

Teachers' notes

Level

The resource is aimed at KS3 and KS4 students of Design and Technology and anyone else who is interested in gaining an understanding of the process of iterative design development.

Learning objective

The objective is that students will know, understand and use the process of iterative design development in their D&T work, i.e. the cyclic process of analysing, evaluating, modifying and recording design ideas.

Resource description

The resource consists of lesson plans, HTML and PDF teaching notes and exercises.

The methodology used is Presentation, Practice, Production (PPP). Each lesson consists of a lead-in, presentation, controlled practice, free practice, production and review.

The lesson plans guide the teaching of:

- analysis, evaluation, modification and recording of modifications by using questions that elicit student descriptions of the stages of design development and the cyclic nature of iterative design development
- the many ways that designs may be developed
- the many reasons for design development.

The HTML version of the iterative design development teaching resources contain detailed Flash animations that clearly illustrate the process of iterative design development.

The PDF version of the iterative design development description can be easily printed and used as student "hand-outs" for their records.

The iterative design development model used in this resource is shown opposite.

The process of developing 1) a hazy idea into a detailed design and 2) developing a design into something new and better is illustrated in this resource using Flash animations.

Detailed examples of how designs may be further developed are also given, e.g. making products more suitable for a particular user, changing the manufacturing material etc.

The exercises included in this resource enable students to use the iterative design process to develop new and better designs.



How to use the resource

Use the lesson plans to guide students through activities that help them develop a thorough understanding of the cyclic process of iterative design development.

Use the ways that designs may be developed to extend design activities.

Differentiation may be achieved through:

- the amount of support given (by guided questions from the teacher, support from peers during student – student interaction)
- the complexity of task, (e.g. the depth of design development)
- the amount of research that students need to undertake.

Iterative design development lead-in lessons

Learning to analyse, evaluate, modify and to record modifications

T = Teacher

S = Student

Lesson length approx. 55 minutes

Stage	Activity 1 – Learning to analyse	Reason	Interaction	Time
Lead-in to analysis	<p>Required resource: balancing toy visual aid as illustrated in Appendix 1 and something to stand it on so that it is clearly visible to all students in the class.</p> <p>Teacher shows students the balancing toy balancing on his/her finger and pushes the weight to make the toy rock back and forth. Teacher places visual aid on the stand so both his/her hands are free.</p>	<ol style="list-style-type: none"> 1. Arouse curiosity and interest 2. Elicit emotive responses about the visual aid/product. 	T - S	2 mins
Presentation	<p>Teacher asks students why the toy does not fall over, what it's made from, how many parts has it got, how the parts are fixed together, what type of finish it has, what is "finish" and elicits responses from individuals.</p> <p>Teacher tries to elicit "ANALYSIS" by asking students if anyone knows what this type of close scrutiny is called/ very close look at a product is called.</p>	<p>Students are required to study the product and identify its parts, how its made etc, i.e. to analyse the product.</p> <p>Questioning the group does not focus attention on reluctant or less able learners.</p>	T - S	5 mins
Controlled Practice	<p>Teacher sketches product on board then elicits responses about the details of the product. Teacher writes responses on board.</p> <p>Before free practice session, teacher wipes student answers from the board</p>	Students are shown how a product analysis can be presented on paper.	T - S	10 mins
Free practice	<p>Students split into pairs or groups of four.</p> <p>Students analyse the product as a group and write their answers on a sheet.</p>	All students will have a detailed analysis in note form.	S - S	10 mins
Production	Students work individually and draw the balancing toy visual aid and write a detailed analysis of it.	All students will have a neatly drawn product with a detailed analysis of it.	S - S	25 mins
Review	Teacher questions students about the meaning of analysis and how an analysis could be carried out.	Confirms that all students have understood the meaning of "analysis" and are able to analyse a product.	T - S	3 mins
Follow on activity	Practice analysing other readily available products.	Develops the ability to carry out a detailed product analysis and record findings.		

Stage	Activity 2 – Learning to evaluate	Reason	Interaction	Time
Lead-in to evaluation	Teacher reminds students that they'd analysed a balancing toy. Teacher asks students what they thought about it. Teacher elicits personal responses and prejudices.	Lead-in to subjective evaluation, i.e. eliciting student statements about what they liked and disliked about the product.	T - S	2 mins
Presentation	Teacher writes likes and dislikes on board one above the other in a column. Teacher tells students that by stating what they like and dislike, what they think is good about the product and what they think is bad, they are evaluating the product. Teacher writes "SUBJECTIVE EVALUATION" at the top of the column. Teacher asks what a "good" balancing toy should be like. Teacher writes responses on board and tells students that their answers are design criteria and that specific criteria are called specifications. <i>Example design criteria:</i> the toy must have a counterbalance weight. <i>Example design specification:</i> the toy must have a counterbalance weight that consists of a 300 gram steel ball with a Ø4 hole drilled 10mm deep at the centre.	Students will learn that: <ol style="list-style-type: none"> by applying emotions to an evaluation they are making a subjective evaluation objective evaluations need design criteria and specifications design criteria and specifications describe what a product or design must be like and parts that it must have. 	T - S	10 mins
Controlled Practice	<ol style="list-style-type: none"> Teacher asks students for criteria and specifications for the balancing toy. Teacher writes responses on board. Teacher asks students to compare the balancing toy with the criteria and specifications; teacher writes responses in a vertical list on board and tells students that their responses are objective evaluations. Teacher writes "OBJECTIVE EVALUATION" at the top of the list. 	<p>Students develop an understanding of design criteria and specifications.</p> <p>Students learn to compare designs and products to design criteria and specifications and so develop evaluations.</p>	T - S	10 mins
Free practice	Students split into pairs or groups of four. They are told to: <ol style="list-style-type: none"> make a list of what a good balancing toy should be like and to write whether each statement is a design criteria or a design specification. make subjective and objective evaluations of the balancing toy. 	Students practice formulating design criteria, specifications and evaluations.	S - S	10 mins
Production	Students work individually and add to their product analysis of the balancing toy by adding: <ol style="list-style-type: none"> a subjective evaluation design criteria and specifications an objective evaluation. 	In addition to the detailed product analysis, all students will have design criteria, specifications for the balancing toy plus a subjective and objective evaluation of it.	S - S	20 mins
Review	Teacher questions students about the meaning of design criteria and specifications and asks for examples.	Confirms that all students have understood the meaning of: <ol style="list-style-type: none"> "design criteria" and "specifications" "evaluation". 	T - S	3 mins

Stage	Activity 3 – Learning to modify and to record modifications	Reason	Interaction	Time
Lead-in to modification	Teacher reminds students that they'd analysed a balancing toy, written design criteria and specifications for it and have written an evaluation of it. Teacher reads some of the negative statements in a student's evaluation and asks the class for one change to the product that would improve it.	Lead-in to modification, i.e. eliciting student statements about how the product could be improved.	T - S	5 mins
Presentation	Teacher continues asking students about ways that the design could be improved until about 6 – 10 suggestions have been made. Teacher asks: <ol style="list-style-type: none"> 1. what the first suggestion was, and 2. which was the best idea for improvement. 	Teacher elicits suggestions for modifications and the need to record ideas or they will be forgotten.	T - S	5 mins
Controlled Practice	Teacher tells students that a design change is called a modification. Teacher draws on the board and uses notes and sketches to record a modification. Students draw the modification on their design analysis, evaluation sheets (record modification). Teacher asks students to look at the modified design (analysis); to say what is good, bad or unlike the specification (evaluation) and asks for another suggestion for improvement (modification). Teacher draws the second modification on the board and tells students to copy it.	Students record the first modification. Introduction to iterative design development.	T - S	10 mins
Free practice Production	Students work in pairs or groups of four and continue the cycle of analysis, evaluation, modification and recording modifications to the balancing toy.	Students practice iterative design development	S - S	25 mins
Review	Students volunteer to show their design sheets to the group and to explain how their design developed. Teacher finishes by showing the “ Iterative Design Development ” animation included in the Iterative Design Development software.	Students get to show their work to others, compare their work to others, and learn to accept and to give suggestions, compliments and criticisms.	S - S	10
Follow on activity	Prior knowledge of orthographic projection is required for this exercise. Teacher reminds students about the process of technical drawing using orthographic projection and tells students to draw a front and side elevation of the balancing toy to scale, e.g. scale 1:5	Students need an orthographic drawing, drawn to scale to see what their design will actually look like and (by analysis and evaluation) if it needs further development.	T - S	

Iterative design development in detail

Learning to analyse, evaluate, modify and to record modifications

T = Teacher S = Student

Stage	Activity 1 – Developing knowledge of iterative design development (Building on previous learning about iterative design development)	Reason	Interaction	Time
Lead-in	Teacher questions students about what they remember about design development.	To elicit statements about analysis, evaluation, modification and recording the modification, the cyclic process of iterative design development.	T - S	3 mins
Presentation	<p>Teacher questions students in order to elicit that design development can be used to:</p> <ol style="list-style-type: none"> 1. improve a design 2. make a design suitable for a particular purpose 3. change a hazy idea into a clear and detailed plan 4. change a design from what it is into what the designer wants it to be. <p>Also that changes to a design are called modifications.</p> <p>Resource required: Design_development.html on interactive whiteboard. Teacher and students briefly discuss the first part of the notes about design development and the two models illustrating the cyclic nature of iterative design development.</p> <p>Teacher also shows that designs can be developed by working in a sequence, a series of small changes developing the design.</p>	Students learn how design development can change a design and that design development is a cyclic process.	T - S	10 mins
Controlled Practice	<p>Resource required: Design_development.swf full screen on computers</p> <p>Teacher shows Design_development.swf on interactive whiteboard and shows students how to work through the animation.</p> <p>Teacher reminds students to look out for ways that the design develops and how ideas are tested, sometimes improving the design and other times not.</p>	Students see an example of design development and that the iterative process leads to many possibilities.	T - S	2 mins

Free practice	<p>Students play the animation and observe:</p> <ol style="list-style-type: none"> 1. how a hazy impression of a design can be developed into a clear and detailed plan. 2. how a design can be changed into something new or better. 	Students learn that designs can be developed in many ways.	S - S	15 mins
Production	<p>Resource required: Toothbrush_holder_design.html on interactive whiteboard.</p> <p>Students start with a hazy idea for a toothbrush holder and develop the idea into a clear and detailed design.</p>	Students can work in pairs or groups to implement the iterative design development process; they produce their own design sheets.	S - S	20 mins
Review	Students volunteer to show their design sheets to the group and to explain how their design developed.	Students get to show their work to others, compare their work to others, learn to accept and to give suggestions, compliments and criticisms.	S - S	5 mins
Follow on activity	Students act on recommendations for improvements to their designs/design sheets.	Students learn to act upon suggestions for design development and quality of presentation of designs.	S - S	

Stage	Activity 2 – Ways that designs may be developed	Reason	Interaction	Time
Lead-in	Teacher quizzes students about refining designs.	Elicits meaning of refining a design, adding detail, sizes, materials, components etc.	T - S	3 mins
Presentation	Teacher uses “Who, What, Where, How” to elicit design development refinements, e.g. making a design more suitable for a particular person, material, environment etc.	Elicits the need to design for particular groups, environments etc.	T - S	10 mins
Controlled Practice	Teacher asks for ways that designs may be developed and refined and writes responses on board.	Students are guided to make design development suggestions.	T - S	5 mins
Free practice	Students work in pairs or groups of four and list ways that designs may be developed.	Group work will produce a variety of ways that designs may be developed.	S - S	10 mins
Production	Students produce their own lists of ways that designs may be developed and add as much information and examples as they can think of.	Students produce a list of ways that they can develop any design.	S - S	20 mins
Review	Students present their lists of ways that designs may be developed. They may compare their list to the list in the “Design Development” PDF.	Students compare ideas about ways to develop designs and produce a definitive list of ways to develop designs.	S - S	7 mins
Follow on activity	Students work through some/all of the design development exercises included in the Iterative Design Development package.	Students will develop their iterative designing capability.		

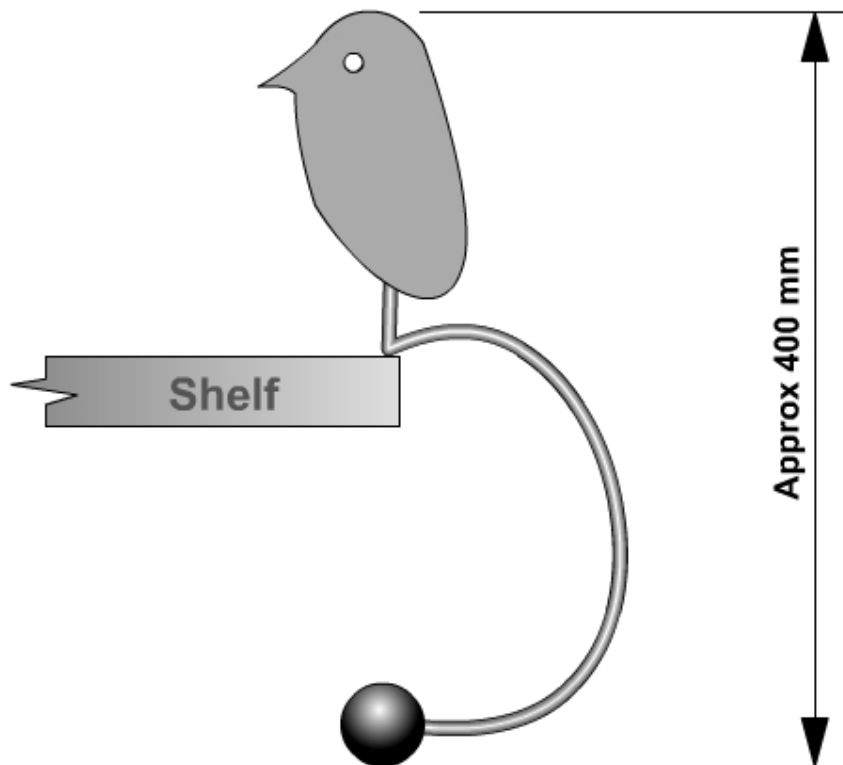
Appendix 1

Basic design for a balancing toy visual aid

An idea for a design development starting point is shown below.

The visual aid could consist of any shape that could easily be developed further.

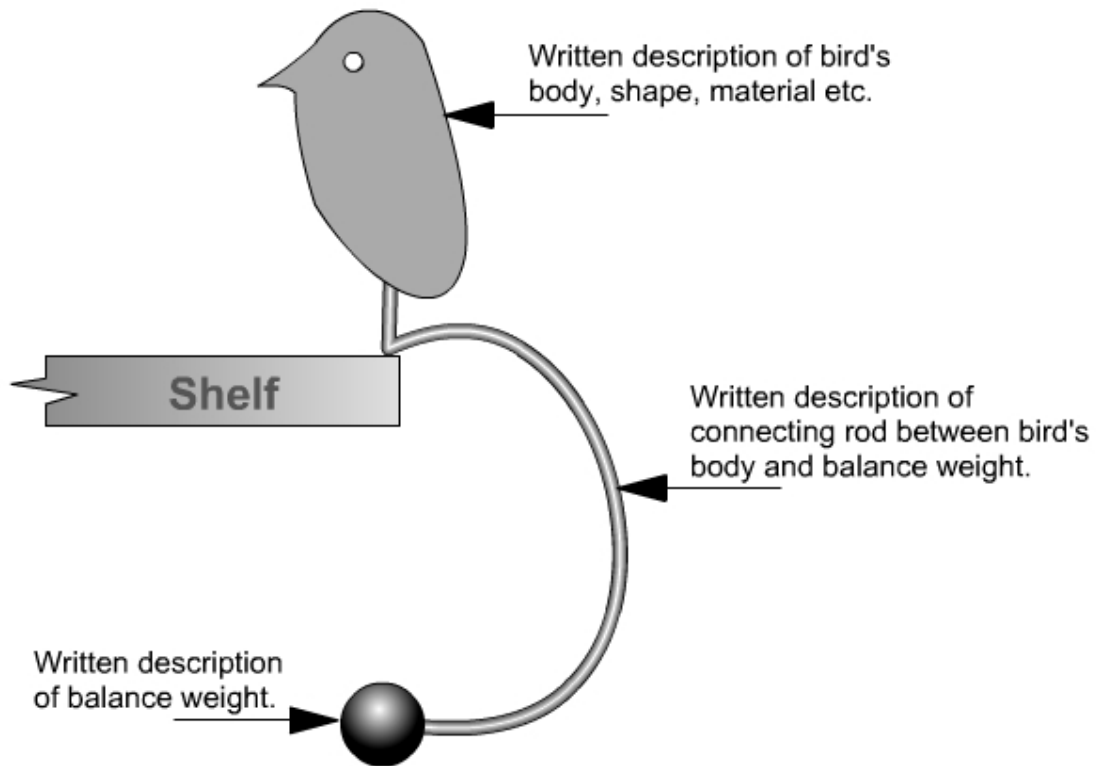
The visual aid should be large enough for students to see it from all areas of the class.



Appendix 2

A possible way of presenting the balancing toy analysis

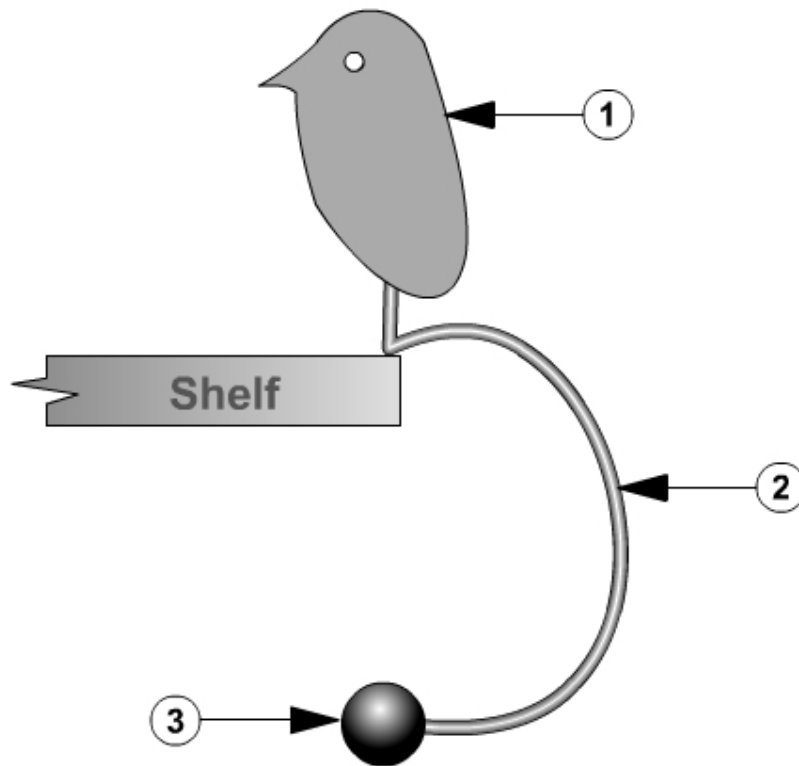
Students draw the visual aid and add their analysis to the drawing as shown below.



Appendix 3

A possible way of presenting the balancing toy analysis

Students draw the visual aid and add their analysis to the drawing as shown below.



1. Written description of bird's body, shape, material etc.
2. Written description of connecting rod between bird's body and balance weight.
3. Written description of balance weight.