Qualification Accredited

OCR
Oxford Cambridge and RSA

GCSE (9–1)

Delivery Guide

DESIGN AND TECHNOLOGY

J310
For first teaching in 2017

Topic Area 4: Designing thinking and communication – Holistic delivery

Version 1

www.ocr.org.uk/gcsedesignandtechnology

Contents

TOPIC AREA 4: DESIGNING THINKING AND COMMUNICATION - HOLISTIC DELIVERY

Introduction

GCSE (9-1)

DESIGN AND TECHNOLOGY

A guide to approaching the teaching of the content related to Topic Area 4: Design thinking and communication – Holistic delivery

Delivery guides are designed to represent a body of knowledge about teaching a particular topic and contain:

- **Content:** A clear outline of the content covered by the delivery guide;
- **Thinking Conceptually:** Expert guidance on the key concepts involved, common difficulties learners may have, approaches to teaching that can help learners understand these concepts and how this topic links conceptually to other areas of the subject;
- **Thinking Contextually:** A range of suggested teaching activities using a variety of themes so that different activities can be selected which best suit particular classes, learning styles or teaching approaches.

If you have any feedback on this Delivery Guide or suggestions for other resources you would like OCR to develop, please email resources.feedback@ocr.org.uk

Link to qualification:

http://www.ocr.org.uk/qualifications/gcse-design-and-technology-j310-from-2017/

Specification content (Sub Topic 1)

Sub Topic 1: Techniques for communicating ideas

Exam content

4.1 How can design solutions be communicated to demonstrate their suitability to a third party?

The use of graphical techniques to communicate ideas, modifications, constructional and technical considerations, such as:

- clear 2D and 3D sketches with notes
- sketch modelling
- exploded drawings
- mathematical modelling
- flow charts.

NEA content

d. Apply techniques in order to communicate and record design ideas suitable to the stage of development in order to justify their own thinking and present their thinking and intentions to a third party, such as:

- informal 2D and 3D sketching and modelling to communicate initial ideas
- system and schematic diagrams, annotated sketches, exploded diagrams, models and written notes, to communicate development iterations
- audio and visual recordings to share thinking, explorations and the functionality of ideas
- formal 2D and 3D working drawings to outline specification requirements; 3D illustrations, mathematical modelling and computer-based tools to present final design solutions; schedules and flow charts to deliver planning
- presentations and real-time evidence to communicate throughout the project.

Thinking conceptually

General approaches:

The communication of ideas is essential in a designer's toolkit, in order not only to be able to create and develop their own ideas and thought processes, but also to be able to explain those ideas clearly to other people.

Communicating an idea can take on many forms and is not explicitly referring to sketching and annotation; although in the exam this will be the main area of focus when assessing a learner's ability on this topic. Learners can communicate their ideas through a number of methods, especially within the NEA where learners may exploit any means available in order to portray their methodology. This may take the form of short video or voice clips explaining or demonstrating an idea or annotated sketch or physical modelling. Learners will often, and should be able to, find a method that suits them and their chosen task, especially within the NEA.

It is important for learners to understand the need of both basic and technical annotation; basic annotation can include the indication of features such as materials and finishes, whereas technical annotation will include dimensioning or mechanism explanation for instance. It is not only sketches that learners should be encouraged to annotate however, any form of media such as images & videos, screen captures, CAD models etc. can all be annotated to communicate a learner's thoughts or feelings towards them. It is important to highlight that these annotations may take the form of both short and extended statements.

When presenting an idea it can often be much clearer to a third party if distinctly different features are detailed separately through the use of exploded or section views, rather than attempting to detail all features in one go. Exploded views allow learners to detail assembly methods or interaction between parts. A sectional view will allow hidden features or intricate mechanisms to be detailed on a larger, easy to view scale.

Ultimately techniques used to communicate ideas should be appropriate to the stage of design thinking and development. Early ideas are likely to be quicker and rougher, but having confidence to deliver these skills are just as important as the more detailed techniques used to offer clarity and detail through later development.

Common misconceptions or difficulties learners may have:

Learners often present their own barriers with statements such as 'I can't draw/sketch very well' or 'I'm rubbish at CAD'. It is important for learners to understand that they are not assessed on how well the can sketch or use CAD for instance, but how well they can communicate their thoughts. For instance a 'low-level sketch' is easily enhanced with simple annotations stating materials, finishes or mechanisms etc. that the learner has not been able to communicate in the sketch itself. On the other hand it is important for learners to understand that excess amounts of time spent beautifully illustrating designs with intricate sketched detail does not necessarily grant access to higher marks.

Building confidence through developing skills in communication and drawing as a designer rather than as artist should form a significant part of learning throughout the Key Stages. Many learners that feel they can't draw find they can when following clear rules and practice to draw in different perspectives.

Additionally many learners have the illusion that communication always has to be well presented. This is not really the main focus when communicated this thinking, it is more like 'Pictionary'. Simple communication through quick sketching is a skill most designers possess as it is a vital way of having dialogue with stakeholders that you are sharing your thoughts with. Developing these quick sketching skills to communicate initial design ideas can be supported by demonstrating the work of many professional designers that are not always the best illustrators.

Conceptual links to other areas of the specification – useful ways to approach this topic to set learners up for topics later in the course:

Effective use of annotation in both a thought provoking and analytical manner is useful throughout this specification to demonstrate an applied understanding especially of Topic Areas 5, 6 and 7 that cover the more substantial technical principles.

Thinking contextually

It is important for learners to understand the importance of annotating and explaining the features of their design proposals for the NEA content, but also to explain technical understanding in the examined content. It can sometimes be challenging for learners to pin-point the topics or features that they should annotate or explain. A good way to develop this understanding is to explore product catalogues which display an image and a short description. The descriptions are concise but detailed enough to explain the key features of the product. Without the description, potential consumers would not have a clear understanding of what they are looking at and would more than likely not purchase the product.

Assembly instructions for self-assembly products often display exploded views providing consumers with an understanding of how the product is assembled. A number of assembly guides often use imagery alone to communicate with user. Exploring the needs and benefits of these methods of communication provide extremely useful insights into the importance and usefulness of clear communication.

Learner Resources – Activities

Title	Organisation/ Company	Web link	Summary description	Additional description detail	Relevant chapter (i.e. Content, Thinking Conceptually, Thinking Contextually)	Mapping to specification level
Product Descriptions	Amazon	www.amazon.co.uk	Explore shopping websites such as amazon and investigate how short feature descriptions are used to give key details about products. For some teaching groups it may be beneficial for the teacher to preselect the products and provide hyperlinks, screenshots or printouts of the product pages.	Learners should attempt to identify the importance of the short statements when advertising and ultimately selling a product to consumers. How do the short descriptions, sometimes just a few words, support the product imagery? What information is provided in the intial description? Are the bullet points expanded/ explained in the full product description further down the page.	Thinking conceptually	4.1 d
Assembly Instructions	IKEA	http://www.ikea.com/gb/en/customer-service/assembly-instructions	IKEA Instruction booklets for self-assembly products provide a great resource to explore the use of infographics to portray important information without the use of complicated descriptions.	Use the link provided to download instruction booklets which pupils can explore and evaluate the effectiveness of. These booklets often omit the use of text, discuss the benefits and drawbacks of this form of communication.	Thinking contextually	4.1 d
Communicating Design Ideas			Learners often find it difficult to effectively communicate their design ideas and decisions. This task is designed to develop the annotation of design sketches to further inform third parties.	Educators may wish to use peer to peer evaluation in order for learners to develop their skills within this topic. Once a design idea has been sketched and annotated it should be swapped with a partner who will then constructively evaluate the effectiveness of the annotation provided.	Thinking contextually	4.1 d

Learner Activity

Product Descriptions

Introduction

Consumers often like to know key information about a product to further inform their purchase. During this activity you will explore the usefulness and relevance of this information and the impact that it has on the consumer.

The activity

Explore products on Amazon.com paying particular attention to the initial product description bullet points found underneath the pricing information. Consider the following questions when analysing each of the products.

- What is the purpose of the short descriptions provided by the bullet points?
- Do they provide informative and useful information?
- What sort of information do they provide?
- Has enough information been provided or what should be added and why?

Extension activities/questions:

Try to create your own 'key product information' for a product you own considering the above points.

Learner Activity

Communicating Design Ideas

The activity

Annotate one of your initial or developed design sketches considering the following points:

- What materials have you decided to use and why?
- What finish will be applied to your product and why?
- Are there any mechanical features of your design, how do they work?
- Are there any hidden features in your design not currently visible?
- How does the user interact with the product?
- Which manufacturing techniques will you use?
- Are all of the key features of your design clear?
- How have the stakeholders been considered?

Now swap your annotated design with a partner and constructively evaluate the annotations provided considering the following points:

- Are you able to clearly understand the key features of the idea?
- Are you able to understand how the user will interact with the product?
- Are you left with any further questions about this design?

Extension activities/questions:

Learners could the same initial design sketch with the features/information they derive from the initial sketch. Annotations can then be compared and analysed for effectiveness.

Specification content (Sub Topic 2)

Sub Topic 2: Supporting design thinking and problem solving

Exam content

4.2 How do designers source information and thinking when problem solving?

a. Awareness of different design approaches, including:

i. user-centred design

ii. systems thinking.

b. The importance of collaboration to gain specialist knowledge from across subject areas when delivering solutions in design and manufacturing industries.

NEA CONTENT

a. Demonstrate an ability to identify and formulate appropriate requirement lists and specifications, reflecting on their own investigations and considering stakeholder needs, including:

- requirements that cover stakeholder needs and wants
- requirements that cover technical needs
- technical specifications that outline the specific requirements needed to support the design solution being made into a final prototype.

b. Be able to use different design strategies and approaches such as collaboration, user-centred design and systems thinking when generating and developing innovative design ideas that avoid design fixation.

Thinking conceptually

General approaches:

In order to arrive at effective design solutions stakeholders must be considered; often this will require the sourcing of information from multiple sources or through a range of different approaches.

When considering stakeholders it is important to first understand the needs and requirements of each. Without identifying each stakeholders needs and wants it is very difficult to formulate appropriate requirements for design development. Brainstorming or listing stakeholder's requirements is a good starting point in further understanding the wider context of a product. Highly effective design solutions can only be produced when all stakeholders are considered therefore it is recommended that some stakeholder analysis takes place before design ideas are formulated.

When considering the User Centred Design approach, often abbreviated UCD, the user is at the forefront of every design decision. This UCD process aims to gain an in-depth and analytical understanding of how the intended user will interact with the product being developed. This can be achieved in a number of ways such as interviews with, observations of and feedback from the potential primary user. When considering a systematic approach the focus shifts to how a products individual systems or features link to each other and contribute to the overall functionality of the design solution.

Technical specifications are generally produced to inform and direct the manufacture of a product. For instance the final dimensions and material selections will be identified alongside the manufacturing method. These may be presented in the form of exploded views or technical drawings accompanied by information tables stating each technical specification point with further information identified if necessary.

Common misconceptions or difficulties learners may have:

Often designers and engineers will also need to seek expert advice from third parties in order to develop an appropriate and effective design solution. The need to seek specialist advice should not be viewed as a weakness but as strengths in improving a products ultimate quality. If a product could be manufactured or function more efficiently through expert collaboration then the end user will only benefit.

When considering stakeholder needs and wants, learners should be able to identify basic requirements but liaison between potential stakeholders should be encouraged as requirements that may have initially been overlooked often arise.

Conceptual links to other areas of the specification – useful ways to approach this topic to set learners up for topics later in the course:

The ability to demonstrate clear and justified design decisions linking further aspects of Design Communication in 4.1 (exam) and 4d (NEA). Much of this also links into the evaluative aspects of Topic Area 2 and 8.

Thinking contextually

Analysing existing products from both a UCD and systematic approach is a useful way for learners to begin to understand the design process that has led to a products conceptualisation. Taking the example of a bicycle helmet encouraging learners to identify how the user would be at the forefront of the designer's thoughts when considering design features such as materials, comfort, aesthetics, price etc. When considering the systems thinking approach a designer would need to consider how the helmet is secured to the user in an efficient manner, how the component materials are connected and how the helmet can be adjusted to suit the user etc. In terms of collaboration learners should begin to identify where the designer may have needed to work with other experts. Continuing the example of the bicycle helmet, the designer may need to seek expert advice from materials scientists in order to select appropriate materials able to both absorb impact and protect the user in the event of an accident whilst balancing other important identified technical requirements. Alongside this information the designer would need to liaise with potential manufacturers as to how the chosen material may be manipulated and formed into the required shape. These considerations will have significant impact on the final design solution. The same can be applied to and will also influence the final technical specification of a product before it enters the manufacturing praise.

Learners need to develop the ability to identify the numerous stakeholders involved in the conceptualisation of products and services. Developing a broad knowledge of range of stakeholders not limited to the user alone will strengthen the quality of design proposals. For instance the consideration of material or component suppliers, manufacturers, retailers and stockists, local authorities, parents or carers, emergency services etc., will all provide varying insights towards and needs of a product or service. It is the consideration of a variety of stakeholders that contribute to a well-considered and effective design solution.

Learner Resources – Activities

Title	Organisation/ Company	Web link	Summary description	Additional description detail	Relevant chapter (i.e. Content, Thinking Conceptually, Thinking Contextually)	Mapping to specification level
Strategic Approaches – Design Process			Through exploring a range of different products, (these may be physical products or simply images of) learners must identify the key factors that may have been influential in both the UCD and systems thinking approaches.	Learners should identify the features of a product that would relate to either or both approach and be able to justify their reasoning's for each. When considering the systems approach it may be easier to use products that feature mechanical or electronic elements that lend themselves more to the systems approach.	Thinking conceptually	4.2 a, b
User Centred Design	Usability.gov	https://www.usability.gov/what-and-why/user-centered-design.html	This is a useful resource to further explain the user centred design process. A number of infographics are available via the links displayed on the page.	This usability.gov website also provides information related to the benefits of UCD and UX (user experience, which is closely linked to UCD). A alternative infographic explanation of the user centred design process is also illustrated via a 'UCD Waterfall Process Map'.	Thinking contextually	4.2 a
Systems thinking	Dubberly Design Office	http://www.dubberly.com/wp-content/uploads/2008/06/ddo_article_systemsdesign.pdf	A useful .pdf document explaining the definition of and approach to the systems thinking design process.		Thinking contextually	4.2 b

Learner Activity

Strategic Approaches – Design Process

Introduction

When designing products it is important to apply and appropriate design strategy to ensure that all relevant stakeholders are considered.

The activity

Using the product images shown below, consider how the following design strategies may have been applied. Try and justify your responses with as much detail as possible.

- User Centred Design
- Systems Design

Extension activities/questions:

Consider and discuss the collaboration opportunities that may be present in the three example products.

Specification content (Sub Topic 3)

Sub Topic 3: Developing design solutions

NEA content

c. Be able to design and develop at least one prototype that responds to needs and/or wants and is fit for purpose, demonstrating functionality, aesthetics and marketability.

Thinking conceptually

General approaches:

The NEA requires learners to design and develop and least one prototype that responds to needs and or wants and is fit for purpose, demonstrating functionality, aesthetics and marketability. This does not mean that the learners are limited to one prototype only however. It may be more effective or possible for the learner to produce a number of prototypes that demonstrate different features or elements of the final proposal. For instance a centre may not have the resources to produce a fully functional single prototype for any number of reasons, therefore the learner may demonstrate the functionality of their prototype through a number of additional prototype models that may demonstrate how a mechanism or circuit would function inside or as part of the final solution.

Digital design and manufacture must be used either throughout the development of the final design solution or when making the final prototype(s). This may be evidenced in the form of CAD drawings, renders or simulated analysis, and/or use of CNC machinery such as laser cutters, 3D printing, CNC routers/engravers, digital sewing machines etc.

As stated within the specification; when evidencing the final prototype(s) within the NEA, in order to make an appropriate evaluation of the final prototype(s), analysing stakeholders' opinions will be required. This should be sought from meaningful sources rather than superficially within the teaching group. It may be necessary to analyse the final prototype(s) in the situation it is designed for. If taking this approach centres must ensure that the required photographic and/or video evidence must be taken prior to the prototype(s) being taken from the centre to ensure a valid assessment can be made should anything happen to the prototypes(s) whilst out of the centre.

Common misconceptions or difficulties learners may have:

In order for learners to be able to design and develop at least one prototype that responds to needs and/or wants and is fit for purpose both the technical specification and identified stakeholder needs/requirements need to have been considered throughout the design process. For instance if previously identified needs/requirements have been omitted in the production of the final prototype, without justification, learners will limit themselves to Mark Bands 2 and 3 and will be unable to access Mark Band 4 (16-20) marks for Strand 4 of the marking criteria.

Learners are not expected to produce 'market ready' prototypes. In the context of this qualification, the term 'prototype' refers to a functioning design outcome. A final prototype could be a highly finished product, made as proof of concept prior to manufacture, or working scale models of a system where a full-size product would be impractical.

Conceptual links to other areas of the specification – useful ways to approach this topic to set learners up for topics later in the course:

Throughout the iterative design process it is important to encourage learners to produce simple prototype models alongside their design sketches. Producing and analysing simple initial prototypes will allow learners to develop their skills in relation to examined content 1.2 and also NEA points 4, 7 and 8.

Thinking contextually

When considering the iterative design process, in order to evaluate potential design solutions it may be beneficial to physically model an initial prototype. These initial prototypes will only need to prove or omit design decisions therefore may be relatively crude in their approach. Card models of structural components or mechanisms may be produced; similarly existing pre-made, re-usable components may be assembled to prove a concept. It is important for learners to consider how viable a design decision may be by physically modelling it and understanding how the various components may interact with each other and identify possible problems or opportunities.

Continual, regular liaison with relevant stakeholders will allow learners the opportunity to obtain external feedback related to their design proposal. If stakeholders are only considered at the beginning of the task and the end, learners may find that their final prototype contains fundamental flaws that could have been avoided with regular liaison with the relevant stakeholders. Learners can often become 'blinkered' with their design solutions and fail to recognise potential areas for development that would have been highlighted with more regular liaison.

In order to demonstrate the functionality of a final prototype, videos clips are often the most effective form of communication. The use of video footage is not expected to be edited to "movie" standard, short and simple clips that clearly demonstrate a mechanism or electronic system functioning, for instance, are perfectly adequate to demonstrate the functionality of a final prototype. These video clips may be embedded within the e-portfolio format or submitted as separate files clearly referenced within the main body of the submission.

Learner Resources – Activities

Title	Organisation/ Company	Web link	Summary description	Relevant chapter (i.e. Content, Thinking Conceptually, Thinking Contextually)	Mapping to specification level
Prototyping	Product Tank	https://www.youtube.com/watch?v=gWk6br5Ngkc	This is a very useful YouTube clip that explores the reasoning for creating prototypes and what prototypes should expect to prove or demonstrate. The clip also provides ideas on how to prototype using readily available materials.	Thinking contextually	NEA c
Prototyping using card	James Dyson Foundation	http://www.jamesdysonfoundation.co.uk/resources/cardboard-modelling	JDF have produced a number of short videos related to the design process. This particular clip demonstrates how card and paper can be used to prototype relatively complex designs in a simplistic yet effective manner.	Thinking contextually	NEA c
Testing/ Evaluation	James Dyson Foundation	http://www.jamesdysonfoundation.co.uk/resources/dyson-does-it-test	This short clip gives an insight into how Dyson tests and evaluates their products. This is a great clip for demonstrating product testing and evaluation in industry.	Thinking contextually	NEA c

The small print

We'd like to know your view on the resources we produce. By clicking on the 'Like' or 'Dislike' button you can help us to ensure that our resources work for you. When the email template pops up please add additional comments if you wish and then just click 'Send'. Thank you.

Whether you already offer OCR qualifications, are new to OCR, or are considering switching from your current provider/awarding organisation, you can request more information by completing the Expression of Interest form which can be found here: www.ocr.org.uk/expression-of-interest

Please get in touch if you want to discuss the accessibility of resources we offer to support delivery of our qualifications: resources.feedback@ocr.org.uk

Looking for a resource?

There is now a quick and easy search tool to help find **free** resources for your qualification:

www.ocr.org.uk/i-want-to/find-resources/

www.ocr.org.uk/gcsereform

OCR Customer Contact Centre

General qualifications

Telephone 01223 553998
Facsimile 01223 552627
Email general.qualifications@ocr.org.uk

OCR is part of Cambridge Assessment, a department of the University of Cambridge. *For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored.*

Cambridge Assessment

LLOYD'S REGISTER · LRQA
ISO 9001
UKAS MANAGEMENT SYSTEMS
001