Use the best headings to help in your analysis of your possible materials, equipment or procedures.

		Factor Analysis (select what factors are most sensible for your project).					
		Cost	**Durability**	**Availability**	**Ease of Use**	**Etc.**	**Etc.**
MATERIALS, EQUIPMENT AND PROCEDURES	**Materials**						
	Equipment/Tools						
	Processes						
	Etc.						

DESIGNING THE MOST LIKELY SOLUTION

SOLUTIONS AND DECISION

Section 7 — Describing three solutions

Describe 3 possible solutions to the problem that respond to client needs and/or specifications.

Possible Solution 1

Describe briefly

Draw a labelled sketch or plan to show what it would look like.

Use the answers in your grid in Section 6, to explain why you are suggesting this solution.

Possible Solution 2

Describe briefly

Draw a labelled sketch or plan to show what it would look like.

Use the answers in your grid in Section 6, to explain why you are suggesting this solution.

Possible Solution 3

Describe briefly

Draw a labelled sketch or plan to show what it would look like.

Use the answers in your grid in Section 6, to explain why you are suggesting this solution.

Section 8 — The best solution

Identify and justify the proposed solution.

Choose ONE solution from *Section 7*. This will be the solution you are going to use.

List the reasons why this is the best solution.

■
■
■
■
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■
■
■
■

Explain how it fits the specifications described in *Section 2*.

Specification 1

Specification 2

Specification 3

Specification 4

Explain why the materials and equipment chosen are the most appropriate – refer to *Section 5* and the grid in *Section 6* for reasons.

Materials chosen and reasons:

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Equipment chosen and reasons.

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■

THE INTERVIEW

Your teacher may interview you so you can explain in your own words about your research and investigation of the product you plan to make. (you are explaining what you have written in your Design Journal).

These are the kind of questions you will be asked:

1. *Describe the problem and explain why this problem needs to be solved.*
2. *Explain which specifications caused the most difficulty for you, and why.*
3. *Explain how the solution you have designed will meet the needs described in the brief you were given.*
4. *You have investigated a number of materials/processes that could possibly be used in your solution:*
    a. *Select one or two you have chosen to use and explain why you have decided to use these.*
    b. *Select one or two you have chosen <u>not</u> to use and explain why you have decided not to use these.*
5. *Explain why the solution you chose best met the specifications of the Design Brief.*
6. *Explain the plan you have drawn (in Section 7) for your chosen solution.*
7. *Explain the reasons for your choice of equipment.*

PRODUCING THE SOLUTION

In each project your teacher will assess the quality of your skills in the use of equipment, tools, etc., in the making of your product.

- Competently perform the procedures required
- Use equipment safely and competently
- Select and use materials appropriately
- Use oral, written and graphical instructions
- Complete task within planned timeline.

For each task, the set of particular skills being tested will be provided, and your teacher may use a Skills Test Checklist like this one.

SKILLS TEST

MARK SHEET

Student: _____

School: _____

Module Name: _____

	Competency Demonstrated		
Skills Demonstrated	**Competent** (***5 marks)***	**Developing** ***(3 marks)***	**Still to be Demonstrated** ***(1 mark)***
Procedures required			
Use of equipment			
Selection and use of materials			
Use of instructions			
Completing task on time			
TOTAL MARK (maximum 30)			

EVALUATING THE OUTCOME

Section 9 — How well has the Design Brief been met?

You were given a problem to solve, together with a set of Design Specifications. How well have the specifications been met?

For each specification - write the specification as you were given in *Section 2*. List how the outcome was successful in meeting this specification. Then list how it was unsuccessful (areas where it could have been improved.)

Specification 1

In what ways was the outcome was successful?

•
•
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•

In what ways was the outcome not successful (areas where it could have been improved)?

•
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•

Specification 2

In what ways was the outcome was successful?

•
•
•
•

In what ways was the outcome not successful (areas where it could have been improved)?

•
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Specification 3

In what ways was the outcome was successful

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•
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In what ways was the outcome not successful (areas where it could have been improved)?

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Specification 4

In what ways was the outcome was successful?

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In what ways was the outcome not successful (areas where it could have been improved)?

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Specification 5

In what ways was the outcome was successful?

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In what ways was the outcome not successful (areas where it could have been improved)?

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Specification 6

In what ways was the outcome was successful?

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In what ways was the outcome not successful (areas where it could have been improved)?

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Section 10 — What changes would I make if I could do it again?

1. How well does it work?
2. Could it be improved?
3. What remains to be done?

Go back to the grid you used in Section 6 to make decisions about materials and equipment and processes to be used in producing your outcome.

How appropriate were your choices of <u>materials</u>?

Knowing what you do now, having made your product (outcome) are there any changes you would have made to these choices?

How appropriate were your choices of <u>equipment</u>?

Knowing what you do now, having made your product (outcome) are there any changes you would have made to these choices?

How appropriate were your choices of processes?

Knowing what you do now, having made your product (outcome) are there any changes you would have made to these choices?

How effective was your plan?

Was it detailed enough?

Were any steps left out? If so describe these.

Did your plan consider safety and hygiene issues? How was this done?

As you were following the plan to make your product, did any new design ideas emerge?

What were these?

Did you adapt your plan to include any of these ideas? If so, explain what they were and how the design was changed.

How efficient was the process you used?

How efficient was the product you designed?

Was your design correctly costed? How closely were you able to meet cost constraints in the brief?

Is there anything you would have done with your product if you had more time to work on it? Describe what you would have done if you had more time.

Section 11 — Conclusions

Taking into account all the things you have discussed in *Sections 1 and 2*, discuss how well do you think you have met the design brief? You must give reasons to justify your conclusion.

Consider and discuss, giving reasons:

The features of your product that you are happy about

How well does it meet the needs specified

What you have learned about making the product

If making the product again, changes you would make:

To the design

To the materials used

To the equipment used

To the processes used

DISCUSSION

You are required to present a structured reflection (lasting about 5-10 minutes) on the success of your product as a response to the design brief. (You are explaining what you have written in your evaluation report).

It is very important that you explain the reasons for your decisions (WHY you chose to do things)?

You will discuss and explain:

- The main strengths of your finished product (for each specification, the ways the outcome was successful)

- Which specifications caused the greatest difficulty, and why (refer to section 1 of your evaluative report)

- The client's needs were described in the specifications. How well does your product meet these needs?

- What you have learned about making this product. Discuss, giving reasons for each answer:
    - How effective was your planning?
    - What changes would I make if I were to do this again?
        - Changes to my design
        - Changes to my materials