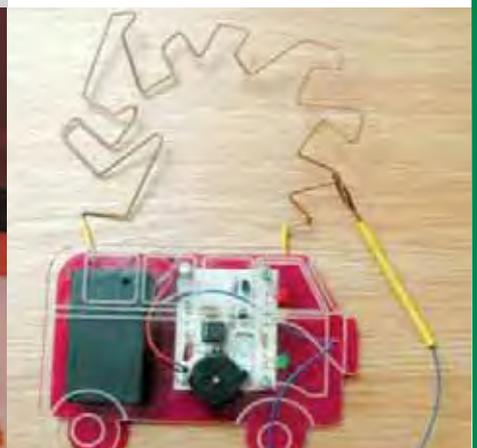


Design and technology

Guidance for Key Stages 2 and 3



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Llywodraeth Cynulliad Cymru
Welsh Assembly Government

Design and technology

Guidance for Key Stages 2 and 3

- Audience** Teachers at Key Stages 2 and 3; local authorities; regional consortia; tutors in initial teacher training; and others with an interest in continuing professional development.
- Overview** These materials provide key messages for planning learning and teaching in design and technology. They include profiles of learners' work to exemplify the standards set out in the level descriptions and illustrate how to use level descriptions to make best-fit judgements at the end of Key Stage 3.
- Action required** To review learning plans and activities at Key Stages 2 and 3, and to prepare to make judgements at the end of Key Stage 3.
- Further information** Enquiries about this document should be directed to:
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- Additional copies** This document can be accessed from the Learning Wales website at gov.wales/learning
- Related documents** *Design and technology in the National Curriculum for Wales; Skills framework for 3 to 19-year-olds in Wales; Making the most of learning: Implementing the revised curriculum; Ensuring consistency in teacher assessment: Guidance for Key Stages 2 and 3; Food and fitness in the curriculum in Wales* (Welsh Assembly Government, 2008)
- This guidance is also available in Welsh.

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Introduction

The programmes of study set out the opportunities that learners should be given at each key stage and provide the basis from which you, as a teacher, can plan learning and teaching. They are divided into two sections, Skills and Range. The Skills section lists the skills to be developed in a subject and the Range section comprises the opportunities and contexts through which these skills should be developed and consolidated.

Ongoing formative assessment – assessment **for** learning – lies at the heart of good teaching. Through the assessments that you make in the course of your teaching, you will build up an extensive knowledge of your learners' strengths, as well as the areas that need further development, and you will use this knowledge to help you plan for the next steps in their learning. Learners will also gain understanding of specific learning goals and the associated success criteria so that, supported by you, they can develop their capacity for self-assessment and peer assessment. In this way, they can establish their current position, set and move towards targets, and discover if and when the targets have been reached. Individual targets are linked to improving the quality of a learner's work, as highlighted through formative feedback, and are therefore linked to success criteria for specific tasks. Level descriptions do not make effective targets as these describe attainment across the breadth of the programme of study at the end of a key stage.

Level descriptions can help to inform your planning, teaching and assessment at Key Stages 2 and 3 by indicating expectations at particular levels and progression in the subject. Evidence from assessment for learning will indicate where more time is needed to consolidate learning and when learners are ready to move on. You may wish to keep some evidence so that you can discuss a learner's work and progress with them and/or with colleagues or parents/guardians. However, there is no statutory requirement to keep unnecessarily complex records or detailed evidence on every learner.

The essential function of level descriptions is to help you make rounded summative judgements at the end of Key Stage 3 about a learner's overall performance. Level descriptions are designed neither to be used to 'level' individual pieces of work nor for the production of half-termly or termly data. It is only by the end of the key stage that you will have built up sufficient knowledge about a learner's performance across a range of work, and in a variety of contexts, to enable you to make a judgement in relation to the level descriptions.

It may be that some learners will be more advanced in some aspects of the work than in others, and that no one level description provides an exact fit. That is to be expected, and the range of individual learners' work included in these materials illustrates the making of best-fit judgements under those circumstances. Many schools/departments have found it helpful to develop their own learner profiles to support moderation of end of key stage judgements. These profiles also help to maintain a common understanding of standards when they are reviewed annually and refreshed when necessary.

When making judgements at the end of Key Stage 3, you should decide which level description **best fits** a learner's performance. The aim is for a rounded judgement that:

- is based on your knowledge of how the learner performs across a range of contexts
- takes into account different strengths and areas for development in that learner's performance
- is checked against adjacent level descriptions to ensure that the level judged to be the most appropriate is the closest overall match to the learner's performance in the attainment target.

National curriculum outcomes have been written for learners working below Level 1. These are non-statutory and guidance on their use is planned.

Using these materials

This booklet is divided into four sections.

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|-----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Section 1 | highlights key messages for learning and teaching in design and technology. |
| Section 2 | highlights expectations and progression in design and technology. |
| Section 3 | contains a series of Key Stage 2 learner profiles. These are designed to show the characteristics of the level descriptions. |
| Section 4 | contains a series of Key Stage 3 learner profiles. These are designed to show the use of the level descriptions in coming to judgements about a learner's overall performance at the end of the key stage. |

This booklet is for reference when you wish to:

- review your learning plans and activities
- consider the standards set out in the revised design and technology Order
- work with other teachers to reach a shared understanding of the level descriptions
- prepare to make judgements at the end of the key stage
- develop your own learner profiles
- support transition from Key Stage 2 to Key Stage 3.

For ease of reference, the level descriptions are included in a leaflet with this booklet.

A CD-ROM is also included with this booklet. It contains a PDF version of *Design and technology in the National Curriculum for Wales, Skills framework for 3 to 19-year-olds in Wales* and this guidance.

This guidance is part of a series of materials that will help teachers at Key Stages 2 and 3 to implement the revised curriculum and its associated assessment arrangements. The series includes:

- *Making the most of learning: Implementing the revised curriculum* – overview guidance on implementing the new curriculum
- *Skills framework for 3 to 19-year-olds in Wales* – which includes guidance about progression in skills
- *Ensuring consistency in teacher assessment: Guidance for Key Stages 2 and 3*
- *A curriculum for all learners: Guidance to support teachers of learners with additional learning needs*
- specific guidance for all national curriculum subjects, personal and social education, careers and the world of work, and religious education.

Section

1

Key messages for learning and teaching
in design and technology

The focus of this section is to help you plan for your teaching of the revised programmes of study to be relevant and motivating for each learner, i.e. to be learner centred. You should plan to provide opportunities for learners to develop skills through activities that are identified under the Range section in the design and technology Order and in which they can:

- be creative and innovative
- evaluate products
- develop and practise particular skills
- design and make products
- work independently and in groups.

You should use the Skills and Range sections of the programme of study as a flexible framework from which it is possible to select contexts and develop activities that will be relevant and motivating for learners. You should use the Range as a starting point, but you are free to build upon the activities and examples listed to take into account the needs and interests of individual learners and developments in design and technology.

Developing a Skills focus

Your learning plan should ensure that learners have opportunities to develop, practise and apply the skills identified in the programmes of study for design and technology – Designing and Making – and the related skills in the *Skills framework for 3 to 19-year-olds in Wales*.

Safe and appropriate use of tools/utensils and equipment should be embedded throughout all activities. Learners should progress from working safely with support and supervision to working safely, responsibly and independently, thus ensuring their safety both within and outside of the school environment.

Your learning plan should allow relevant and realistic experiences through which learners are able to develop skills for life.

Useful questions to guide planning and develop a skills focus might be:

- Does this sequence of activities progress skills?
- Which skills from the design and technology programme of study does this lesson develop?
- What is the purpose of this activity? Does it introduce a new skill, consolidate a skill or apply and extend a skill?

A learning plan is more likely to support the development of a range of skills if it offers opportunities for learners to:

- work practically, taking a hands-on approach, using personal experience and investigation
- work in a variety of settings in groups and individually
- use thinking skills to think critically and creatively about their design and technology activities
- use a variety of communication, number and ICT skills.

Implementing the Range

The activities included in your learning plan should cover, as a minimum, those listed under the Range in the relevant programme of study. This will ensure balance and breadth for learners at each key stage. In designing the learning plan, your focus should be on the learner and, in selecting various activities, it may be helpful for you to ask the question 'How relevant is this activity to learners in this school/class?' The Range is designed to offer flexibility for you to choose activities and topics that will be relevant for all learners. Materials may be covered separately or combined. They do not necessarily require equal amounts of study time. They may be used as a flexible framework within which to explore design and technology topics of interest to the learners.

Design and technology and skills across the curriculum

A non-statutory *Skills framework for 3 to 19-year-olds in Wales* has been developed in order to provide guidance about continuity and progression in developing thinking, communication, ICT and number for learners from 3 to 19.

At Key Stages 2 and 3, learners should be given opportunities to build on skills they have started to acquire and develop at Foundation Phase. Learners should continue to acquire, develop, practise, apply and refine these skills through group and individual tasks in a variety of contexts across the curriculum. Progress can be seen in terms of the refinement of these skills and by their application to activities that move from: concrete to abstract; simple to complex; personal to the 'big picture'; familiar to unfamiliar; and supported to independent and interdependent.

Icons have been used in the design and technology Order to signal explicit requirements for the development of skills and learning across the curriculum. However, in planning a learning plan relevant to their learners, teachers should identify other opportunities to enrich skills and learning development. The skills framework may be used alongside the design and technology Order and other subject Orders to help the process of curriculum planning.

Developing thinking



Learners develop their thinking across the curriculum through the processes of **planning**, **developing** and **reflecting**.

In design and technology, learners design and make products through the iterative process of creating and developing ideas, designing products, planning, making and reflecting on their decisions and outcomes in terms of their finished product.



Emma's Key Stage 3 profile illustrates the development of thinking where she has demonstrated her capability to gather information independently to help develop a number of ideas. She also reflected on those ideas using sketches and models and made choices between them.

Developing communication



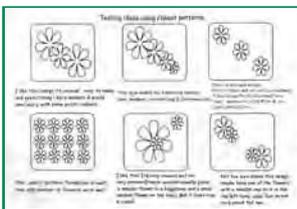
Learners develop their communication skills across the curriculum through the skills of **oracy**, **reading**, **writing** and **wider communication**.

In design and technology, learners ask questions and seek out information to develop and support their design ideas. They communicate and record their ideas and intentions by explaining, writing, sketching, using detailed technical drawings and three-dimensional models.



Rhys' Key Stage 2 profile illustrates the development of communication skills where he has expressed his ideas in a number of ways including sketches and formal drawings with written details of manufacture.

Learners also use computer-aided design (CAD) in order to communicate, model and evaluate ideas.



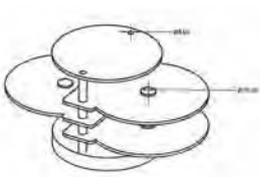
Mali's Key Stage 3 profile illustrates the innovative and creative use of CAD to communicate her ideas.

Developing ICT



Learners develop their ICT skills across the curriculum by **finding, developing, creating and presenting information and ideas** and by using a wide range of equipment and software.

In design and technology, learners research and develop their ideas by using ICT to find information from databases and the internet. They communicate and present their ideas using word processors/desktop publishing, presentation software, computer-aided design (CAD) and computer-aided manufacture (CAM). Learners use ICT individually and collaboratively, depending on the nature of the activity in hand.



Mali's Key Stage 3 profile illustrates the development of ICT skills where she used the internet to research materials and structures to develop her ideas. Mali also presented her ideas and manufactured her product using CAD/CAM.

Developing number



Learners develop their number skills across the curriculum by **using mathematical information, calculating, and interpreting and presenting findings**.

In design and technology, learners use mathematical information and data, presented numerically and graphically, to research and develop their ideas. They use number to measure and calculate sizes, fits and materials.



Ffion's Key Stage 2 profile illustrates the development of number skills where she programmed her floor turtle to go to the Maldives. This involved her interpreting the journey to the Maldives, firstly as a floor model and then as a sequence of programmed instructions that involved distance, time and angles.

Design and technology and learning across the curriculum

At Key Stages 2 and 3, learners should be given opportunities to build on the experiences gained during the Foundation Phase, and to promote their knowledge and understanding of Wales, their personal and social development and well-being, and their awareness of the world of work.

Curriculum Cymreig



Learners should be given opportunities to develop and apply knowledge and understanding of the cultural, economic, environmental, historical and linguistic characteristics of Wales.

In design and technology, learners should be given opportunities to use the rich characteristics and resources of Wales as a source of inspiration and a context to design and make products.



Ffion's Key Stage 2 profile illustrates such an opportunity, where she has designed a logo to advertise the Eryri Mountain Railway.

Personal and social education



Learners should be given opportunities to promote their health and emotional well-being and moral and spiritual development; to become active citizens and promote sustainable development and global citizenship; and to prepare for lifelong learning.

In design and technology, learners should work in contexts that allow them to make decisions based on the values that underpin society, helping them become active and informed citizens. They should be made aware of human achievements and the big ideas that have shaped the world. They should be encouraged to be enterprising and innovative in their designing and making, while having regard for sustainability and environmental issues in the twenty-first century.

Regard for health and safety, in its broadest sense, should be a central feature of all design and technology activity. Learners should be taught how to use tools/utensils and equipment safely and to consider the hazards and risks in their activities, behaviour and lifestyle. They should be able to follow instructions to control risk to themselves and others and, where appropriate, take account of user safety in the products they design and make. They should be aware of the possible impact on their health of certain behaviours such as eating habits.

Where ICT is used, for example in internet-based research, learners should be taught to use the technology comfortably, safely, legally and responsibly, and to consider the hazards and risks in their activities. The aim should be to develop learners' understanding of the issues so that they move from using the technology safely under supervision to becoming safe, autonomous users of ICT. Opportunities for discussions around the responsible use of technology can help learners deal confidently with issues that may arise within or outside of school.

All of the profiles shown in Sections 3 and 4 of this document illustrate the safe use of tools, utensils and, where appropriate, ICT. Learners have undertaken their practical work in safe environments, under appropriate supervision. Where it is relevant to do so, learners have considered the safe use of their products.



In Mali's Key Stage 3 profile she considers the safety of users of her steady hand game by ensuring it has no sharp edges.

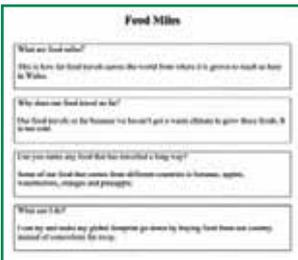
The place of food education has been strengthened considerably in the revised national curriculum. Food and practical skills have been given greater significance in the design and technology Order. Additionally, the importance of both food and fitness, and the links between them, are highlighted in several other national curriculum subject Orders and frameworks, for example, the science Order, the physical education Order, and the personal and social education framework. You may also wish to refer to a document entitled *Food and fitness in the curriculum in Wales* which was published by the Welsh Assembly Government in 2009. Design and technology contributes to learners' awareness of the importance of food and fitness by encouraging them to *apply current healthy eating messages and consider nutritional needs when undertaking food preparation tasks (KS2)* or *apply current healthy eating messages in relation to the nutritional needs of different groups in society (KS3)*.



Rhys' Key Stage 2 profile includes an activity where he made a fruit salad. As part of their research during this activity, the class discussed the importance of eating fruit and having a healthy diet.



Sam's Key Stage 2 profile includes an opportunity for the promotion of global citizenship with the 'hands in different cultures' wall banner.



Rhys' Key Stage 2 profile includes a fruit world map with consideration of 'food miles' – an ideal opportunity to develop learners' regard for environmental issues surrounding food production, transportation and availability.



George's Key Stage 3 profile includes work on recyclable packaging for a pizza, that increased his awareness of the issues surrounding the disposal of fast-food packaging.

Careers and the world of work



Learners should be given opportunities to develop their awareness of careers and the world of work and how their studies contribute to their readiness for a working life.

Design and technology contributes to learners' awareness of careers and the world of work by providing opportunities for them to understand how consumer products and services are developed and brought to the marketplace and by raising their awareness of the range and diversity of careers associated with manufacturing in the wider world. Design and technology also allows learners to engage with the design and manufacturing technologies that are increasingly used in the workplace.



Emma's Key Stage 3 profile illustrates her use of CAD/CAM to design and manufacture a photoframe. In this work Emma gained an insight into how modern technologies can both speed up the design process and help ensure a high quality product is made with the minimum of waste.

Section

2

Expectations and progression in
design and technology

This section is designed to help you come to a common understanding of the standards associated with Levels 1 to Exceptional Performance in the level descriptions for design and technology, in the context of the Key Stage 2 and Key Stage 3 Programmes of Study.

The level descriptions incorporate the main characteristics of progression in design and technology and within the level descriptions are the two key themes of designing and making products. While designing and making should be considered as an integrated activity, it is useful to look at the skills and knowledge that make up the process of designing and making and the way in which the level descriptions are constructed. Understanding the structure of the level descriptions in this way enables us to focus more clearly on the progress of individual pupils.

Level descriptions in design and technology focus on pupils' capabilities with respect to: generating, developing and communicating ideas; planning and producing quality products; and evaluating. The level descriptions are not related to a particular phase or key stage but describe the types and range of performance that learners working at a particular level should characteristically demonstrate.

Progression in any of the above may be mapped with reference to the appropriate characteristics of the level descriptions. For example, in the context of evaluating pupils' progress from talking about what they like or dislike about what they have made at Level 1, to evaluating their work as it develops while bearing in mind their original intentions at Level 5, to devising evaluation procedures, and using these to indicate ways of improving their products, and implementing those improvements at Exceptional Performance.

In the table across the following pages, progression from Level 1 to Exceptional Performance in the central activities of generating, developing and communicating ideas; planning and producing quality products; and evaluating is shown to help identify progression in each strand. In the table the strands are set out in levels to help identify progression in each one. The tables can be used horizontally to look at performance at a particular level or vertically to trace progression within a particular strand. Illustrating the structure of the level descriptions in this way should help planning for a whole departmental approach to the delivery of design and technology.

Progression in design and technology

Level	Generating, developing and communicating ideas	Planning and producing quality products	Evaluating
	This part of the level descriptions is about pupils developing initial ideas for products, applying knowledge and understanding to develop their ideas and communicating them in sketches, drawings, models and through using ICT.	This part of the level descriptions is about planning the making of the product sequentially and anticipating potential problems and the skills, knowledge and understanding of working materials to produce well-finished products. At the higher levels the products should demonstrate originality, innovation and creativity.	This part of the level descriptions is about pupils reflecting on their decisions as they design and make their product, comparing it to their original intentions or specification.
1	When designing and making, pupils talk about familiar products in terms of appearance, function, likes and dislikes. They assemble and rearrange given materials, ingredients and components in different ways.	Pupils use simple tools/ utensils and talk about what they will make and how they will make it. They make simple constructions and products.	
2	When designing and making, pupils ask questions and suggest ideas for making things based on their examination of familiar products and their experience of using materials, ingredients and techniques.	Pupils use pictures and words to convey what they want to do. They manipulate simple tools/ utensils and assemble, join and mix materials and ingredients in a variety of ways.	Pupils talk about what they like or dislike about what they have made.

<p>3</p>	<p>With guidance, pupils gather given information to support their ideas when designing and making. They draw on their developing knowledge and understanding of materials, ingredients and components to develop their ideas, and begin to consider sustainability issues related to the materials and ingredients they are working with. They use labelled sketches and/or models to develop and show the detail of their designs.</p>	<p>Pupils use simple tools/ utensils and techniques to cut, shape, join and mix materials and ingredients.</p>	<p>Pupils' products are similar to their design intentions and any changes are identified.</p>
<p>4</p>	<p>When designing and making, pupils gather information independently and use it to help generate a number of ideas. They develop ideas for products recognising that users have views and preferences and consider sustainability. They illustrate alternative ideas using sketches, models and/or ICT, and make choices between them based on their experiences.</p>	<p>Pupils outline what they are going to make and how they are going to make it. They select and use appropriate tools/utensils and equipment when working with a range of given materials and ingredients, and produce functional or edible products.</p>	<p>Pupils evaluate their work as it develops, making changes when necessary.</p>
<p>5</p>	<p>When designing and making, pupils develop an outline design specification/ recipe using supporting information gathered from various sources, and use it to help generate a number of imaginative ideas for products considering the user, health and safety and sustainability. They research a range of their ideas using sketches, models and/or ICT, and make choices between them based on their knowledge and understanding.</p>	<p>Pupils produce drawings/ patterns/recipes with outline dimensions and sequence what they are going to do. They select and use appropriate tools/ utensils and equipment to measure, mark out, cut, join and mix a range of materials and ingredients, and produce products of acceptable quality, function or taste.</p>	<p>Pupils evaluate their work as it develops, bearing in mind their original intentions.</p>

<p>6</p>	<p>Pupils identify and use a range of information sources to research and develop a specification/recipe. They recognise the need to refine or change ideas in the light of their research, user needs, health and safety considerations and sustainability. They produce formal drawings/patterns/recipes with details of manufacture using a range of skills, including the use of CAD.</p>	<p>Pupils sequence the manufacture of their product and use tools/utensils and equipment accurately, adapting to unforeseen problems. They choose from a range of materials and ingredients and produce products to an appropriate standard of construction, finish or taste.</p>	<p>Pupils evaluate the final product comparing it with their original specification/recipe, and suggest improvements.</p>
<p>7</p>	<p>Pupils seek out relevant information sources to research details of their ideas and generate a detailed specification/recipe. Their work demonstrates elements of creativity, innovation and originality, and they modify or change ideas in the light of their research and knowledge and understanding. They consider user needs, health and safety and sustainability when making decisions about their products. They annotate design ideas and, where appropriate, model them in order to aid development. They communicate appropriately, using a range of skills including the use of CAD.</p>	<p>Pupils order and sequence the manufacture of their product, and use tools/utensils and equipment with increasing precision, making changes in the light of unforeseen problems. They choose from a range of materials and ingredients, and produce products to a good standard of construction, finish or taste.</p>	<p>Pupils evaluate the final product comparing it with their original specification/recipe and identify possible improvements.</p>

8	<p>Pupils are focused and selective when identifying and using research materials, and in the way they explore and evaluate existing products. They demonstrate creativity, innovation and originality in generating and developing design solutions. They are responsive to limitations of cost, user preferences, health and safety, and sustainability. They can cross-reference ideas in their specification/recipe to their research. They use high-level communication skills, including detailed annotation of development sketches, accurate drawings and CAD models.</p>	<p>Pupils can sequence manufacture and are becoming increasingly independent in the selection of equipment and potential materials and ingredients. They are able to make products with precision and a high standard of manufacture, finish or taste.</p>	<p>Pupils use a range of evaluation strategies, including detailed testing against the specification/recipe, considering user response and future developments.</p>
Exceptional Performance	<p>Pupils systematically seek out information to aid their design thinking, recognising the needs of a variety of client groups. They successfully combine design ideas and concepts from their research to reach creative, innovative and original design solutions that satisfy conflicting demands, including issues of sustainability. They draw on their accumulated knowledge and understanding to arrive at a justifiable optimum solution through modelling, and communicate to others the key features of their designs, together with information that will aid manufacture in a detailed specification/recipe.</p>	<p>Pupils produce and work from plans that specify how each stage in the making is to be achieved, and that make best use of the time and resources available. They work with a high degree of precision to make products that are healthy, sustainable, reliable, robust, and that fully reflect the quality requirements and detail given in the specification/recipe.</p>	<p>Pupils devise evaluation procedures, use these to indicate ways of improving their products, and implement those improvements.</p>

Progression in design and technology is characterised by the refinement of Designing and Making skills and by their application to activities that move from simple to complex and familiar to unfamiliar. Pupils progress from needing close supervision and support to independent and interdependent working. There is also a developing sense of purpose for the work and increasing competence and sophistication in the creative use of materials, techniques and processes.

In practice, progression may not necessarily be regular or linear; pupils might regress in some aspects of their work, they might reach a plateau for a while or they might progress significantly in one or more aspects. They will have strengths and areas for development and, for example, partial success in a more complex task has to be judged against a very successful outcome in a less challenging task. The familiarity of the context or the materials they are working with, the complexity of the task and the degree of individual responsibility (or support needed) all have to be considered.

As far as health and safety is concerned, progression is not just about a reduction in support or supervision, but development of awareness and understanding to ensure pupils remain safe whenever and wherever they use tools and equipment.

Although it can be useful to separate the different aspects of the level descriptions in order to understand progression, effective learning and teaching in design and technology bring together all of these aspects. When judgements are made about a pupil's attainment at the end of Key Stage 3, it is important to consider a particular level description as a whole as each pupil's work is likely to demonstrate characteristics of more than one level and the final decision on which level to award will be based on a best-fit judgement.

It is worth re-iterating here that level descriptions are neither designed for day-to-day use with pupils nor for the production, for example, of half-termly or termly data. A single piece of work should not be levelled. It cannot provide the range of information needed to make a 'best-fit' judgement although it may demonstrate characteristics of a particular level. Each activity shown in the profiles in Sections 3 and 4 should be viewed in this manner, i.e. considered as demonstrating characteristics of, for example, Level 5 rather than being a Level 5 piece of work.

For ongoing, formative assessment – assessment for learning – it is necessary to focus on the characteristics of a pupil's achievement and on details of ways to move forward rather than on the national curriculum levels. This will involve pupils gaining understanding of specific learning goals and the associated success criteria so that, supported by you, they can develop their capacity for self-assessment and peer assessment. In this way, they can establish their current position, set and move towards targets and discover if and when the targets have been reached. The profiles include details of the anticipated learning outcomes for each activity.

Progression from Foundation Phase to Key Stage 2

Seven Areas of Learning are identified in the Foundation Phase:

- Personal and Social Development, Well-Being and Cultural Diversity
- Language, Literacy and Communication Skills
- Mathematical Development
- Welsh Language Development
- Knowledge and Understanding of the World
- Physical Development
- Creative Development.

As children move into Key Stage 2, it is important to build on the learning and teaching that has taken place in the Foundation Phase. Although all Areas of Learning can provide a foundation for design and technology at Key Stage 2, links with Creative Development – in which children engage in creative, imaginative and expressive activities in art, craft and design – are particularly evident.

Progression from Key Stage 2 to Key Stage 3

It is important to build on the learning and teaching that has gone before when planning the next steps in design and technology. This is especially important at key transition points. The teaching of design and technology in Year 7 might reflect the approach being taken in partner primary schools so that teachers and learners can build on progress made in Key Stage 2 right from the start of Year 7.

Providing Year 7 teachers with relevant information on individual learners' prior achievements, strengths and areas for development, sharing schemes of work and developing projects which span Year 6 and Year 7 can improve transition and ensure that Year 7 teachers have realistic expectations for each learner.

Year 7 teachers benefit from a thorough understanding of what learners already know, and what design and technology skills they already have when they join the secondary school. There will be variations between individual learners, but relevant knowledge about their learners is necessary for Year 7 teachers to develop appropriate schemes of work. These should provide learners with opportunities to utilise their existing skills, knowledge and understanding, avoiding unnecessary repetition of work and the demotivation and underachievement to which this can lead.

Section

3

Using the level descriptions in Key Stage 2

There is no requirement to make end of key stage judgements in design and technology at Key Stage 2. However, knowledge of the characteristics of the level descriptions will help you to recognise learners' strengths, as well as areas for improvement, and to plan for progression.

You may find the following points useful when considering the profiles in this section.

- The learner profiles are not presented as a model for how you should collect evidence about your learners. Decisions about collecting evidence, and about its purpose and use, are matters for teachers working within an agreed school policy.
- The commentaries on the pieces of work have been written to indicate particular qualities of the work and make links to characteristics of the level descriptions. They are not intended as an example of a report to parents/guardians.
- The materials in each learner profile can only represent a small part of the information and experiences that make up a teacher's knowledge of each learner. They do not reflect the extent of the knowledge of each learner that you will have built up over time across a range of different contexts. You will use this knowledge to recognise learners' strengths and areas for development, and to plan for progression.
- Some of your learners may need to use a range of alternative forms of communication to show what they know, what they understand and what they can do.

This section includes profiles for three learners. For each learner a description is provided that outlines the context of the activities, a summary of the design and technology skills shown, and possibilities for further development. While the context of the activity adds to the evidence presented in each profile, it is important to remember that images of the learners' work generally show only the final outcomes. Researching, planning and developmental work, some of which may be ephemeral in nature, should all be considered when recognising learners' strengths and planning for progression.

Ffion | Characteristics of Levels 2, 3 and 4

Ffion is a 10-year-old learner in Key Stage 2.

Her teacher knows much more about Ffion's performance than can be included here. However, this profile has been selected to illustrate characteristic features of Ffion's work across a range of activities. Each example is accompanied by a brief commentary to provide a context and indicate particular qualities in the work.

Ffion's profile shows some characteristics of Levels 2, 3 and 4, but mainly characteristics of Level 3.

During Key Stage 2, Ffion completed a number of focused practical tasks and activities in which she investigated and evaluated familiar products. These teacher-directed activities are aimed at developing particular skills, knowledge and understanding and, in Ffion's case, have been used to prepare her for the full design-and-make activities illustrated in her profile. For example, she has been taught:

- about different methods of finishing a range of materials
- to construct a frame structure
- to construct a simple circuit using a range of components
- to use appropriate tools and techniques to work and join a range of materials
- to evaluate a range of commercially produced products.

Muesli



In this activity, Ffion asked questions and *suggested ideas for making things based on her examination of familiar products* (a characteristic of Level 2), using a range of muesli from local supermarkets. She separated out the various ingredients and recorded her findings. The class then discussed healthy eating and investigated the nutritional properties of various brands of muesli, and used this research to inform their choices in their own designs for muesli.

We looked at the nutritional value of these mueslis.

<u>Fruit muesli (100g)</u>		<u>Luxury fruit muesli (100g)</u>	
Energy	343 kcal	Energy	no information on the packet
Carbohydrates	69.6g	Carbohydrates	
Protein	7.4g	Protein	
Fat	3.7g	Fat	
Fibre	6.6g	Fibre	
Salt	0.3g	Salt	
<u>Swiss style muesli (100g)</u>		<u>Nut and fruit muesli (100g)</u>	
Energy	356 kcal	Energy	332 kcal
Carbohydrates	64.56g	Carbohydrates	64.2g
Protein	10.9g	Protein	8.1g
Fat	6.0g	Fat	4.7g
Fibre	7.8g	Fibre	7.8g
Salt	0.2g	Salt	0.1g

Ffion designed and made her own muesli choosing the ingredients that she liked from her research of the commercial products. She investigated how the commercial packaging was made from a flat piece of card with the fold lines carefully worked out, going on to produce a simple box for her muesli.

Product: Muesli
What is it made from? Nuts, fruit, oat flakes, wheat flakes, dried fruit, sultanas, raisins
List the things you like about this product I like the dried fruit, the oat flakes, wheat flakes and everything else.
List the things you don't like about this product I don't dislike anything about this product.
If you were to design your own, what would you use? = I would use nuts, fruit, oat flakes, wheat flakes, dried fruit, sultanas and raisins. I would put more dried fruit and oat flakes in than anything else.

Horsebox

In this activity, Ffion was asked to design and make a powered vehicle of her choice. She chose to design and make a model of a horsebox. The class had already been taught about simple electrical circuits and learnt how to connect a battery, switch and motor. They had also been taught simple construction techniques.

Ffion designed and made a simple vehicle using square section timber to construct a chassis as a base for the wheels and axle. The body was constructed from cardboard and glued to the chassis. She *used simple tools and techniques to cut, shape and join materials* (a characteristic of Level 3). Ffion's horsebox was *similar to her design intentions* (a characteristic of Level 3) and, to her delight, did work when switched on.



T-shirt

In this activity, Ffion was asked to design an effective logo to be printed on a t-shirt to advertise the Eryri Mountain Railway.

With guidance she gathered information to support her ideas (a characteristic of Level 3) and evaluated existing logos before developing her own ideas. Using ICT she produced three possible designs and *made choices between them* (a characteristic of Level 4), before developing one of these into her final design.

Ffion then printed her chosen design onto iron-transfer paper and, with the help of her teacher, carefully ironed the logo onto a t-shirt removing the backing paper without smudging the transferred logo.



Message in a bottle

Ffion worked as part of a group developing her System and control skills using a programmable floor turtle. The class was given a scenario based on a bottle thrown into the sea at Colwyn Bay. The group requested that anybody who found the bottle should send a postcard and they received a post card from the Maldives.

The class was asked to plot the path the bottle would have taken to reach the Maldives. Ffion researched where the Maldives could be found and planned a route for the floor turtle using an atlas.



Ffion worked collaboratively laying out a route in floor tiles and *used a labelled sketch and the floor model* to develop her programme (a characteristic of Level 3), showing an understanding of degrees and angles. She *evaluated her work as it developed, making changes when necessary* (a characteristic of Level 4).



Summary

Ffion's profile shows some characteristics of Level 2, Level 3 and Level 4 but mainly the characteristics of Level 3.

Ffion demonstrated her ability to suggest ideas for making things based on her examination of familiar products. She also demonstrated her ability to join and mix materials in a variety of ways. Ffion talked about what she likes and dislikes about what she has made.

Ffion used given information to support her ideas and developed her ideas using labelled sketches to show the detail of her designs. She also used simple tools and techniques to cut, shape and join materials, and produced products similar to her design intentions. She gathered information independently and she evaluated her work as it developed making changes where necessary.

As a next step, Ffion could be encouraged to consider users' views and preferences when developing her ideas for products. Her choice of designs should begin to depend upon her developing knowledge and understanding of materials and processes.

Sam | Characteristics of Levels 4 and 5

Sam is a 10 year-old learner in Key Stage 2.

His teacher knows much more about Sam's performance than can be included here. However, this profile has been selected to illustrate characteristic features of Sam's work across a range of activities. Each example is accompanied by a brief commentary to provide a context and indicate particular qualities in the work.

Sam's profile shows some characteristics of Levels 4 and 5, but mainly characteristics of Level 4.

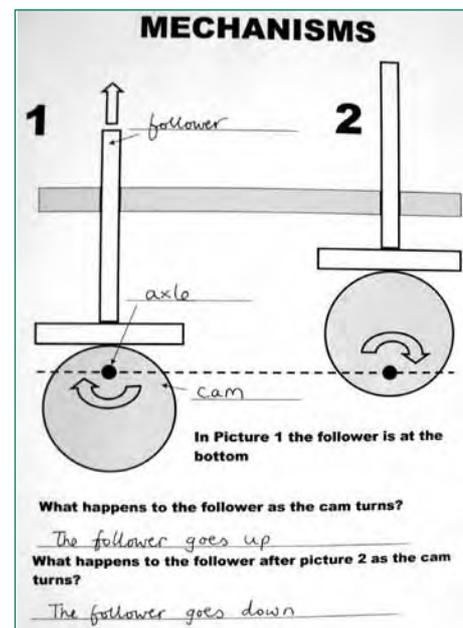
In preparation for the full design-and-make activities illustrated, Sam completed a number of focused practical tasks aimed at developing particular skills, knowledge and understanding. For example, he has been taught:

- about different methods of finishing a range of materials
- to construct a frame structure
- to construct a simple circuit using a range of components
- to use appropriate tools and techniques to work and join a range of materials
- to evaluate a range of commercially produced products.

Moving display

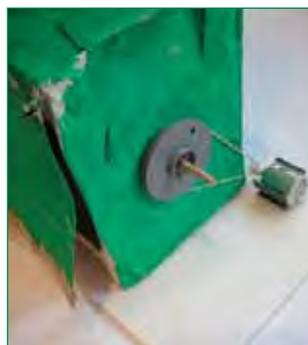
In this activity, Sam was asked to design and make an animated display with the movement produced by a motor-driven cam mechanism. The whole display would be housed in a reinforced wooden frame structure. Sam's choice of theme for his display was a football game.

Sam generated a number of ideas (a characteristic of Level 4) on how to animate his display and settled on using cams to provide an up-down motion for his footballers. He researched a range of ideas using sketches, models and ICT, and made choices between them based on his knowledge and understanding (a characteristic of Level 5).



Sam constructed the frame structure upon which to mount the cam mechanism and built his cams by drilling offset holes in circular timber disks using appropriate tools and equipment (a characteristic of Level 4).

By evaluating his work as it developed and making changes where necessary (a characteristic of Level 4), he realised that by mounting the cam-follower slightly off-centre his footballers would also rotate as well as rising and falling, adding an extra feature to his display.



Wall banner

In this activity, Sam worked collaboratively to produce a wall banner based on the importance of hands in different cultures. A class discussion revealed that there were five nationalities in the class and it was decided that it would be a world banner, starting in Wales and spiralling out around the world picking out the countries that the pupils came from.

The banner would be based on a large white cotton sheet and the images would be produced using fabric crayons, fabric paint, iron transfers, stitching and glueing.



Sam joined in the class research by *gathering information independently* (a characteristic of Level 4) on Indian culture. He produced some images *using sketches and ICT and made choices between them* (a characteristic of Level 4).

Sam printed his chosen image onto iron transfer paper and ironed his image onto the banner *using appropriate tools and equipment* (a characteristic of Level 4). He drew his own hand onto fabric using fabric paint, adding patterns that he had seen on Indian culture, and then stitched his fabric hand onto the banner.

Robots



In this activity, Sam worked as part of a team. The task was to build a robot that could escape from a maze. The class was taught how to use a programmable controller and how to write and save simple routines to control the motors in their robots. The pupils were then given a two-motor buggy kit to assemble.

Sam worked with a range of given materials and produced a functional product (a characteristic of Level 4), following the instructions to build the robot. He helped design and make the body of the robot from reclaimed material using card boxes, plastic items and lollipop sticks. Wheels were fitted to the motor using appropriate tools and equipment (a characteristic of Level 5) so that the robot would move. After the routines were written the robot would have to escape from a simple maze. Sam understood how to write and edit the routines so that his robot followed the correct course, evaluating his work as it developed, bearing in mind his original intentions (a characteristic of Level 5).

Summary

Sam's profile shows some characteristics of Level 4 and Level 5 but mainly the characteristics of Level 4.

Sam gathered information independently to help generate a number of designs using sketches and models, and made choices between the designs based on experience. Sam demonstrated his capability to draw on his developing knowledge and understanding of materials and components to develop his ideas. He also demonstrated his ability to use labelled sketches to show details of design.

There is further evidence of him working with a range of given materials and producing functional products. Sam outlined what he was going to make and how he was going to proceed. He evaluated his work as it developed, making changes when necessary.

As a next step, Sam could be encouraged to learn how to develop and work to a specification. He needs to add outline dimensions to his drawings and sequence what he is going to do. Sam will find it easier to evaluate his final products when he has specified his intentions earlier in the project.

Rhys | Characteristics of Levels 4 and 5

Rhys is a 10 year-old learner in Key Stage 2.

His teacher knows much more about Rhys' performance than can be included here. However, this profile has been selected to illustrate characteristic features of Rhys' work across a range of activities. Each example is accompanied by a brief commentary to provide a context and indicate particular qualities in the work.

Rhys' profile shows some characteristics of Levels 4 and 5, but mainly characteristics of Level 5.

In preparation for the full design-and-make activities illustrated, Rhys completed a number of focused practical tasks aimed at developing particular skills, knowledge and understanding. For example, he has been taught:

- about different methods of finishing a range of materials
- to construct a frame structure
- to construct a simple circuit using a range of components
- how to use a computer to control motors, bulbs and buzzers
- to use appropriate tools and techniques to work and join a range of materials
- to evaluate a range of commercially produced products.

Fruit salad

In this activity, Rhys designed and made his own fruit salad. The class began by evaluating different bought salads, then moved on to taste a range of fresh fruit so that they could decide which fruits to include in their fruit salads, *recognising that users have views and preferences* (a characteristic of Level 4).



Apples	😊	😊	😊	😊	😊	😊		
Orange	😊	😊	😊	😊	😊	😊		
Strawberries	😊	😊						
Raspberries	😊	😊	😊	😊	😊	😊		
Peaches	😊							
Watermelon	😊	😊	😊	😊	😊			
Kiwi	😊	😊						
Blueberries	😊	😊	😊	😊	😊	😊		
Pineapple	😊	😊	😊	😊	😊	😊		

Food Miles

What are food miles?
This is how far food travels across the world from where it is grown to reach us here in Wales.

Why does our food travel so far?
Our food travels so far because we haven't got a warm climate to grow these foods, it is too cold.

Can you name any food that has travelled a long way?
Some of our food that comes from different countries is bananas, apples, watermelons, oranges and pineapples.

What can I do?
I can try and make my global footprint go down by buying food from our country instead of somewhere far away.

Rhys looked at packaging to identify the country of source and produced a fruit world map. The class discussed food miles, *considering the user, health and safety and sustainability* (a characteristic of Level 5), and alternative sources that would reduce the distances travelled by the food that we eat.

Rhys *used sketches* (a characteristic of Level 4) to design his own salad, and went on to make an edible product that he evaluated.



Bridges

In this activity, Rhys designed and made a model of a road bridge over a river that could be raised for boats to pass underneath. In his design the structure of the bridge was made from a timber frame, joined with triangular corner pieces made from card.

bridge

	THIS BRIDGE AT ST. ASAPH IS AN ARCH BRIDGE. IT IS MADE FROM STONE AS THIS IS A HARD AND STRONG
	THE CONWY RAILWAY BRIDGE IS A FAMOUS TUBULAR BRIDGE BUILT BY ROBERT STEPHENSON. IT IS MADE FROM STEEL WHICH IS VERY STRONG
	THIS STEEL BRIDGE AT RHYL IS CALLED THE BLUE BRIDGE. IT IS A GIRDER BRIDGE SUPPORTED BY A STEEL ARCH
	THE MENAI BRIDGE IS A FAMOUS SUSPENSION BRIDGE BUILT BY THOMAS TELFORD IN 1826. IT IS ONE OF THE FIRST EVER BUILT.

Rhys conducted research into types of bridges before thinking about designing his own bridge.

Rhys *generated a number of imaginative ideas before producing a drawing with outline dimensions and sequencing what to do* (characteristics of Level 5).

Rhys added a set of traffic lights to the model bridge. He wrote a programme to stop the traffic before the bridge was raised and to allow traffic across when the bridge was lowered. Rhys *produced a product of acceptable quality and function* (a characteristic of Level 5).



Feltmaking

In this activity, Rhys made a small felt bag to hold and protect his calculator. The class were shown how to make felt by layering different coloured wool over a piece of bubble wrap, then wetting, rolling and drying the piece to form a felt base on which to add other pieces of felt or fabric to produce a finished product.

Rhys developed a *number of ideas* (a characteristic of Level 5) for his felt bag, *considering the user* (a characteristic of Level 5) by using surplus wool from home and deciding that the bag would have no sharp fastenings or decoration. He *measured and cut* the wool (a characteristic of Level 5) and layered strips of his chosen colours vertically and horizontally across the bubble wrap. He *researched a range of his ideas using models* (a characteristic of Level 5) by stitching and sewing test pieces of patterns.



Rhys manufactured his felt bag by *measuring, marking out, cutting and joining a range of materials* (a characteristic of Level 5). He handstitched the patterns and edging, and *produced a product of acceptable quality* (a characteristic of Level 5).



Summary

Rhys' profile shows some characteristics of Level 4 and Level 5 but mainly the characteristics of Level 5.

Rhys demonstrated his capability to generate ideas for products recognising that users have views and preferences. He outlined what he was going to make and how he was going to make it.

Rhys researched a range of ideas using sketches and models, and made choices between them based on his knowledge and understanding. He also demonstrated his capability to select and use appropriate tools/utensils and equipment to measure, mark out, cut, join and mix a range of materials and ingredients in a range of contexts.

Rhys was able to produce products of acceptable quality, function or taste. He also evaluated his work as it developed, bearing in mind his original intentions. Rhys used a range of information sources to research his ideas and, in the bridge activity, he succeeded in producing formal drawings with some detail of manufacture.

As a next step, Rhys could be encouraged to use a broader range of skills, including the use of CAD, to produce details of his designs. He could sequence the manufacture of his products and adapt to unforeseen problems. Rhys needs to be able to suggest improvements to his final products.

Section

4

Making judgements at the end of
Key Stage 3

This section shows how level descriptions can be used when making judgements about which level best describes a learner's overall performance at the end of the key stage.

You may find the following points useful when considering the profiles in this section.

- The learner profiles are not presented as a model for how you should collect evidence about your learners. Although you will want to be able to explain why you have awarded a particular level to a learner at the end of the key stage, there is no requirement for judgements to be explained in this way or supported by detailed collections of evidence on each learner. Decisions about collecting evidence, and about its purpose and use, are matters for teachers working within an agreed school policy.
- The commentaries on the pieces of work have been written to explain the judgement made about a learner's performance. They are not intended as an example of a report to parents/guardians.
- The materials in each learner profile can only represent a small part of the information and experiences that make up a teacher's knowledge of each learner. They do not reflect the extent of the knowledge of each learner that you will have built up over time across a range of different contexts. You will use this knowledge to make a rounded judgement about the level that best fits each learner's performance.
- You will arrive at judgements by taking into account strengths and weaknesses in performance across a range of contexts and over a period of time. Opportunities will need to be provided for learners to demonstrate attainment in all aspects of the level descriptions.
- Some of your learners may need to use a range of alternative forms of communication to show what they know, what they understand and what they can do.

This section includes profiles for three learners. For each learner a description is provided that outlines the context of the activities, a summary of the design and technology skills shown, and possibilities for further development. While the context of the activity adds to the evidence presented in each profile, it is important to remember that images of the learners' work generally show only the final outcomes. Researching, planning and developmental work, some of which may be ephemeral in nature, should all be considered when making a judgement about the level that best fits each learner's performance.

George | Level 5

George is a 14-year-old learner in Key Stage 3.

His teachers know much more about George's performance than can be included here. However, this profile has been selected to illustrate characteristic features of George's work across a range of activities. Each example is accompanied by a brief commentary to provide a context and indicate particular qualities in the work.

George's teachers judge his performance in design and technology is best described as Level 5.

George has been taught different sections of the Key Stage 3 Programme of Study by specialist teachers in a range of contexts. He has worked individually and as part of a team. Some of his work has been done in class and some outside taught time. During Key Stage 3, George completed a number of focused practical tasks and activities in which he investigated and evaluated familiar products. These teacher-directed activities are aimed at developing particular skills, knowledge and understanding and, in George's case, have been used to prepare him for the full design-and-make activities illustrated in his profile. For example, George has been taught:

- to evaluate commercially produced products
- different methods of finishing a range of materials
- to construct electronic control circuits
- to use appropriate tools and techniques to work and join a range of materials
- to use computer-aided design (CAD) software
- to use computer-aided manufacturing (CAM) equipment.

Lamp

In this activity, George was asked to design and make a small, safe, low voltage reading lamp that could be used in his bedroom. He was given the limitation that the lamp should be constructed from plastic and aluminium.

After conducting a simple investigation and analysis George developed a specification and went on to investigate low voltage lamps.

Brief

Write your own design brief stating clearly what the task is.

Design and make a low voltage battery powered bedside light.

Situation 1

Illustrate clearly where the lamp will be used with a photo or simple floor plan diagram.



Specification

Make a list of the important things your design must do. Include the user and what they want from the lamp.

- Provide low voltage light
- Minimalist - small area
- Modern style
- Nice colour
- Use some recycled materials

Investigation

Investigate the kinds of modern low voltage lamps sold in shops. Choose one that appeals to you and investigate its main features.

2

Investigation Points:

Who might use the lamp?
A person who likes reading or doing their fingernails

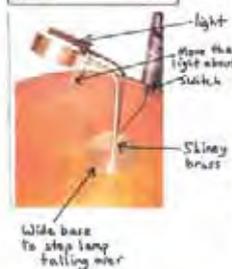
How much does it cost?
£29.99

Write down three things you like about the lamp.
Sleek design
Flexible
Bright, shiny texture

How is the lamp powered?
By 2.5V cell brought down to 1.5V

What materials are used in its manufacture?
metal, Glass, Plastic

How could the design be improved?
A switch on the lamp itself



George used his investigation independently to help generate a number of imaginative ideas. Using a CAD system he also produced a drawing with outline dimensions.

Initial Design Ideas

Make a series of simple sketches and notes to show your first ideas.

3

Explore the shape and form of the base for your lamp.
Try to make your ideas original and creative.
Where will the battery pack go?
Where will the bulb go?
How can the bulb be held in place?

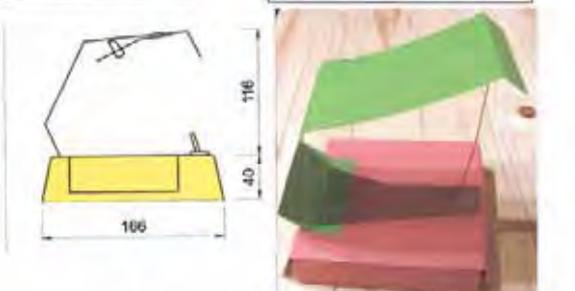


Development of Ideas

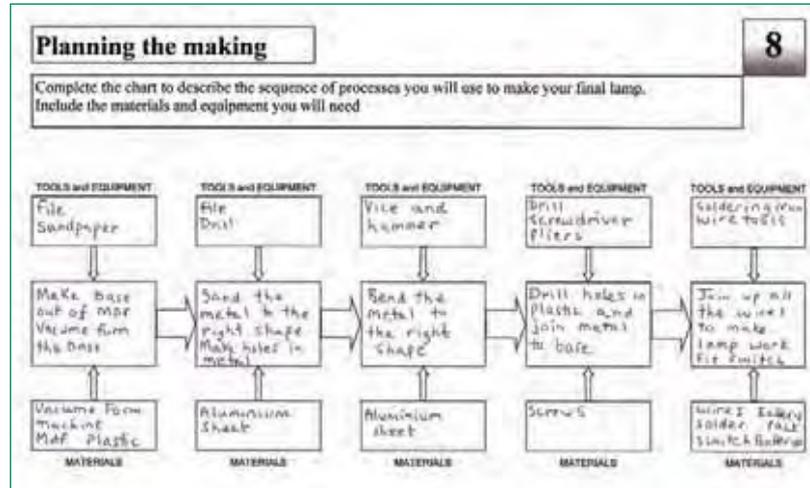
Use computer aided design (CAD) to draw your chosen idea.

4

Make a full size card model of your chosen idea.
Alter changes if it is not right.
Write down all the measurements



Once George had chosen a final solution he sequenced what he was going to do.



George then went on to use appropriate tools and equipment to measure, mark out, cut and join a range of materials to produce a product of acceptable quality.



Hat

In this activity, George was asked to take on the role of a designer for one of the high street fashion stores, and his task was to design and make a hat suitable for sale in the store. Part of the specification stated that the hat should have a decorative feature, be as original and innovative as possible and appeal to young people. The hat should be finished to a high standard.

George first looked at existing hats to generate ideas for his design.

Group task - Look carefully at the hat handling collection your group has been given. Discuss with other pupils in your group what design aspects you like and why the make the hat look good. You may like to make quick notes or sketch these design features.

Positive design aspects

- Complementing colours.....
- Bold shapes
- Bright colors
- Simple shape
- Functional
- Features that work together

Sketch here

Positive design aspects

- Bright colors
- Variety of shapes
- Bold shapes
- Good stability
- Complementing colors.....
- Bold shapes
- Simple shapes
- Functional
- Features that work together

In the space below, quickly sketch your initial ideas, label to explain your thinking. You have 10 minutes. Now pass these ideas to your one of your design team and ask them to improve your ideas.

Initial idea

Next designer

George researched a range of ideas using sketches and sequenced what he was going to do.

Continue to refine your ideas develop further - with a further emphasis of decorative features to the hat - e.g. logos, tassels etc.

Adding a leaf

Adding a tassel

Added pom-poms

Must look like a hat

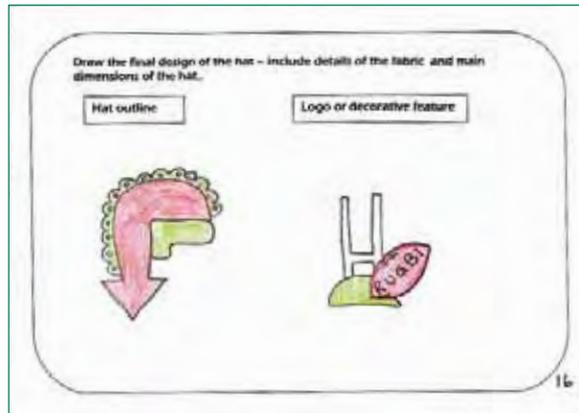
Production plan of the hat - include details, product and any quality control points.

```

graph TD
    A[we chose our fabric] --> B[we cut our fabric]
    B --> C[we pinned the shape together]
    C --> D[attach the sp crown to brim]
    D --> E[we sewed the logo & attached it to the hat]
    E --> F[we put a point on the scal]
    F --> G[cut the long threads off]
    G --> H[we attached the spilt to the brim crown]
    H --> I[we pinned the shape together]
    I --> J[we cut our fabric]
    J --> K[we chose our fabric]
  
```

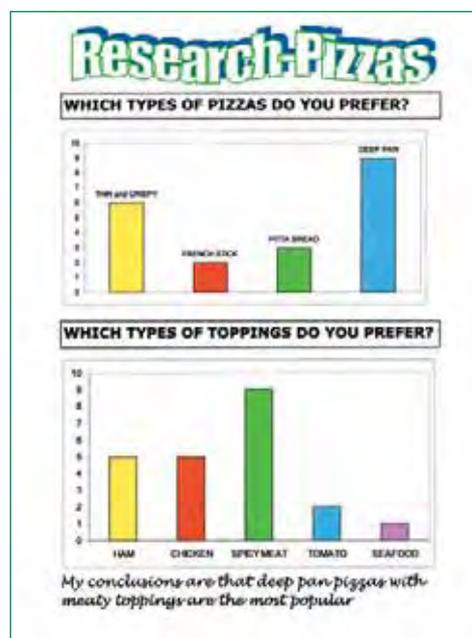
Pin side seams Cut out hat from fabric Embroider logo Attach brim to main hat design & scan logo make decorative features Pin top of hat

He finalised his chosen design and produced a product of acceptable quality.

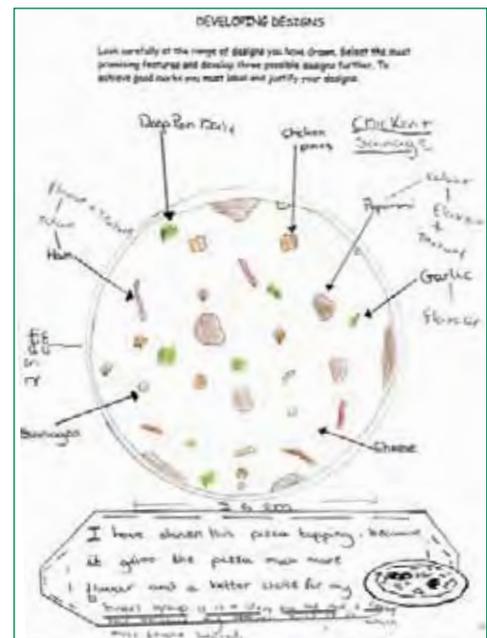
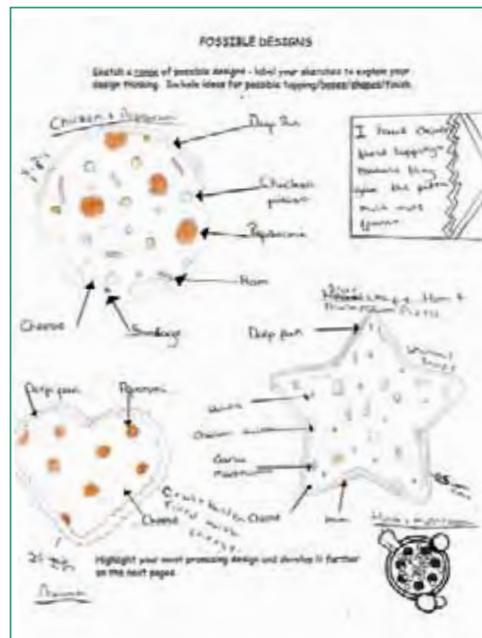


Pizza

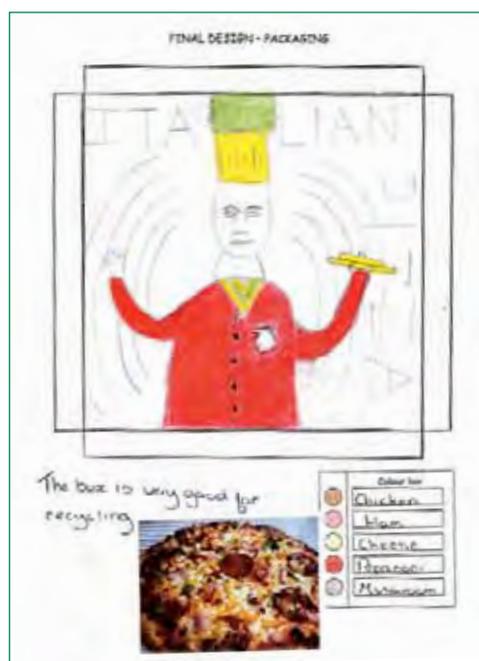
In this activity, George was asked to consider a target group of young people for an easy-to-prepare but wholesome food product. He investigated pizzas considering them a more sophisticated and healthier option than other fast foods. He carried out some market research with young people to help generate ideas and produced a graph of his findings using ICT.



George researched and communicated a range of ideas using quick and simple sketches. He went on to make a pizza of acceptable quality and taste.



George was then asked to design recyclable packaging for his pizza. He chose card for his packaging, deciding that it could be easily recycled, and he went on to develop designs using ICT.



Summary and overall judgement

Levels 4, 5 and 6 were considered and Level 5 was judged to be the best fit.

When undertaking research during the activities, George demonstrates his capability to *gather information independently* that he can use to produce ideas or suggestions of *what he is going to make and how he is going to make it* (characteristics of Level 4).

When designing George developed outline specifications and used this to guide his designing. He developed innovative and interesting products by *researching a range of ideas using sketches, models and making choices between them based on his knowledge and understanding* (a characteristic of Level 5). As shown in the lamp activity, *George can produce final products of acceptable quality* (a characteristic of Level 5). Also in the lamp activity, he used CAD to produce *formal drawings* (a characteristic of Level 6). George *selects and uses appropriate tools, utensils and equipment* when producing products (a characteristic of Level 5). He also showed some evidence that he *evaluated his work as it developed, bearing in mind his original intentions* (a characteristic of Level 5).

To progress George could be encouraged to evaluate his final products by comparing them to his original specification and suggest improvements to his final products. He could improve the accuracy of his manufacturing, and also make greater use of CAD and CAM.

Emma | Level 6

Emma is a 14-year-old learner in Key Stage 3.

Her teachers know much more about Emma's performance than can be included here. However, this profile has been selected to illustrate characteristic features of Emma's work across a range of activities. Each example is accompanied by a brief commentary to provide a context and indicate particular qualities in the work.

Emma's teachers judge that her performance in design and technology is best described as Level 6.

Emma has been taught different sections of the Key Stage 3 Programme of Study by specialist teachers in a range of contexts. She has worked individually and as part of a team. Some of her work has been done in class and some outside taught time. During Key Stage 3, Emma completed a number of focused practical tasks and activities in which she investigated and evaluated familiar products. These teacher-directed activities are aimed at developing particular skills, knowledge and understanding and, in Emma's case, have been used to prepare her for the full design-and-make activities illustrated in her profile. For example, Emma has been taught:

- to evaluate commercially produced products
- different methods of finishing a range of materials
- to construct electronic control circuits
- to use a computer to control motors, bulbs and buzzers
- to use appropriate tools and techniques to work and join a range of materials
- to use computer-aided design (CAD) software
- to use computer-aided manufacturing (CAM) equipment.

Photoframe

In this activity, Emma was given the following brief and told she would have the option of using a laser cutter to cut out the various parts of her product. The laser cutter had been demonstrated to the whole group and Emma realised that this machine would give her product a far better finish than she could achieve using hand tools.


1

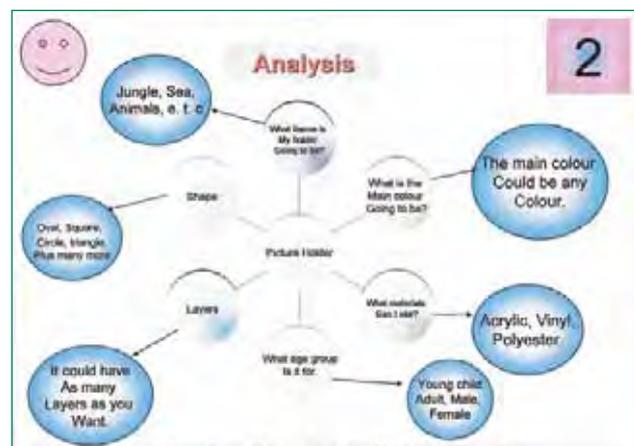
Brief

Design and make a picture holder out of plastic and other suitable materials. Which materials you chose will be your choice, but the main part can NOT be greater than A5 in size. Other materials can be used to decorate and enhance the appearance.



What is the size of A5?
The size of A5 is 150mm by 210mm.

What is the size of your picture?
The size of my picture is _____.



Emma moved on to independently analyse her options for designing and making, and used a range of information sources to research and develop a specification.


4

Some photo frames similar to my idea!



Similar to my idea as it has animals. Bright and colourful. Animated.

Yellow background

Suitable for younger children.

This frame uses various pieces of material to create this frame.

It is very creative.

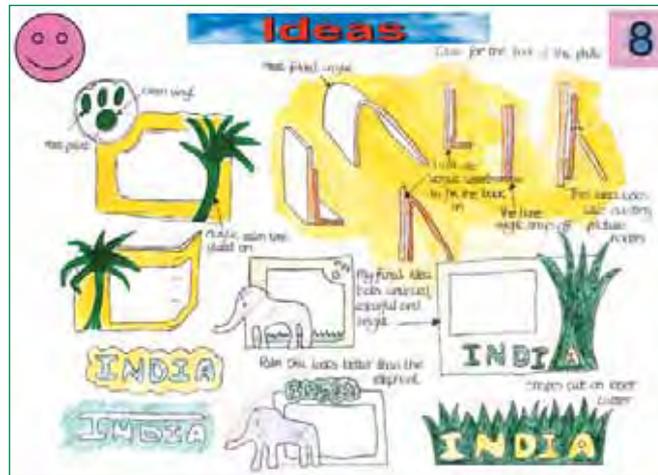
My idea


7

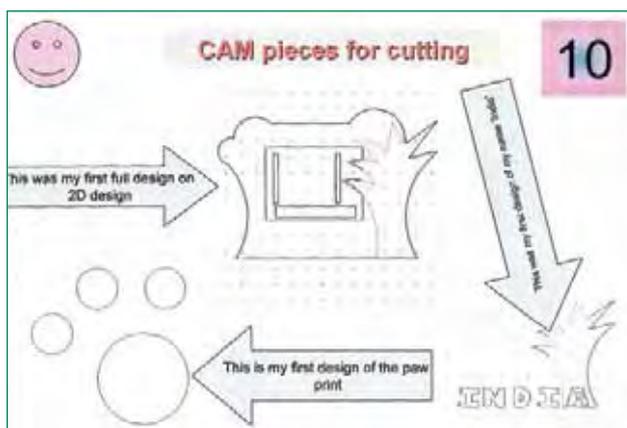
Specification

I am going to design and make a themed picture holder for myself who is in the 12-13 age group. The design must:

- Be based on a theme of Interest Captures
- Use elegant technology for different designs on my picture holder
- The frame must be easy to the picture on the main part.
- It will be using acrylic for the frame and vinyl for the extra designs.
- It will use acrylic cement to stick acrylic to acrylic.
- It must use PVC.
- It must be beautiful and bright.
- It must like my idea so that it looks like a piece of fun and messy.



With the use of the laser cutter in mind, Emma chose to use CAD to finalise her ideas and prepare a file for downloading to the laser cutter.



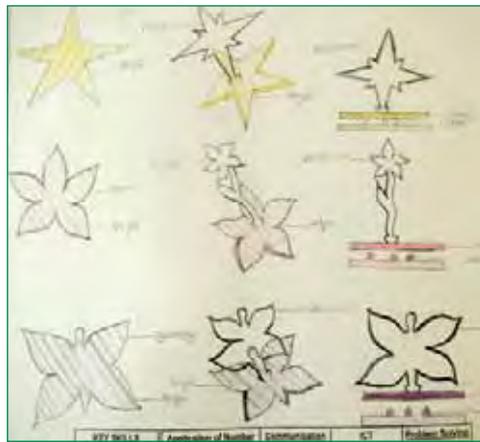
After analysing her research Emma developed a specification to guide her designing.



Emma then moved on to develop and refine her ideas, producing a range of well-annotated sketches as well as some detailed drawings.



Emma considered and developed a range of shapes for both the body of her game and for the copper wire that would be connected to the electronic circuit, gathering information from various sources and using it to help generate a number of designs. She also used card models to refine and test aspects of her design.



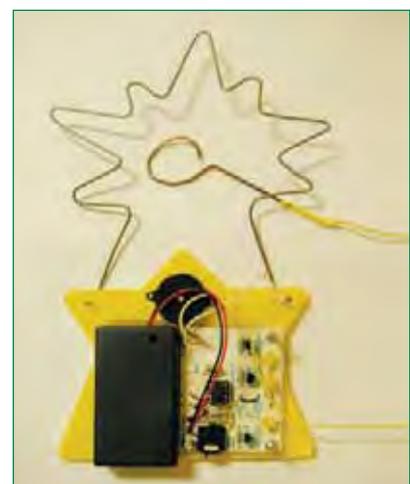
Emma soldered her components to the circuit board neatly, without burning out any of them, and she went on to make the body of the game using tools and equipment safely and accurately. She assembled her game producing a product to an appropriate standard of construction.

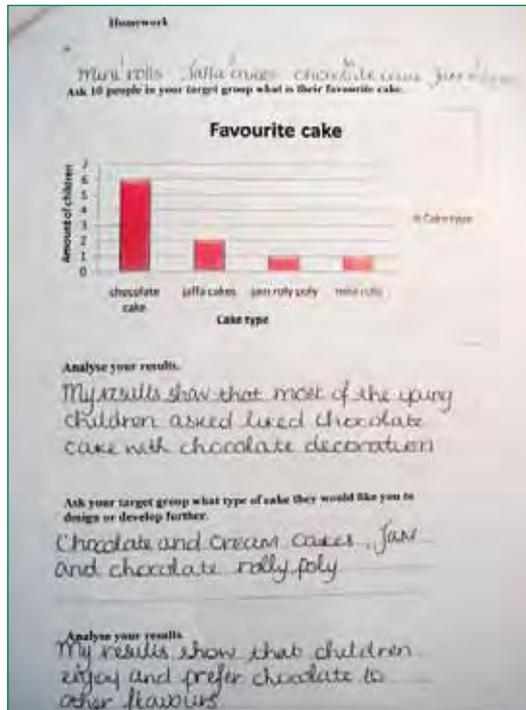
Emma developed and wrote a simple programme for the game which played a tune when the game was turned on, and produced a jingle and lit up several LEDs when the game was lost. She connected her own circuit to a computer to download her programme into her product.

```
File Edit Format View Help
'The Muppets Theme
tune 0, 6, ($46,$46,$43,$45,$43,$45,$01,$6C,

main:
if pin3 = 1 then event1
goto main

event1:
sound 2,(100,2)
sound 2,(110,2)
sound 2,(105,2)
high 4
high 2
high 1
high 0
pause 500|
low 4
low 2
low 1
low 0
goto main
```





DESIGN SPECIFICATION - all listed items with down time will guide your design thinking. This is not a final specification but a product specification. As you explore your ideas they will inform you for the hearts of the target group, but you are not bound by them - you can change your mind!

What the cake will look like (style type e.g. small, large, round, etc.)
Young children style, small fairy cakes, jaffa, with mini eggs

Nutritional Aspects: wholemeal flour and organic chocolate

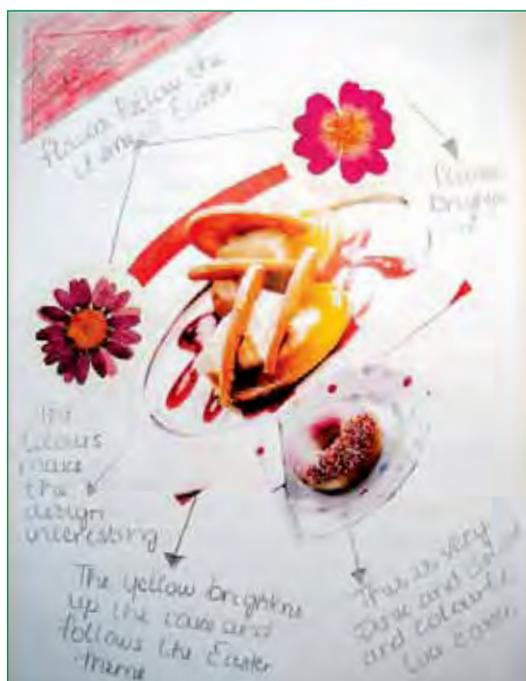
Size/portion: small fairy cakes size / large cake cut into small slices

Price range: £1.99 for 18 cakes / £2.49 large cake

Packaging: reusable packaging

Any other aspects eg organic, organic flour and wholemeal flour and organic eggs and butter

Emma developed her ideas with 'inspiration' mood sheets and by using simple sketches, and again considered organic ingredients for her designs.



POSSIBLE DESIGN

Sketch a range of possible designs. Label your sketches to explain your design thinking. Indicate ideas for possible back considerations: Dyeing, packaging, colour, shapes and form.

1. Organic chocolate frosting

2. Orange flavoured sponge

3. Strawberry cake

4. Mini egg

5. Pink egg

6. Low fat ingredients

7. Organic chocolate filling

8. Organic chocolate buttercream

9. Organic chocolate frosting

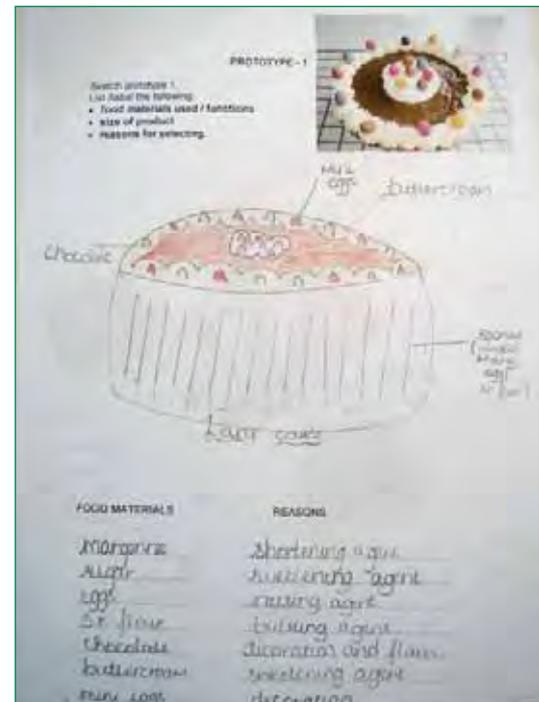
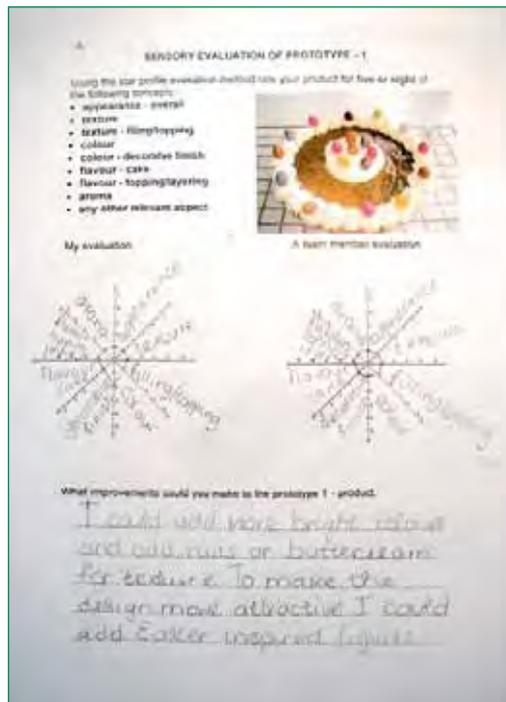
10. Organic chocolate buttercream

Easter eats

Highlight your most promising design and develop it on the next page.
My preferred design is my design number 4. It has an Easter theme that is traditional and it is attractive for children.

Emma developed a number of prototype products, testing or modelling her ideas and making choices between them. She made her choices based on appearance, texture, flavour, aroma and colours, and evaluated her prototypes before finalising her design.

Emma also considered marketing and packaging and produced a suitable design for her product using ICT.



Summary and overall judgement

Levels 5, 6 and 7 were considered and Level 6 was judged to be the best fit.

In all her designing, Emma demonstrates her capability to *develop an outline design specification using supporting information gathered from various sources, and uses it to help generate a number of ideas* (a characteristic of Level 5). In her photoframe activity, she also *produces drawings with outline dimensions and sequences what she is going to do* (a characteristic of Level 5).

Emma demonstrates her capability across a range of activities to *produce formal drawings with details of manufacture using a range of skills, including the use of CAD* (a characteristic of Level 6). In the cake activity, Emma has shown that she is *able to refine ideas in the light of her research* (a characteristic of Level 6).

Emma showed commitment and perseverance across all her activities and contexts by readily using non-taught time to complete her work. She also *evaluated her work as it developed, bearing in mind her original intentions* (a characteristic of Level 5).

Emma's work in textiles and systems shows elements of originality, innovation and creativity. She also *models her ideas to aid development* (a characteristic of Level 7).

As a next step, Emma could be encouraged to annotate design sheets to show her design thinking by reference to criteria such as user needs, health and safety, and sustainability. She needs to order and sequence the detailed manufacture of her products. When the manufacturing of her products does not go well, Emma needs to *make changes in the light of unforeseen problems* (a characteristic of Level 7), such as identifying and rectifying the sharp edges in her photoframe.

Emma needs to allow time to *evaluate the final product comparing it with her original specification and identify possible improvements* to her products (a characteristic of Level 7).

Mali | Level 7

Mali is a 14-year-old learner in Key Stage 3.

Her teachers know much more about Mali's performance than can be included here. However, this profile has been selected to illustrate characteristic features of Mali's work across a range of activities. Each example is accompanied by a brief commentary to provide a context and indicate particular qualities in the work.

Mali's teachers judge that her performance in design and technology is best described as Level 7.

Mali has been taught different sections of the Key Stage 3 Programme of Study by specialist teachers in a range of contexts. She has worked individually and as part of a team. Some of her work has been done in class and some outside taught time. During Key Stage 3, Mali completed a number of focused practical tasks and activities in which she investigated and evaluated familiar products. These teacher-directed activities are aimed at developing particular skills, knowledge and understanding and, in Mali's case, have been used to prepare her for the full design-and-make activities illustrated in her profile. For example, Mali has been taught:

- to evaluate commercially produced products
- different methods of finishing a range of materials
- to construct electronic control circuits
- to use a computer to control motors, bulbs and buzzers
- to use appropriate tools and techniques to work and join a range of materials
- to use computer-aided design (CAD) software
- to use computer-aided manufacturing (CAM) equipment.

Steady hand game

In this activity, Mali worked in the same group as George. She developed her skills, knowledge and understanding of systems and control through a series of theory lessons and short focused tasks. She learnt to build systems from a range of electronic components understanding input, process and output devices. Mali also learnt how to write control routines using ICT and to save them to microcontroller. However, unlike George, Mali chose to use CAD/CAM to design her game and manufactured the individual parts for her game using the laser cutter.

Mali investigated a familiar product that could help her with her designing. By disassembling a commercially available steady hand game Mali was able to identify key criteria for a detailed specification.

BRIEF: I will design and make an electronic toy.

Investigation into Existing Toy

DINOSAUR STEADY HAND GAME

The toy is a steady hand game. It is simple to use and the wire is shaped like a dinosaur. It has a purple plastic see-through base. It is steady and strong. There is a black wire that joins the handle to the base. The handle is see-through purple plastic with a shiny steel hook. When the handle wire touches the wire, lights flash on the base and there is a loud bleeping noise.

The flashing lights and see through base make this game imaginative and attractive. I like the way the handle colour matched the base. The dinosaur shaped wire really makes this game stand out from other games in its league.

I haven't seen other toys like this that have a dinosaur shape so I think it is a unique design.

There are some speck of rust on the wire puzzle and the wire is a bit wobbly. There are bits loose inside the base because they rattle when the game is shaken. The game is only two years old so that is not a good sign.

KEY CRITERIA

Safe	✓
Fun	✓
Looks good	✓
Durable	✓
Challenging	✓
Value For Money	✓
Easy to play	✓
Eye catching	✓
Themed	✓
Original	✓

Internet Research COMPONENTS



LEDs are light emitting diodes. They have a longer positive + leg and a shorter negative—leg which is next to a flat part on the LED. The LED comes in Red, Green, Blue, Yellow, Orange, White, Pink and a purple UV LED. They are better than bulb because they are cheaper, easier to use, use less energy and come in more colours.



TRANSISTORS are electronics switches that turn on or off when electricity is connected to their middle leg, called base b. They control components like LEDs



CAPACITORS store a tiny charge of electricity. They can help circuits work without electrical interference



RESISTORS resist the flow of electric current. They can protect sensitive components from too much electricity, such as LEDs



A sounder uses a piezo crystal inside. It takes electricity and produces sound. They are used in toys, birthday cards and mobilephones



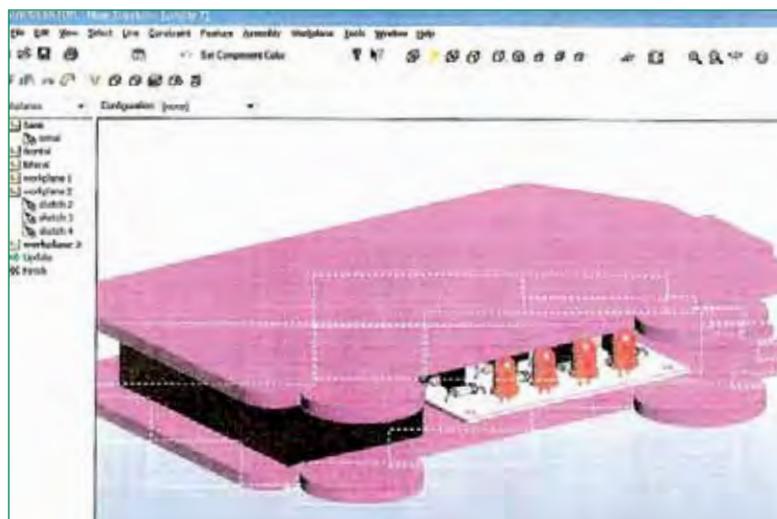
The PIC chip is a integrated circuit that contains a micro-processor and other parts that make it like a mini computer. It can store a program and using inputs it can control things like LEDs, sounders and even motors.

Mali was able to further her investigation by conducting internet research into manufacturing processes.

My SPECIFICATION

- It has to be safe*
- It has to look cool and attractive.*
- The toy needs to have a good theme*
- The toy needs to durable*
- The toy should be good value for money*
- The design must be unique*
- The toy must be have lights and be musical*
- The toy must be challenging*
- The toy must have an On/off switch*
- The toy must not have to be painted*

Mali communicated her ideas appropriately using a range of skills including the use of CAD and full-size card models to refine her designs. She considered sustainability by choosing to use rechargeable batteries. Mali considered the health and safety of the users by attempting to ensure that her designs had no sharp edges or loose parts.





Mali demonstrated fine motor control skills as she soldered her components to the circuit board. The circuit worked without any need for fault finding.

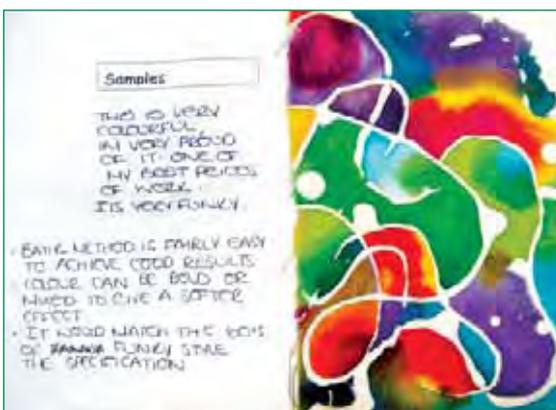
After making a full-size prototype in card Mali went on to make the body of the game from two pieces of plastic using the laser cutter (CAM), etching the outline of doors and windows onto the plastic again using the laser cutter. She then assembled her game producing a product to a very good standard.

Cushion

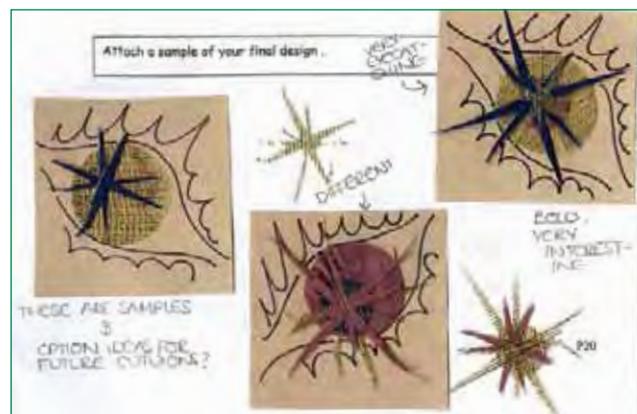
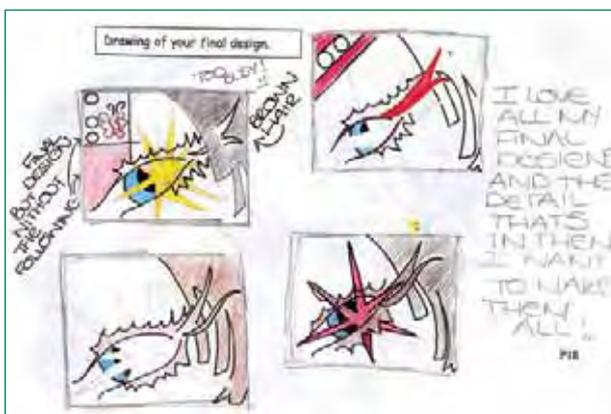
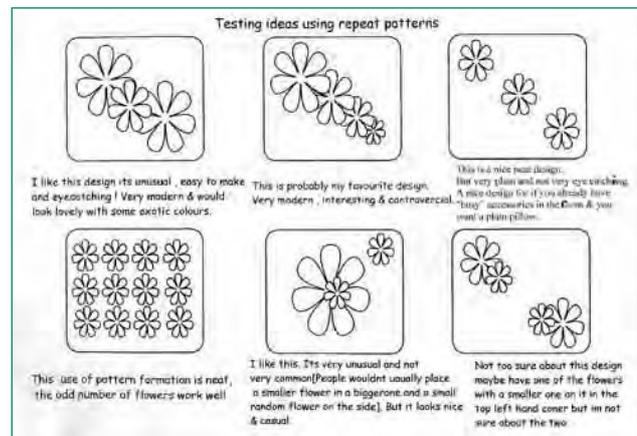
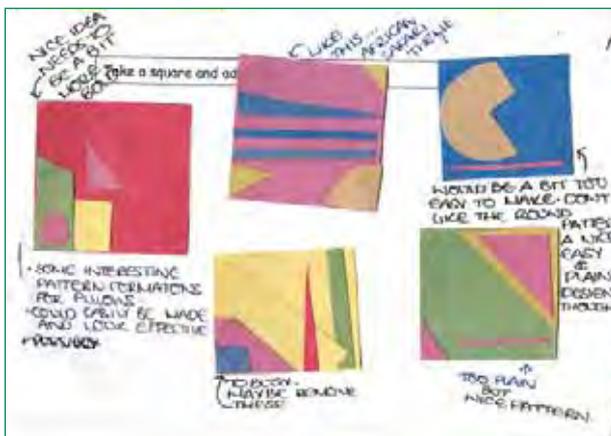
In this activity, Mali was given the opportunity to design and make a cushion. Although she had a free choice of fabrics Mali was limited to using four decorative techniques: batik, cutwork, iron-on tape and CAD/CAM embroidery.

Mali decided that her cushion was to be for a teenager, should look good, and be funky, colourful and exotic.

Mali conducted her research into possible shapes, styles and the four techniques available to her. She produced sample pieces of batik, iron-on tape and computer-aided embroidery. This type of research that involves testing and evaluating is a form of modelling that will inform Mali's design choices later in her project.



Mali moved on to develop her annotated ideas demonstrating significant originality, innovation and creativity. Mali showed her design thinking by specifying the use of the laser cutter to cut the finer pieces of her design, realising that the heat would seal the edges of these finer pieces. She produced drawings and chose actual materials to model her ideas and used these mock-ups to seek the views of classmates as potential users of her cushion.



Mali finalised her designs and produced a cushion demonstrating independence in the selection of equipment and materials, and the ability to make products with precision and a high standard of manufacture. Mali then produced a simple evaluation of her final product, identifying its strengths and room for improvement.



Evaluation

N.B. Refer to the Colour, shape, design/decoration and construction of your cushion.

What are the strengths of your cushion?
 I like my eye design I have always loved drawing eyes but never thought of putting it on a pillow. Its very original though

What improvements could be made to your cushion?
 I could have stayed during breaktimes etc to finish my cushion quicker.

CD holder

In this activity, Mali was given the opportunity to design and make a CD holder. A range of materials were available for the manufacture of the product and the full range of workshop tools and machines were also available to her, including the laser cutter. Mali developed her own design brief and started her research independently. By undertaking her own design brief Mali was focused and selective when identifying and using research materials.

Brief

- I am going to design a functional, modern, high-tech, storage system using a wide range of materials.
- I will be creative and original in my ideas.
- I will use the techniques I have been taught whilst ensuring I am working safely and sensibly.
- I must ensure that my design fits in with the project and the customer I am marketing for.
- I will use bright colours and various textures.
- I will ensure that I have a high quality finish on everything I do.

Identifying the need

CD Holder, Mp3, Headphones, Computer, Hair brush, CD Player, High-Tech Tidy, Straighteners, Mobile Phone, Charger

Brief: I am going to make a storage system to hold. I will use some of the following materials:

- Softwood (300 x 120 x 15mm)
- Acrylic (up to 300 x 120 x 3mm)
- Polystyrene sheet (up to half a sheet)
- Aluminium, brass and acrylic rods and tubes as required in small amounts.
- Other materials / finishes as found by myself or my teacher.

Mali started to consider possible designs for her product annotating her ideas with functional details. At this point she modified and changed all her ideas in the light of her research, knowledge and understanding, and she produced a new design specification.

Properties of materials 8

I have gathered information on the materials I could use.

Acrylic

Positive	Negative
Has a breakage resistance 6-17 times greater than glass.	Scratches easily
It is available in both opaque and clear colours	Tends to splinter
It is very versatile	It is flammable

Polystyrene

Positive	Negative
It is available in both clear and opaque colours	It is not resistant to UV light
It is very versatile	It is flammable
It is stiff	Low Cost

A new idea 15

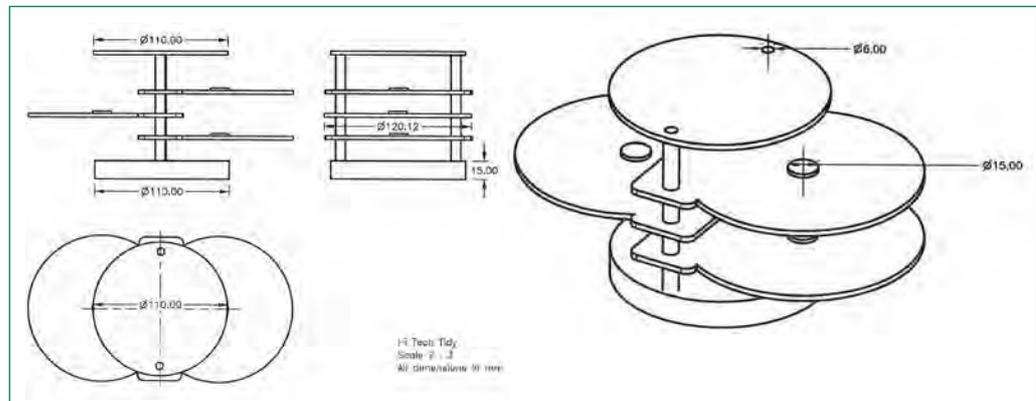
Whilst designing my product, I realised that holding a mouse mat was not a practical idea. One of the designs I came up with was suitable to hold CD's. I have decided to use this as my design idea.

Because of this I will write a new design specification.

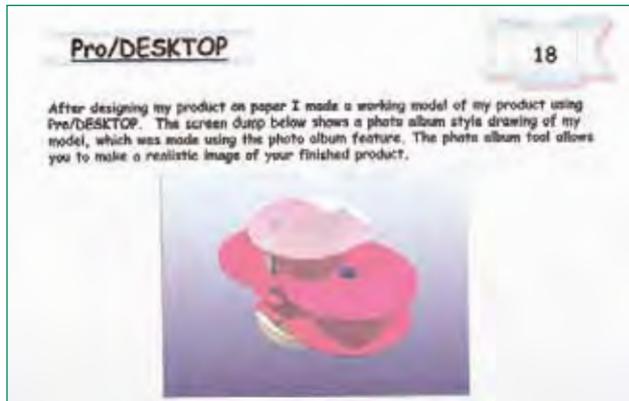
Design Specification

- Store CD's
- Make sure the CD's are secure, and do not move about
- Be durable enough to withstand constant use
- Be suitable to sit on a computer desk, whilst providing enough room for the desired function
- Appeal to teenage girls by using modern colours and logos
- Use the materials available to create different textures, shapes, and logos.
- Try to make use of the machining capabilities of the tech department.

Mali continued her use of ICT to develop and record her design work, using high-level communication skills, including detailed development sketches, accurate drawings and CAD models.



She then moved on to manufacture her individual parts using the laser cutter and assembled a final product with precision and a very high standard of manufacture and finish.



Coffee shop product

In this activity, Mali was given the opportunity to design within an unfamiliar context. Her brief was to design a food product to sell at a local coffee shop. Mali looked at the products currently sold at the shop. Her research considered the wants and needs of the customers as well as the opinions of the coffee shop manager.



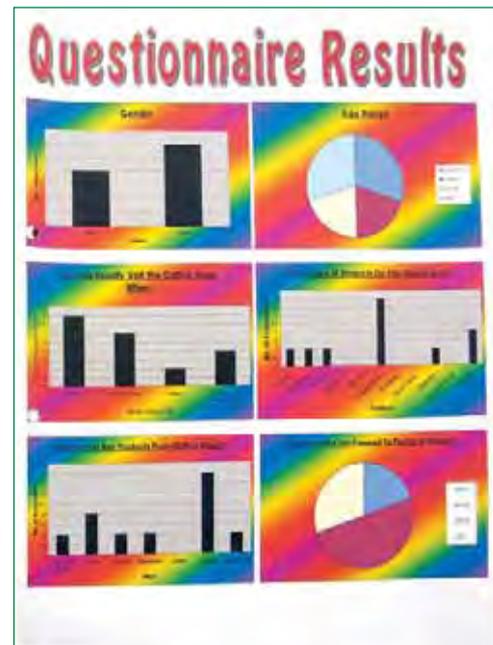
Mali sought out information sources in order to identify the actual features her product needed to be successful. Her market research was well planned and executed, and the results were analysed.

Questionnaire

The aim of this questionnaire is to find out what products you buy in a coffee shop and what new products you would like to see on offer.

Please circle the relevant answers:

- Gender:**
Male Female
- Age:**
Under 18 18-30 31-50 50+
- Do you usually visit the coffee shop when:**
Out Shopping On A Work Break Hungry
Meeting With Friends/Family
Other (Please State) _____
- What type of products do you usually buy?**
Scones Brownies Muffins Doughnuts
Biscuits Cheesecakes Pancakes
Wash Cakes Pasticcies Sponge Cakes Cookies
Other (Please State) _____
- Why do you buy products from coffee shops?**
Value For Money Taste Texture
Presentation Variety Quality Portion Size



Mali considered sustainability issues and investigated the local availability of products and possible ingredients.

RESEARCH CONCLUSION

What have you learnt from your research?
I've learnt 4 different methods of making a cake. I've also discovered what types of products a local coffee shop sells. The questionnaire helped me find out what products people buy and what they would like to see on offer. The most popular answer was a sponge. I've also found out what some products that is available. I've also understood the quality of my research.

DESIGN BRIEF

I did this by local coffee shops. I am going to design and make a cake product which will contain all the ingredients that are available in a local coffee shop with a sponge.

The design brief summarises the aims of the design and the kind of product that is needed.

DESIGN SPECIFICATION

The product I will design and make must:

- be a cake product
- contain fruit
- have at least one
- have appealing taste from
- be a local product
- suitable to serve with tea/coffee

The specification develops the brief and gives a detailed list of features that the final product must have.

Local Produce

Here are some locally produced ingredients of which you could use in this product:

Mali considered a wide range of possible ideas and tested some of them.

DESIGN IDEAS

In the space below draw, colour and label several designs for a product that answers your design brief. By each drawing highlight the strengths and weaknesses of each idea.

Strengths and Weaknesses

Chocolate Orange Cake

Chocolate Orange Slice

Chocolate Orange Cake

Chocolate Orange Cake

My best idea of product is **Chocolate Orange Cake** because it is delicious, it has a crunchy outside and a soft middle. It is also healthy because it has fruit in it.

DEVELOPMENT OF IDEA

After making your idea what improvements or new features could you make to the design to develop it further? Draw them below.

Chocolate Orange Slice

Chocolate Orange Cake

Chocolate Orange Cake

PRODUCT SPECIFICATION

Name and description of product Chocolate Orange Cake

Chocolate and orange taste delicious together. Wholesome ingredients that come naturally around the edges, while the yogurt makes it light in the middle.

Target group: day visitors

Drawing

MATERIALS needed

- 1 medium orange
- 175g (6oz) soft margarine
- 175g (6oz) caster sugar
- 3 medium eggs
- 2 tablespoons cocoa powder
- 2 tablespoons warm water
- 1 teaspoon baking powder
- 200g full-fat natural yoghurt
- 8 tablespoons plain natural yoghurt

Description of expected appearance and texture of product. I expect the wholemeal flour make this cake crunchy along the edges, while the yogurt makes it light in the middle. The appearance will be a round cake, dark brown sponge, with a darker chocolate topping with fruit decorations.

How is the product made?

1. Zest the rind of the orange, using the medium holes of the grater. Cut the orange in half and squeeze out the juice.
2. Put the margarine into a large mixing bowl. Beat it until it is soft and smooth. Stir in the sugar and orange rind. Beat the mixture until it is light and fluffy.
3. Beat the eggs into a small bowl and beat them well with a fork. Pour the eggs into the large mixing bowl, a little at a time. Beat the mixture well after each addition.
4. Put the cocoa powder into a small bowl. Add in the water so makes a smooth paste. Add the paste to the mixture in large spoon.
5. This is meant to rest the baking bowl.
6. Take half of the flour over the mixture. The other half of the flour, gently fold the ingredients together.
7. Spoon the mixture into the tin. Bake for one hour. Check it in the tin to see.

(continued on next page)

Mali demonstrated creativity in her choices and she modelled her ideas to aid development. She completed a final product to a good standard.

Function of Ingredients		
Ingredients	Local produce	Function
Orange		Add flavour and colour
Margarine		To trap air with sugar in order to give the cake a light texture
Caster sugar		To sweeten the cake
Eggs	Lampeter eggs	To give the cake a light airy texture
Cocoa powder	Pemberton cocoa	To add chocolate flavour to the cake
Water		To moisten cocoa
Baking powder		To help the cake to rise
Wholemeal flour	Bachelde mill flour	To bulk and give shape to the cake.
Natural yoghurt	Rachels Dairy	To give the topping a creamy smooth texture
Chocolate strands		To decorate



Summary and overall judgement

Levels 6, 7 and 8 were considered and Level 7 was judged to be the best fit.

In her designing and making, across a range of activities, Mali uses *relevant information sources to research details of her ideas and generate a detailed specification* (a characteristic of Level 7). Working well across a range of contexts Mali has been *focused and selective when identifying research materials* (a characteristic of Level 8), especially evident in the coffee shop product activity. In the cushion activity, Mali *demonstrates creativity, innovation and originality in generating and developing design solutions* (a characteristic of Level 8). In the cushion activity, and to some extent in the CD holder activity, she *uses high-level communication skills, including detailed annotation of development sketches, accurate drawings and CAD models* (a characteristic of Level 8). Across all activities Mali is *responsive to user preferences, health and safety, and sustainability when making decisions about her products* (a characteristic of Level 7).

Mali demonstrates her capability to be able to *sequence the manufacture of her product* (a characteristic of Level 6). She *chooses from a range of materials and ingredients, and produces products to a good standard of construction, finish or taste* (a characteristic of Level 7). Mali has taken full advantage of the CAM facilities available to add precision and quality to her products. In the cushion activity, Mali has shown that she can *evaluate the final product comparing it with her original specification, and suggest improvements* (a characteristic of Level 6).

Mali's strengths are in using high-level communication skills to produce very good quality outcomes. She works well within a structure that involves good access to CAD/CAM facilities. As a next step, Mali could be encouraged to strengthen the tie between her research, specification and design ideas. She could further improve her design thinking skills by analysing and justifying her optimum solution to a problem and communicate to others the key features of her designs, particularly those that provided opinions earlier in the task. Mali could also identify possible improvements in her products by testing and considering the views of the intended end users.

Acknowledgements

The Department for Children, Education, Lifelong Learning and Skills (DCELLS) would like to thank the many teachers, schools, local authorities and other organisations who have helped in the development of this guidance.

Special thanks are given to the Guidance Group, Robin Jones, Anne Martin Jones, Rhys Evans, Kevin Tulliver, Mari Langabeer, Richard Jones, Anita Jones and Ffion Owen, who gave up valuable time to assist us in the development of this guidance.

DCELLS would also like to thank those pupils and parents/guardians who agreed to allow examples of work to be reproduced in this guidance.

In particular, DCELLS is grateful to the following schools for providing help and materials:

Bro Gwydir Primary School, Conwy
Denbigh High School, Denbighshire
Dinas Bran High School, Denbighshire
Dyffryn Comprehensive School, Neath
Fairwater Comprehensive School, Cwmbran
Llangodog CP School, Camarthenshire
St Mary RC Primary School, Bridgend
Ysgol Amlwch, Anglesey
Ysgol David Hughes, Anglesey
Ysgol Eifionydd, Gwynedd
Ysgol Glan Clwyd, Denbighshire
Ysgol Gyfun Gŵyr, Swansea
Ysgol Gyfun Pantycelyn, Camarthenshire
Ysgol Gynradd Llannon, Camarthenshire
Ysgol Gynradd y Felinheli, Gwynedd
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