Contents

Foreword

Design and Communication Graphics affords the student the opportunity to develop skills in graphical communication, creative problem solving, spatial visualisation, design capabilities, computer graphics and CAD modelling.

The Student Assignment provides the medium through which some or all of these skills may be expressed and assessed. 40% of the total marks in Design and Communication Graphics are allocated to the production of the student assignment. Because of the unique situation this assignment presents, T4 in conjunction with the NCTE, issued a sample brief to ten schools nationwide in March 2008. The students in these schools were given a limited timeline, six weeks in total, to work through the sample student assignment and record their experience of the process.

Some areas of particular interest to students and teachers, which were highlighted by the experience of working through the pilot Student Assignment, included the importance of structured file management, time management, protection of data, acquisition of the necessary I.T. skills and comfort in freehand sketching.

Participating students and teachers concluded that the necessary skills should be developed and practiced throughout the teaching of the course and not solely during the completion of the assignment. Skills such as, freehand sketching to communicate ideas, appreciation of aesthetics and good design, ability to conduct effective research, constructive reflection, presentation skills and competence in the use of CAD as a design tool, were seen as essential for the successful completion of an assignment.

This further emphasised the importance of an integrated approach to the teaching of Design and Communication Graphics. CAD should be seen not just as a means of accurately modelling designs but also a medium through which students can visualise and comprehend concepts in a manner previously inaccessible. In the same way, freehand sketching skills may be acquired and developed through the exploration of 3-dimensional problems and the application of geometric principles in their solution.

The ability on the part of the student to communicate the thought process throughout the production of the assignment is also deemed as being of utmost importance. It is essential this thought process is evident to any person that reads, or indeed assesses, the portfolio. Annotations, sketches, questions

and conclusions on each section of the assignment will allow the student to communicate their thoughts distinctly to the reader. Therefore, it is critical that the process of reflection become an everyday activity in the Design and Communication Graphics class.

The purpose of this document is to offer guidance to both teachers and students on possible approaches to successfully completing the DCG Student Assignment by drawing on the knowledge, experience and wisdom gained from the development of the Student Assignment process to date. The advice given is informed by the recommendations made by NCCA Course Committee for Design & Communication Graphics (Appendix 1) regarding the outputs of the assignment.

T4 Technology Subjects Support Service
September 2008

What is a DCG Student Assignment Brief?

The DCG assignment brief is a written description that outlines the problem posed and the requirements of a design situation.

There are two distinct parts to the assignment, (a) and (b). Part (a) deals with the analysis, investigation, evaluation and illustration of an existing object(s). This section is considered to be essential preparation for Part (b). Part (a) requires you to closely observe, examine, compare and contrast the design features of the object(s) while using sketches and SolidWorks drawings to enhance the overall outcome. Part (b) is more about the actual process of designing, whether it is modifying existing design features of the object in question *or* developing a completely new design solution to the brief. The success of Part (b) is dependent on the analysis and the research undertaken in completing Part (a).

The DCG Student Assignment Brief, which was issued in the pilot project, is outlined below:

Design and Communication Graphics
Student Assignment
Pilot Brief

Exterior lighting in the vicinity of our front doors and entrance ways serves to enhance appearance and increase safety and convenience. This lighting can be provided by a variety of lamp types, from traditional lantern styles to sleek and modern wall mounted units. Many of these have additional features such as daylight and/or motion sensors, low energy (CFL) bulbs to minimise energy use while models with built in CCTV capability are also available. Some are designed to operate independently of connection to an electrical supply and take their energy from other sources.

All are designed and manufactured to withstand exposure to wind and rain in varying degrees, while retaining a pleasing appearance.

(a) (Outputs 1 to 6)
  You are asked to investigate developments in exterior domestic lighting. Analyse and communicate these developments graphically
                                    and
(b) (Outputs 7 to 9)
  1. Suggest graphically the modifications which you would make to an existing light

                                    or

  2. Develop and graphically communicate an exterior light as a concept design.

   Note: Output 10 should be considered at all points in completion of your Assignment.

How important is the Student Assignment?

The Student Assignment is worth 40% of the overall marks for the subject.

Of the 160 marks allocated to the student assignment, approximately two thirds are allocated to Part (a) and one third to Part (b).

How am I expected to know everything about the particular area in which the Student Assignment Brief is dealing with?

You're not. The vast majority of students and teachers are in the same position as you. However, with careful and thorough analysis of the brief you will lay the foundation for an excellent assignment. Throughout the assignment you will find yourself taking your own unique direction through the design situation.

Where do I start?

Simply start with Output 1 and progress to Outcome 9 in chronological order. However, it is important to note that the process of design is cyclical by nature, and further research may uncover areas which were not previously considered. This in turn may warrant a revision of any of the previous outputs.

What is Output 1, how much do I need to produce?

Output 1 – Exploration of the brief and presentation of existing artefacts in graphic format

Students at Higher level are expected to produce one to two A3 sheets for this output. The same is expected at Ordinary level.

Where do I go from here?

Explore the brief carefully. A very useful group exercise at this stage is ***brainstorming***. Through group discussion, this exercise serves as vital preparatory work for identifying the direction you may wish to go with your own individual assignment.

Brainstorming is a group creativity technique designed to generate a large number of ideas for the solution to a problem. Exploring a brief is essentially a brainstorming process. All good design companies start with this exercise. Remember:

- Focus on quantity.
- No criticism is allowed.
- Unusual ideas are welcome.
- There are no wrong answers at this stage.
- Combine and improve ideas.

These three photographs show a group of students actively participating in a brainstorming session during the pilot assignment. On this occasion one particular student records all the suggestions on the interactive whiteboard. The group is seated in a U shape to generate discussion. The teacher takes a passive role but facilitates and guides the situation as necessary.
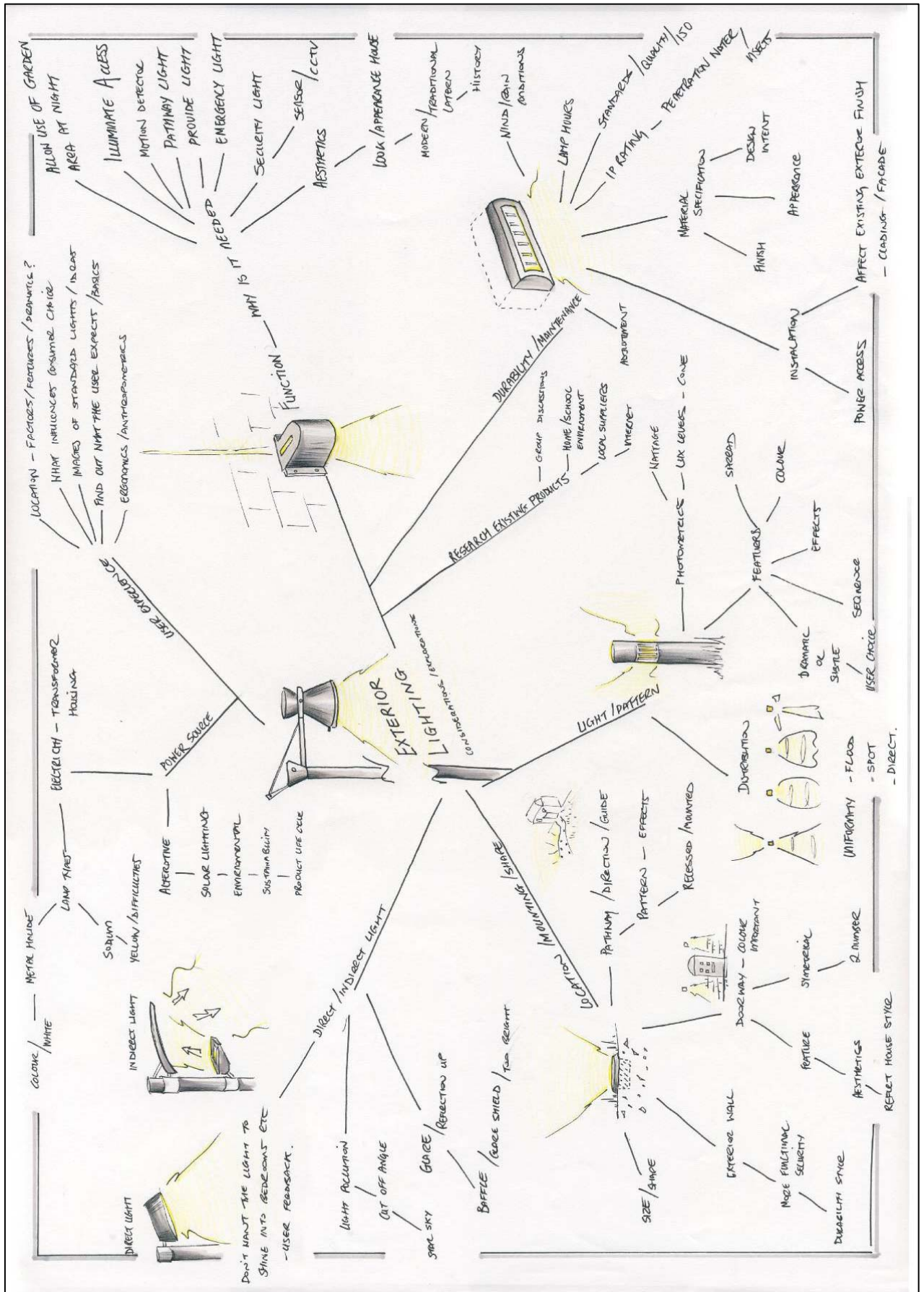
Highlighting keywords and phrases.

- Highlighting keywords and phrases can help to isolate elements and break down the design situation one step at a time.

- From your own experience what do you know about any of the keywords?

- Keep adding more and more suggestions to the diagram.

- After all possibilities as a group have been exhausted, each student should capture the discussion in a personalised 'mindmap' or 'spider diagram'. It could take two or three attempts before something resembling the example on the next page is generated.

Exterior lighting in the vicinity of our front doors and entrance ways serves to enhance appearance and increase safety and convenience. This lighting can be provided by a variety of lamp types, from traditional lantern styles to sleek and modern wall mounted units. Many of these have additional features such as daylight and/or motion sensors, low energy (CFL) bulbs to minimise energy use while models with built in CCTV capability are also available. Some are designed to operate independently of connection to an electrical supply and take their energy from other sources.

All are designed and manufactured to withstand exposure to wind and rain in varying degrees, while retaining a pleasing appearance.

- Evaluate all information known about the design situation posed and identify areas which will require further research. In this way scrutinising the brief will direct you along the necessary research paths.

- A guest speaker, who is knowledgeable in the area under investigation, may be invited to speak to the group in relation to various aspects which may be overlooked in the brainstorming session.

What methods of research should I use?

There are two types of research you should undertake – Primary Research and Secondary Research.

Primary Research

This involves the observation of associated objects in your immediate environment or locality. For example the students shown here are photographing and recording important details including dimensions of some of the exterior lights in their vicinity.

Secondary Research

This may include any or all of the areas listed below.

<div align="center">

Libraries - Books - Magazines - Catalogues - Interviews

Surveys - Supply Stores - Exhibitions - Websites

</div>

Inspiration will be derived from all of the above methods of research. Keep an open mind as you work through them. Internet research is probably the most accessible method but it must be clearly stressed it is not the only one.

"I think we are sometimes too quick to go straight to the web for inspiration or to look something up, so much so that we forget to take a look around our environment and take inspiration from that." James Dyson 2008

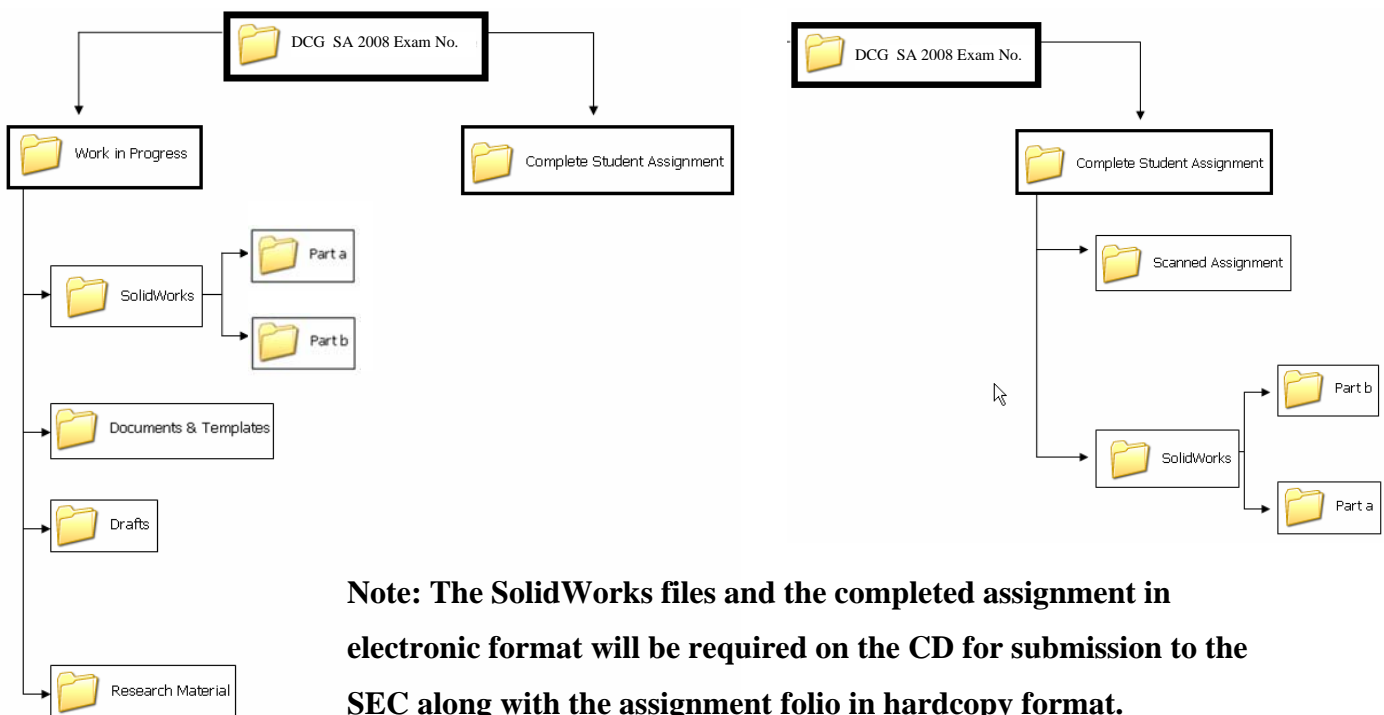**What is the best way to store all the information I receive?**

Hardcopy materials

You will need an A3 folder to store all the hardcopy items such as photographs, charts, practice sketches and so on. Although this folder is not submitted as part of the finished project it is important that all research materials are stored for the completion of the various outputs.

Electronic data

The following approach to file management is suggested:

- A new folder must be created within your student profile to store all electronic materials for the assignment. This folder should be named *"DCG S.A. 2008 Exam Number"* for example.
- All work relating to the assignment must be saved to this folder. This will ensure that all work can be saved onto a CD for submission to the SEC.
- Sub folders should be created to manage files efficiently, an example is shown below left.
- Two sub-folders should be created within the 'SolidWorks Files' folder;
    - A folder for Part (a) of the assignment
    - A folder for Part (b) of the assignment
- Upon nearing completion of the assignment the folder "Complete Student Assignment" should be created with subfolders for the Scanned Assignment and the necessary SolidWorks files.

Note: The SolidWorks files and the completed assignment in electronic format will be required on the CD for submission to the SEC along with the assignment folio in hardcopy format.

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A lot of the images I have collected do not include dimensions. How will I be able to model one of these later in Output 4?

You will need sufficient detail of the particular item you intend to model in Output 4. Inferring detail, scaling or estimating the dimensions are all skills which are necessary when creating a model based on images. However, every effort should be made to obtain as much information about the object being modelled eg. specifications, dimensions, method of assembly etc.

How do I present the information I have collected?

Your thought process should be clearly conveyed in the manner in which you present your analysis and investigation. Individual approaches are encouraged including photographs, sketches, handwritten notes or typed details.

The following points should be considered in your approach to output 1;

- The presentation, in whatever format you choose must tell its own story, as opposed to a random mural of images/sketches/annotations that the reader is expected to interpret for themselves.
- Virtually any conceivable method of presentation can be used to convey the thought process.
- Try to be as creative and unique as possible.
- If you have prior knowledge of any word processing/desktop publishing software you should use it here.
- Present one or two A3 pages in a graphic format of your choice. These can include sketches, annotations, digital photos, images from magazines, books, newspapers and the Internet.

The presentation must tell its own story through images, sketches and annotations.

This example (right) looks quite good. However, further examination reveals:

- No chronological order or sequencing.
- No information in the form of text.
- A rather cluttered array of photographs.
- No indexing.
- It doesn't tell a story.
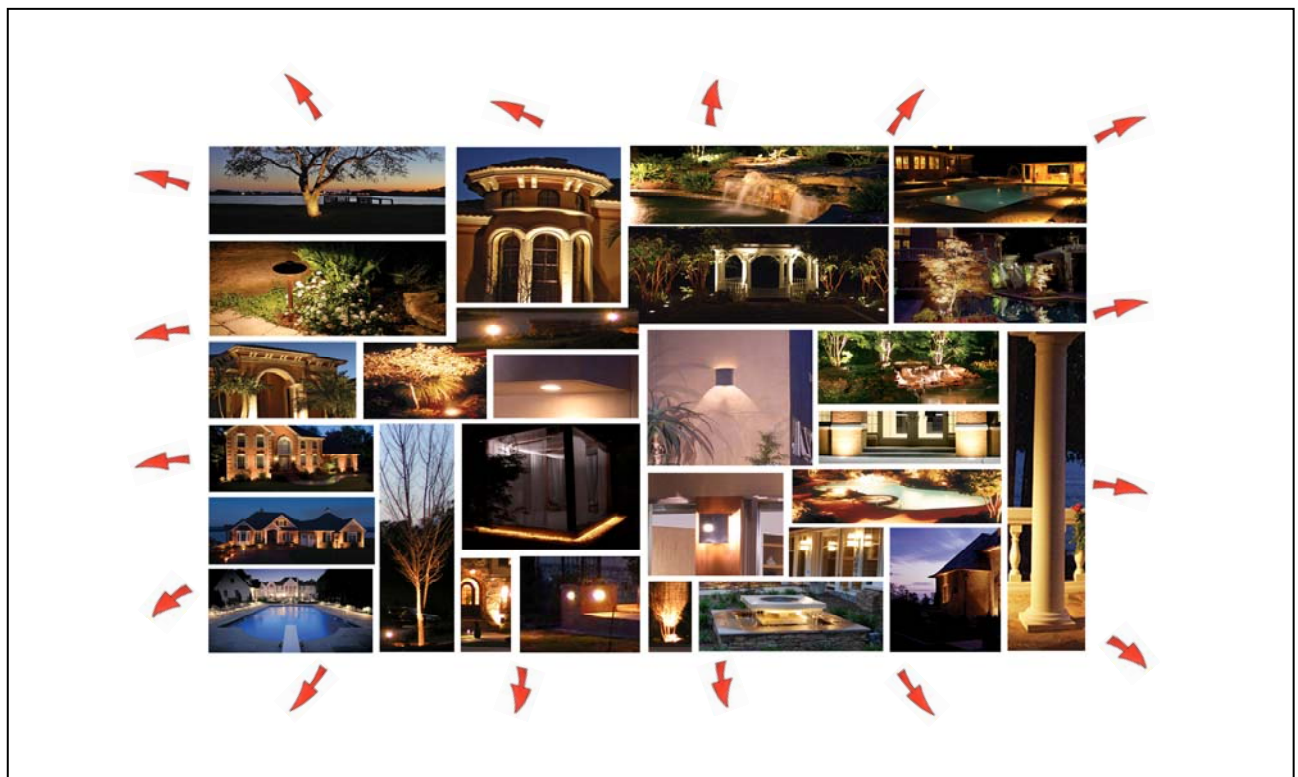
One option would be to reduce the size of the presentation thus allowing an area for annotations and sketches to convey the significance of the selection of images and the thought process involved.

This example gives a very clear separation of all the various categories in which the analysis was conducted, i.e. aesthetics, materials, efficiency, safety and uses. However, the presentation of the work could be improved if a greater link was created between the text and the images.

The images only convey one aspect of the investigation, the light source. Maximum use should be made of the available space to convey fully the thought process.

In this example, the connection between the various images is portrayed by the use of annotations. It may not be necessary to use up a significant amount of page space rewriting the assignment brief.

Sketches and hand-written annotations could be used to enhance and personalise the presentation in the available space.

- The images with common features could be grouped together to satisfy the requirements of the brief. In the case below, presenting the lights in chronological order was in keeping with what was required in the design solution.

- Notes and explanations can be inserted wherever it is deemed necessary.

- The example below is a magnified section of another approach to meeting the requirements of Output 1. Note the grouping of similar features in relation to weather exposure. The slight overlapping of photographs along with text adds to a more appealing appearance.

- Experiment with various types of print paper other than standard cartridge paper. If your output is in electronic format make sure the paper you select is suitable for the classroom printer.

  - Heavy gauge cartridge paper
  - Coloured paper
  - Watercolour paper
  - Coated paper / Photographic paper / Trace paper

- Keep your layout very clear. It should be easy to follow but unique to your creative ability. It should have a logical format and evidence of good research.

The example below (left) uses visual effects on glossy photographic paper and the text is supplied in the form of a transparent trace overlay (right).
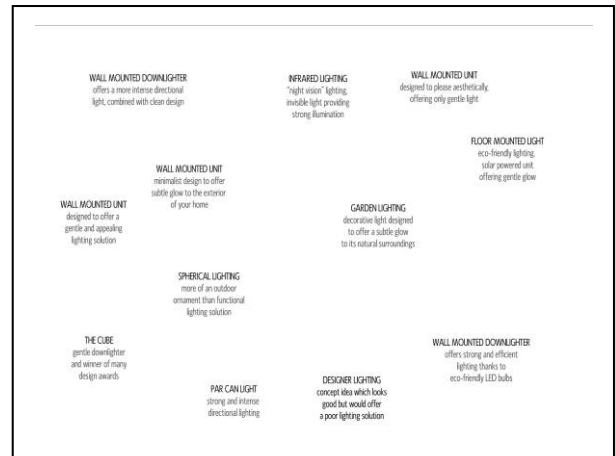
Time management for each output?

Time management is a crucial aspect of the overall project. Each teacher may decide to allow different time constraints for each individual output. If so, a spreadsheet depicting the dates and projected outcomes could be clearly displayed in the classroom. The example shown overleaf was one used by a teacher on the pilot programme and serves as a guide, open to interpretation by teachers or students.

Student Name	Distribution of brief	Output 1		Output 2		Output 3		Output 4		Output 5		Output 6		Output 7		Output 8		Output 9 & Completion	
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
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18																			
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21																			
22																			
23																			
24																			

Output 2

What is Output 2, what do I need to produce?

Select two images and illustrate/explain the main design features. Insert the main dimensions. Compare and contrast the main design features of both using suitable freehand sketches and presentation techniques.

Students at Higher level are expected to produce two to three A3 sheets for this output. At Ordinary level one to two sheets are expected.

What are the best two images to select?

Select two images from the existing objects in Output 1 and compare and contrast them under several headings. These may include features such as:
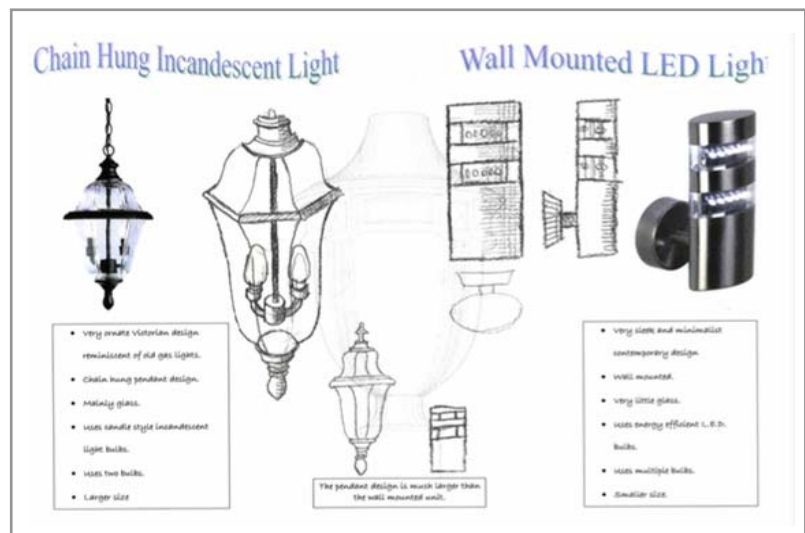
Physical size (ergonomics) - **Shape** (form) - **Material** (durability) - **Finish** (exposure to the elements) – **Texture** - **Style** (features that link it to a particular period) - **Date of manufacture / Manufacturer** - **Weight** - **Cost** – **Colour** - **Other design features……**

Note: One of these chosen artefacts must be modelled using SolidWorks in Output 4.

How should I present this output?

The communication of your ideas, as in Output 1, should be clear and easy to follow with ample information demonstrating a good knowledge of the chosen artefacts.

The example shown presents the selected objects, represented by digital images, sketches and text, which compare and contrast their design features. Like the other samples in this section, they have been taken from the recent pilot project dealing with '*Exterior Lighting'*. The illustrations above could possibly have been enhanced with more detailed written information. The overall dimensions of the objects should also have been included here. More relevant information could have been included in the available space. Colour rendering could have been used to further enhance the presentation

The second page to this output shows a clear set of freehand sketches. These sketches identify features such as mounting techniques and the advantages of one over the other, the efficiency of LEDs over filament bulbs, surround illumination technique and light pollution, aesthetics, style, materials and cost. More detailed investigative research could have been included in annotation format.
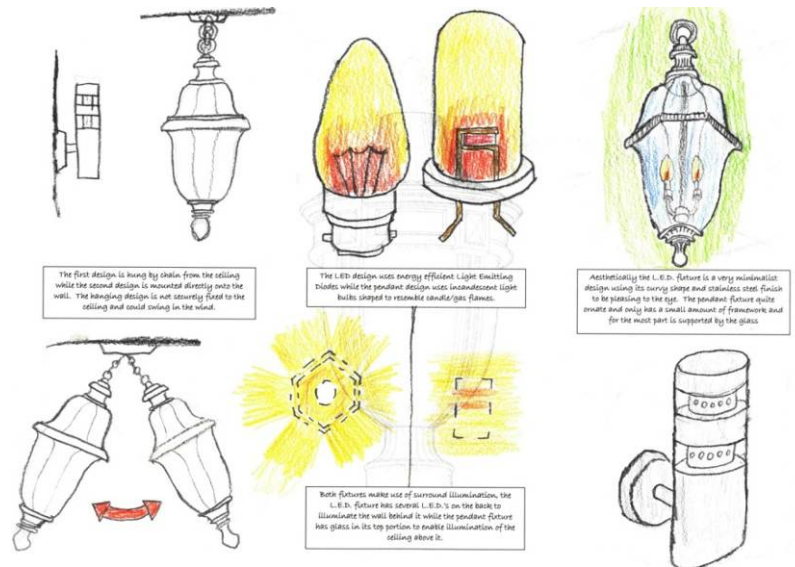
Shortcomings in the designs could have been identified which will inform the modifications/concept design in Part (b)

This example shows two contrasting exterior lights represented using freehand sketches. The pendant outdoor chandelier on the left is enhanced using pastels (if choosing this form of representation don't forget to spray it with a fixative to prevent future smudging) while the wall mounted lamp on the right is finished with watercolours. Hand written notes (annotations) including dimensions are inserted.
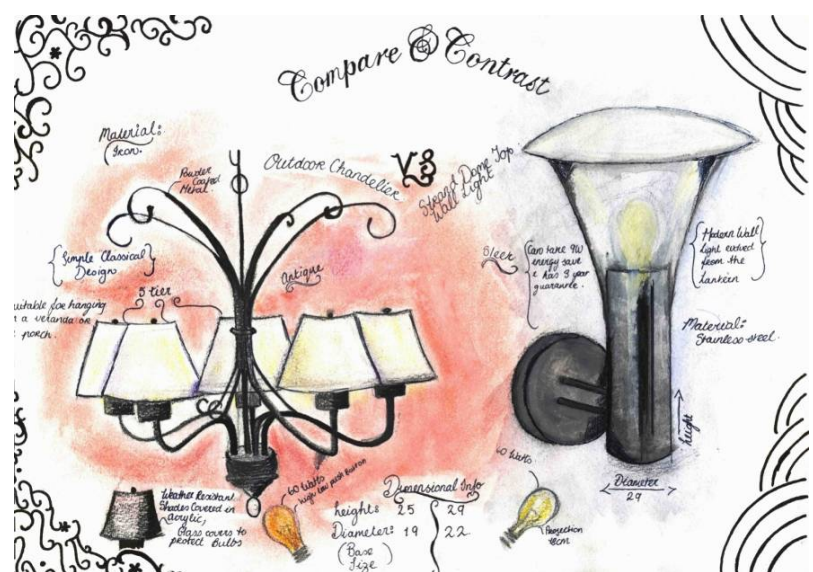
These annotations are where the real *'critical thinking'* takes place. Insert these throughout this output as much as possible. It demonstrates a good understanding for the design features of the article and further prepares the student for deconstructing the item during the modelling phase.

The first step in completing this output is to analyse both objects and compare and contrast their design features. The second stage of the process is to choose suitable presentation techniques and media to present this information. Decide what techniques you will use when freehand sketching and

practice them several times before producing the final presentation.

These may include:

<div align="center">

Cross hatching / Pointillism - Colour pencils - Water-colours / Gouache

Pantone / Pro markers – Pastels - Shadows / Shading

</div>

The choice of paper used will depend on which of these rendering techniques you apply.

These may include:

- Heavy gauge cartridge paper (pencils, charcoal, pastels)
- Coloured paper (contrasting background)
- Watercolour paper (watercolours / gouache)
- Coated paper / Photographic paper (markers)
- Trace paper (pencils / markers)

What is the reason for this output?

The purpose of this output is to:

- Draw your attention to the main components and design features that make up the objects you are analysing.
- Encourage awareness of **aesthetics, durability, dimensions, materials and other relevant characteristics of the product** (see example below).

It is important that the model is broken down into its component parts, thus creating an awareness of how it goes together, thereby informing the modelling of the artefact in SolidWorks.

The samples shown throughout this chapter are taken from the recent pilot project and are not intended to be definitive but they should act as examples of some of the several ways in which this output may be presented.

The student is encouraged to be as expressive as possible but in a clear and concise format.

Good quality factual information and dimensions of the chosen objects should be included.
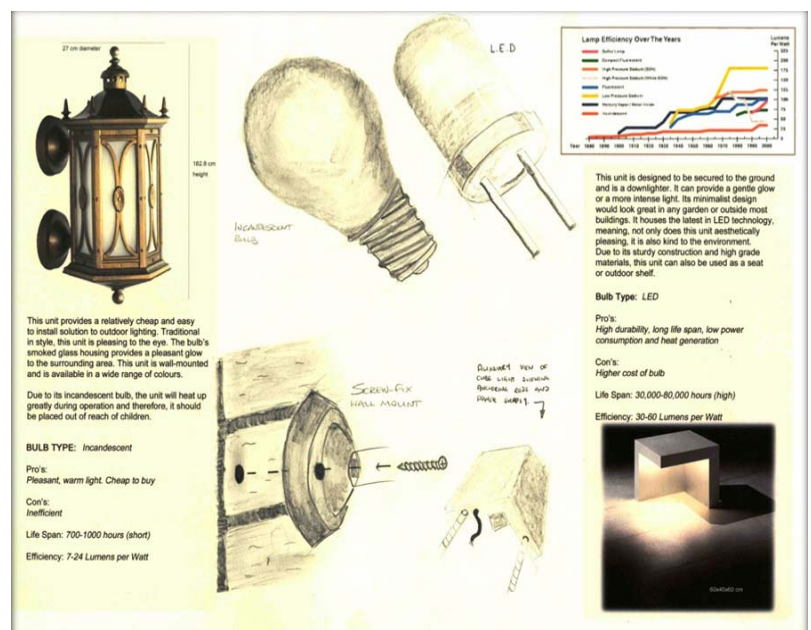
Which of the 2 artefacts shall I select to develop further in Output 3 and 4?

At higher level the artefact selected should contain at least 5 or more components.

At ordinary level an artefact with 3 or more components is required.

The object selected should have the potential to demonstrate the range of skills that the student has acquired in SolidWorks over the course of the DCG programme.

Contemporary styles tend to be sleek and minimalist in design and may not provide enough of a challenge during the modeling process. This is evident from the example shown (left). The lantern (right) was chosen because it offered the potential of demonstrating a wider range of skills.

Output 3 - Choose one of the artefacts and make a detailed graphical presentation of this artefact. This should include a rendered 3-dimensional freehand presentation quality drawing.

How many sheets do I need to produce?

Students at Higher level are expected to produce at least <u>one</u> A3 sheet for this output. The same is expected at Ordinary level.

**What exactly are you asked to do in output 3?**

At this stage in the student assignment we have closely examined the composition of two separate artefacts. In output 3, you are required to select one of the artefacts and make detailed graphical drawings of it to include a rendered 3-dimensional presentation quality freehand drawing.

Some of the following views could be used in the production of this output.
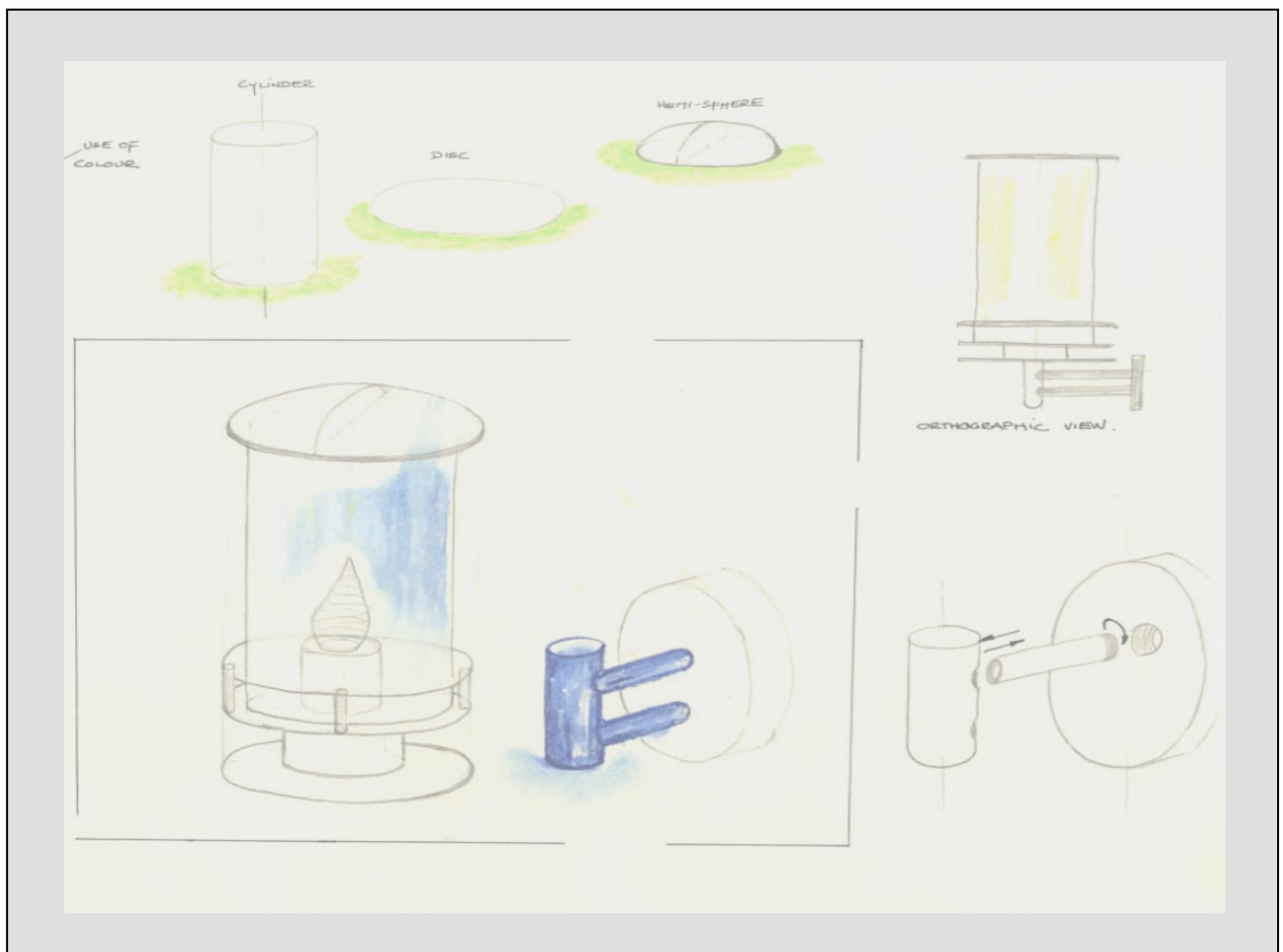
Having chosen one of artefacts what is my next step?

At this stage, a good deal of knowledge has been acquired about the artefact, which should include its shape, size and how the parts go together. Now you need to decide on what further information you are going to convey in this output. You are trying to represent and not reproduce the artefact with sketches. It is important that the sketches are in proportion; this is as simple as making sure that the width and height in your drawing is proportionally similar to the actual object.
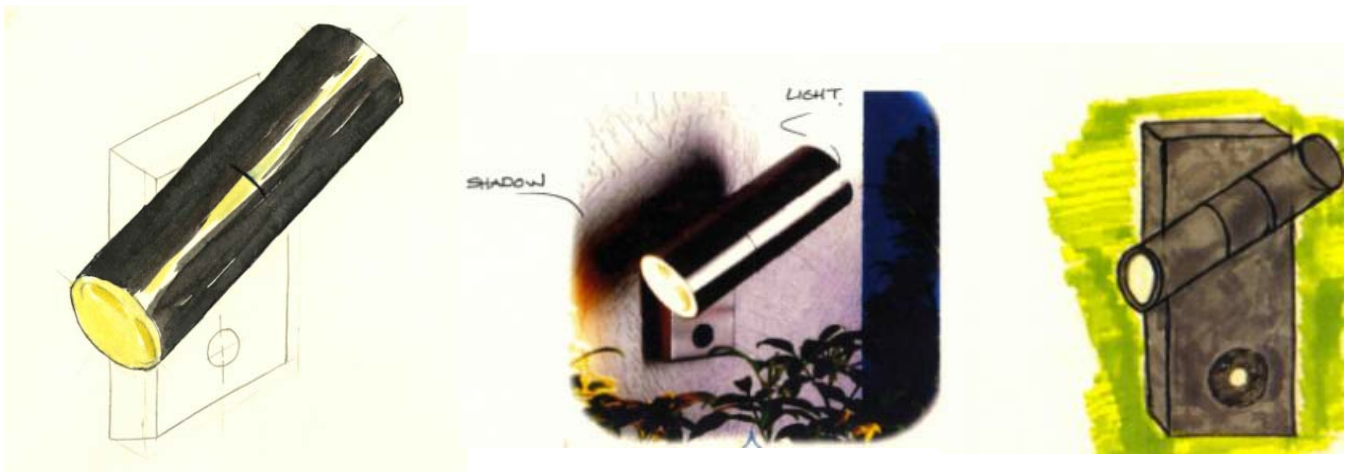
If we look at the sketches shown above it is clear that the sketch on the left has clearly observed and represented the proportions of the exterior light effectively, while the sketch on the right has failed to do so. You don't need to know the actual measurements of the artefact: instead measure the relative sizes of the elements to achieve an accurate representation. This can be done using various methods as shown.


Do I have to use freehand sketching to complete this output?

Yes, drawing on this sheet must be sketched. You don't have to draw your initial sketches on quality paper or use watercolours or pantone pens, don't be self conscious just sketch and develop your own style. Freehand sketching is really important; it's a way to show people what you are thinking, to

record your ideas and to solve problems. Sketching also helps to capture the design process and promotes reflection and debate. Progress in freehand sketching will only take place if you practice.

If the chosen object is very complex in its shape break it down into shapes that your recognise. Sketch these parts roughly and do many drawings until you have the overall form clear in your head. Remember that many complex objects are based on basic geometric shapes. Start sketching roughly and do many practice drawings until you are happy with the shape. Do not be afraid to add text to help explain a particular detail. Show your sketches to others. Do they understand what the drawings show? Do they have suggestions? Some examples of practice sketches are shown on the following sheets.
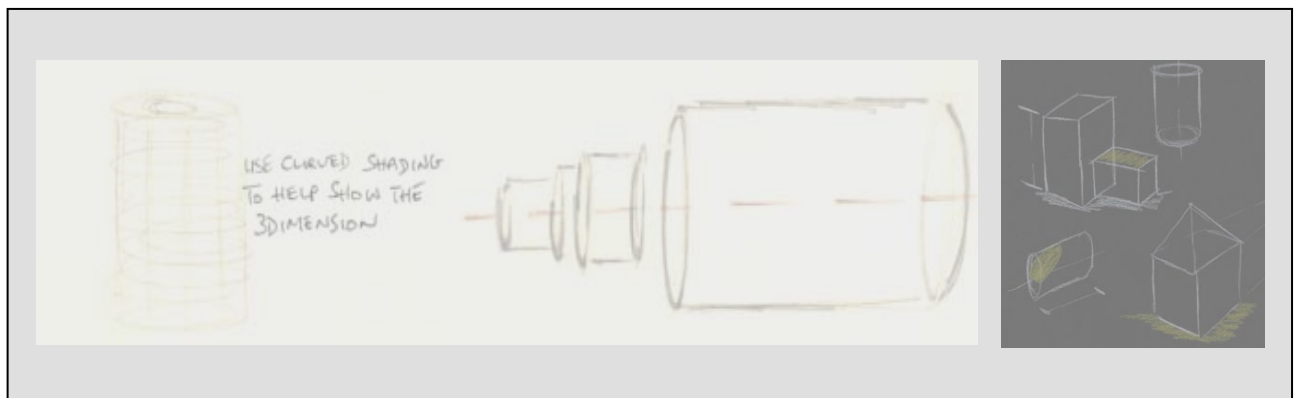
How should I decide on which media to use?

Paper is available in a wide range of weights, textures and colours. The character of the paper can influence a drawing quite dramatically, so it is important to choose carefully.

Is it pen, pencil, markers, or is it a mixture of several. Is it watercolour paper, cartridge paper, colour card, glossy paper, tracing paper or is it a collage of some of them. That decision must be made by the individual student. Work with media that you are comfortable with or ones that you have used before. Some of the following were used by the students in the pilot project.

2B and 3B graphite pencils - Polychromos pencils – Markers - Chalk pastels - Felt tip pens

Watercolours - Tracing paper - Watercolour paper - Colour paper - Cartridge paper - Glossy paper

How many drawings must I sketch in this output?

It is not a question of quantity, but rather quality. However, one of your drawings must include a rendered 3-Dimensional presentation quality freehand drawing. Sketching is about recording and communicating your ideas on paper in a manner that allows others to clearly understand your train of thought. For example, if you are representing an exterior light you could sketch out the individual parts and their relationship with each other. The following sheet shows a students initial sketches.

How should I layout my sketches on the sheet?

The composition and layout of your sketches on your page will depend on your individual graphic style and the depth of information you want to communicate. Make sure that the rendered 3-dimensional presentation quality freehand drawing captures the viewer's attention. To ensure that this occurs this sketch should be larger than any other sketches and in the centre of the sheet. All other sketches and annotations should be placed around the edges of the sheet, by doing this your are focussing the viewer's attention towards the middle of the sheet. The following sheet may be considered as one possible layout.
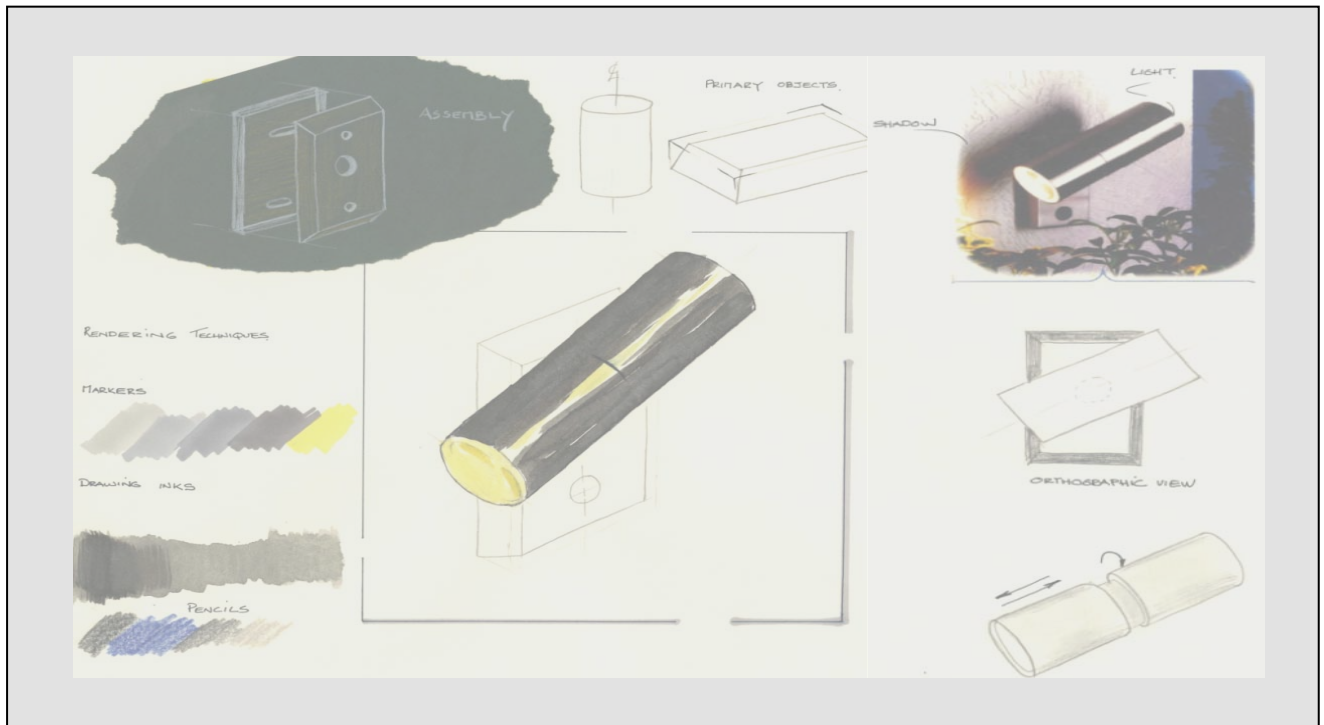
How do I render the 3-dimensional presentation quality freehand drawing?

To generate a good rendering, one must be familiar with the 3 H's. How to draw? How to see? and How to apply? Here we need to concentrate on how to apply rendering to the artefact that you have already sketched lightly. Rendering is based on a solid understanding of light and its characteristics, including shade and shadow. Any media type can be used to render. Graphite pencils, felt tip pens and charcoals can be used to give a black and white finish, while polychromos pencils, markers and pastels will add colour to the artefact as shown.

Each media has its own benefits and challenges. Make sure that you experiment on practice sketches so that you are confident to use them on the final sketch. Be sensible and do not over render an object. Remember, we are looking to bring the initial pencil sketch of the artefact to life.

Output 4 – Generate a detailed computer model, comprising at least 5 parts at Higher Level and at least 3 parts at Ordinary Level. Economy of design and design intent will be considered in the marking of the assignment.

- **An electronic file**
- **An e-drawing**

Output 5 – Produce: detailed orthographic views, a pictorial which has been coloured and with textures applied and an exploded view.

Set-up of Computer Facilities in DCG Room

DCG Network

- All computers should be networked so that each PC can communicate with one another and access printers, the Internet and other hardware devices. Students may access their individual accounts through any computer and an automated backup of student material can be facilitated.

- It is impossible to guarantee the safety of data if it exists in only one place. All files should be backed up automatically every 3 to 7 days. This process minimises the effects of any potential loss of data.

- Backup media should be stored in a safe location, ideally located in a remote area away from the school.

- Adequate protection such as up-to-date anti-virus software and a firewall must be put in place.
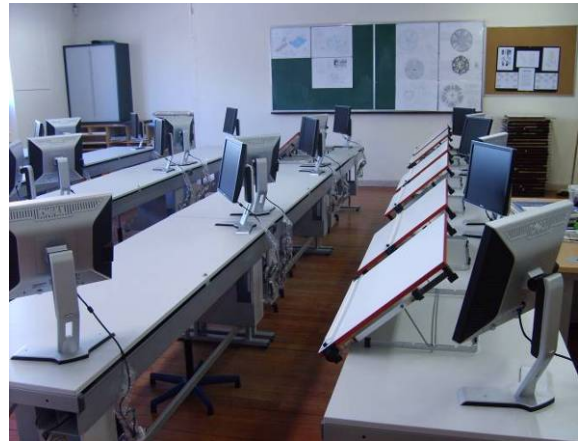
User Accounts

- An account should be created for each individual student upon commencement of DCG.

- The account should provide an individual logon/username/password and folder for each student.

- The students may only access/save files/view contents of their own folders.

- Students must be alerted to the importance of keeping their username and password confidential.
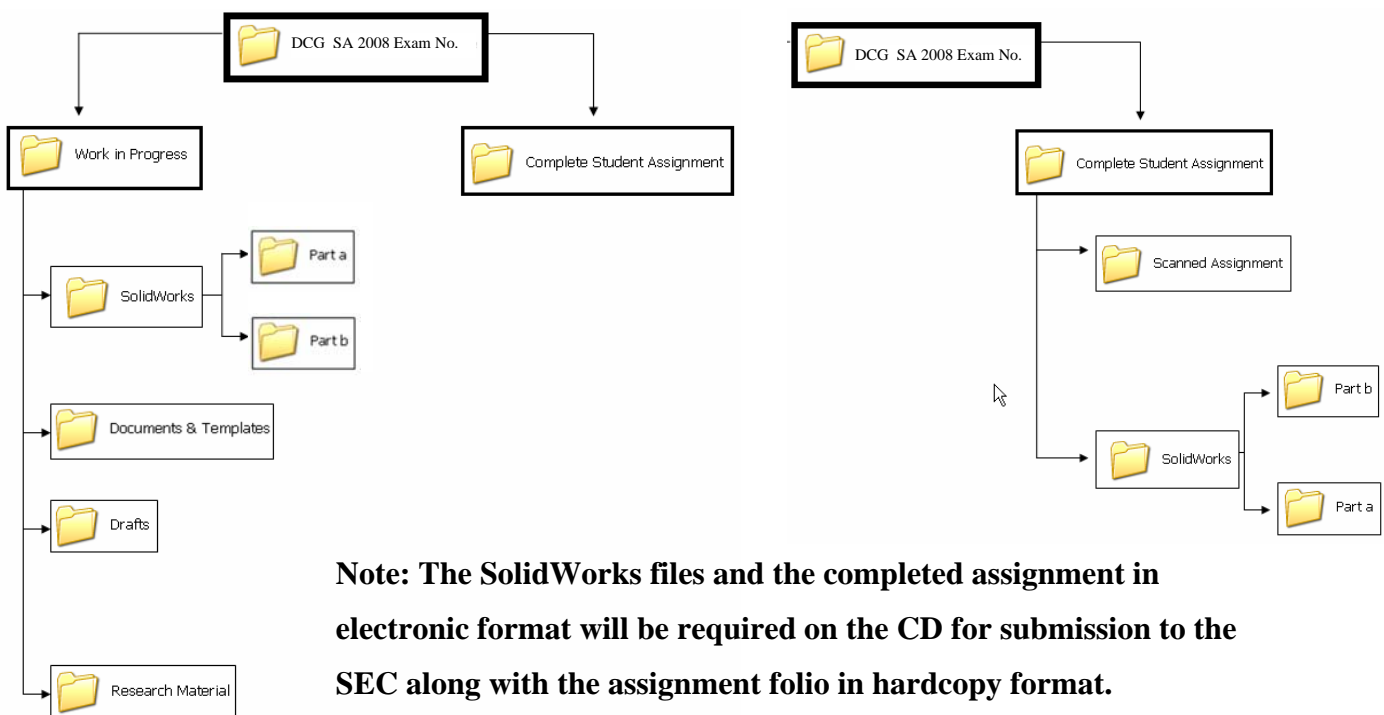
File Management

File management is an essential part of the assignment process.

🞣 *Some SolidWorks files in the pilot assignment could not be opened due to poor file management.*

The following approach to file management is suggested:

▪ A new folder must be created within your student profile to store all electronic materials for the assignment. This folder should be named *"DCG S.A. 2008 Exam No."* for example.

▪ All work relating to the assignment must be saved to this folder. This will ensure that all work can be saved onto a CD for submission to the SEC in January.

▪ Sub folders should be created to manage files efficiently, an example is shown on the left below.

▪ Two sub-folders should be created within the 'SolidWorks Files' folder;

    ▪ A folder for Part (a) of the assignment

    ▪ A folder for Part (b) of the assignment

Note: The SolidWorks files and the completed assignment in electronic format will be required on the CD for submission to the SEC along with the assignment folio in hardcopy format.

▪ Upon nearing completion of the assignment the folder "Complete Student Assignment" should be created with subfolders for the Scanned Assignment and the necessary SolidWorks files.

The completed outputs must be digitally recorded and the resultant files saved to the **Scanned Assignment** folder. These provide the students with a useful method of saving a copy of their work for themselves having sent their hardcopy assignment to the SEC for marking.

SolidWorks Settings Options

There are various settings within SolidWorks which if chosen prudently will aid the completion of the student assignment and avoid unnecessary work and duplication of effort.

The **Options** dialog box which is located in the **Tools** menu, allows for customisation of the SolidWorks software to reflect such things as individual preferences and work environments. Two levels of customisation are **System Options** and **Document Properties.**
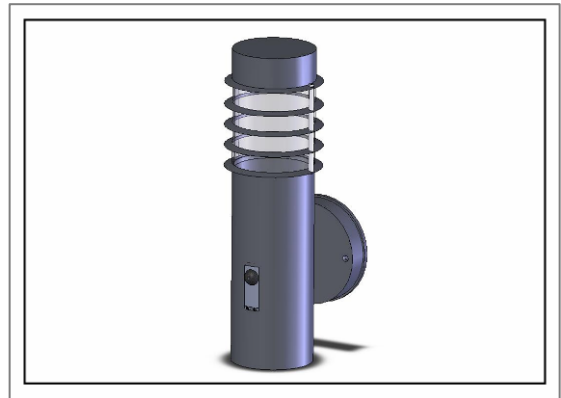
System Options

System Options are saved on the system and affect every document that is opened in a SolidWorks on that computer. System options allow the user to control and customise the work environment.

Changing the Background Colour

It may be useful to change the viewport background colour to white so that files saved as pdfs or jpegs from SolidWorks will appear on a white background.
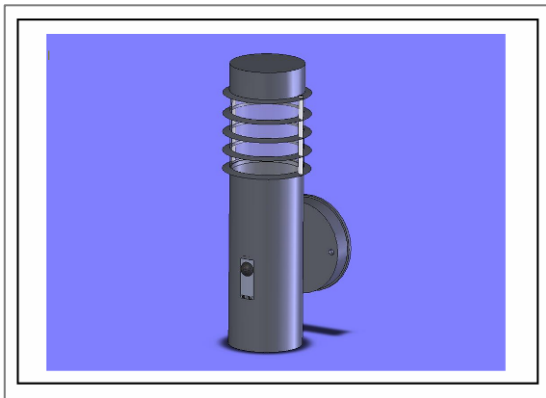

A jpeg of CAD model with blue background   A jpeg of CAD model with white background

- Click on **Tools, Options, System Options, Colors**.
- Click on **Viewport Background** and choose **Edit**.
  The Color Dialog box appears.
- Select **white** and click **OK**. The colour in the preview window changes to white.
- Note: If gradient colours are applied to screen display it will be necessary to change **top gradient color** and **bottom gradient color** to white also.
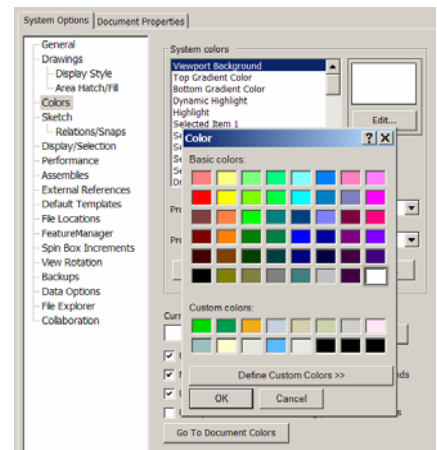
Document Properties

Document Properties contain the default settings for templates. Creating a template with the appropriate settings at the outset will avoid unnecessary duplication of work.

Image Quality

Image quality needs to be balanced between the quality of the image and software performance.

Shaded and draft quality HLR/HLV resolution controls the tessellation of curved surfaces for shaded rendering output. A higher resolution setting results in slower model rebuilding but more accurate curves.

**Setting the Image display quality options:**

- Click **Tools**, **Options**.
- In the **Document Properties** tab, select **Image Quality**.
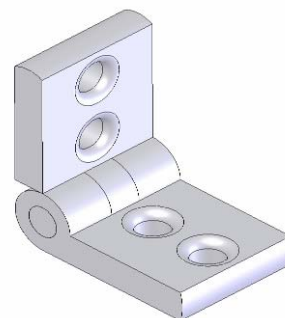- Move the slider to a high setting as this slider controls the image quality resolution.
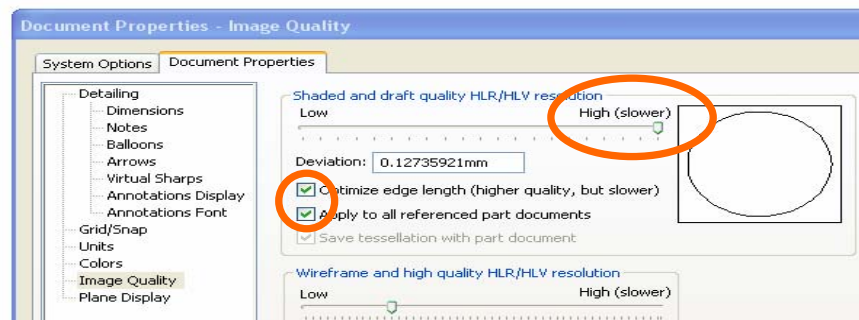
- Select **Optimize edge length (higher quality, but slower)** if even further improvement is required.

  Note: This option causes slower system performance and increased file size.

- **Apply to all referenced part documents:** This setting is only available within the assembly environment. Choosing this option applies the image quality settings to all of the part documents related to the assembly.
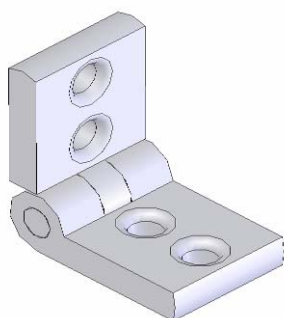

Model with low image quality   Model with image quality increased

Renaming Features

Renaming entries meaningfully in the FeatureManager is good practice. The diagram below (left) shows a model of a holder for fixing a light to a wall. It is created from three extrude features - Extrude1, Extrude2 and Extrude3. The diagram below (right) shows the same model with the features renamed. It is good practice to name features appropriately as it adds clarity to the model.
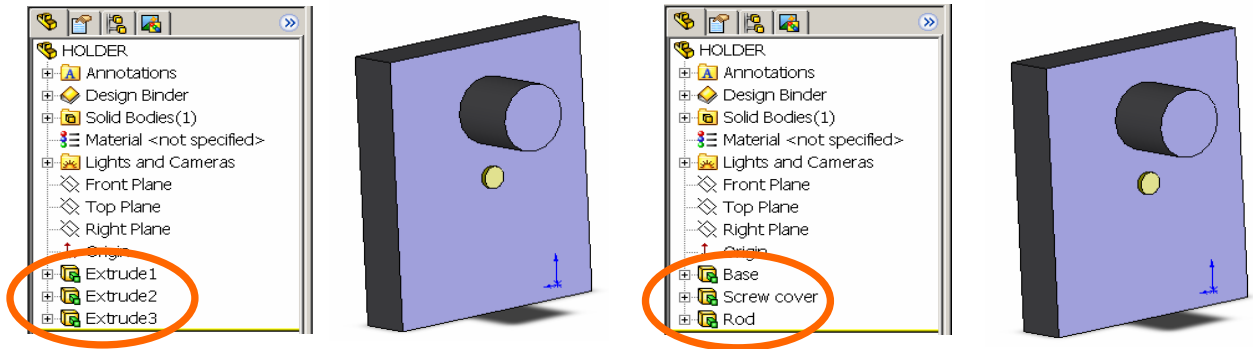
Naming Features on creation option

SolidWorks allows the user to name a feature on creation.

- Click on **Tools, Options, System Options, FeatureManager.**
- Select **Name feature on creation** and click **OK**.
- With this option, the feature name in the FeatureManager design tree is automatically selected when a new feature is created and is ready for an appropriate name to be entered.
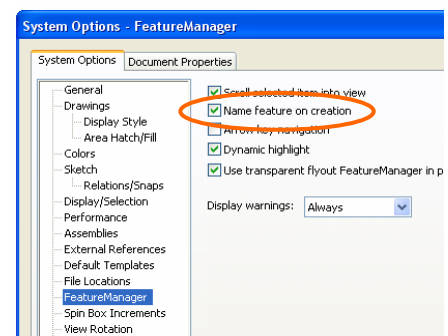
Renaming Sketches and Features

Renaming sketches by selecting on the text in the FeatureManager is good practice. Two LED parts are shown below. **Sketch1** is the name of the sketch used to create the **Base** feature. The diagram on the left shows the FeatureManager where the sketch has not been renamed. The one on the right shows the FeatureManager with the sketch renamed appropriately.
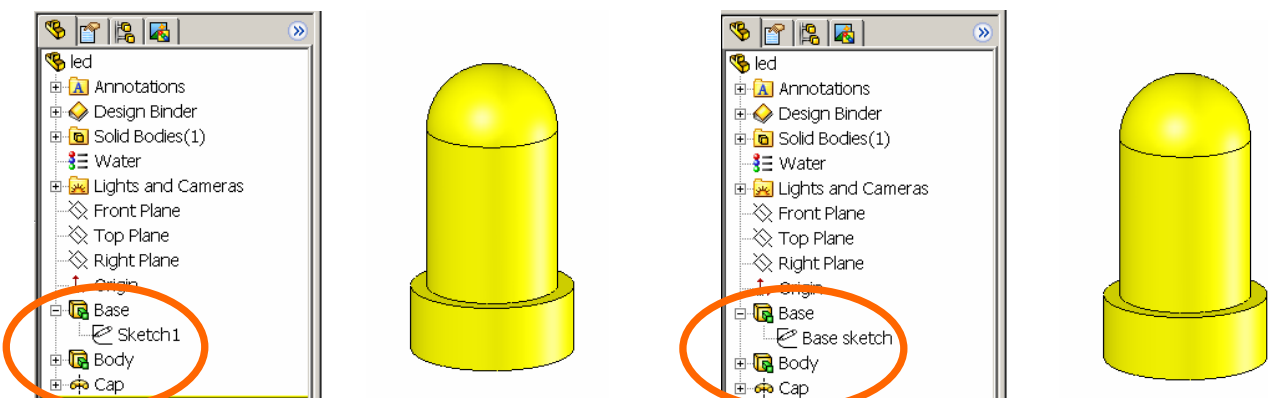
Fundamentals of Part Modelling

Managing Parts

In a SolidWorks session, the first system default part filename is named: Part1.sldprt. The second created part in the same session, increments to the filename: Part2.sldprt.

In order to avoid confusion, and to help identify the various parts, it is recommended that each part should be saved, on creation, with an appropriate filename that describes that part. For example, the part over is named "**GLASS PROTECTOR**".
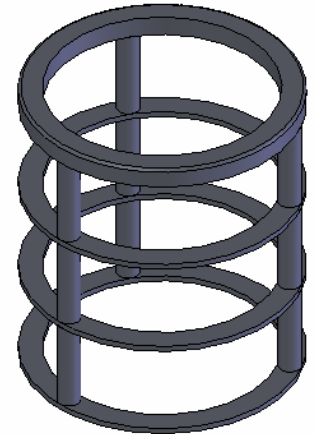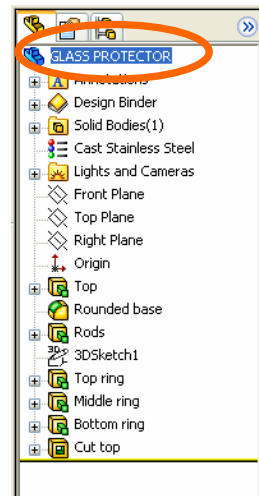
Steps in Creating a Part:

Before setting out to model an artefact it is essential that it is thoroughly analysed. Where do you start? What is the best approach to modelling it? What geometry exists within the object? How do parts go together? It may be advantageous to have the object but if that is not possible a similar object may aid modelling.

Choosing the best plane on which to create a sketch:

If the best profile of a part is viewed in plan, the best plane to create this profile of sketch is on the Top Plane. Choose a plane which generates the best profile of the object.

Choosing the best profile:

The best profile of a part to sketch is the profile which generates more of the model than any other profile.

Status of a Sketch

- All sketches must be **fully defined.**
- Many of the SolidWorks files in the pilot assignment contained under defined sketches.
- Although features may be created in SolidWorks without dimensions, dimensions provide location and size information. Models require dimensions for manufacturing.
- By creating fully defined sketches, future rebuild problems are prevented and faster rebuild times are obtained.

Four states are used when describing the status of a sketch:

1. **Under Defined**: This sketch does not have sufficient dimensions or sketch relations or its location in relation to the origin has not been defined. In an under defined sketch (see over), the entities that require position, dimensions or sketch relations are displayed in **blue**.

2. **Fully Defined**: The sketch has sufficient dimensions and relations to completely define its geometry. Its location in relation to the origin is defined through dimensions or relations. In a fully defined sketch, all entities are displayed in **black**. The sketch can be extruded or revolved and the design intent is captured.

3. **Over Defined**: The sketch has too many relations or dimensions. The sketch will be displayed in red.

4. **Dangling**: Dimensions and relations are said to be dangling when they reference something that has been deleted or that is otherwise unresolved.
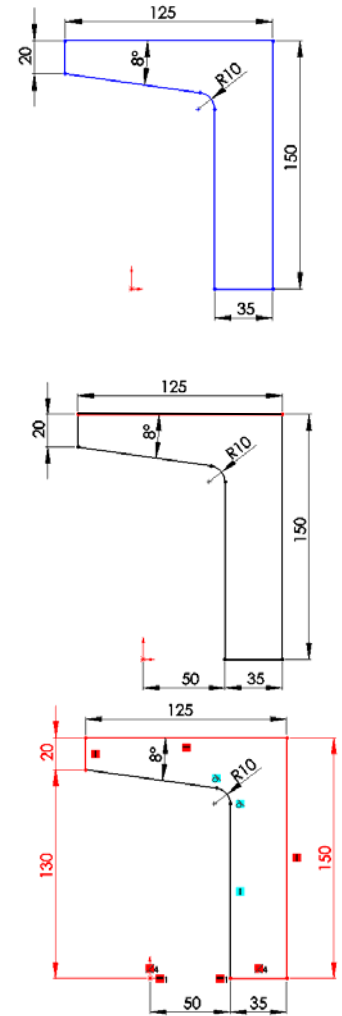
> It is imperative that all sketches be **fully defined** before a part is considered complete.

When creating a sketch, the following sequence is considered good practice;

<div align="center">

Sketch – Add Relations – Add Dimensions – Fully Defined Sketch

</div>

Sketch Relations

Relations if used properly will reduce the amount of dimensions necessary to fully define a sketch and will embed good design intent.

(a)   (b)
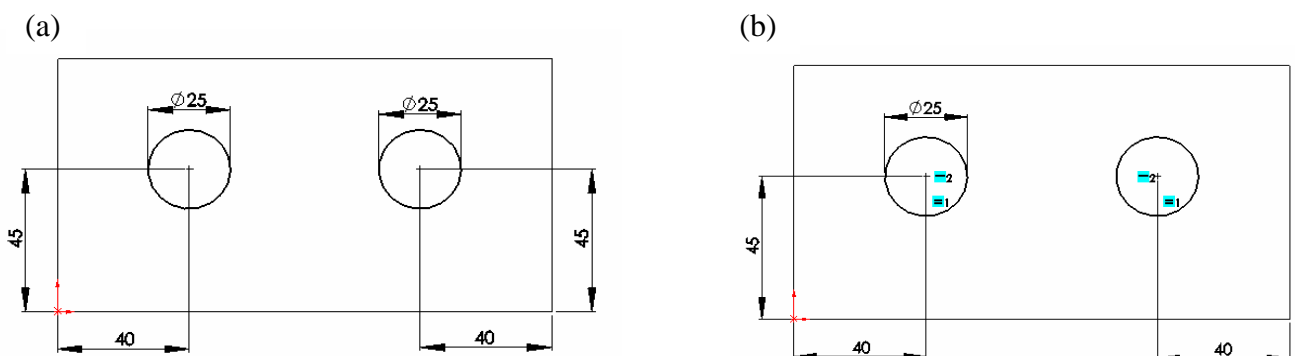
Materials/Textures/Colours

A **material** may be applied to an entire part within SolidWorks. The material is then used to calculate such properties as mass, density etc. The material will give the part a realistic appearance.

Texture may be applied to bodies, features or faces. Texture will override the appearance of a material.

A hierarchy exists in the application of textures;

Texture on a face will takes precedence over that on a feature which overrides that on a body.

In the diagram shown a **Brushed Metal** texture was applied to the entire part. **Plastic Polished/Plastic** texture was applied to the boss feature which changed its appearance. This in turn was superseded by a **Plastic Brushed/Blue** texture, which was applied to the face.
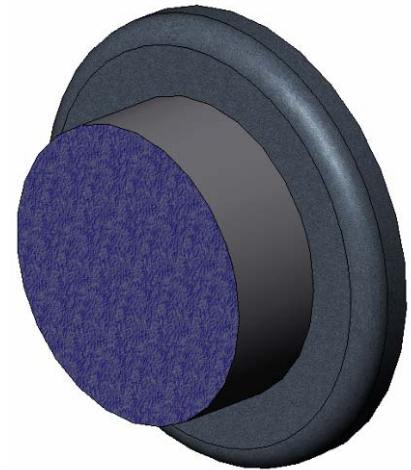
Colours

Colour may also be applied to bodies, features or faces. Colours observe the same hierarchy as that which exists with textures.

Face colour will override feature colour which will override body colour, as shown opposite.
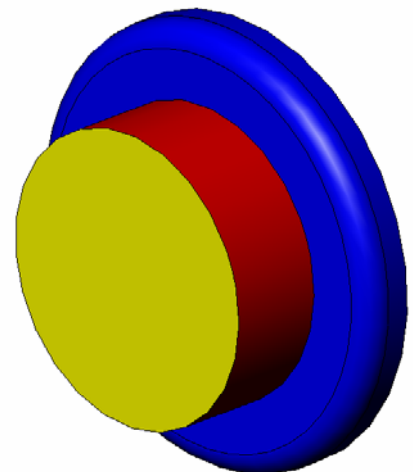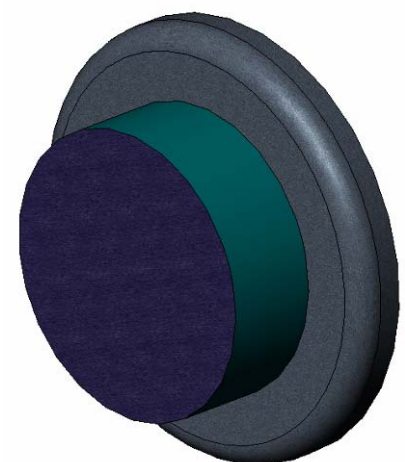
Colours & Textures

If a texture has been applied to a face, changing the colour of the feature containing that face will not affect the appearance of the face.

In the part shown opposite, the boss feature colour has been edited but the face has remained the same.

To avoid confusion when applying colours and textures be aware of the hierarchy that exists between them.

Assemblies

When creating an assembly, part files are drawn together. **It is critical that all of the necessary files to create the assembly be stored in one location along with the completed assembly**.

For this reason, when setting out on a new project the first step is to create a folder to contain all of its component parts.

Save the assembly under a recognisable name eg. **Light Assembled.**

Drawings

A drawing consists of several views generated from the model or assembly.

- When creating a drawing, it is important to select the most appropriate drawing views to use.
- The three orthographic views; front, right and top are often the basis of a drawing.
- Other drawing views such as Isometric, Auxiliary, Section, Broken Section, Detail etc. may also be created.
- It is important to identify and understand the reason for choosing a particular view.
- It may also be necessary to add detail such as dimensions, notes and symbols to document the drawings.

Exploded View

Having completed the Orthographic views it is a necessary part of the assignment to present the assembly in **exploded view** format.

Inserting an image into a SolidWorks Drawing

Images to be inserted into a SolidWorks drawing should be saved in **bitmap format - *.bmp**

Should you wish to import a jpeg it is best to convert it to a **.bmp** format in advance.

Creating a Drawing File with Multiple Sheets

Any number of drawing sheets, containing different views, can be created within one drawing file. This reduces the need for several drawing files of the same assembly/part.

When a new drawing file is created **Sheet 1** is presented by default and views are created on this sheet. It is possible to rename this sheet and add further sheets.

Renaming Sheets.

Right Click on the **Sheet1 tab** and select **Properties**

Insert the chosen name in the dialog box as shown.
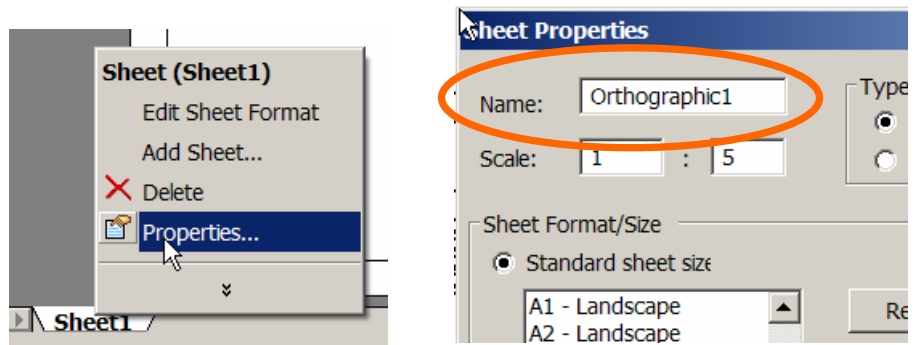
Adding Sheets

- Right-click in the Graphics window.

- Click **Add Sheet…** The Sheet Properties dialog box is displayed.

- Name the sheet to reflect the views which will be contained on the sheet.

- Click **Standard sheet size**.

- Choose the required sheet format/size

- Check **Display sheet format**.
  The chosen sheet format is displayed.

- Click **OK**.
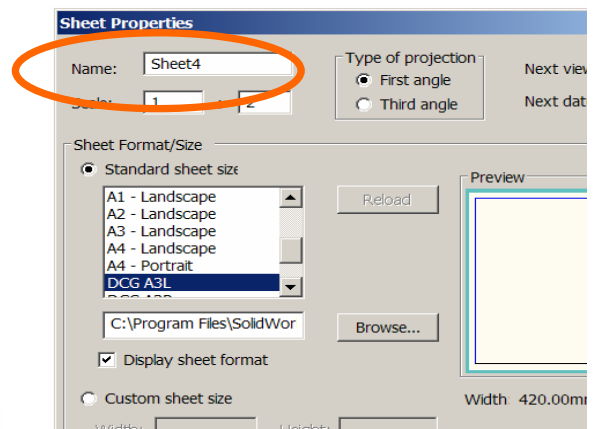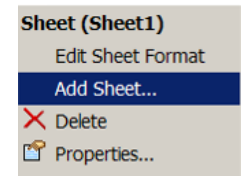
Repeat the process to add as many sheets as necessary.
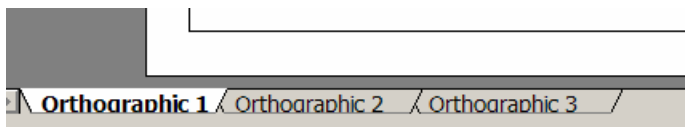
PDF Files

SolidWorks drawing documents can be saved as Adobe® Portable Document Format (pdf) files. These files may be viewed by someone who does not have the SolidWorks software.

Saving a SolidWorks document as a PDF file

With a SolidWorks document open:

1. Click **File**, **Save As**.

2. Input the **File name**.

3. Select **Adobe Portable Document Format (*.pdf)** from the **Save as type** options. Click **Save.**

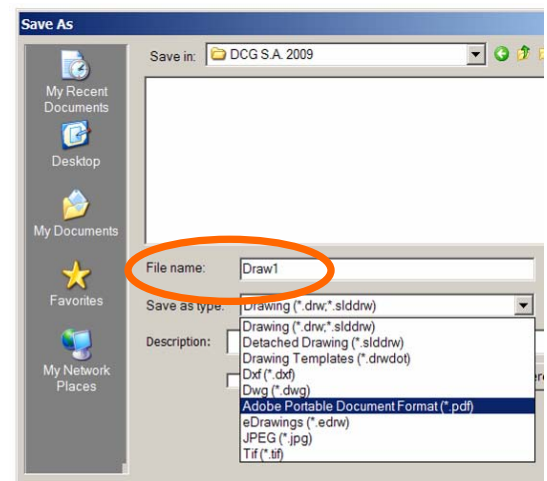**Note:** The PDF files must be opened in Adobe Reader® 5.0 or later. If opened in an earlier version, an error message appears prompting the user to download the latest Adobe Reader version.

An updated copy of Adobe Reader can be downloaded from **http://www.adobe.com**.

eDrawings

An eDrawing is a file format which allows a SolidWorks document to be viewed in an eDrawing viewer or **eDrawings 2006** without having the SolidWorks software.

Saving a SolidWorks document as an eDrawing

With a SolidWorks document open:

1. Click **File**, **Save As**.
2. Input the **File name**.
3. Select **eDrawings(*.edrw)** from the **save as type** options.
4. Click **Save.**
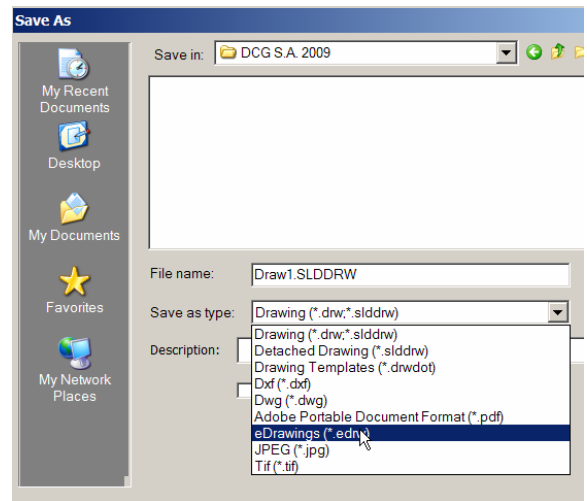
Note: The eDrawing file may be opened using **eDrawings 2006** *or* by downloading **eDrawings Viewer** from **www.solidworks.com/pages/products/edrawings/eDrawings.html**

Useful Tips

- All computers should be networked.

- Each student should have an individual logon/username/password

- Backup must be created at regular intervals.

- Good File Management technique must be employed.

- SolidWorks Files and completed assignment in electronic format will be required on the CD for submission to the SEC along with the portfolio in hardcopy format.

- Renaming entries meaningfully in the feature manager is good practice.

- It is imperative that all sketches be **fully defined** before a part is considered complete.

- It is critical that all of the necessary files to create the assembly be stored in the one location along with the completed assembly.

- The eDrawing file may be opened using eDrawings 2006 *or* by downloading eDrawings Viewer from **www.solidworks.com/pages/products/edrawings/eDrawings.html**

- In order to maintain the same border for all sheets submitted, print the border on all sheets before printing all word documents, sketches and CAD drawings.

- When your assembly is saved to a CD, open the file on another computer to see if the assembly will open and can reference all of its component parts.

Output 6 – Produce a photorealistic computer generated view of the artefact.

Students at Higher level are expected to produce at least <u>one</u> A3 sheet for this output. The same is expected at Ordinary level.

Photorealistic imaging is a rendering tool that allows designers to create photorealistic images from 3D CAD models and include them in presentations and proposals.

PhotoWorks is one such software package which is an add-in within SolidWorks. A SolidWorks model may be imported into PhotoWorks and a photographic image created based on materials, colours, lighting, shadows, environment etc.

At a basic level colours may be added to the model within SolidWorks as shown below left. PhotoStudio may then be used to generate a photorealistic image from that model, adding a default scene, lighting, shadow and shade. Within PhotoStudio all of these aspects are pre-setup and the image is achieved, quite literally, with the press of a button. However, the results are limited. Six default scenes are available and image quality and darkness/brightness are the only settings that may be changed. Textures and materials do not transfer from SolidWorks, only colours.

SolidWorks Model with Colours applied.

Photorealistic image generated using PhotoStudio within PhotoWorks

Within PhotoWorks more freedom is afforded to add colours, materials, scenes, decals, lights, shadow and shade. This will result in a better quality output as shown below. Note the textured finish on the PhotoWorks model.

Figure showing a PhotoWorks Model with chosen materials, colours, lighting and scene.

Output 7 – Analysis of the brief and an illustration of the progression of ideas and solutions

What is involved in Output 7?

The design cycle calls for designers to research existing products and situations and to then use this information to improve the world around them.

Part (b) is the second stage of your Assignment Brief and is directly linked to the work completed in Part (a). Output 7 requires you to graphically communicate your observations and suggestions to either modify an existing design or create a new concept design.

How many sheets do I need to produce?

Students at Higher level are expected to produce two to four A3 sheets for this output. At Ordinary level one to two sheets are expected.

It is important to remember that marks are awarded throughout the entire project for *thought and reflection (Appendix A)*. To complete this section ensure that your sheets show how you have taken information gained from Part (a) and used this to influence your decisions in this Part (b).

What are the differences between *Design Modifications* and a *Concept Design?*

Design modifications are changes or improvements you might make to an existing design. A Concept Design is a completely new design which can be inspired by a theme or research material collected.

We will first look at Design Modifications and some of the questions you might have. The examples provided are purely guidelines and therefore should not be taken as the only approach. Your creative style is key to achieving individual design sheets.

I want to choose the Design Modifications option, where should I start?

As a starting point you should concentrate on what you have learned from the exploration of the brief in Outputs 1 and 2. A design modification is based on your observations of the chosen artefact selected in Part (a). These modifications can be subtle changes to improve the user's experience. Modification is not always about adding on elements but often assessing what is missing or what features present are not actually used. Keep in mind the success of the Apple iPod range, its simplicity and unnecessary detailing meets the market needs.

Companies modify their product ranges continuously to keep up with market trends and to meet their user's changing needs.

How should I decide which areas of the design to modify?

There are numerous approaches to modifying an existing design. The first approach should be to focus on your observations of the design from outputs 1 & 2. Other possible approaches are as follows:

- Create a Mind Map or Scatter Diagram of areas to explore.
    - From this quick visual exercise you might discover 3-4 keys areas that require further modification. (For example you might focus on the features, the power source, and user feedback).
    - The example below shows a mind map which identifies the key areas to modify with an exterior light design. The key is to use the mind map as a visual tool to condense all your knowledge of the subject onto a single sheet.
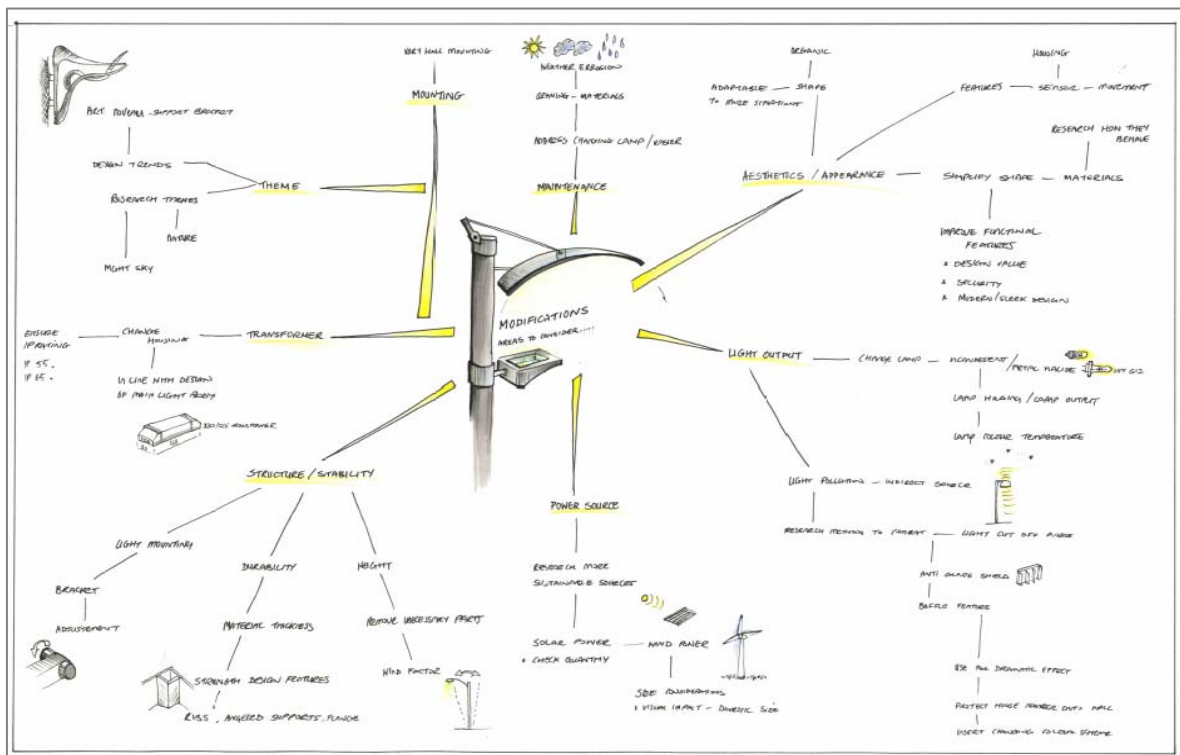
- Create a list of questions as a guide to research the area further……Possible questions
    - Is the design fit for its purpose?
    - Does the design meet its user's needs?
    - List all functional features from your exploration. Are all existing features used? Can you add /remove features?
    - Is the design aesthetically pleasing?
    - Is the design adaptable to a range of situations / environments?

- Is the design sustainable and environmentally friendly?

- Are the chosen materials and finishes suitable?

- Is the design durable and easy to maintain? Are all components accessible?

- Are there any safety features in need of improvement?

- Can the existing technology be improved?

- Create a detailed list of the design's strengths and weaknesses

How many modifications do I need? Is changing the colour considered a modification?

You are encouraged to explore between 4 to 5 design modifications. Each modification should be justified. Your annotations should communicate why this change is either necessary or valid. Altering the product's colour is not considered a modification unless there is a valid reason which impacts the design success.

How should I present my ideas for design modifications?

How you layout you sheet will depend on your individual graphic style and the depth of information you want to communicate. The design can be modified using a range of techniques from freehand sketches and annotations to photographs. Your modification sheet should convey the progression of your ideas as they lead to a final solution. You should ensure that you clearly detail all of the feature changes and your thought process.

Modification Design Ideas Sheet
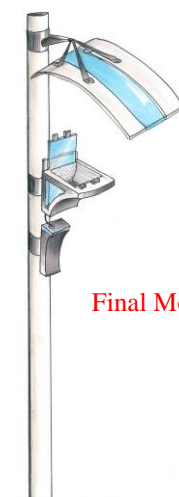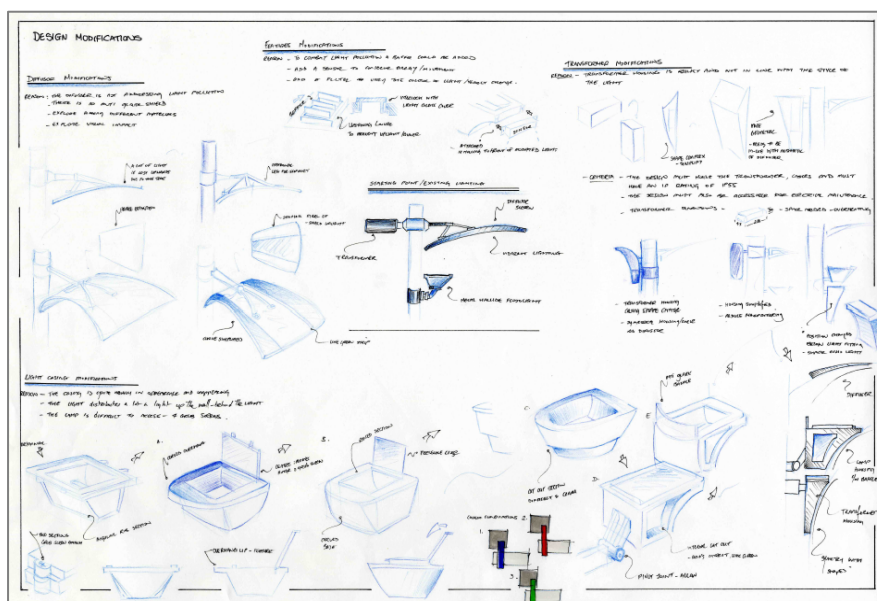

Final Modified Design

In the example on the previous page, four areas which require modification have been identified. Each of these modifications have been developed through sketches and detailed notes. The notes provide an opportunity to explain your design thinking particularly if the idea is difficult to sketch!

More Examples below ….. both students have listed the areas for modification and have explored these.
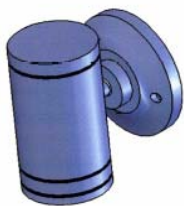
Areas identified for Modification

Top Cap – Flat level / Problems with rust

Limited light emitted – Change output levels

Visual Impact – improve overall appearance
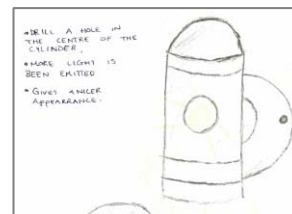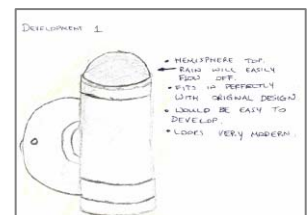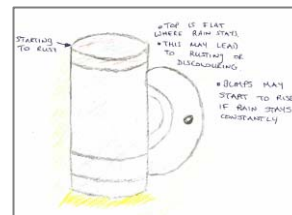
Areas identified for Modification

Body Shape – Strength & Aesthetics

Flange – Design & Structural support

Additional feature lights on body

Sustainable power source

Should all design modifications be justified?
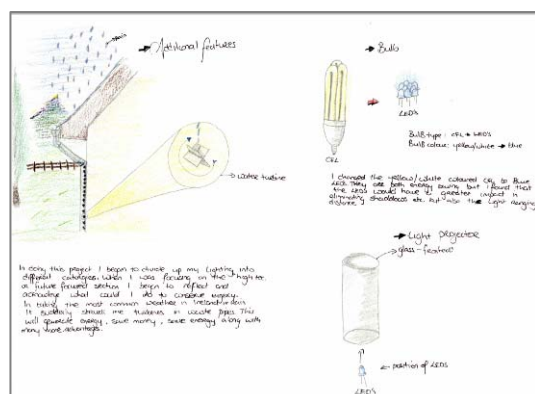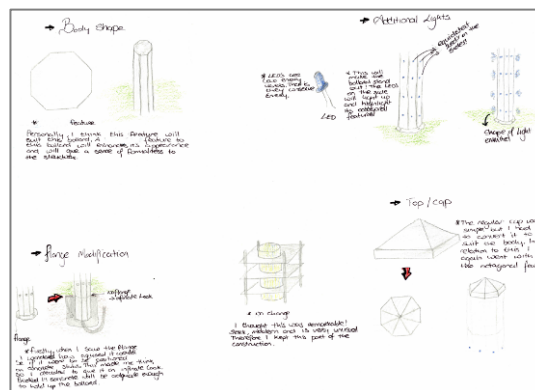
Yes, it is very important that you specify your reasons for each design modification. List why this change is necessary and how the improved version will add to the design's function or aesthetics etc. Your decisions and thought progression must be clearly communicated.

Can I complete additional research if I need to explore an area for modification?

Of course, to modify the existing design it might be necessary to research new advances in technology, in this case for example, alternative power sources. Ensure that you record all research gained and document this in your decisions.

When I have all the modifications and research completed how do I condense the information?

This is your opportunity to communicate all your knowledge on the chosen theme and your design skills. Be creative and individual with your sheet layout. Think about different graphic materials, papers and editing programmes. You may need to complete several preparatory sheets which then lead to your final sheet layout. The examples below show two different layout sheets for both the mind map and the design modifications.
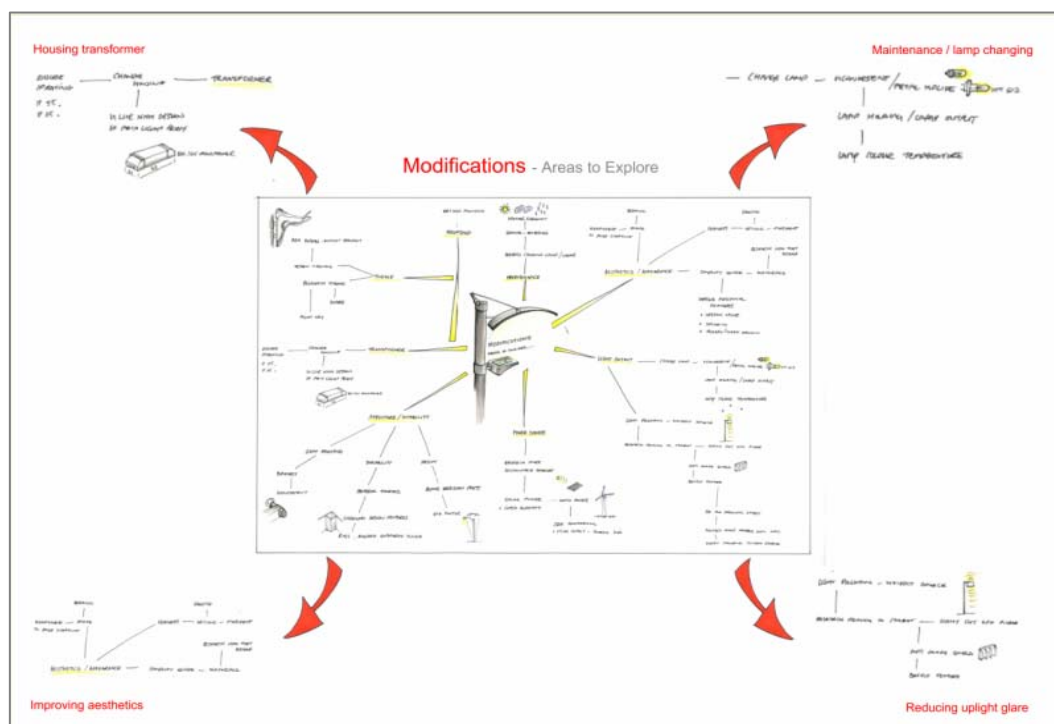
Sheet 1 Layout Option 1 - Centre Mind Map showing all areas which were explored. The outside space shows four chosen areas for modification and sketches. *A lot of blank areas on the sheet*
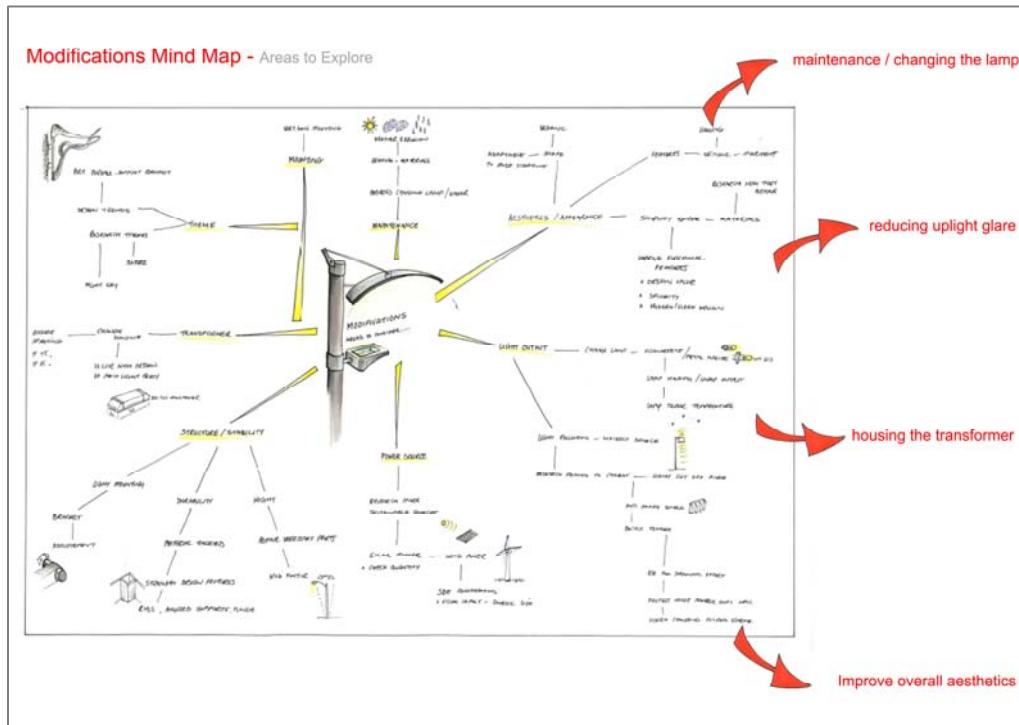
Sheet 1 Layout Option 2 - Enlarged Mind Map showing all areas explored. The outside space showing four chosen areas for modification. * *Better use of white space*
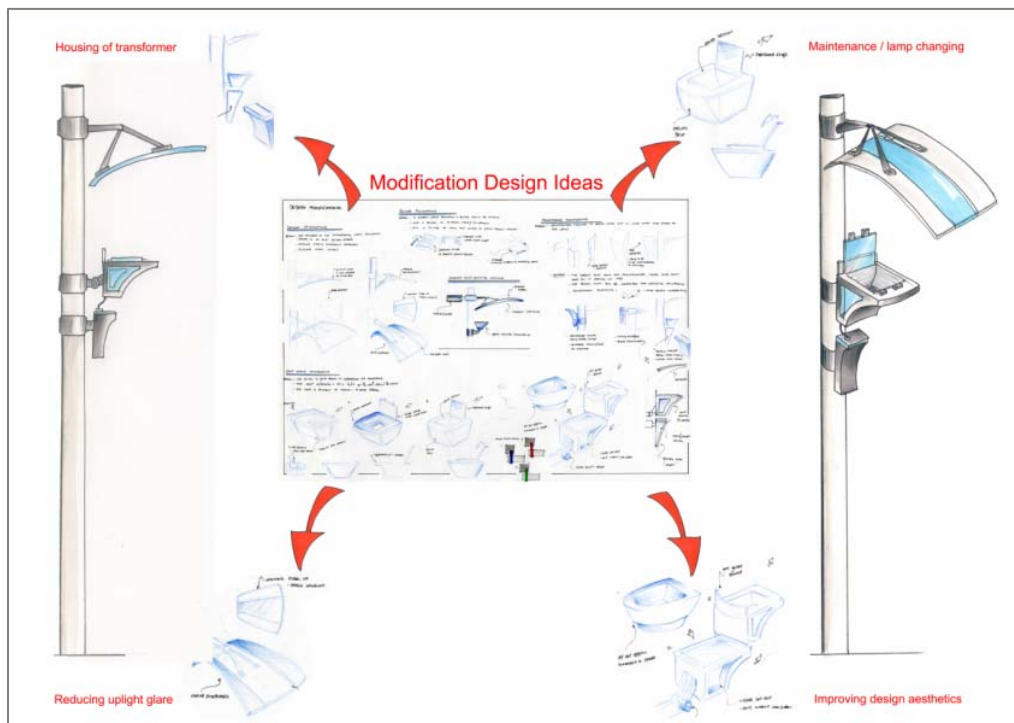
Sheet 2 Layout Option 1 - Reduced Modification ideas sheet in centre. Four modified features sketched on outside. The final modified design positioned at the sides. * *Difficult to read the modifications and decisions made.*

Sheet 2 Layout Option 2 - Enlarged Modification Ideas sheet. Four modified areas highlighted at the bottom. Final modified ideas to one side. *Clearer Communication*
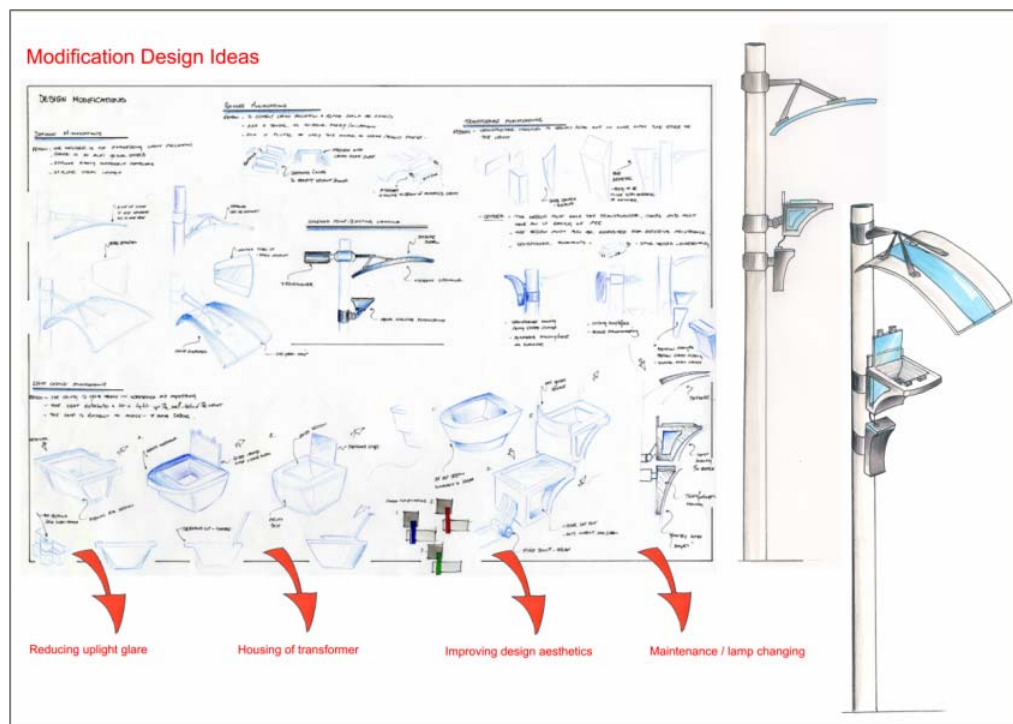
Modifications Checklist

- Ensure all decisions are communicated and detailed evaluative annotation has been used.

- Be creative and individual with your presentation.

- Conclusions – What did you want to achieve on each sheet? What have you learned? What decisions have you made? How can you use this information to influence the next stage!

What is a Concept Design?

A concept design is a completely new design, inspired by investigative research. As with the Design Modification option, the information gained through exploration in Output 1 and 2 should directly influence your Concept Design. For example if you have learned about the functional criteria for exterior lighting then these factors should be evident in your concept design.

If you choose the Concept Design option, is it worth the same marks as the Design Modification Option?

Yes, both options require you to submit the same number of sheets and offer equal marks.

Students at Higher level are expected to produce two to four A3 sheets for this output. At Ordinary level one to two sheets are expected.

I want to choose the Concept Design option, where should I start?

The key to creating an interesting concept design is preparation. You need to find visual material to inspire a creative final idea, rather than stating; "It's a good design, because I like it". It is easier to make a design decision when you have created personal boundaries. The following are suggested starting points;

- Choose a **Theme** to inspire your thinking.
    - (Nature, Art Period, Film, Sport, Music)
- Choose a **Target Market.**
    - Often it is easier to design when you have a target group of people in mind. It helps you to assess the user's needs, what styles would interest them, the places the design would be used and their budget.
- Choose a **Message** you would like to convey.
- Create a list of **Key Words**/ Quotation to set a tone.
    - Natural, Green, Organic, Simple, Elegant, Soft, Garden, Lush, Eco, Pure.
- Choose a **Location / Environment.**
    - The solution therefore should fit within a specific location / surroundings.
- Create a **Mood Board.**
    - A mood board is a visual tool which may help at the design stage. It is used in industry to set a tone for a project. For example if you want to create a natural, soft theme you might collect a range of images, colours, textures and key terms and arrange them on a page to communicate the direction you want to take.

The Mood Board sets the tone and direction for the project. A range of images for an exterior light concept have been collected. The message conveyed is that the concept design will be simple in shape, geometric and inspired by nature.

Remember creating a mood board is only one approach to researching a theme.

How do you find inspirational research material?

Inspirational material is all around you, from the items in the classroom to your individual thinking and experiences. Some of the most successful designs are those which are clever, simplistic and address the user's needs. Inspirational material is something which basically interests you in some way. The material can be collected from your own environment, interviews, photographs, books, magazines, and the Internet.

Nature may have provided the inspiration for this stool.
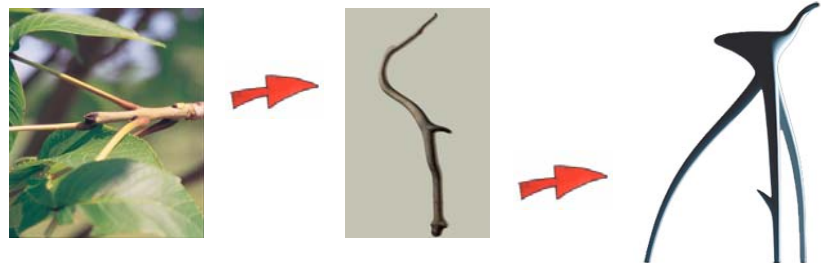
The Nokia 7280 collection is inspired by the geometric patterns of the 1920s Art Deco designs. Influences such as flow, movement, colour, geometry and bold graphics were typical of this period.
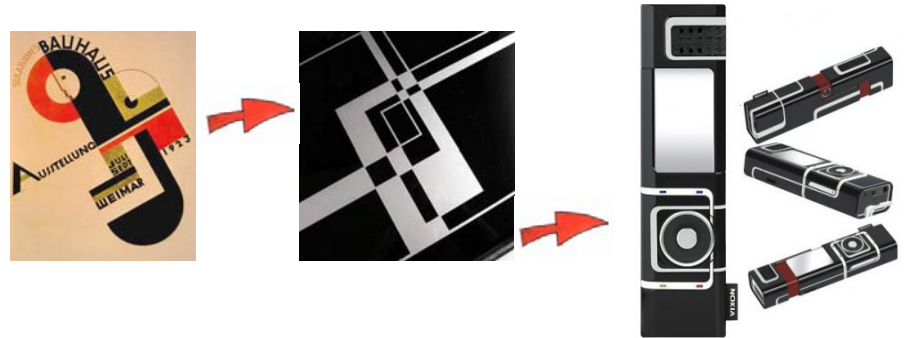
When I decide on a theme, do I record the images I've collected?

Yes, the idea is to create a visual story which communicates your design thinking and progression. One approach is to create an image board. This is basically a visual tool to use when designing. The images are laid out in a clear graphical format, with notes and sketches if necessary.

The image board below follows the chosen theme of *Carnivorous Plants*. The designer was inspired by the line, shape and elegance of the plants. The images are presented on a black sheet, using white colouring pencil to record any observations. Often it is only when we look at something from a different angle that we notice something interesting and new!

I have an idea already; do I still need to find inspirational material?

While it is good to have a visual theme in mind it not advisable to fix on a specific idea too soon. One approach might be to take this idea as a starting point and then use your creativity to develop this further. You might possibly take the idea and then recreate it for a different target market or adapt it for a different situation. Often the most interesting concept idea comes from rethinking the design completely.

I have researched my chosen theme and I am ready to start designing, should I write an individual design statement?

Writing a short design statement can be a good idea as it gives you boundaries to design within and something to refer to if you are having difficulty creating ideas.

Example:

"Following research, I am going to design an exterior street light for a public space. The design will be organic in style and reflect the shape of my chosen theme, Carnivorous Plants. The design will house a cfl bulb, an electric transformer and will be structurally stable".

How can I communicate my design and progression of ideas?

This is very much about your individual style of sketching and the flow of ideas. There is no definitive way to present your ideas. You have to find a technique that suits your presentation and strengths. Designing and its communication is a practical skill and must be practised.

Should all design ideas be justified?

Yes, it is important that you communicate the thought process which led to your concept design. List the decisions made and how your inspirational material has influenced the design idea.

Do I have to think about how the design works?

Creating a new concept design is not just about styling. This is where your understanding of the product area from Output 1 and 2 directly influences your design ideas.

When designing, how can I use the inspirational material to influence my ideas?

The key is not to copy the inspiration material directly but to use this to inspire and influence your design idea. The research collected is a visual tool. Try to look more at the line, shape and tone of the design and think what it is that interests you. Then take these elements and add your own creativity. Refer to all your research particularly when making design decisions. If you have decided on a target user, a theme, or a location, keep all this in mind and check that your ideas meet your criteria.

The example below shows the thought process behind an idea for the exterior light project with the Mood board and *Carnivorous Plant* theme Image board, as inspirational material. Two A3 sheets were used to explore the design stage. The first is a Concept Design and the second is a Concept Development.
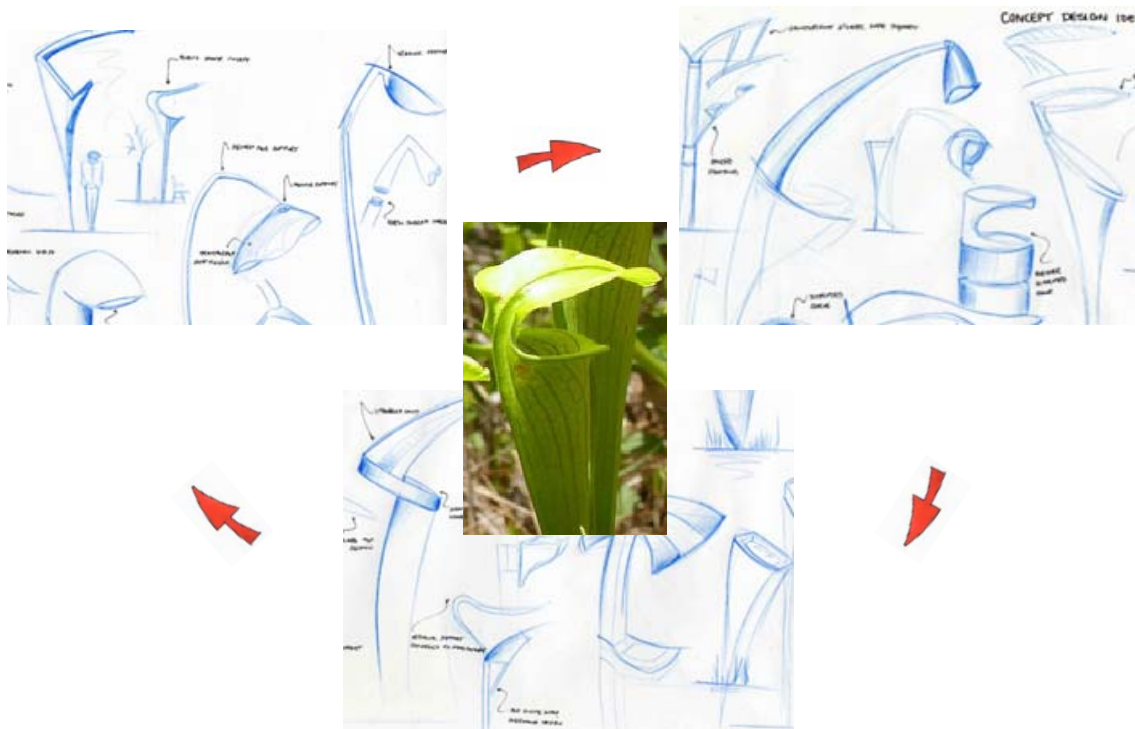
Note: The sheet is full of quick design sketches and annotation. There is no need to create highly finished sketches at this stage as you are just exploring a range of possible solutions. The student might need to add a conclusion to show what they have learned from the process.
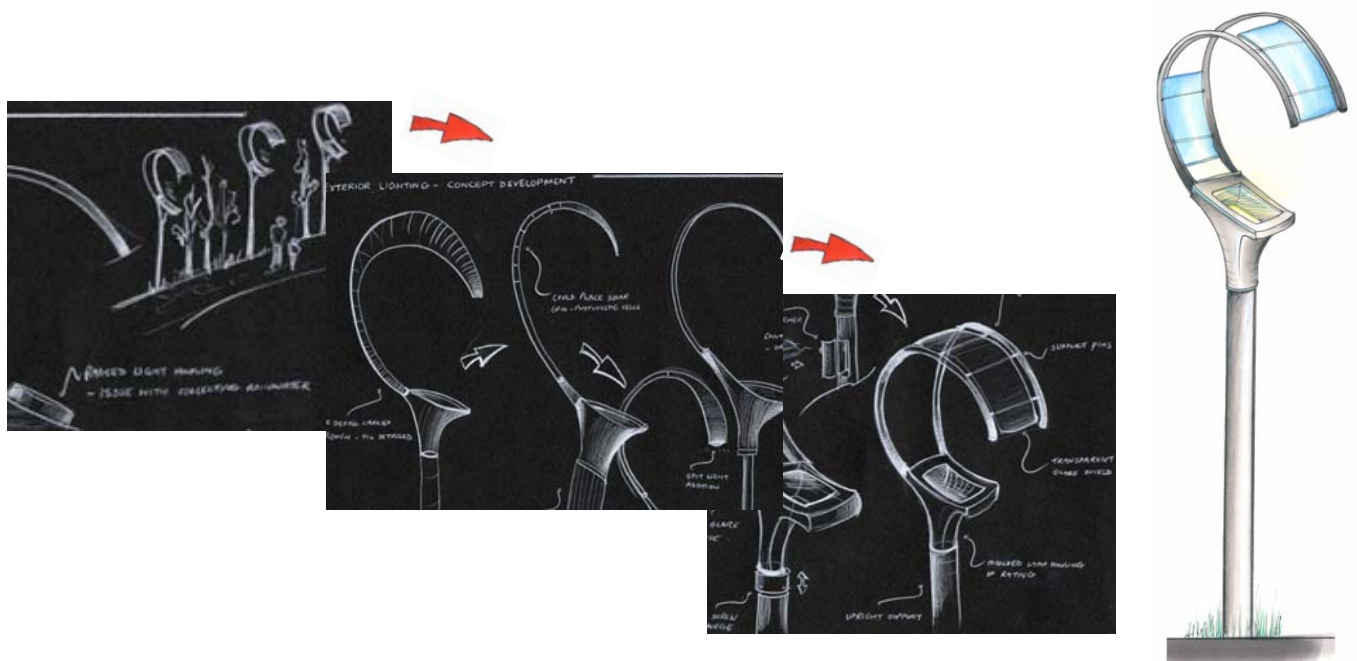
Note: This sheet takes the strongest concept design from the ideas sheet and develops that design a stage further. The objective is to visually show your thought process and progression until you reach a final concept design.

When I have the research and concept design sheets completed how do I condense all of the information?

At this point you have created a range of research material and several design sheets to reach a final concept design.

This is your opportunity to communicate all your knowledge on the chosen theme and your design skills. Be creative and individual with your sheet layout. Think about different graphic materials, papers and editing programmes. You may need to complete several preparatory sheets which then lead to your final sheet layout.

The examples below show two different layout options for the first A3 final Design Concept sheet.
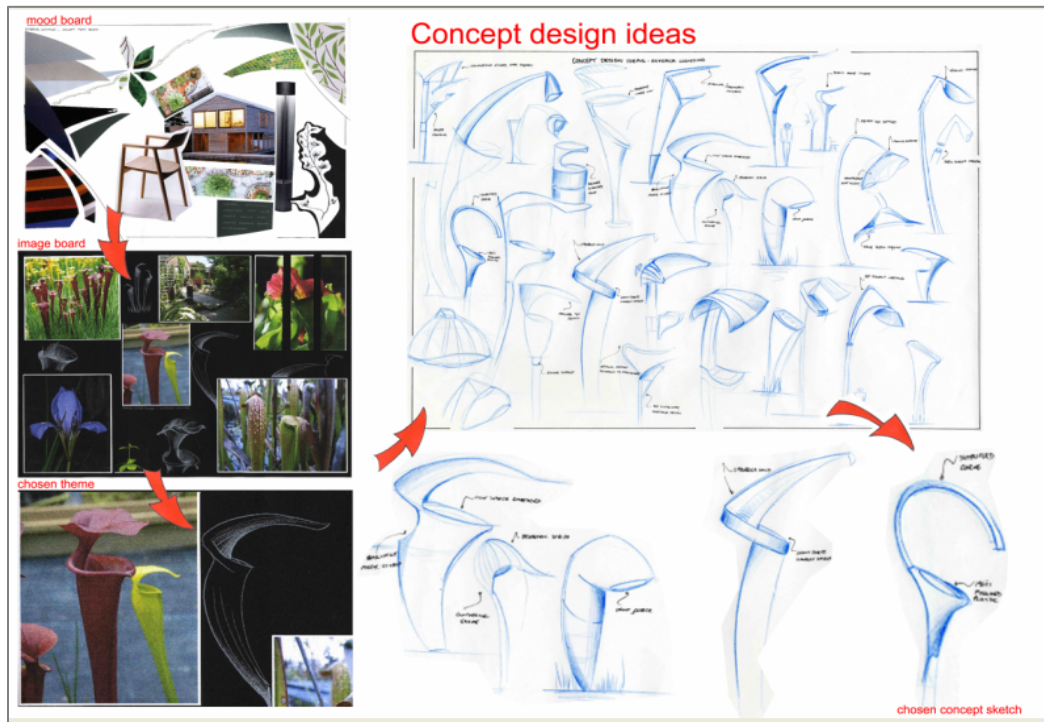
Sheet 1 Layout Option 1 - Centre scanned sketch concept designs. Mood Board, Image Board, Main Image to the left. Strongest design ideas enlarged at base. *Shows good progression of ideas but no sheet conclusion.*
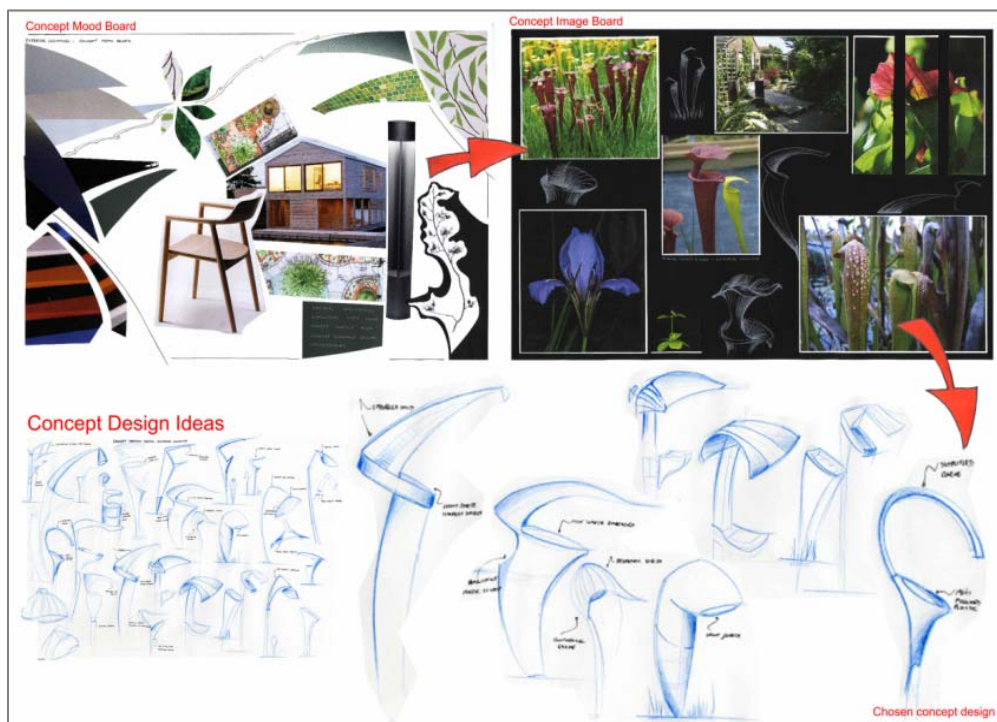
Sheet 1 Layout Option 2 - Top Mood Board, Image Board. Arrows used to show progression. Strongest design ideas enlarged at base. * Slightly cluttered layout and no sheet conclusion.*

The examples below show two different layout options for the second A3 final Concept Design sheet.

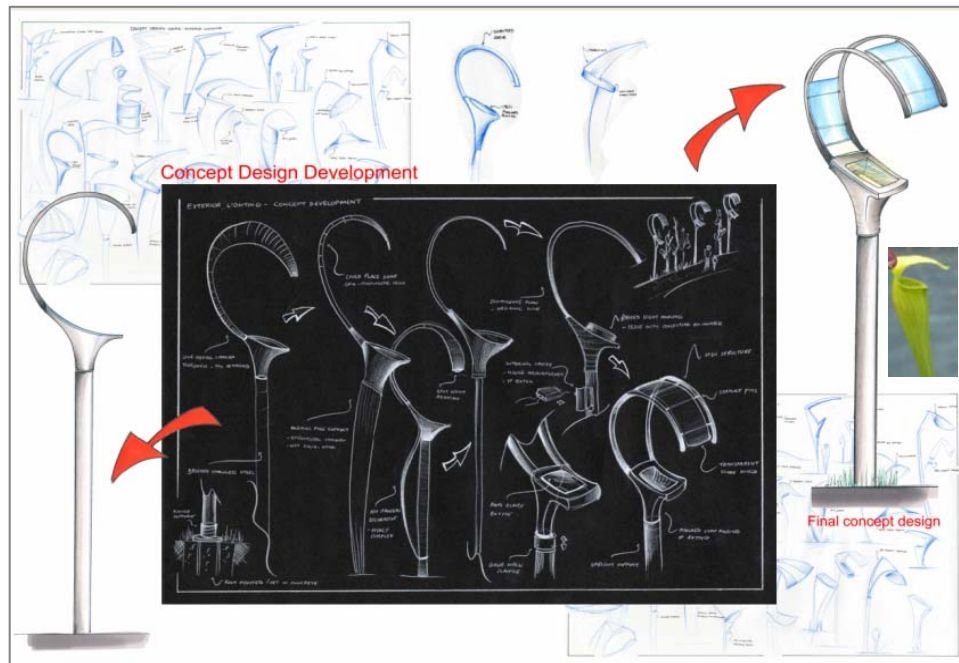Sheet 2 Layout Option 1 - Centre scanned development sketch. Faded sketches as background image. Final concept design in two views. * Shows good progression of ideas but visually difficult to follow.
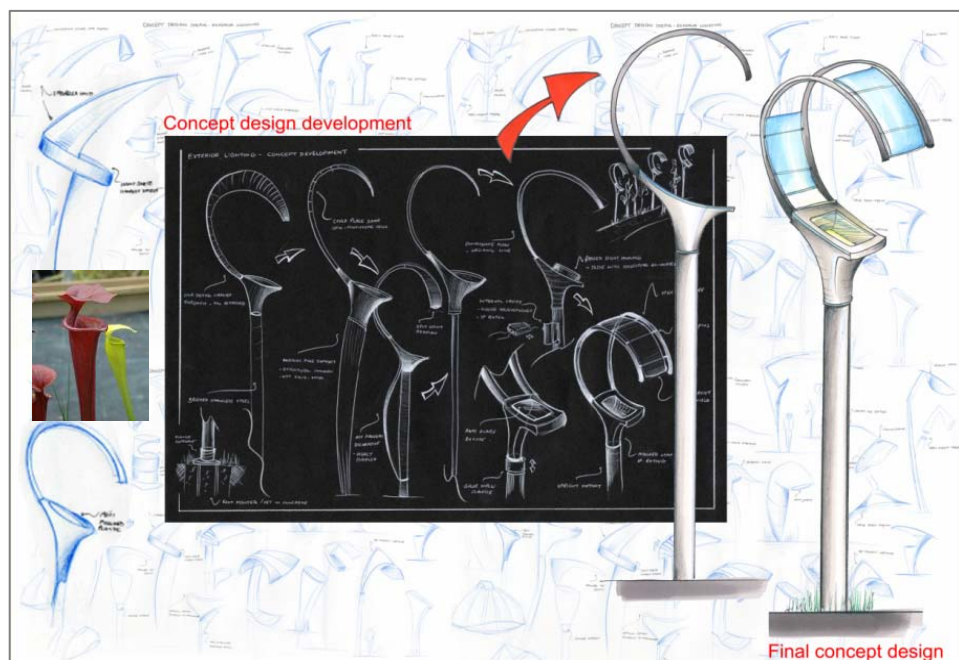
Sheet 2 Layout Option 1 - Background faded sketches. Centre development sheet, main enlarged sketch designs and final concept design * *Shows clear progression of ideas and easier to follow design thinking and progress.*

It is important to remember that marks are awarded through the entire project for *thought and reflection*. To complete this section ensure that your sheets show how you have taken information gained from Part (a) and used this to influence   your decisions in Part (b).

Output 8 – CAD Model and Associated Outputs

In any year a candidate must decide to undertake either a design modification or a concept design.

Design Modification – File Management

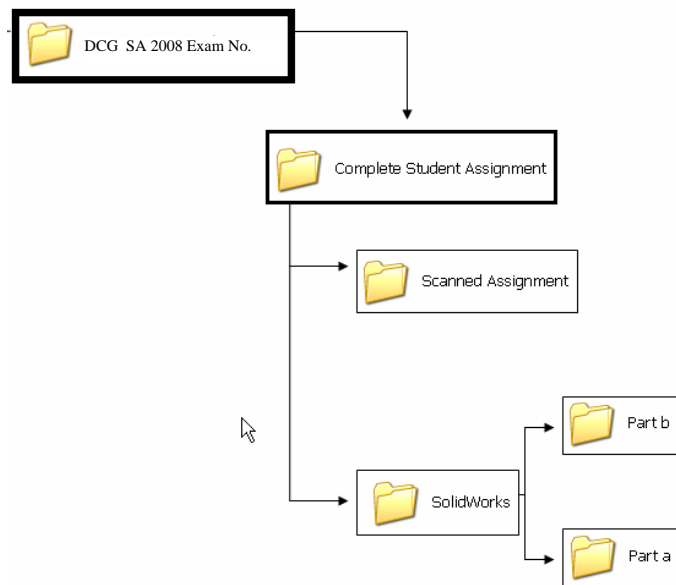If undertaking a modification to an existing artefact the student will be using some or all of the part files from part (a) of their assignment.

Only the part files required should be copied from **SolidWorks Files/Part (a)** to **SolidWorks Files/Part (b)**.

This step is necessary as; any changes made to the part files due to the modified design would be reflected in the original CAD assembly.

It may be prudent to rename the part files in part (b) at this stage to avoid confusion with those related to part (a).

These files may then be edited and in addition to any new files created are assembled to present the modified solution.

It would be essential management that the completed modified assembly located in Part (b) folder should only reference part files within the Part (b) folder, not those in Part (a).

Concept Design – File Management

All SolidWorks files relating to the concept design should be saved in **SolidWorks/Part (b)**

The modelling approach to the concept design should reflect good modelling practice along with reflecting the nature of the object being modelled.

Output 9 - 3-dimensional rendered sketch depicting the modification/concept design.

How many sheets do I need to produce?

Students at Higher level are expected to produce at least one A3 sheet for this output. The same is expected at Ordinary level.

What exactly are you asked to do in output 9?

In output 9, you are required to produce a rendered 3-dimensional presentation quality freehand drawing of either the modified or concept design. For example, if you are producing sketches of a modified artefact make sure that the applied modifications are in proportion and suit the original artefact. The same rendering techniques used in Output 3 should be applied on this sheet. This is not a sheet on which you should try new styles of sketching or rendering techniques. Use techniques that you have practised and are comfortable using. The following sheet maybe used as one possible layout. This sheet shows a comparison between the rendered freehand sketch drawn in output 3 and the concept design sketch in output 9.
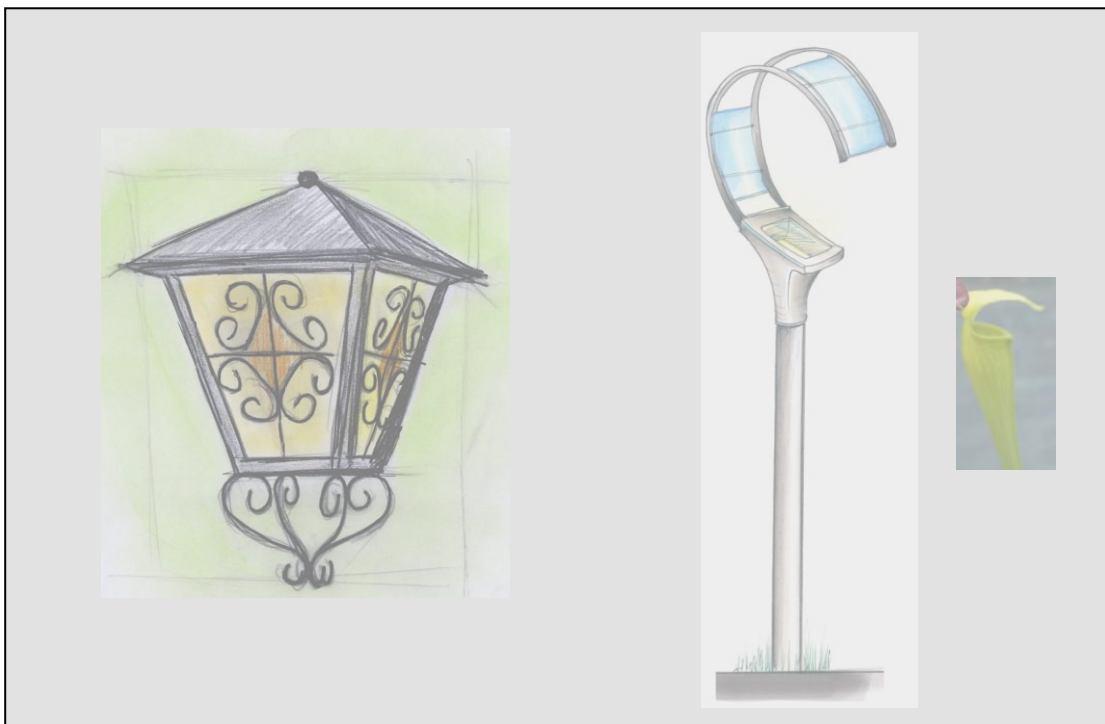
Reflection and Thought Process

Marks for reflection and thought process are allocated under all sections through the assignment.

What is meant by the terms Reflection and Thought Process?

The student assignment should follow a logical progression. Each sheet should exhibit a reflective approach by outlining the design proposals and the reasons for them. This may take the form of relevant knowledge gathered, design proposals and decisions made. The reflection on each sheet should influence and guide what you are about to do in subsequent sheets as shown below. This is your thought process.
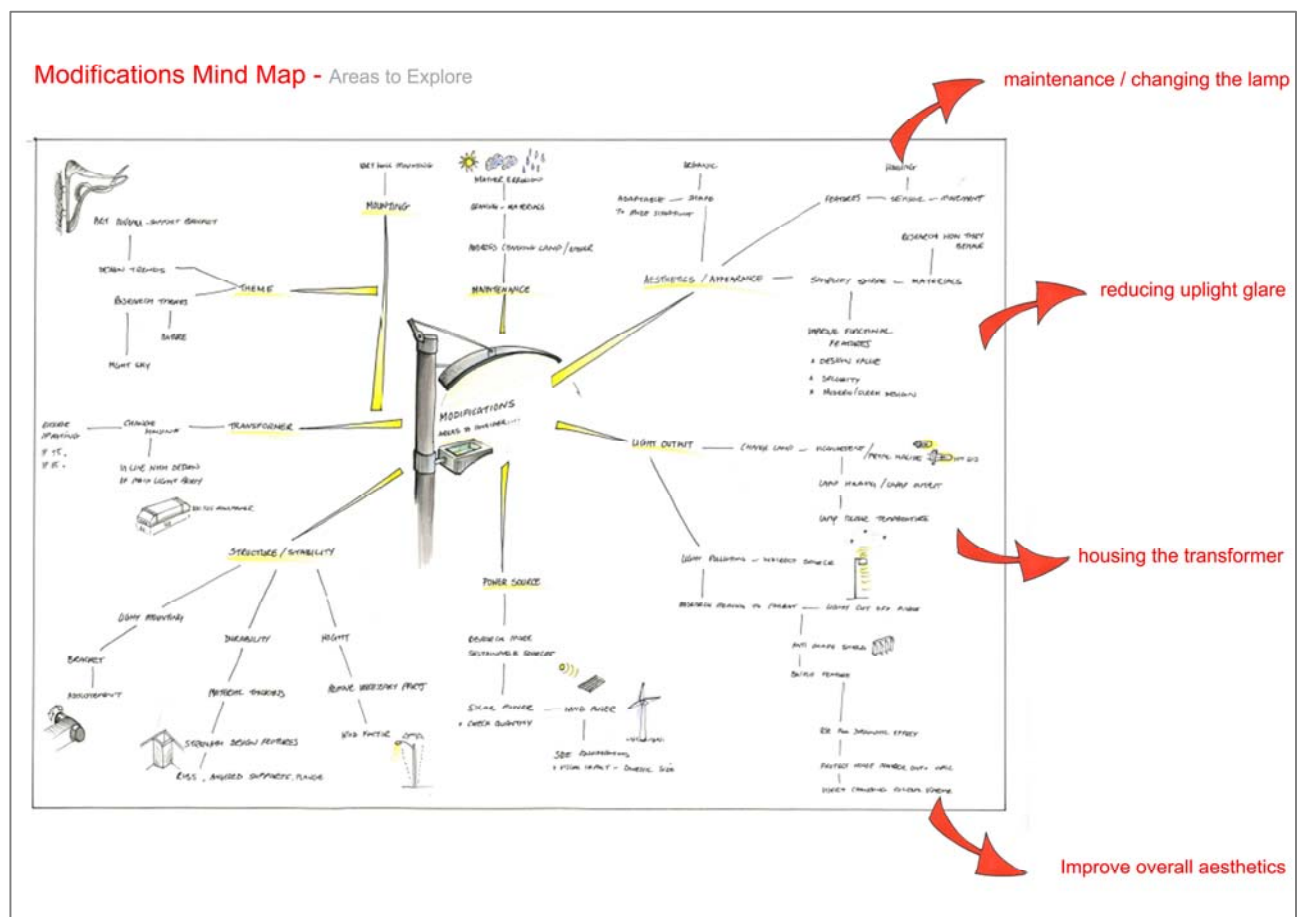
As discussed in Output 1, the design cycle is cyclical in nature. If a design idea is to reach its full potential the designer must explore and reflect continuously through out the design process. It is these reflective decisions and thought processes that we need to record and communicate, throughout the assignment. A key technique in making design decisions is to draw conclusions from each individual output.

How do I make decisions?

Decisions are about finding the best possible solution to the various problems or questions posed. Maybe you should start with a blank sheet of paper and write down every question you can think of relating to your assignment as shown below. Anything that provokes a thought or highlights questions, involves making a decision.
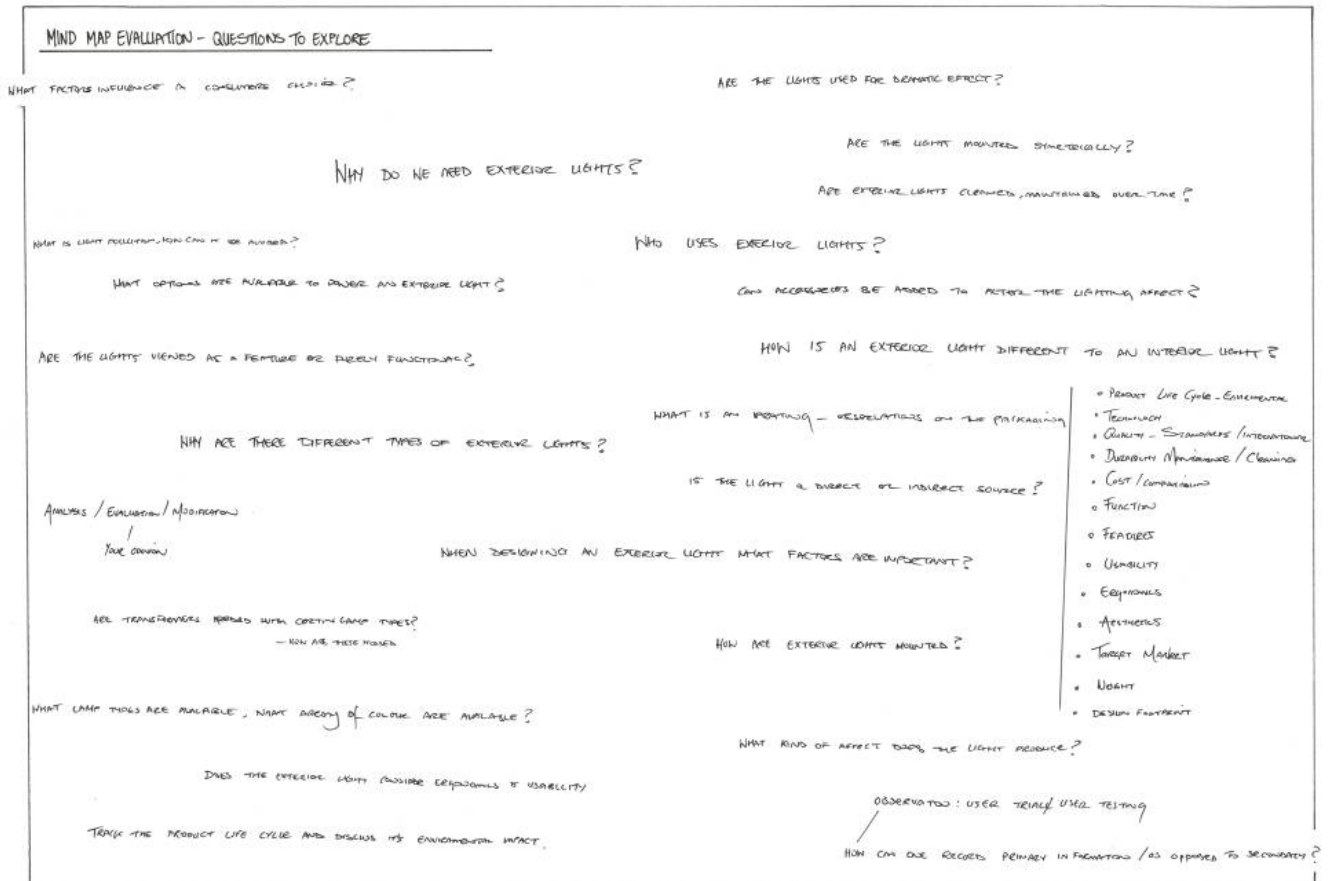
If we focus on the Compare and Contrast section in Output 2, two products to analyse must be chosen. This activity alone, involves making a multitude of decisions. For example: Why did you choose the two particular designs? What is it that you feel separates them from other designs? Is it that they are more attainable? Is it that they are aesthetically and functionally different?

Do I only make decisions at the end of an Output?

No, not at all, you are constantly making decisions. The key is to recognise when this happens and take a note of what you are thinking. Some decisions progress an idea to the next stage while others lead to abandoning an idea, as it is not in line with the project criteria.

For example, take the modification ideas sheet in Output 7. Here you are required to explore several possible design modifications. Numerous decisions will be made while sketching the ideas. Some

ideas may be too difficult to manufacture or are overly complex in their design. If this occurs these ideas may have to be revised or discarded completely and a fresh approach pursued. It is at this stage that you should record your thought process and decisions.
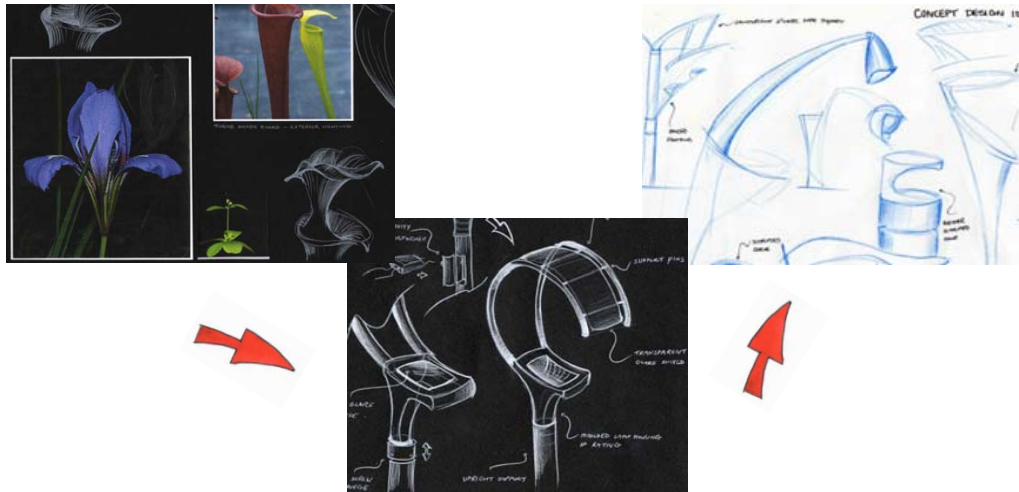
How can I record my decisions and thought process on my assignment sheets?

There are several techniques that may be used to record your decisions. Some of these are listed below:

- **Annotations**

  Annotations are short notes, observations or comments next to a design idea or a section of research. Annotations should reflect both the positive and negative aspects of your design and exploration. You should be constructive in your comments and take into account all your accumulated knowledge of the topic. Constructive annotation allows you to discard one idea and move onto the next.

  For example, *this design idea is an interesting shape but is not stable for an exterior light as the base design is too narrow. An additional support and a straighter shaft may increase the stability.*

- **Write a Sheet Intent at the start and a Sheet Conclusion at the end.**

  Sheet Intent: Before you start any Output list the key criteria you would like to achieve, or the aims of the particular sheet.

  For example: *Within Output 1, I aim to explore existing exterior lighting designs, the function requirements of an exterior light, the range of aesthetic designs and record my observations/discussions with target users.*

Sheet Conclusion: When you have finished an Output, draw on what you have learned, the insight gained and write a brief conclusion.

For example: *After completing this Output 1, I have learned that...I have decided to....   In the next sheet I will use this information to.....*

How can I insure that my decisions are clearly communicated?

Ensure your annotations are neatly presented and inline with your individual graphic style. You may decide to use a particular style of text, colour or a symbol, to highlight key decisions. Graphical arrows can also be used, to track your thought process over a sheet. The latter are suggestions only, the main criteria being that you are creative and consistent in your presentation.

I have collected all the research but I am finding it difficult to make decisions?

You need to be informed to make the right decision. It may be that you have collected all the research material but you need to spend time reading the information and understanding it. Following this, you could draft a list of questions to consider. There are several techniques to employ, some of which are listed below:

A useful technique is to use the **<u>five W's</u>** to draw conclusions/decisions from each section. This questioning process incorporates all aspects of the research topic. After each initial question, several new questions will arise.

- **Who** Who uses the artefact?.....Could it be adapted for other users?
- **What** What is the artefact designed to do?...Is it fit for its purpose? If not, why? If so, could it be improved to appeal to a wider market?
- **When** When is the artefact used? ....If there were other functions incorporated into the design, would it be used more often?
- **Where** Where is the artefact used? ….Can it be adapted to other environments?
- **Why** Why is the artefact needed?..... Are there features missing which would improve the function? Are there existing features which could be removed?

Appendix 1

Recommendations from the NCCA Course Committee on the Student Assignment Outputs and draft marking scheme.

Sample output and marking scheme (Higher level)

	Part (a) Existing Artefacts	Suggested Marks	Suggested outputs
Marks for reflection and thought process are allocated under all appropriate headings.	1) Exploration of brief and presentation of existing artefacts in graphic format.	10 marks	1-2 pages
	2) Select 2 images and illustrate/explain the main design features. Insert the main dimensions. Compare and contrast the main design features of both using suitable freehand sketches and presentation techniques.	20 marks	2-3 pages
	3) Choose one of the artefacts and make a detailed graphical presentation of this artefact. This should include rendered 3-dimensional freehand presentation quality drawing.	20 marks	1 page
	4) Generate a detailed computer model, comprising at least 5 parts, ecomomy of design and design intent will be considered in the marking of the assignment. o An electronic file. o An e-drawing.	30 marks	**Electronic version** two folders, one containing CAD files and one containing scanned images etc.
	5) Produce: o A detailed orthographic. o Pictorial which has been coloured and textures applied. o An exploded view.	10 marks	2-4 pages
	6) Produce a photorealistic computer generated view of the artefact	10 marks	1 page
	Part (b) Design Modification or Concept Design		
	7)Analysis of brief and an illustration of the progression of ideas and solutions	20 marks	2-4 pages
	8) CAD Model and associated outputs	30 marks	2-4 pages
	9) 3-dimensional rendered sketch depicting the modification/concept design.	10 marks	1 page
	10) Presentation of assignment		
	Total	160 marks	

Note: the suggested outputs are as a guideline only
The maximum number of pages is 14

Sample output and marking scheme (Ordinary Level)

Part (a) Existing Artefacts	Suggested Marks	Suggested outputs
1) Exploration of brief and presentation of existing artefacts in graphic format.	10 marks	1-2 pages
2) Select 2 images and illustrate/explain the main design features. Insert the main dimensions. Compare and contrast the main design features of both using suitable freehand sketches and presentation techniques.	20 marks	1-2 pages
3) Choose one of the artefacts and make a detailed graphical presentation of this artefact. This should include rendered 3-dimensional freehand presentation quality drawing.	20 marks	1 page
4) Generate a detailed computer model, comprising at least 3 parts o An electronic file. o An e-drawing.	30 marks	**Electronic version** two folders, one containing CAD files and one containing scanned images etc.
5) Produce: o A detailed orthographic. o A pictorial which has been coloured and textures applied. o An exploded view.	20 marks	1-3 pages
6) Produce a photorealistic computer generated view of the artefact	10 marks	1 page
Part (b) Design Modification or Concept Design		
7)Analysis of brief and an illustration of the progression of ideas and solutions	20 marks	1-2 pages
8) CAD Model and associated outputs	20 marks	1-3 pages
9) 3-dimensional rendered sketch depicting the modification/concept design.	10 marks	1 page
10) Presentation of assignment		
Total	160 marks	

Marks for reflection and thought process are allocated under all appropriate headings.

Note the suggested outputs are as a guideline only
The maximum number of pages is 12