Queensland response to the draft *Shape of the Australian Curriculum: Technologies*

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Queensland Government
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Introduction

The Queensland Studies Authority (QSA), in partnership with Education Queensland (EQ), Queensland Catholic Education Commission (QCEC) and Independent Schools Queensland (ISQ), appreciates the opportunity to provide feedback on the draft *Shape of the Australian Curriculum: Technologies*. Queensland supports the development of an Australian Curriculum that will provide consistent and explicit curriculum expectations across the nation.

This paper is a summary of the collated Queensland feedback submitted from:

- representative curriculum and learning area committees of the QSA
- Queensland teachers from across the Technologies learning area
- representatives of the three school sectors, representing and advocating for 1400 EQ schools, 292 Catholic schools and 188 Independent schools
- professional associations including the Home Economics Institute of Australia (Qld.)
- an academic in technologies education from Griffith University.

Queensland's consultation identified strengths and a range of issues and concerns for the Australian Curriculum, Assessment and Reporting Authority's (ACARA) consideration when redrafting the *Shape of the Australian Curriculum: Technologies* (the shape paper).

The Queensland response is organised in the following way:

- key strengths of the draft shape paper, and broad issues and concerns
- specific feedback on each section of the draft shape paper with suggested ways forward and examples.

1. Key strengths, issues and concerns

1.1 Strengths

The Queensland consultation participants identified the following strengths in the draft shape paper.

- The opportunity to develop common terminology, which will build a shared language for Technologies teachers in all states and territories.
- Overall, the intent of the draft shape paper covers the scope of what would be expected in a Technologies learning area. Most Technologies teachers will be familiar with the proposals presented in the draft shape paper. In the Technologies curriculum, ACARA has a challenging task to bring the range of technologies contexts together with a sense of unity.
- Technologies learning is active learning. It allows students to design and create solutions to challenges and needs relevant to their lives. This type of learning, when applied to real-world situations, helps to give meaning and support student-centred inquiry approaches, which in turn develops a motive for learning. This message is found throughout the draft shape paper.
- The use of "Technologies" in the title of the learning area, strands and throughout the draft shape paper. This plurality reflects the diverse ways of thinking, engaging, communicating and creating through contexts and processes and with an array of tools, materials and media (digital and otherwise).
- The focuses on early years learners are generally appropriate.
- The draft shape paper has a good focus on technology and society and the role of people in shaping technology.
- With respect to digital technologies, the intent that students develop and apply, throughout the curriculum, progressively more complex computational thinking to create digital information products, systems or software instructions is viewed favourably. The term "digital technologies" is perhaps not the right one. But its intent in building a foundation for learning in "computing sciences", especially as it moves up to senior secondary years, is supported.
- The concept of "preferred futures".
- The focus on higher order thinking and 21st century skills.
- The intent in developing a flexible curriculum.

1.2 Issues and concerns

Proposed structure of the curriculum

The draft shape paper proposes that the Technologies curriculum be structured in two strands/subjects — Design and technologies and Digital technologies. This lacks justification and appears to be an artificial separation. Digital technologies are used in all aspects of Design and technologies. The description of Digital technologies seems to be focused on computing and digital information, but this is not encapsulated by the name "Digital technologies".

It is proposed that, in Foundation (F)[1] to Year 8, Design and technologies and Digital technologies are "strands", and in Years 9–12, "subjects". This proposed structure lacks justification, and the distinction between a strand and subject is unclear.

The Nature of the Technologies learning area section is also written as if it is a curriculum construct. This adds a point of confusion in the draft shape paper. Only one hierarchy should be proposed as to how the Technologies learning area is structured.

Way forward

- Consider renaming the strands/subjects "Design and technologies" and "Computing and information technologies".
- Provide reasoning for the strand/subject distinction. States and territories will create their own subjects using the Australian Curriculum: Technologies content descriptions and achievement standards.
- Consider using the structure provided in the Nature of the Technologies learning area section as the strands and sub-strands of the curriculum. That is:
  - Knowledge and understanding
    - materials, information, systems, tools and equipment
    - technologies and society
  - Technologies processes and production
    - apply a range of thinking skills
    - respond to needs, opportunities or problems
    - manage projects.

The suggested strands of Design and technologies and Computing and information technologies could be framed as focus areas from which content descriptions are developed. If this structure is adopted, it should be emphasised that the concepts contained within "apply a range of thinking skills" should be integrated across the whole learning area.

The proposed structure above aligns with the strand and sub-strand organisation of the other curriculum learning areas and deals with the issues of distinguishing between Design and technologies and Digital technologies.

Cohesion and length of the paper

A significant issue with the draft shape paper is its structure and repetitiveness. Many sections repeat information included in other sections. Much of the important information, such as the overarching idea "Engaging in creating preferred futures", is hidden in the middle of the paper. As a consequence, the draft shape paper is too long. By comparison, the longest of the English, Mathematics, Science and History shape papers was 16 pages. Some specific examples below serve to illustrate this issue.

Paragraphs 17–20 (p. 4), for example, attempt to capture every possible instance of how and why technologies are used and their importance, as well as what they do for people and students. The importance of technologies is not in dispute. This information could be significantly condensed.

Further, much of what is in paragraph 17 (p. 4) is unnecessary as it is again covered in paragraph 21 (p. 5):

- Paragraph 17 keywords: enterprise, innovation, take risks, seize opportunities, ethical decisions, creative and innovative solutions, complex problems, preferred futures, active, creative, engaging, discriminating and informed users, producers and innovators.

[1] The Foundation Year (F) of the Australian Curriculum is Prep (P) in Queensland and refers to the year before Year 1. Children beginning Prep in January are required to be five years of age by 30 June.

- Paragraph 21 keywords: discriminating, ethical, innovative, creative, enterprising, create, design, develop, produce, innovative technological solutions, play, learn, create, produce, access, manipulate, create, critique, ethically produce, imaginative and innovative in their production of solutions.

These paragraphs are not identical, but they essentially say the same thing. Paragraph 21 also unnecessarily discusses the scope of learning from the early years to the senior secondary years. It belongs, and already appears, in the Scope and sequence section.

Paragraphs 30 and 31 (p. 7) provide another example. They use different words, but make essentially the same point — people create solutions using technologies understandings and skills. This point is made in paragraphs 5, 6, 17, 18, 20, 21, 22, 23, 48, 49, 59 and 119.

Throughout the draft shape paper, there are frequent examples of repetitiveness and wordiness.

As noted earlier, the Nature of the Technologies learning area section is written as if it is a curriculum construct. The next section, Structure of the Australian Curriculum: Technologies has a different hierarchy. Much of the information in these two sections is the same. This adds a point of confusion in the draft shape paper.

Way forward

- Consider audience. The shape paper's main audience is curriculum writers. They need to have a clear understanding of the intent and structure of the curriculum as outlined in the paper. The shape paper should be consistent in style, follow a simple structure, deliver an unambiguous message and be concise. The shape papers for English, Mathematics, Science and History provide good examples, as does the current draft *Shape of the Australian Curriculum: Health and Physical Education*.
- Start the shape paper with big conceptual ideas — what Technologies is about (including the Nature of Technologies learning), and the curriculum's:
  - aims
  - overarching idea(s)
  - structure
  - scope and sequence
  - relationship to the general capabilities and cross-curriculum priorities.
- Co-locate the sections of the shape paper with the same message or information — do not repeat them.
- Use the hierarchy proposed in the Nature of the Technologies learning area section as the structure of the Australian Curriculum: Technologies, and merge the information from the Structure of the Australian Curriculum: Technologies section. If the structure is to remain the same, merge the information from the Nature of the learning area section into the appropriate places in the current structure.

Clarity and consistency of language

The terminology used in the draft shape paper is often unclear and, throughout the document, language is used inconsistently or imprecisely. The draft shape paper presumes that readers have a common understanding of many of the terms used. The draft shape paper has a glossary, but many of the terms in the paper are not included in it. Those that are, are ill-defined or are defined in a way that is inconsistent with how they are used in the draft shape paper. The following specific examples illustrate this general issue.

Separate definitions are given for "information and digital information". "Information" is only defined with respect to Design and technologies. Yet, information clearly is a significant aspect of Digital technologies. "Digital information" is defined tautologically (digital information is "information that is stored digitally") and then only in terms of the structures and processes involved in storing, transferring and transforming it.

“Services” is another example of a glossary entry that lacks definition. It begins with the tautological statement: “one of the outputs of technologies processes — the intangible product of technologies processes …” It then explains that a service “...may involve development or maintenance of a system …” and provides examples of systems including “ecosystem” and “internet”, which further confuses the definition, given these examples are so broad. Further, according to the glossary entry, one communicates a “service” by “ … charts, diagrams, posters and procedures.” Communicating in this way applies to most things and is not specific to *services*.

“Systems” is defined by referring to “natural, constructed and virtual systems, and the interrelationship between systems.” This is a self-referential definition.

The draft shape paper refers to “knowledge, understanding and skills” in some sections and “knowledge, processes and skills” in others. It is unclear if these statements are intended to be interchangeable and mean essentially the same thing, or if they are deliberately different in meaning (and if so, it is unclear as to what the difference is).

Paragraphs 38–40 (pp. 8–9) have the following statements:

- applying thinking skills, including design or computational thinking
- using technologies processes and production and project management
- deep knowledge and understanding of technologies thinking and processes
- use higher order thinking skills to reflect, evaluate and validate their technological knowledge
- design thinking, problem solving, procedural thinking and innovation skills
- develop the ability to use a range of thinking skills.

Much of this could be condensed. The variety of thinking skills and processes referred to in these paragraphs make it difficult to gain a clear picture of what, precisely, the curriculum will expect students to know and be able to do.

Terms are often explained within the document well after they are introduced. “Preferred futures”, for example, is first mentioned in paragraph 17 (p. 4). The notion of “preferred futures” is intended to be a curriculum construct and is not explained until paragraphs 52 and 53 (p. 12). It should not be in paragraph 17, and it should only be referred to after being properly introduced as an overarching idea. “Preferred futures” should also be included as a glossary entry.

Way forward

- Explain the meaning of key terms when they are first introduced.
- Refine and increase the precision of the glossary entries for key terms. Avoid self-referential or tautological definitions.
- Ensure key terms and phrases are used consistently throughout the paper and adhere to their meaning as given in the glossary.
- Increase the scope of the glossary to include all learning area specific terminology.

2. Section-by-section analysis

The following provides a section-by-section analysis of the draft *Shape of the Australian Curriculum: Technologies*. It particularly focuses on the clarity, coherence, appropriateness and structure of the draft shape paper.

2.1 Background of the paper

Strengths

The following strengths were identified in consultations about the Background.

- The overarching focus of the Technologies learning area is clear.
- It is aligned with the intent of the *Melbourne Declaration on Educational Goals for Young Australians*. It recognises that both Information and Communications Technologies, and Design and Technology are central to Australia's skilled economy.
- Reference to the Early Years Learning Framework.
- The proposed organisation of the Technologies learning area — in the strands/subjects of Design and technology and Digital technologies — is foregrounded.
- That Technologies refers to the inventive processes and knowledge that the students develop rather than subject or object knowledge which they might acquire. That is, the curriculum will not be focused on specific technologies because this knowledge would become rapidly dated and mundane. Rather, it will focus on the processes through which technologies are designed and developed; concepts associated with human innovation, creativity and the translation of ideas into practice; and the impact arising from the use and application of these processes on humans and the environment. A curriculum designed with this in mind should develop students with a critical appreciation of the processes through which Technologies are developed and an ability to participate and shape these processes within society.

Issues and concerns

The following issues and concerns were raised in consultations about the Background.

- An apparent lack of research informing the draft shape paper. Only 16 reports or papers are cited in the bibliography, many of which are self-referential. With respect to looking at trends in Australian and international Technologies curriculums, the paper referenced, *An Analysis of the Technology Education Curriculum of Six Countries*, is dated, having been written in 2003.
- In paragraph 6 (p. 1), an intent to differentiate areas of technology, using the strands/subjects of Design and technologies and Digital technologies, is clear. However, what the differences are is not made clear in the draft shape paper.
  - The proposed strands/subjects of Design and technologies, and Digital technologies lack justification and appear to be an artificial separation. Digital technologies are frequently used in design — nearly all 21st century products include some form of digital technology. "Design and technologies" and "Computing and information technologies" would be more apt names.

- A clear distinction between the two strands is not provided. The description of Design and technologies could include Digital technologies. That is, only the reference to "traditional" in the description of Design and technologies demarcates it from Digital technologies. Deleting the word "traditional" from this paragraph would make it an equally valid description of Digital technologies.
- A risk exists that, with their current descriptions, people will perceive Design and technologies as "low tech" and Digital technologies as "high tech".
- The attempt to separate Design and technologies and Digital technologies into two distinct strands is flawed when, arguably, a clear separation of the core learning in these is not discernible. The Information and communication technology (ICT) competence general capability overlap creates further confusion. A possible way of distinguishing between the two strands/subjects is by using "materials, systems and information" to frame how technology products are used and created. Design and Technologies would be predominantly focused on materials and systems, and Digital technologies would be predominantly focused on digital information and systems.
- Paragraph 6 discusses "knowledge, understanding and skills", but the bullet points about Design and technologies and Digital technologies refer to "knowledge, processes and skills". That is, processes and understanding appear to be interchangeable. It is not clear if this is this a deliberate difference and, if so, what the difference is.

- Technologies contexts are described in paragraph 7 (p. 1) as "fields of endeavour". Contexts listed are: agriculture and primary industries, constructed environments, engineering, entertainment, food technology, home and personal settings, manufacturing, materials and product design (for example electronics, metals, plastics, textiles, timber) and retail.
  - A clear rationale is not provided for the listed contexts.
  - The list of contexts does not all match the description of a field on endeavour, or what is generally considered a context. For example, "engineering" is too broad and "personal settings" is arguably a context but is not a field of endeavour. "Materials and product design" do match the description of a context, but within the parentheses following it are further mismatched examples: metals, plastics, textiles and timber are materials — electronics are not.
  - Later in the draft shape paper, different contexts are listed. Paragraph 113 (p. 24) refers to "digital" contexts. Paragraph 124 (p. 27) refers to "architecture", "media design", "digital design", and "industrial design". Paragraph 125 (p. 28) refers to "digital design" and "industrial design".
- The reference to contexts in paragraph 7 (p. 1), the change from strands in F–8 to subjects in Years 9–12, and the reference to students studying other " … Technologies subjects offered by states and territories that complement and do not duplicate the Australian Curriculum" in paragraph 8 (p. 2) are a points of confusion.
  - ACARA's remit is to write content descriptions and achievement standards for the Australian Curriculum. No rationale has been provided as to why Years 9–12 are being framed as "subjects".
  - In Years 8–10 in Queensland, a school wishing to construct the subject Home Economics can do so using the current Queensland *Essential Learnings and Standards* and Year 10 Guidelines curriculum documents for Technologies and Health and Physical Education (see the *Lower Secondary Subject Guidelines* <www.qsa.qld.edu.au/12326.html>). It is not clear whether it is intended for the Australian Curriculum: Technologies to be used in a similar fashion.

- It is not clear if a state or territory could, for example, offer a subject called “Food technology” in Years 9 and 10 if it, in part, uses Design and technologies knowledge and processes. This could be both complementing and duplicating the Australian Curriculum: Technologies and would more accurately be called a “Contextualised Design and technologies course of study”.

- While the draft shape paper is still conceptualising the potential structure of the curriculum, at no stage is there justification or reasoning provided for any of the proposed structures — strands from F–8, then subjects from Years 9–12. Paragraph 13 (p. 2) goes on to state other structures are possible, but does not provide any background, criteria or reasons for choosing one or another. That is, the final structure of the curriculum will seemingly have no basis other than popular opinion.
  - Students in Years 9–12 are capable designers and able to use the digital technologies effectively to support their design work, using computers and computer-aided manufacturing processes to enhance their design work, production and rapid prototyping processes. Contextualised specialisation is appropriate as the curriculum progresses in the senior secondary years. However, forced separation based on the strands/subjects Design and technologies and Digital technologies is artificial.
  - The computing science aspects of Digital technologies might be lost with the placement of Digital technologies as one strand of the Technologies learning area. This construct imposes constraints that limit the scope and focus of computing sciences. The broad definition of technologies presents a focus on materials and tools, types of technologies and processes that do not naturally fit with the key concepts of computing sciences.
  - The Design and technologies strand in F–8 does not do justice to the breadth of learning that is typically offered in schools across numerous contexts currently under the broad heading of “Technology”. A number of schools, for example, pride themselves on the rich learning they offer students through an agricultural science context.
- Paragraph 14 points out that ACARA is open to considering other approaches. This response proposes some approaches that are based on the view that states, territories, and most significantly schools, are best placed to make decisions about how specialisation occurs in a learning area as broad as Technologies, especially in Years 9–12.
- The differentiation between the ICT competence general capability and the Digital technologies curriculum is not included in the Key considerations section. It currently does not appear in the draft shape paper until paragraph 76 (p. 17).
- The background does not place enough emphasis on the need to consider how physical and digital learning spaces have changed and will change in the future. The curriculum should take into account that, in order to keep up with the rapid pace at which technology changes, much learning in Technologies involves actively seeking student input.

Way forward

- Provide a reference list for the background research that informed the draft shape paper.
- Further clarify the difference between the digital technologies used in Design and technologies and the Digital technologies strands/subjects. Suggestions include:
  - acknowledging that, in Design and technologies, students will develop solutions that may include digital technologies, and the Digital technologies strand/subject is about explicit learning of how digital information is processed, managed and transformed, and can be applied in the real world to solve problems. That is, the Digital technologies strand/subject is not about the digital technologies *per se*. It is a way of working with and thinking about data and information and developing information products and solutions.
  - clearly articulating that Digital technologies is focused on ICT products (if the two strands/subjects Design and technologies and Digital technologies remain). This should further help differentiate that, in the 21st century classroom/workshop, many students in Design and technologies will be using computational thinking and engineering and design and problem-solving strategies to create products that include digital components.
  - distinguishing between the two strands/subjects by using "materials, systems and information" to frame how technology products are used and created.
- Consider changing the strand/subject names to "Design and technologies" and "Computing and information technologies". This would clarify what is seen as the key difference between the strands/subjects; that is, the material (in the broadest sense) that is manipulated to develop a product. Digital technologies applies to the entire Technologies learning area. Computing and information technologies is a specific subset of learnings that focuses on working with and thinking about data and information and developing information products and solutions.
- Provide a rationale for using strands in F–8 and subjects in Years 9–12.
- Reconsider the organisation of the Technologies curriculum. Some suggestions provided by consultation participants included:
  - adopt strands in F–10, and subjects in senior secondary, as has been done for the Australian Curriculum in English, Mathematics, Science and History
  - adopt strands in F–12, with capacity for states and territories to create subjects/courses
  - create two distinct subjects across F–12 under the Technologies banner
  - organise the curriculum using stands consistent with other learning areas and the Nature of the Technologies learning area section. That is, use the strands Knowledge and understanding, and Processes and production. Frame Design and technologies and Computing and information technologies as focus areas that provide a broad umbrella from which content descriptions are developed. (See section 2.4 for further information about this proposal.)
- Decide on a rationale for the contexts, by the:
  - area of design (software design, architecture, graphic design, industrial design, engineering).
  - product (information systems, communication system, home and personal products, agricultural products, primary industry products, manufactured products, entertainment products, built environment).
  - materials (food, timber, information, images, textiles).
- Emphasise that the examples of contexts listed are neither prescriptive nor exhaustive.
- Clarify how the Technologies curriculum distinguishes between "curriculum", "strand", "subject", "context", "course of study", and "program of learning". Do this early on in the draft shape paper and add these as glossary entries.
- Differentiate between the ICT competence general capability and the Digital technologies curriculum in the Key considerations section.

2.2 Introduction of the paper

Strengths

The following strengths were identified in consultations about the Introduction.

- When designing and using technologies to shape the world in which we live, recognition that this involves ethical decision-making, challenges and critical examination of technologies is important. This is clearly evident in the Introduction.
- That the overarching idea for Technologies involves students in developing technologies, knowledge, understanding and skills to engage purposefully in a global setting, and helping to create a sustainable future.
- A thorough summary of the contributions of technologies in shaping the world in which we live.

Issues and concerns

The following issues and concerns were identified in consultations about the Introduction.

- Paragraphs 17–29 (pp. 4–6) are unnecessarily lengthy, with information that overlaps and overly long sentences containing too many concepts.
- The list of industries in paragraph 17 (p. 4) could include “education”.
- Paragraph 23 (p. 5) refers to “digital systems” and “ICT systems”. It is unclear if these terms are used interchangeably.
- Paragraph 27 (p. 6) does not overtly bring attention to national and international research on gender specifics in Science, Technology, Engineering and Mathematics (STEM) education.
- Paragraph 29 (p. 6) refers to disability but does not define it.

Way forward

- Focus the Introduction to make it more succinct. Scan for redundant statements. For example:
  - merge paragraphs 22 and 24 as they both outline knowledge and skills development
  - merge paragraphs 23 and 25 as they both describe contributions and future opportunities.
- Consider adding “education” to the list of industries in paragraph 17.
- Clarify the use of the terms “digital systems” and “ICT systems”.
- Further strengthen paragraph 27 with reference to national and international research on gender specifics in STEM education.
- Define “disability” using the *Disability Discrimination Act* 1992.

2.3 Nature of the Technologies learning area section and the aims

Strengths

The following strengths were identified in consultations about the Nature of the Technologies learning area section and the aims.

- Paragraph 32 recognises that technology is used across learning areas and that these areas are a context in which technology education can occur.
- That the aims of the curriculum include developing:
  - knowledge, understanding and skills in students through the discriminating, ethical, innovative, creative and enterprising use of a range of technologies
  - the processes through which students can create, design, develop and produce innovative technological solutions.
- The inclusion of the need to play, learn, create and produce using a range of technologies from the early years, and the need to be able to continue this pursuit of technological learning through to the senior secondary years.
- The concept of project management is important and should be retained. Project management is fundamental to the development of almost all technologies and as a cognitive construct for the students, as well as a way of working that relates to the real world.
- The notion that students develop a critical framework through which they can understand the processes of technological development, and participate in technological development as active and informed citizens is important here.
- The reference to technologies-specific graphic techniques and modelling in paragraph 44 (p. 10) was strongly supported.

Issues and concerns

The following issues and concerns were identified in consultations about the Nature of the Technologies learning area section and the aims.

- The importance of students being able to communicate their ideas, plans and solutions could also be emphasised in paragraph 31 (p. 7).
- Much of what is written in paragraphs 33–47 (pp. 7–10) does not belong in this section. The information has been organised under what appear to be curriculum constructs, rather than elements that comprise the nature of Technologies. “Knowledge, understanding and skills” (p. 7) is the structure of nearly all of the learning areas and is the proposed structure in Technologies. “Knowledge and understanding” and “Technologies processes and production” (p. 8) are the sub-strands in the structure of the curriculum.
- An important aspect of Digital technologies is being able to interpret information, systems, and problems. This is missing from the descriptions in paragraphs 41 and 43 (p. 9).
- Paragraph 44 (p. 10) is too specific for the Nature of the Technologies learning area section. This would be better placed in the scope and sequence.

- Paragraph 49 (p. 11), point 3, states “critique, evaluate and apply thinking skills and technologies processes that people use to shape their world, and to transfer that learning to other technology situations”. The grammar of this point is confused and does not make sense as it is written.
- The aims of the Technologies learning area as given in paragraph 49 (p. 11) are all utilitarian in nature. An aim that emphasises the value and joy people find in using and creating with technologies for its own sake should be produced.

Way forward

- Move and merge many of the points in paragraphs 33–47 into the Structure of the Australian Curriculum and Scope and sequence sections of the draft shape paper. Keeping them separate makes the paper difficult to read and hard to gain a clear picture of what will be in the curriculum.
- Clarify “thinking skills”. Use terminology that is common and meaningful to all.
- Add “interpret” to paragraphs 41 and 43:
  - Paragraph 41: “In Digital technologies, students develop and apply progressively more complex computational thinking to *interpret* and create digital information products, systems or software instructions … ”
  - Paragraph 43: “In Digital technologies students create digital solutions by *interpreting*, formulating and investigating problems … ”
- Clarify the distinction between Knowledge, understanding and skills, and Knowledge and understanding and Processes and production, and how they interact.
- Write an aim that places emphasis on the intrinsic motivation people have in using and creating with technologies.

2.4 Proposed organisation and structure of the Australian Curriculum: Technologies

Strengths

The following strengths were identified in consultations about the proposed organisation and structure of the F–12 Australian Curriculum: Technologies.

- While the curriculum is presented as two discreet strands across F–8, schools are not precluded from integrating the strands in teaching and learning and assessing. This is important because integration is one of the central pedagogies found in both the early and middle years of schooling.
- The complementary sub-strand structures Knowledge and understanding and Processes and production are favourably viewed. These acknowledge and highlight similarities across the strands/subject and should facilitate an integrated approach to the Technologies curriculum. This also broadly aligns with the constructs of Understandings and Skills used in other learning areas.
- The emphasis in paragraph 59 (p. 13) that students develop the required knowledge, understanding and skills in order to produce solutions to meet the needs of others and designs for others was viewed favourably. This is critical to their understanding of how designers work. It is also a good example of a paragraph that is succinct and to the point.
- The explicit inclusion of project management in the curriculum is an excellent addition. It mirrors both the learning process and the processes used in real industry.

Issues and concerns

The following issues and concerns were identified in consultations about the proposed organisation and structure of the F–12 Australian Curriculum: Technologies. Many of these are related to the strands and sub-strands as indicated earlier.

- The curriculum is to be shaped around students' knowledge, understanding and skills. The relationship to the sub-strands Knowledge and understanding and Processes and production is not clear.
- A clear understanding of the nature and structure of the Technologies learning area is difficult with this section separated from the previous section. The broad discussion of the nature of the learning area should be retained, but the information organised under Knowledge and understanding, and Processes and skills, from the Nature of the Technologies learning area section should be merged into this section.
- As identified in previous sections, the delineation between the two strands and their subject areas are not clear. It is difficult to relate the proposed Australian Curriculum: Technologies to subjects currently offered in schools in Queensland, such as Agricultural Science and Home Economics.
- Design should be used in a broader sense throughout the draft shape paper. For example, production is an integral part of the design process as a way to confirm the solution meets design requirements.
- The Digital technologies strand seems to be focused on computer programming and does not take into account other areas, such as digital production (presentation, gaming, music, podcast, photography and web).
- The description of Digital technologies should refer to students "interpreting".

- No mention of digital manipulation for primary students is made. Students need to know how to use digital technologies.
- “Critically” and “creatively” often appear together in the draft shape paper. If they are being referred to as separate thinking processes or relate directly to the Critical and creative thinking general capability, their order is appropriate. However, if they are being outlined as a part of the design process, as appears in paragraph 50 (p. 12), “creatively” should come before “critically”. Creative thinking tends to be a focus in the initial stages of ideation, and then critical thinking follows on from this in order to analyse possible solutions and to develop a solution to meet the required need.
- The description of preferred futures in paragraphs 52 and 53 (p. 12) is lost in the middle of the draft shape paper. An overarching idea in a curriculum document should be foregrounded.
- “Overarching idea” is a misnomer for Engaging in creating preferred futures. Some state and territory Technologies curriculums have statements relating to preferred futures, and Queensland's feedback supports this. However, it arguably does not make sense as single overarching idea. It lacks specificity and is not related to many potential contexts for learning, e.g. video game design. Other overarching ideas exist in technologies, such as user/human-centred design, use-centred design, sustainability and innovation. If “preferred futures” remains as an overarching idea, other ideas should be included to provide more scope or elements within preferred futures (such as sustainability) and should be more explicitly identified.
- Paragraph 64 (p. 14) states: “This sub-strand focuses on designing.” Designing is a subset of technologies processes. As such, it appears that this sub-strand is focused on a subset of the sub-strand.
- There is limited emphasis on control systems. The curriculum should provide an opportunity for students to learn about mechanical technology controlled through programming.

Way forward

- Merge much of the information from paragraphs 33 to 47 into this section.
- Consider an alternative organisation of the curriculum. As noted in section 2.3, the Nature of the Technologies learning area section (paragraphs 33–37) is written as a curriculum construct. Consider using this, or similar, as the organisation of the curriculum, with strands and sub-strands as follows:
  - Knowledge and understanding
    - Materials, information, systems, tools and equipment
    - Technologies and society
  - Technologies processes and production
    - apply a range of thinking skills
    - respond to needs, opportunities or problems
    - manage projects.

  This aligns with the strand and sub-strand organisation of the other learning areas and deals with the issue of distinguishing between Design and technologies and Digital technologies.

  Consequently, Design and technologies and Computing and information technologies could be framed as focus areas from which content descriptions are developed.

  If this structure is adopted, it should be emphasised that the concepts contained within "apply a range of thinking skills" should be integrated across the whole learning area.
- Provide a clear commitment for alternative approaches to how the Technologies learning area is delivered that provide further flexibility for schools in implementation.
- If the current structure is maintained, clarify earlier in the draft shape paper that a "range of subjects" may be studied and that the range includes the two ACARA technologies subjects (in Years 9–12) and the additional subjects which may be offered by states and territories for other technologies specialisations.
- Clarify what is meant by "curriculum", "strand", "subject", "context", "course of study", and "program of learning". These should appear early on in the draft shape paper and again as glossary entries.
- Remove "designing" from the first sentence of paragraph 64 so that it reads: "This sub-strand focuses on identifying, exploring and critiquing a need or opportunity … "
- In Design technologies, further emphasise computational thinking related to physical technologies that are controlled digitally.
- Refine the Digital technologies paragraphs to include "interpreting":
  - Paragraph 6 (p. 1), point 2: "Digital technologies will have students learning to *interpret*, develop and apply technical knowledge … "
  - Paragraph 41 (p. 9): "In Digital technologies, students develop and apply progressively more complex computational thinking to *interpret* and create digital information products, systems … "
  - Paragraph 43 (p. 9): "In Digital technologies, students create digital solutions by *interpreting*, formulating and investigating problems … "
  - Paragraph 70 (p. 15): "This sub-strand focuses on *interpreting*, formulating and investigating problems … "
  - Paragraph 72 (p. 16): "Computational thinking involves students learning to *interpret* and formulate problems … "
- Use a diagram to clarify some of the complex ideas explored in this section.

2.5 Proposed scope and sequence of the Australian Curriculum: Technologies.

Strengths

The following strengths were identified in consultations about the proposed scope and sequence of the Australian Curriculum: Technologies.

- Overall, the descriptions seem appropriate for the phases of learning.
- In F–2, the focus on play-based learning and recognition of children's rights to be active participants in all matters affecting their lives is viewed positively. The focus on personal forms and use of technologies in children's immediately relevant environments, such as home, aligns with other learning areas. This reference to “play” in the early years is positively viewed, but needs to be clearly defined and explained.
- In Years 3–6, that students progressively engage with more abstract ideas was viewed favourably. Students become more concerned with the social and environmental use of technologies, and a broadened scope of investigations to consider safe and ethical use of technologies exists, which is appropriate at this phase.
- In Years 7–10, the increase in independent thinking and the awareness students will develop of the interdependence of technology development, culture, environment, developer and user.
- The flexibility for students to undertake more specialised learning pathways in Years 9–12.

Issues and concerns

The following issues and concerns were identified in consultations about the proposed scope and sequence of the Australian Curriculum: Technologies.

- The format of the draft shape paper makes difficult in this section to gain a clear picture of the curriculum across the stages of schooling.
- The draft shape paper underestimates the prior understandings of digital technologies that early years students bring with them to school. Children in the early years frequently use digital cameras, smartphones, tablet computers and so on.
- The Years 3–6 sections of the scope and sequence do not place enough emphasis on students testing design ideas.
- Much of what is written in the Years 11 and 12 sections is too general to appreciate what “subjects” ACARA intends to offer in the senior secondary years and how these will relate to Queensland’s current senior Technologies curriculum.
- The scope and sequence could place further emphasis on the opportunities for team work and collaboration using technologies.
- The senior secondary Design and technologies descriptions in paragraph 125 (p. 28) lack clarity about higher level thinking skills and abilities when compared to their equivalents in the Years 9 and 10 descriptions. Specifically, those related to investigating and making judgments; ethical, social and environmental sustainability implications; creativity and innovation; critiquing; and the level of independence. The Years 9 and 10 descriptions seem to place greater emphasis on higher order thinking skills, with the senior secondary descriptions placing their emphasis on the depth of understanding of materials.

- Important contexts and approaches are missing from senior secondary Design and technologies (p. 28) such as architecture, media design and engineering.
- Paragraph 125 (p. 28) should place a greater emphasis on the ability to communicate ideas, plans, products and solutions using a variety of modes.
- Paragraph 127 (p. 29), point 5, is unrealistic in expecting F–2 students to " … evaluate ethical digital solutions …"
- Paragraph 130 (p. 30), point 2, is an unrealistic expectation for students in Years 7–10.
- Paragraphs 131 and 132 (pp. 30–31) imply, but are not explicit about, programming.

Way forward

- Reformat the scope and sequence section into a table with four columns for each row (F–2, Years 3–6, Years 7–10, Years 11 and 12), keeping the relevant descriptions for each phase together.
- Emphasise that, in the early years of the curriculum, children are encouraged to take considered risks and learn from mistakes in creative play.
- Give further emphasis to the opportunities for team work and collaboration using technologies.
- Place more emphasis on Years 3–6 students testing design ideas.
- Provide more explicit descriptions of what "subjects" ACARA intends to offer in the senior secondary years.
- Provide more focus on high order thinking skills in senior secondary Design and Technologies descriptions.
- Include "architecture" and "media design" in the list of contexts in paragraph 125 (p. 28).
- Add a reference to engineering approaches to design as a focus in senior secondary years.
- Place a greater emphasis on the ability to communicate ideas, plans, products and solutions using a variety of modes in paragraph 125 (p. 28).
- Be more explicit about programming and perhaps include algorithmic and declarative logic in paragraphs 131 and 132 (pp. 30–31).

2.6 General capabilities and cross-curriculum priorities and how they apply to the Technologies curriculum

The following strengths were identified in consultations about the clarity, coherence and appropriateness of how the general capabilities and cross-curriculum priorities apply to the Technologies curriculum.

Strengths

- The descriptions of how the general capabilities and cross-curriculum priorities apply to the Technologies curriculum were all generally supported in Queensland's feedback.
- The relationship between Digital technologies and the ICT competence general capability, as framed in paragraph 80 (p. 18), seems to be a reasonable distinction in theory.

Issues and concerns

The following issues and concerns were identified in consultations about the clarity, coherence and appropriateness of how the general capabilities and cross-curriculum priorities apply to the Technologies curriculum.

- The distinction between the description of the Digital technologies strand and the ICT competence general capability, as given in paragraph 80 (p. 18), is not as clear-cut as the statement claims. The ICT competence general capability describes aspects associated with the development of ICT products. One of the sub-strands of the ICT general capability is "generating solutions to challenges and learning area tasks". Many learning area tasks are likely to be real world problems and therefore match the description of the Digital technologies strand/subject.
- The first time the draft shape paper explicitly describes "users" and "developers" is paragraph 80 (p. 18). This needs to be stated earlier in the paper if it is the key difference between the ICT competence general capability and the Digital technologies strand/subject.
- The description of ethical behaviour in paragraph 83 (p. 19) should include reference to legal issues.
- Paragraph 84 (p. 19) highlights the importance of intercultural understanding, but this could be strengthened throughout other parts of the draft shape paper, i.e. organisation.
- The application of the Intercultural understanding general capability in the Technologies learning area could be broader and take to into account digital access and the digital divide, ageism, gender and assumptions about technologies. This leads to cross-cultural understandings and unique communities of interest. Further, different cultures develop different technologies in response to their needs, environment, and their technical needs and capabilities. These technologies are important transmitters of culture. For example, the American movie industry is an area of technological innovation and is rightfully a technological icon of America. Through this, American culture is powerfully transmitted around the world.
- Asia and Australia's engagement with Asia could include the issue of workers' rights in Asia in connection to the production of digital technologies as part of their significant contribution to global technological development.
- Sustainability does not incorporate the idea of e-waste.

Way forward

- Emphasise more clearly the difference between the Digital technologies strand/subject and the use of digital technologies in Design and technologies and the ICT general capability in other learning areas throughout the paper.
  Further to this, the key distinction of Digital technologies is that it is explicitly taught. The ICT competence general capability is about using ICTs in a learning area. When Digital technologies are used in Design and technologies, it is about using. The focus of the Digital technologies strand/subject is on explicit learning of how digital technologies work and can be applied in the real world to solve problems.
- Consider referring to legal issues in paragraph 83 (p. 19).
- Broaden the description of intercultural understanding in the Technologies learning area to take to into account digital access and the digital divide, ageism, gender and assumptions about technologies.
- Include the issue of workers' rights in Asia in the production of digital technologies.
- Incorporate the idea of e-waste in sustainability.

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