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OCR
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A LEVEL

Delivery Guide

DESIGN AND TECHNOLOGY

H404, H405, H406
For first teaching in 2017

Topic Area 3: Implications of Wider Issues - General overview

Version 1

Contents

TOPIC AREA 3: IMPLICATIONS OF WIDER ISSUES - GENERAL OVERVIEW

Introduction

A LEVEL
DESIGN AND TECHNOLOGY

A guide to approaching the teaching of the content related to Topic Area 3: Implications of Wider Issues - General overview

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/as-a-level-gce-design-and-technology-h004-h006-h404-h406-from-2017/

Specification content (Sub Topic 1)

Sub Topic 1: Implications when considering the conflict between moral and commercial factors

Exam content

3.1 What factors need to be considered whilst investigating design possibilities?

a. Understand how social, ethical and environmental issues have influenced and been impacted by past and present developments in design practice and thinking, including:

i. consideration of lifecycle assessment (LCA) at all stages of a product's life from raw material to disposal

ii. the source and origin of materials; and the ecological and social footprint of materials

iii. the depletion and effects of using natural sources of energy and raw materials

iv. planned obsolescence

v. buying trends

vi. environmental incentives and directives.

NEA content

a. Understand the impact of social, moral, and ethical factors when investigating and analysing existing products, systems, technologies and technological developments in order to consider and apply these principles when designing and creating prototypes.

Thinking conceptually

General approaches:

Wherever possible, the specification is aiming to closely mimic real-world design experiences. This means that learners should understand and be able to make informed choices regarding the implications of their design choices. Overall, this will be evidenced by their ability to navigate a process which mixes sound, informed moral choices within a context to ensure the commercial requirements for a viable product. To do this effectively, learners will need to develop their understanding of the potential opportunities to choose sustainable materials and working practices over approaches where profit is the primary driver.

Learners can improve their understanding of sustainability options from a wide range of source materials. To introduce meaningful and accessible theory content, teachers should guide learners to increase their awareness of LCA (Lifecycle Assessments). In doing so, they will have a better understanding of all implicit impacts of a product, rather than just the effects of it during use or in disposal stages of its life. A more detailed understanding of a LCA in use, can promote a broader understanding of the varied options covered for a given product and encourage debate about the issues at hand within a legislative framework. For example, Volvo have implemented a wealth of changes to their Torslanda plant to reduce environmental impacts, meet increasingly tough legislation with a view for improved long-term profits. Introducing learners to this level of detail allows them to fully understand the level of scrutiny within a commercially led LCA.

There is an ever growing breadth of evidence showing the impact of industry on all parts of the environment. Focusing on one part and following through options will help learners understand the issues while looking at the differing points of view of different stakeholders. For example, learners can look at the sourcing of wood for furniture. At present, WWF has a range of petitions with UK-based companies about the sourcing of their wood. A debate can be had as to why these companies can't currently evidence that the wood they use is FSC (Forest Stewardship Council) approved. This brings about debate as to where the wood is from; why they choose not to gain FSC approval; the cost implications for the companies from lost trade due to negative public opinion versus the profit evidently being made under their current process. Learners can consider where other forms of sustainable materials could be sourced; the implications this would have on the environment distribution, global economies and the long term impacts and knock-on effects if these practices remain unchecked.

With the focus on profit for many companies, it is clear that they wish to create new markets and benefit from additional sales. Both planned obsolescence and encouraging customer-led trends for new products are prevalent in many consumer products. The use of mobile phones as a vehicle to help learners understand and access content is useful in this area. Learners can be encouraged to consider why they need to upgrade phones on a biannual basis. Learners can be challenged with the idea that with fashion trends to have the latest model, new technology emerging and phone companies choosing to no longer support older models, do consumers have a real choice or has planned obsolescence become the accepted norm regardless of the cost and sustainability issues this trend causes?

Common misconceptions or difficulties learners may have:

Learners can find difficulty with the breadth and depth of study in this area. The wide range of principles, legislation and differing viewpoints necessitate an extended period of learning which, in some centres, is viewed as a lower priority due to time constraints Learners often miss opportunities to evidence their understanding of the pros and cons and are unable to adequately show their understanding of both sides of the debate.

Learners often understand the facts at surface level and are able to plan and outline key issues with clarity. However, they often gloss over issues or when challenged, it is clear that they have not fully engaged with the subject matter at a deeper level of learning. As such, a real debate is not evidenced and often does not include wider implications including the knock-on effects or ripple effects of the issues at hand.

Due to a widespread misunderstanding of the concept, learners often assume that recycling is always the best option. They often miss opportunities to consider other approaches in terms of mitigating the original cause or reducing impacts. They often do not evidence an understanding of the difficulties and underlying costs associated with recycling from design through to breaking a product down for disposal.

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

1.1/1.2 Wider implications feed into and builds from learners' work on feasibility analysis as they grow their awareness of how to meet and consider conflicting stakeholder needs.

1 and 2 NEA. This area links closely to learning from existing products and identifying requirements for chosen NEA projects. The close links between LCA and iterative designs moving forward can be linked to the planned key criteria critical for success.

8 NEA – For learners with a deeper understanding of these aspects, the design specification for the final design can be considered in terms of meeting stakeholder needs and analysed in terms of links to LCA and whether the product meets moral and legislative sustainability issues.

Thinking contextually

To introduce learners to the considerations and uses of LCA within an environmental framework, they can be asked to look at the use of plastic forks. Currently, India alone uses 120 billion plastic forks each year and this has a huge local environmental impact. Learners can look at the production impacts combined with the environmental issues associated with this single-use disposable item. Due to the short product LCA, the understanding gained of how the product is produced, used and disposed of is easy to access. Learners can then be asked how they could resolve/lessen this issue given the high rates of poverty and demand for this type of product. This could be input as a group-led discussion or as a group design task. Learners can then be shown 'The spoon you can eat' Youtube clip https://www.youtube.com/watch?v=r4Cc5zmy0eY to further push their consideration of problem solving and lateral thinking.

A good understanding of product analysis helps learner learning in a number of areas. Product Analysis can be undertaken with a variety of pedagogical goals in mind and lead to very different outcomes depending on planned outcomes or foci. Learners can be tasked to look at how a given product is made and to what extent it is recyclable. Learners can be given a product involving mixed materials like a toothpaste tube or featuring complicated integrated mouldings such as a razor blade. Questions such as 'how much can be recycled?' and 'what are the barriers to recycling?' can be posed. Learners should justify their thinking and consider what changes can be made to allow increased recycling. What knock-on effects or cost implications do these changes have?

Teachers can take the concept of Products Analysis as a delivery tool further by asking learners to consider a more complex product like a car. What are the issues that result in most cars being only 75% recyclable? Given an average weight of just under 2 tonnes, nearly half a tonne becomes waste. Learners can consider the barriers to recycling or reuse of parts and how manufacturers can meet EU targets of 95%. Given that stakeholder interests surround commercial viability and legislation, these topics can be introduced to further extend learning outcomes and embed understanding for addressing future problem solving tasks.

To fully understand the complete breadth of impacts associated with LCA. It is important for learners to comprehend the wide range of stakeholders involved at all stages. Learners can be asked to consider a product such as a standard desk top computer. They can be asked to look at the LCA of the product, what drives upgrading them and what can be done to reduce this? Learners can consider sourcing materials in a global economy, manufacture and chemical contaminants used, distribution, the product in use and the issues surrounding disposal and E-waste (Electronic Waste). In doing so, teachers can guide learners to consider all stakeholders including resource/manufacturing companies and their staff, retail, energy requirements and then how and where the product is 'recycled'.

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
A Spoon You Can Eat Is a Tasty Alternative to Plastic Waste	National Geographic	https://www.youtube.com/watch?v=r4Cc5zmy0eY	Plastic cutlery has been around for years, it's widely considered the only choice for cheap, disposable cutlery. Knowing the threat plastic poses to our environment and health, Narayana Peesapathy created a tasty and nutritious alternative: edible cutlery.		Thinking Contextually	3.1, 3.2c, 3.2d
Pumpkin Interactive education DVD's	Pumpkin Interactive	https://www.pumpkin-interactive.co.uk/collections/design-technology-and-textiles	Pumpkin produce a range of videos covering a wide breadth of topics. Many of these cover wider issues that are relevant to learning for A Level D&T covering various areas, but with strong connections to textiles.	This is a paid for resource. Some video content is a little slow going but allows coverage of many topic areas.	Content	3.1
WWF website	WWF	https://www.wwf.org.uk/what-we-do/projects/forests-campaign-businesses	WWF forests campaign can be an ideal resource to outline issues of sustainability of wood and problems surrounding public awareness.		Thinking Contextually	3.1, 3.2c
Lifecycle analysis	OCR		Teacher-led lifecycle analysis task looking at the LCA of a banana.	This will inform learners as to contextual thinking and the knock-on effects to a variety of stakeholders.	Thinking Contextually	3.1, 3.2c, 3.2d

Learner Activity

Lifecycle analysis (LCA)

Introduction

We are going to look at the LCA of the banana. In doing so you should consider work force, economic and environmental issues.

The activity

Teachers will lead a whole class activity where learners are asked to determine and consider all the effects of making a simple purchase of a banana.

Learners should be led to consider all facets of:

- Where the banana may be grown (Costa Rica is ideal here)?
- How is it grown (in bags and harvested to ripen during transport)?
- Who grows it?
- How is it transported to a UK supermarket?
- What are the stages of shipping?
- Once at the supermarket, how do you take it home?
- What waste is there?
- Where is the waste taken?
- What happens to the waste?

Learners should then consider the environmental impacts – where pollutants, energy and waste are caused. This can be CO_2 and energy from transport (including litter or recycling management), packaging waste, biodegrading, power required for a variety parts of the lifecycle.

Learners should then consider cost implications through the process and the employment it supports.

Learners can then be asked what happens when 'Fair Trade' is introduced for the farmers. Consideration should then be given into where new moneys will benefit the immediate local community. These will likely include the farmer and his/her standard of living but also additional trades, local retail, education etc. This can be termed as a ripple effect.

Extension activities/questions:

Learners can independently consider a different product and consider its lifecycle as outline above to embed their understanding of immediately linked issues. To stretch and challenge, learners can consider wider-reaching issues around employment and sweatshop labour.

Specification content (Sub Topic 2)

Sub Topic 2: The influence of technological developments in Design Engineering

Exam content

3.2 What factors need to be considered when developing design solutions for manufacture?

a. Awareness of the responsibilities and principles of designing for manufacture (DFM)/ Total Quality Management (TQM), including:

i. planning for accuracy and efficiency through testing and prototyping

ii. being aware of issues in relation to different scales of production

iii. designing for repair and maintenance

iv. designing with consideration of product life.

b. Awareness of product lifecycles that extend useful product life through planning for and consideration of maintenance, repair, upgrades, remanufacture and recycling systems.

c. Demonstrate an understanding of how environmental factors impact on:

i. sourcing and processing raw materials into a workable form

ii. the disposal of waste, surplus materials and components, by-products of production including pollution related to energy

iii. cost implications related to materials and process.

d. Demonstrate an understanding of sustainability issues relating to industrial manufacture, including:

i. fair trade and the Ethical Trade Initiative (ETI)

ii. economic issues and globalisation

iii. material sustainability and optimisation, availability, recycling and conservation schemes, such as:

- exploring the impact and use of eco-materials
- exploring how materials can be up-cycled.

3.3 What factors need to be considered when manufacturing products?

a. Demonstrate an understanding of how to achieve an optimum use of materials and components, including:

i. the cost implications of materials and/or components

ii. stock sizes and forms available

iii. sustainable production.

NEA content

c. Review wider environmental implications when creating prototypes, understanding the use of product lifecycle analysis to consider factors such as the disposal of waste, surplus materials, components and by-products and sustainability.

Thinking conceptually

General approaches:

DFM/TQM

With the specification aiming to base learner experience on real-world practice, learners should be guided to consider the design process with a focus on DFM (Design For Manufacture). Learners should reflect on their own practice and look at designing from a manufacturing process perspective. They should show they have an understanding of the factors surrounding optimising fabrication, testing, resourcing, transport, service and repair within a framework which aims for quality, financial resilience, reliability and safety while meeting legislative requirements.

To allow learners to access DFM more easily, they can be first introduced to TQM (Total Quality Management) and the major impact it has on product design since its inception after World War Two. The cycle of 'Plan, Do, Check, Act' aims to attain continuous, on-going improvement and can be closely linked to the iterative design cycle. The TQM approach engages learners with a reflective, experimental approach to designing which allows them to take risks and to trial new conceptual solutions. It can also be used throughout longer fabrication processes where learners are seeking to improve their skills and manufacturing accuracy.

Environmental issues with regards to manufacture and related products can be effectively considered as part of a wider reaching LCA (Lifecycle Analysis). See LCA approaches in greater detail in the **Implications when considering the conflict between moral and commercial factors** section. Once a full LCA has been considered learners can apply DFM methodologies to look deeper into potential sources of, and ways to mitigate waste over the course of the manufacturing process.

The scope of possible cost implications for differing materials and manufacturing technologies is vast. Learners are will not be required to specify particular costs in an exam context, these would always be given to them. However, they should be able to show understanding of theory including economies of scale, bought-in components and JIT (Just In Time) production. All of these areas can be covered through early stages of the Scheme of work (SOW) with a wide variety of DVD and YouTube resources available covering content.

Common misconceptions or difficulties learners may have:

In some cases, learners add consideration of sustainability issues as an afterthought or retro-fit them into design solutions. This is a problematic approach as often the resulting analysis and raised improvements are simply ignored as learners move on through the iterative design process. Learners should be guided to implement this analysis during the design process to ensure that when problems or design changes are indicated, they are acted upon in a meaningful way.

Consideration of DFM, TQM and the related issues are often poorly evidenced in many NEA projects which simply focus on UCD. This lack of consideration often has an impact on the learners' understanding of these issues and their skills at applying the principles to contextual externally assessed tasks.

Learners will, in many cases, evidence consideration of cost implications in very generic terms using bland, unjustified statements such as 'cheaper' or 'expensive'. In doing so, they are not evidencing higher-order skills or deeper understanding of the subject matter. These unqualified responses rarely attract marks and learners should be steered towards fuller, more complete answers that justify thinking which utilise contextually-based supporting evidence.

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

NEA. Planning of the final prototype(s) is likely to have very close links to the quality of prototype modelling and learners need to understand how planned quality checks impact positively on modelling so that they meet high standard modelling requirements.

1.1 Environmental contexts may also impact on sustainability issues and, as such, close links to learner investigations covering the overriding contextual use of products can be linked here.

8.2 Detail gathered by learners focusing of DFM, can help inform the technical specification requirements of the NEA. Learners can utilise this as a starting point to aid evaluation of final designs and to ensure it fulfils the needs of manufacturing stakeholders.

7.5 TQM can prompt learners to think more deeply about quality control throughout manufacture. As such, the planning and improvement cycle can help build skills and the reflective process should aid continual improvement and accuracy.

Thinking contextually

Learners will undertake a variety of modelling tasks as they move through the SOW to meet the content coverage they will need for their NEA, including requirements surrounding machine use, risk assessment etc. During these modelling processes, learners can be asked to embed quality checking. This is often easiest approached in two ways. The first way is to ask learners to pre-plan the fabrication process. Learners can utilise flow charts to plan steps and stages and incorporate quality reviews throughout sections. The level of depth they go into should be guided by staff. Learners should become familiar with tolerances, methodologies of quality checking and ways to ensure steps are repeatable by using templates and jigs. The second way, which could be undertaken as a standalone task or consecutively to the process above, is for learners to undertake a TQM approach to the build itself. During the process they should be asked to review progress and identify quality issues and formally plan approaches to ensure higher levels of accuracy while reducing the range of tolerances or to undertake new methods of fabrication that will produce better outcomes. This may also include looking at manufacturing processes from a DFM stance to look at reducing waste, time etc. and to improve accuracy.

As part of product analysis reviews, learners can be asked to consider the cost of parts and where parts are manufactured or sourced. This can help embed understanding of bought-in or standardised parts and also help them in understanding further the concept of global manufacturing and JIT. Learners can be asked if there are ways to optimise the product further by interrogating methods of manufacture and the range of parts (are the bolts all standard? Has the manufacturer minimised waste in all areas? Which parts could be reduced or removed without impacting on the products function?).

In both externally assessed tasks and in the NEA, learners often make comments which are not backed up by reasoned supporting statements or that are lacking in justification. For example, learners looking at hand-held products can often make bland statements such as, 'It is light weight' or that 'the product is cheap'. Statements of this nature without context are meaningless – it could be argued that a car is light weight or cheap if compared to a jumbo jet. Learners should be encouraged from the outset of the specification, to justify their reasoning. This will improve both their written responses and tie in closely with literacy objectives and subject specific terminology. Work should be done with learners to help them gain a strong understanding of relevant characteristics so they can be used in the correct context and use technical terminology specifically focused on allowing them to fully articulate the reasoning behind their choices, thoughts or arguments. A glossary of terms is available in the OCR Specification booklet on pages 107-109. These can be used in conjunction with sentence starters and key technical language in wall displays or within prescribed tasks undertaken by learners as they move through the SOW.

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
Saltwater Brewery 'Edible Six Pack Rings'	We Believers	https://www.youtube.com/watch?v=-YG9gUJMGyw&t=51s&index=18&list=PL7M35dpw3U3B1Qc9hZ6OyPyOSnCjR4Q9h	Many plastic six-pack rings end up in our oceans and pose a serious threat to wildlife.	A short film about the possible sustainable opportunities for common disposable products.	Content	3.2 d
Colombia builds houses with blocks made of discarded plastics	New China TV	https://www.youtube.com/watch?v=uSOh21ooM_E&index=23&list=PL7M35dpw3U3B1Qc9h Z6OyPyOSnCjR4Q9h	Colombian architect Oscar Mendez is building a house with blocks and cuboids made of discarded plastics.		Content	3.2 d
Mardi Gras: Made in China 2005	David Redmon	https://www.amazon.co.uk/Mardi-Gras-China-David-Redmon/dp/B06WVPLYC2/ref=sr_1_fkmr1_1?ie=UTF8&qid=1499164389&sr=8-1-fkmr1&keywords=madis+gras+made+in+china+dvd	The only film to explore how toxic products directly affect the people who both make and consume them.	DVD can be purchased where available. Streaming via Fandor on Amazon free during trial period for £3.49/month after trial	Content	3.2 c, 3.2 d
Class debate on sustainability issues	OCR		Teacher led classroom debate to broaden understanding of stakeholder needs in relation to sustainability.		Content	3.2 d
Specification	OCR		OCR specification covering key terms in glossary section. Pages 107–109		Content	3.2 d

Learner Activity

Class debate on sustainability issues

Introduction

In this section, learners will role play key stakeholders when considering a product such as a pair of safety glasses.

The activity

Assign roles of:

- Worker
- CEO
- Investor
- Retailer
- User

Research task – what do these stakeholders want from the product? Once assigned a role, the learners look into and plan what they want from the product.

Discuss the following issues – what requirements, compromises or changes would need to be made to meet the following:

- Meeting legislation
- Reduction of costs
- Reducing waste
- Fair Trade and rights surrounding workers' rights?

Learners should discuss options including: redlines and possibly sketching new design solutions.

Extension activities/questions:

Learners could apply this understanding of stakeholder requirements to a product of their own choice to embed or reinforce learning.

Specification content (Sub Topic 3)

Sub Topic 3: Implications related to distribution of goods

Exam content

3.4 What factors need to be considered when distributing products to markets?

a. Understand the issues related to the effective and responsible distribution of products, such as:

- • cost effective distribution
- • environmental issues and energy requirements
- • social media and mobile technology
- • global production and delivery.

b. Demonstrate an understanding of the implications of intellectual property (IP), registered designs, registered trademarks, copyright, design rights and patents, in relation to ethics in design practice and consumer rights.

Thinking conceptually

General approaches:

Learners can consider distribution in its widest sense. They should think of all aspects from the stakeholder, the product requirements to customer expectations. Following the journey of a product as part of an LCA can be helpful way to determine key factors within the products journey. To further understand the concepts surrounding distribution and transportation, learners can be encouraged to pick specific products and consider the factors governing their delivery. A range of product journeys can be considered from fruit through to high-end electronic products. The environmental conditions of their transport and bespoke needs during and after the journey, including related timescales, will all help leaners to understand the different market factors in distributors.

Consideration can be given to how the product arrives with retailers or consumers in a suitable condition. This will draw attention to the method of delivery and also the use of packaging and the requirements to ensure safe carriage. Learners should be made aware of any relative cost factors and shipping issues, namely weight and size. In doing so, they may consider DFM (Design For Manufacture) issues that govern product shape as part of the reduction of waste during transport. With air nominally costing the company most to transport due to there being no value attached to it, learners will likely think about the size and shape of products, flat packing, the possibility of allowing assembly by the end user and the reduction of negative space between packages.

It can be highly advantageous for learners thinking of a fully innovative design solution, to plan or at least consider packaging and distribution in their NEA. This will show they are fully engaged with products there are considering, including a study of the packaging. Consideration of the methodologies used to produce the packaging, its protective constraints and the ways the manufacturer has addressed the reduction of materials, processes and waste. Learners can consider how they could further reduce packaging or how they could ensure that packaging is more sustainable. See the links in the 'Activity section' for ways learners can rethink options and think of solutions outside the accepted norms. To further stretch and challenge learners, they can be asked to consider what happens if the product arrives broken, is faulty or unwanted by the customer and needs to be returned. This brings about meaningful understanding of issues about product reuse and reduction of waste.

Learners can lack knowledge and understanding of supply chains and often think of it as being linear. Learners should be made aware of the effects of the globalisation on the distribution of products both as finalised consumer products and as their component parts during fabrication. An understanding of the different distribution paths should be promoted. Awareness should be gained of simply supplying directly to customers from a single manufacturing base, to companies involved in global production using manufacturing hubs in numerous locations to ship around the world to different customer markets. During delivery of this content, learners could be asked, for example, to consider how parcels are tracked during the transport process and how this helps companies meet customer demand around timescales.

Legislative issues will underpin many design decisions. Learners should be able to interpret law pertaining to intellectual property, registered designs, registered trademarks, copyright, design rights and patents. This can be delivered through a theory focused session but is often better done with learners looking at a specific product or range of products and determining what or how this legislation has been applied. For instance, learners could look at vacuum cleaners and determine how they differ, what aspects companies have rights to and have been able to patent. This can also raise the opportunity to talk in more detail about design rights and how patents run out over time, this should also cover ethics and plagiarism.

Common misconceptions or difficulties learners may have:

Learners do not spend enough time considering the different possibilities governing intellectual property rights and are unable to distinguish between them. Due to the similarities in terminology used and the possible overlap of concepts, learners do not evidence sufficiently their understanding of the issues in any depth or support it with appropriate examples of trade or consumer law.

Learners do not consider the effects of globalisation on both manufacture and distribution effectively enough. Learners often incorrectly assume that products are manufactured by a company in a single factory located somewhere in the world. They often disregard possible supply chains or the likelihood of numerous manufacturing centres across the globe being required for popular consumer products.

Often learners respond to questions about distribution from a very polarised or simplistic view point and don't always consider the wide reaching implications of delivery from all stakeholders' perspectives. Consideration is often given to the methodologies of transportation and environmental impacts, but with little balance in terms of cost, effective use of packaging, global demand or issues surrounding damaged or returned goods to the supplier.

Thinking conceptually

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

4.3 During developmental stages of their NEA, learners should embed a variety of designing strategies that consider stakeholder needs. In doing so, they should also consider issues that may have impact on stakeholder perceptions of ethical sourcing of materials and global consideration of the distribution of goods to meet the expectations of increasing globalisation.

5.1 Learners will need to consider ethics and the influence they have as a designer and that of their stakeholders in terms of selection of materials for all aspects of the product. This is likely to include the consideration of packaging, waste in an environment context.

6.1 In this section, learners are likely to consider packaging and its requirements to provide customers with undamaged products regardless of distance travelled. Learners may investigate structural integrity of packaging design solutions to further understand the packaging needs.

NEA. During the early stages, these aspects will be considered as part of the feasibility analysis for their choice of NEA project. In addition, for the NEA, learners may consider all facets of the product and this may include shipping, packaging and marketing options which are all linked to the global production and delivery.

Thinking contextually

When undertaking a mini project of choice or their final assessed NEA project, learners can be asked to consider the transport and delivery of the product. This can fit within the consideration given to the marketability of the product or DFM requirements. Learners can be asked to upscale the number of products being produced to represent a consignment going out for distribution to a global market. Learners should be asked to consider all aspects of the delivery meeting stakeholder requirements. Learners can be asked to consider:

- Packaging –How does it offer adequate protection? Is it sustainable? Can it be used for returns? How does it meet retailer needs?
- Tracking – How can media be used to aid tracking/informing customers? What is needed for this (GPS, RFID, bar-coding)?
- Global shipping – timings, available methods, relative costs, transport hubs and international manufacturing
- Cost reduction – lower cost packaging, larger consignments, tessellated products, less product miles.
- Customer expectations – What do they want? What is the impact of failing to meet user expectations (financial impact and company reputation/further sales)?

There is potentially a substantial amount of ground to cover with regards to IP (intellectual property) and copyright legislation. An effective way to deliver this is to bring about consideration of property rights by role playing the process of bringing a product to market. This assignment is outlined as a role play – see 'Activity task sheet'.

Learners should gain a better understanding of IP and copyright law as part of a product analysis or looking at the salient issues as part of the feasibility analysis of their own mini or NEA project. Learners should not only consider the more obvious stakeholders such as the user, retailer, manufacturer, but also who would hold the rights to the product. In doing so, they can be asked to consider what limitations these have in a variety of contexts, such as global copyright issues and the impacts of international borders, time issues and legislation. Learners with a deeper understanding will be able to identify what consumer rights and trade description issues there are. For example, adverts based on the original health claims of cigarettes and how these have changed over time can be a good way to evidence these themes.

To better understand global manufacture, learners can look at large manufacturers such as BMW or Coca-Cola. Investigations looking at the supply chain for large scale car manufacturers can raise learners' awareness of bought-in component parts, JIT. It allows scope for debate surrounding environmental issues of distribution and sourcing of materials side-by-side with how local and global economies are influenced or sustained by large scale manufacturing employers. Learners can also look at global manufacture by way of Coca-Cola or a similar market leader. Learners can be given an understanding of numerous production sites and the savings this brings in terms of transport and also bring about discussion around quality assurance.

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
Copyright, trademark and patent: What's the difference?	LegalZoom	https://www.youtube.com/watch?v=HsTi3vD_Usw&index=13&list=PL7M35dpw3U3B1Qc9hZ6OyPyOSnCjR4Q9h	A short movie outlining the key differences in copyright and trademark law. A good starting point for learners.	An American bias but can be assimilated by GCE learners easily enough.	Content	3.4 b
Mushroom® packaging	Ecovative	https://www.youtube.com/watch?v=zw2O1PhrzA0	Mushroom packaging is a sustainable replacement for EPS, EPE, EPP and other petroleum based plastic foams. Mushroom packaging is renewable, biobased and compostable. It's also performance and cost competitive.		Content	3.4 a
Saltwater Brewery "Edible Six Pack Rings"	We Believers	https://www.youtube.com/watch?v=-YG9gUJMGyw&index=18&list=PL7M35dpw3U3B1Qc9hZ6OyPyOSnCjR4Q9h&t=52s	Most of the plastic six-pack rings end up in our oceans and pose a serious threat to wildlife.		Content	3.4 a
Copy or Protect	OCR		Class research competition to create understanding of IP law and how and why products are protected.	Teacher will need to adjudicate and manage debate/comp.	Thinking Contextually	3.4 b

Learner Activity

Copy or Protect

Introduction

In this activity, you'll be split into teams and compete to protect a product's rights or find a loop hole and steal the concept.

The activity

Role play. Learners in two groups, one preventing and the other trying to steal the property rights. Can team A cover off the possible outcomes or can team B 'copy' the design and make it their own?

Learners are given a product and, in teams, need to discuss the design rights from two stand points.

Team A – aim to protect the rights and cover off options that could allow someone else to steal the design or patent with a similar product.

Plan a range of legislation/ actions they will take to protect the product. Learners can have access to pre-prepared materials based on IP law, access to course guides or internet, dependent on teacher choice. Learners should consider all aspects, including design rights.

Team B – aim to find a loop hole or aspect that can allow them to copy or produce another product very close to the original.

Plan a range of attacks or planned actions to steal or beat copyright to cover issues laid out above.

Learners can come up with as many ways to counter the opposite team as they can. The game ends when team A has no answers to the attacks from Team B or when Team B runs out of options to beat copyright.

The teacher will play as judge/adjudicator and their opinion is final.

Extension activities/questions:

Learners consider their own project work (mini project/NEA) and determine what they will need to do to protect copyright. This may impact on their chosen or intended USP and adaptations may need to be made to ensure all stakeholder needs can be met with particular attention made to commercial interests.

Specification content (Sub Topic 4)

Sub Topic 4: Implications of designing in isolation

Exam content

3.5 How can skills and knowledge from other subject areas, including mathematics and science, inform decisions in design?

a. Demonstrate an understanding of the need to incorporate knowledge from other experts and subjects to inform design and manufacturing decisions, including the areas of science and mathematics.

b. Understand how undertaking primary and secondary research and being able to interpret technical data and information from specialist websites and publications supports design development.

NEA content

b. Be able to draw on and apply skills and knowledge from other subject areas, including mathematics and science, to inform and support decisions when designing or when developing technological aspects of their product.

Thinking conceptually

General approaches:

Collaboration is a word that is banded around a lot in Design and Technology, in a school environment it is difficult to enable for many reasons; end goals are often not shared; assessment is not best suited to collaboration etc. In industry however collaboration on projects is of vital importance to the success of many design solutions, and it is not important that learner's understand this, but also that they at least seek opportunities to work with an draw on knowledge and understanding from other people as well as from other subjects that they also have an interest in.

Design solutions can be achieved with minimal data driving them. While simplicity is often an advantage in product design, levels of rigor should be considered and evidenced by learners to ensure they can access higher marks within the mark scheme. Knowledge can come from a range of sources including, stakeholders, primary and secondary research and should be used to inform design concepts through the comprehension of stakeholder requirements, competition in the market place and fundamental manufacturing processes. Understanding the skills needed, requires opportunities to interpret and apply these types of data which should be embedded throughout the SOW. It is also important for learners to understand the pitfalls of designing in isolation and how a broader understanding of issues will aid the fluidity of the design process.

Primary research can come from a variety of sources and is often best used to inform on-going decision making and to help the iterative design process. Learners often make good use of peer feedback and hands-on product analysis to inform this process. Learners will ideally become proficient at utilising primary research to support the design process and justifying their iterations and experimentation.

Secondary research is also likely to form a basis for supporting planned iterations and, importantly, to avoid recreating designs which already exist or pursuing flawed design solutions. The strongest learners will aim to show that their work is underpinned by the understanding of problems associated with bias, media interpretation and the reliability and quality of data.

NEA requirements show that learners should apply technical data as needed through the iterative design process. Stakeholders, with a breadth of expertise, can provide an excellent platform or guidance to the design process and promote high quality, fully considered solutions. Teachers should use a variety of approaches to help ensure that learners are able to use data from differing sources and that they are able to apply this understanding to solve problems to meet exam requirements.

Though maths and science are not directly assessed within the NEA, it will always be to the advantage of a learner to utilise and demonstrate their mathematical skills, scientific knowledge and working scientifically.

Common misconceptions or difficulties learners may have:

Avoidance of this subject matter due to limited understanding of topic or process. The up-skilling of learners is important but embedding a willingness to actively seek wider learning and apply new knowledge is key, not only to access other subject specialisms, but in the design process in general. It is after all what many designers undertake in the real world on a project by project basis.

Academic honesty – learners will often find solutions which closely or entirely match their requirements. Rather than manage this process and move their design focus or adapt the original working brief, they will often assimilate the design and claim ownership.

Learners will use skills from other subjects, such as Maths and Science, or from other design disciplines at a very superficial level or simply add it retrospectively. The issue here is that this does not impact on the designing during the process when it needs to be scrutinised in depth. This failure to act in real time can mean that the best design opportunities are missed or that clearly defined needs are not addressed.

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

NEA. The abilities outlined here are linked to the requirement for maths and science content throughout the specification. The skills should underpin and help learners in justifying their design planning and choices of on-going iteration.

NEA. High level research skills will help learners in identifying the contextual issues surrounding their choice of project for the NEA. This will support them in understanding barriers and potential problems. By the stage learners undertake the NEA, teachers will have ideally supported them to become more independent learners with skills to search out and utilise relevant data sets.

H404 A_02 Externally assessed tasks require learners to evidence a range of problem solving skills and the ability to assimilate and use data, maths and science skill sets.a

Thinking contextually

Throughout the SOW, learners should become well versed in identifying, using and applying data from a variety of different sources. The rigor involved in this is governed by the amount of information provided to learners. In early stages, a range of planned data sheets or a given website can allow tasks to take place within defined boundaries to support learning and give clarity to the task. As learners move through the course, they can be set more taxing assignments to promote stretch and challenge and improve problem solving skills.

Anthropometric data driving ergonomic design is an ideal starting point as many learners will be familiar with the concept even if just through prior learning. As such, it can be accessed by all and learning can be driven from the induction project onwards. Learners can be asked to consider basic requirements for the 'average' user. This will lead to them considering appropriate range of size for a given product before it becomes unwieldy or too small to allow easy use. This is likely to raise a range of numeracy tasks and could span basic number tasks through to statistical graph analysis and probability. Further learning from this can lead rapidly into issues surrounding the anthropometric 95th percentile and subsequently on to a meaningful consideration of inclusive design.

After basic skills are embedded, learners can be pushed to more challenging application of data. Technical tasks can be given to improve research skills and to promote interpretation of data. An example of this is for learners to be given a range of web links to documentation for a complex multipart product like an industrial fan. Learners are then asked to virtually model this using CAD. In doing so, they improve their CAD skills whilst being actively required to scrutinise, assimilate, process and apply a range of data from different technical data sources to create the fan body, screws, motor and stand for assembly into a single cohesive model.

Both primary and secondary research form an important part of any planned design task. To make best use of the data driving designing, learners should become familiar with identifying and managing possible sources of bias. Delivery options for this are varied and will depend on depth. An input session covering examples of bias and the need to look into the author or source of a given website or paper can give learners insight into political, ethical or commercial bias. Plenty of examples of this are readily available surrounding political claims made around Brexit, commercial companies using statistically unreliable data and a variety of other web-based media. An example of this is the well-known car manufacturer VW making false claims about the performance of diesel engines CO2 emissions in 2015, leading to them having to recall vehicles and pay very heavy penalties in fines and compensation internationally. http://www.bbc.co.uk/news/business-34324772

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 costing exercise	OCR		Maths based task to embed and understand the costing of a bringing a product to market.		Content	3.5

The small print

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