

Re-designing Design and Technology Education: A living literature review of stakeholder perspectives.

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ABSTRACT

Created following the amalgamation of several individual subject disciplines, in England, design and technology is in decline. Debates about its purpose and position have taken place since its inception but arguably these have not transferred into a rigorous research base. There is a growing body of scholars exploring the field, but with the decline of the subject, so the community working and investigating it is also diminished. Without a strong foundation, the actions of the few may not carry sufficient weight to generate full and meaningful debate that would influence those with the power to change policy on curriculum and lead to innovation.

If we are to have any hope of reversing the subject's deterioration, we must do something bold and significant. While an awareness of the subject's history and its evolution is integral to our understanding of how and why we are where we are, merely reflecting on the past will do little to help the subject move forward. Hence, the principal aim of our research is to explore what a re-designed design and technology could look like. To achieve this, this study draws on different stakeholders' visions of how they perceive the subject's future.

Theoretical underpinning of this work is derived from abductive grounded theory, which aligns with the researcher's individual ontological positions. Drawing together the findings from participants, this paper presents outcomes in the form of a 'living document'. We see this as the first phase in an ongoing study into the future of the subject. Findings indicate a diverse range of opinion relating to the subject's future. Following analysis, outcomes are discussed, and future steps to re-imagine the subject are then explored.

Keywords: Curriculum change, curriculum design, curriculum innovation, design and technology, living document, STEM

Introduction

Design and technology was created following the amalgamation of several individual disciplines, and as an educational construct (Bell et al., 2017) is unique in that unlike its counterpart subjects, for example music, art, science or mathematics, it does not exist beyond the school curriculum.

As a new curriculum subject design and technology was established to serve a very clear purpose, and while in the 30 years since its inception (DfE & WO, 1988) much has changed, the rationale for its creating, to establish a subject that would help to ensure the United Kingdom (UK) would not only maintain its economic global position, but would develop further its industrial and technological capability and capacity, is of no less importance now than it was then.

However, in practice the subject's vision has not ever been fully realised (Barlex, 2017), and in England design and technology is in serious decline. Discussion about its purpose and position have taken place since its creation, but the outcomes of these debates have not transferred into a rigorous research base which could have helped to establish the subject's as one of integral value within the curriculum.

Currently there are a small body of scholars working to explore this field, but coupled with the subject's erosion, the community within which investigations may be conducted is also diminished (McGimpsey, 2011; Miller, 2011; Harris & Wilson, 2003). Without a strong foundation from which to build the actions of the few may not carry sufficient weight to generate full and meaningful debate which may serve to funnel into the ears of those with influence and power to influence policy and hence initiate change.

If there is to be any hope of reversing the subject's decline, we need to do something significant. While an awareness of the subject's history and its evolution is integral to our understanding of how and why we are where we are, reflecting on the past will do little to help the subject move forward.

Hence, considering the future of design and technology, it is from this position, that our interest has been stimulated and we explore the role and purpose of design and technology from the perspective of maintaining design and technology as a school curriculum subject, within an era of political and economically driven change. Therefore, framed from this perspective, the principal aim of this research is to investigate what a re-designed design and technology could look like. To achieve this, this study draws on different stakeholders' visions of how they perceive the subject's future and elicits participant responses to the following questions:

What is design and technology's fundamental purpose; why should it exist? and irrespective any barriers, what should a re-imagined design and technology curriculum 'look like'?

Context

As previously stated, while an awareness of design and technology's history is integral to our understanding of why we are where we are, revisiting the past will achieve little in terms of moving the subject forward. However, to provide a context for this paper this next section will outline, briefly, our beliefs in relation to the subject, its background and the reasons for its underdevelopment, before moving to review recent commentary from members within the community about the subject's future.

Ontologically, our position begins with the contention that because of the nature of design and technology, it has and always will endeavour to keep up to date with technological and economic advances in society, and as such it is and will always be in a constant state of flux.

While this curricular flexibility, which has been an underlying feature of the subject's role in the school curriculum since inception is essential to ensure the subject equips future generations with essential skills, knowledge and understanding to develop both technological capability and confidence, this manifests as a fluid knowledge base, which makes it markedly different to other curriculum subjects. For example, mathematics where the content and knowledge base has not changed significantly for many years.

Drawing upon the theoretical work of Bernstein (1971a, b), who argues that the school curriculum is dominated by subjects which are well defined and have highly classified bodies of knowledge which largely remain consistent over time we believe this, is in part, the reason why design and technology has constantly had to justify its importance within schools' curriculum (McLain et al., 2019, 2018; Bell, 2015; Bell et al., 2017).

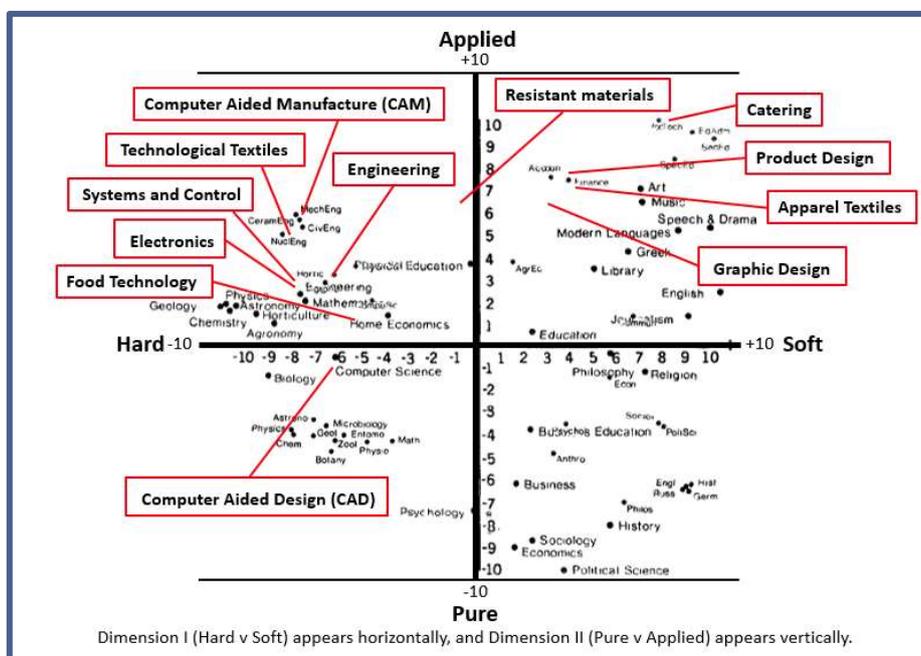


Figure 1
Knowledge territories within design and technology (Bell, 2015)

Positioned from this perspective, when coupled within Biglan's (1973) work which explores the characteristics of subject matter in different academic disciplines, when compared to the more strongly framed and classified subjects, which include mathematics and science, design and technology has, and will always have difficulty in conforming to such 'tight' criteria because of its need to constantly embrace new technological innovations (Figure 1).

As a result, the subject is perceived as having 'weak epistemological roots' (DfE, 2013, p.234), which when positioned within the current knowledge focused curriculum (Gibb, 2016, 2017), combined with a weak research base from which the subject itself may be defined, and indeed defended, it is no wonder that design and technology has consistently failed to establish itself

as a subject of real value, and one that is essentially integral to a child's comprehensive education.

Literature

While literature has illuminated the subject's failings (Miller, 2011), and establish reasons for the issues and challenges faced (Bell et al., 2017), while there has been much discussion within the subject's community (D&T Google Group, 2019) these debates remain unpublished, and hence have not been supportive in developing a solid body research informed by evidence from which the subject may be defended.

Rather than undertaking a radical revision of the subject, in their think piece Barlex and Steeg (2017) focus on rebuilding design and technology. The rationale being that they believe the original vision for the subject, outlined within the Parkes Report (DfE & WO, 1988) remains compelling. Whilst we do not disagree and would concur that the rationale behind the subject's original inception is still persuasive, drawing upon the 'building' metaphor our argument is that in order to build, or indeed re-build, one requires a firm foundation from which to start. In this regard our perspective differs.

Also, while there can be no doubt that the economic imperative remains, and we firmly believe that as a subject discipline design and technology has much to offer, in positioning this work we must also be mindful that in mapping future developments against the subject's original intentions, current directives make clear that the school curriculum has moved on (Gov.uk, 2014). Therefore, this may prove likely to be a painful and potentially damaging exercise. As a subject community we need to be open to the view that other curriculum areas, such as computer science, where there has been significant fiscal investment in recent years (DfE, 2015), may be perceived to be of more value in meeting the country's current technological and economic needs. From this perspective design and technology may no longer retain the currency it once had within the current political and economic agenda.

Irrespective of the material area this paper seeks to align individual participants perspectives and identify those aspects which all perceived as being fundamental to the subject's core. Hence, with a view to the creation of a stable platform from which to instigate further debate, the focus and rationale for this paper is to present stakeholder perspectives from which the re-design the subject may begin.

Methods and Methodology

Theoretically underpinned by social constructivism, which aligns with the authors' individual epistemological and ontological positions, this study adopts a relativist paradigm and we recognise the subjective experiences of multiple realities for the participants, and ourselves (Guba 1981, 1990).

As such methods adopted this work are derived from an approach informed by constructivist grounded theory (Charmaz, 2006; 2014). This approach was selected because it allows for the concurrent gathering and analysis of data which enables outcomes from earlier research phases to set the purpose and direction of the next.

Embracing an abductive methodology, this combines both inductive and deductive theory generating procedures which was adopted because it encouraged the consideration of all possible theoretical outcomes, rather than forcing one to emerge. Strauss and Corbin (1990) and Corbin and Strauss (2008), discuss this method as an effective approach to theory building, whereby the researcher may mix grounded theory with other methodologies and apply existing insights and experiences to the phenomena under study.

Prior to participation the aims and purpose of the study were explained to participants and informed consent obtained, and ethical practices outlined by the British Educational Research Association (BERA, 2018) were adhered to throughout.

In selecting participants respondents were chosen for their abilities to provide rich and varied accounts of their design and technology experience as possible (Geertz, 1973). Considering the future of design and technology the key questions focused on the participants responses to the following question:

What is design and technology's fundamental purpose? Why should it exist? Please try to think '*blue skies*', so irrespective any barriers, what should design and technology look like?

The study elicited responses from ten participants, who were approached on the basis that each was a key stakeholder within the UK design and technology community. Care was taken to ensure participants reflected a diverse mix of age, gender and design and technology subject discipline and included experience serving design and technology teachers, voices from industry and members of the Initial Teacher Education (ITE) community. Consultation also invited commentary from the Design and Technology Association (D&TA) and colleagues from former organisations including the National Association of Advisers and Inspectors in Design and Technology (NAAIDT).

Data gathering and analysis

Using methods advocated by Bryant and Charmaz (2007) and Charmaz (2014), while gathering data care was taken to ask the same single open, exploratory question. Verbal and written discourse with follow up email discourse were used as the primary research tools to gather empirically grounded data relating to the perceptions, understanding, and lived experiences of participants. Where applicable face-to-face interviews were undertaken in accordance with procedures advocated by Bowden and Green (2005), and all data (irrespective of the collection mechanism) was recorded and transcribed verbatim, with care taken to accurately record responses in order to avoid misrepresentation.

Given the diversity of responses, revised from our original intention (which was to present the findings in the form of a living conversation) in order to help assure anonymity and so as not attribute a single ideology to an individual participant, in practice, adopting an approach similar to phenomenography, we pooled the transcripts (Åkerlind, 2005; Bowden and Walsh, 2000), and present the data as conceptual findings which are not aligned with or to individual participant responses. Within phenomenography analysis draws out categories of description and defines outcomes spaces in levels of understanding (Marton, 1994; Marton & Booth, 1997). In a similar way, we pooled the data in order to identify both the similarities and differences between the way in which participants perceived the phenomena under study.

As researchers we understand that different people experience the same 'thing' in different ways, hence during the process of analysis, and mindful of the difficulty of setting aside one's own assumptions and pre-conceptions (Prosser, 2000), to help avoid bias and ensure that a second order perspective was maintained, the strategy of 'bracketing' (Bruce et al. 2004; Ashworth and Lucas 2000; Dunkin 2000) was adopted. Having pooled the data, during analysis and in the process of coding we adhered to procedures advocated by Charmaz (2014).

Presentation of data

With analysis focused on how theoretical aspects of the study relate to what is happening in practice, representative of the complexities found within design and technology in the current schools' curriculum environment, drawn from the diversity of responses, this paper seeks to present individual participant perspectives together in the form of a living narrative to create a coherent whole from which future work can evolve.

In presenting the data, determined to echo the fluid nature of our subject discipline, we draw upon the powerful concept of the 'living document', through which we seek to not only share for dissemination these findings, but to actively encourage open and continuous collaboration to extend and grow this work within and beyond the design and technology subject community.

According to Shanahan (2015) the limitations of the traditional research paper are well known, and advocating a move toward living documents, where a single article exists for a single piece of research, utilising technology, Shanahan claims that it is time to move beyond the '*now obsolete print model*' of research articles, and truly embrace the freedoms that online publications allow. In their work Wambeke et al. (2017) advocate the use of this approach to help ensure that theories in use remain relevant.

Hence, through our adoption of this approach as we seek deliberately to present our findings and analysis as a 'work in progress', informed by emergent thinking and as such open to continual editing and revision by the community in order to enable real evolution and growth in search of the subject re-imagined.

Initial coding and analysis of the data were identified and refined, with participants responses relating to design and technology activity falling into three broad central themes, ideation, realisation and critique (Figure 2):

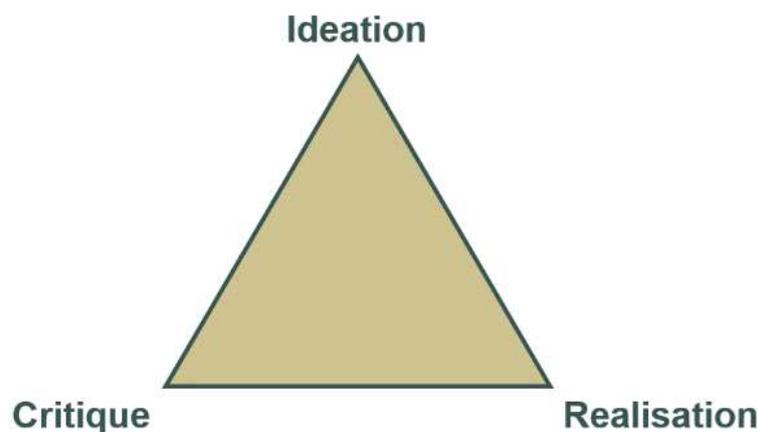


Figure 2
Design and technology activity: ideation, realisation and critique

The terms ideation, realisation and critique have been adopted in place of the more common designing, making and evaluating, in order to 'disrupt' the dialogue and historicised understanding of the subject. We also acknowledge the potential for a perceived hierarchy and separation between the three; instead, considering them as interacting in a dynamic

manner, each having an inherently symbiotic relationship within design and technology activity, and a pedagogue of transformation (Morrison-Love, 2017).

Critique

In this category (Figure 3) we present for consideration participant responses that illuminate the subject as one where knowledge for action transcends procedural knowledge (Kimbell, 2018; Kimbell et al., 1996).

Within this context technology is explored as a tool to serve human needs in order to develop a better society for all citizens.

Through the exploration of authentic activity, contextualised within society, the focus would address issues including (but not exclusive to) sustainability and product evaluation, well-being and human rights, always in consideration of the impact and consequences technological innovations may have. Advocating above all that individuals develop ways of understanding the complexities of life, are open minded in the generation of solutions, give meaning and through their ideas' connections to the past. Be mindful of the present, and with an eye on the future, be cognisant of the notion that just because you can does not always mean that you should.



Figure 3: Critique

Ideation

Within ideation (Figure 4) design and technology is conceived as a subject which transcends traditional material areas and goes beyond a defined body of knowledge and skills. Here the focus is the creation of authentic opportunities for learners to engage in speculative questioning and deferred judgement, always being encouraged to consider alternative technological solutions to human centric problems.

To engage in non-restrictive, open and playful design; to be imaginative and creative in developing design capability. To become fluent in the connection and external communication of ideas, and to explore ways of thinking. To explore and engage in the creation of 2D and 3D ideas and visualization, developing prototypes and models, and it is not always necessary to realise a complete artefact. To recognise and acknowledge the folly in creating unneeded solutions.

In doing so develop individual agency and autonomy, build resilience and an ability to handle uncertainty with confidence. A discipline which moves beyond the bounds of a traditional curriculum, which in practice, irrespective of the original intention, the focus inevitably becomes about doing and making stuff.



Figure 4: Ideation

Realisation

There is something unique about making, the ability to manipulate and control a material to create an artifact. Within this category (Figure 5) participants cited the importance of the feel of the material and bringing a product into being, with the skills required to create a physical response to a given question being cited as a transformative pedagogy.

In addition to developing autonomy and building confidence, essential skills which participants cited included interpreting instructions, working to a set brief, the development of eye hand co-ordination, manual dexterity and fine motor skills. Within this outcome there were a number of tensions. The first was in relation to a subject 'not pretending to design'. Here responses questioned the need to design before embarking upon the manufacture of a product. This objectification of technology was supported by a number of responses which indicated that working to develop a prescribed set of material related knowledge and skills in order to create a high-quality take home product was itself sufficient to be stand-alone discipline. Related to this a further tension arose with regard to the development of skills, with some questioning the value in relation to the increased use of technology, for example Computer Aided Design (CAD) within the subject.

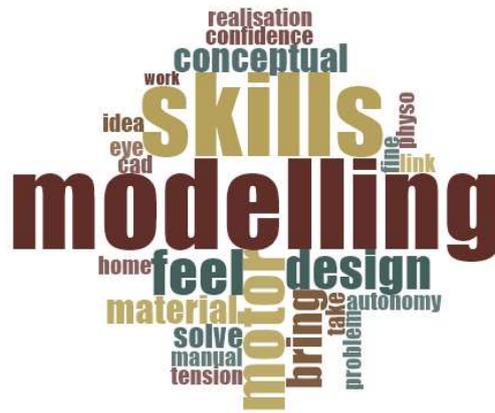


Figure 5: Realisation

Discussion and conclusion

While research has, as was expected, brought to the fore a breadth of opinion in relation to the content of design and technology, analysis has elicited some areas of ‘non-negotiable’ common ground as well as tensions. In addition, consider features of what might design and technology’s curriculum intentions emerged and have been coded as knowledge, experience and dispositions (Figure 6). In this section of the first iteration of this living research informed document, we seek to align these outcomes within the current educational and political context, and with consideration of the wider global setting.

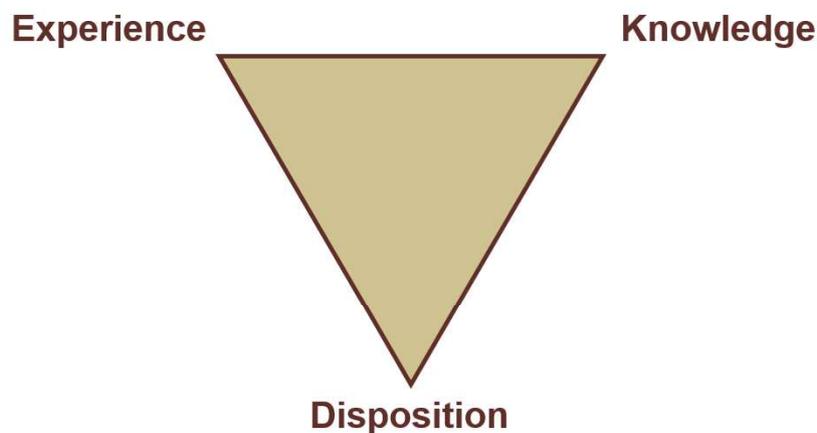


Figure 6

Design and technology curriculum intentions: experience, knowledge and disposition

Curriculum intentions

Spanning all participant responses, a series of desirable **dispositions** for learners emerged (Figure 7). Participants felt strongly that the subject should seek to develop attributes including team building, communication (including the extrapolation of ideas) and collaboration. Resilience, and the development of an ability to take informed risks and engage in ‘proud failures’ was also cited by participants. Integral to these notions appeared to be the desire to encourage the emergence of a curriculum which developed dispositions that align within the

domain of so-called soft skills. Particularly within the context of this study, where design and technology itself is categorised as soft, we believe that it is important to note that the interpretation of language, particularly around the use of hard and soft subjects, which implies that one is harder and therefore more important than another is grossly misleading. This notion also applies therefore to the development of so called 'soft skills', which within the context of technological innovation and a potential move away from a knowledge-based curriculum are becoming increasingly more important (Staufenberg, 2019) and this is a trap which we must avoid falling into.

A second emergent category, **experience**, relates to what learners 'do' (i.e. what they experience) within the subject, what is important to know. Participant responses include reference to authentic approaches to problem solving, context and an awareness of human needs and wants within a technological society. An additional strand explored by some participants valued the working knowledge of materials alongside the development of physical skills including manual dexterity, although this relationship (between materials knowledge versus developing manual skills) as articulated below was also illuminated as a dimension of tension within the data.

The third category, **knowledge**, extends beyond the boundaries of the subject and relates to participant perceptions of a broader body of knowledge. Dimensions of knowledge considered were, by the learner in relation to political and global agendas, knowledge for action and situated knowledge, within the context of other subject disciplines. The nature and role of knowledge has been written about and discussed by a number design and technology authors, including in relation to the interaction between mind and hand during ideation (Kimbell, 2018; Kimbell et al., 1996) and the complex relationship between conceptual (knowing that) and procedural (knowing how) knowledge (McCormick, 1997). In addition, design and technology has historically acknowledged drawing on bodies of knowledge from other subjects (DfE, 2013).

The triad represented in Figure 6 reflects some of the contemporary and competing perspectives on curriculum. Young (2008) promotes the notion of so-called powerful **knowledge**, currently promoted by political decision makers in England (Gibb, 2017), whereas others focus on **experience** (Biesta, 2014) or aims (Reiss and White, 2013), where aims include skills and **dispositions**, as more cogent drivers for curriculum design. The emergence of these 'codes' in the findings highlights potentially useful and disruptive tensions with which to explore design and technology, without the distorting effect of imposing a single curriculum theory, focus on limited intentions. This is particularly relevant in the current context in England, where there is a shift in the Office for Standards in Education (Ofsted) inspection framework for schools away from teaching and learning and towards curriculum intent, implementation and impact (2019).



Figure 7
Design and technology curriculum intentions: learner dispositions

Tensions

Commonly held tensions focused around political drivers, fiscal demands and constraints and the academic versus vocational debate. Within the responses half of the participants made some reference to design and technology's vocational heritage, and as a vehicle through which young people could study technology in order to help to meet the needs of a contemporary work force. During the process of analysis, it became clear that there are tensions between the concept of a discipline which moves beyond specific materials or a set body of knowledge, and one which advocates traits which could be perceived as being more aligned with established subject origins and traditions. Where this encultured versus transcended view of materials occurred, tensions tended to be crystallised around material areas which aligned with participants individual subject disciplines. Given that previous inspection findings have concluded that design and technology teaching of design was less effective than of making, with pupils "often spending too much time on superficial work" (Ofsted, 2001, p.1) one might be forgiven for assuming that the tensions between designing and making might have been resolved. However, materials in design and technology appear to continue to be a point of contest (Figure 8).



Figure 8
Design and technology curriculum tensions

A missing tension?

There can be no doubt that design and technology has much to offer the STEM agenda, and a number of commentators (Banks & Barlex, 2014; Barlex, 2009; Bell 2016), including the National subject association (D&TA, 2017) have discussed the relevance of design and technology as a subject for the 21st century within this context. Many advocate that in order to maintain its influence, design and technology must demonstrate the effective use of science and mathematics (Barlex, 2007) and from this perspective we were anticipating that a significant proportion of responses would reflect this view in that in order to help create a firm foundation for any future iteration of the subject to thrive an alliance with STEM would be desirable.

However, despite a breadth of literature which would support this notion, irrespective of the participants background or material area during analysis we were surprised that in discourse responses made little or limited reference to STEM.

First phase reflections

Unsurprisingly findings present a diverse range of opinion relating to the subject's future. However, in seeking to attain some semblance of cohesion rather than continue to focus on the differences, analysis has sought to disentangle the data and bring to the fore common

insights and understandings; with themes from the nature of design and technology **activity** (ideating, realising and critiquing) and its curriculum **intentions** (knowledge, experience and dispositions). Not to mention, **tensions** created by the subject's relationship with materials (metals, polymers, textiles woods, etc.) and the STEM agenda.

Only through illumination of the mutual ground, those key elements and features which all agree are fundamentally integral to the subject, can we begin to move forward.

To note this is not in any way to say that diversity is not desirable. For clarify, in seeking to identify commonality, within the context of this paper we mean the identification of shared aims, and make clear that we firmly believe that in order to move forward as a unified community, it is essential that we celebrate and promote the interdisciplinary diversity of the subject as a strengthen; and the diversity of the individual disciplines must no longer be allowed to manifest as division as perhaps externally it has been perceived. Division, internal or external, perceived or real, will serve no purpose other than only to further weaken the subject's position.

Rather than seeking to reclaim, re-name or re-frame, throughout we have sought to avoid a focus on repairing the subject, which we believe would potentially result in a make do and mend approach to the development of a revised curriculum. In moving this 'think piece' forward, working again with stakeholders it is intended that the proposed next step subsequent to the dissemination of these initial findings will be to formulate a consensus of opinion that leads to a vision of the subject re-imagined and what, in practice for those charged with delivery, that may look like. In the spirit of the living document approach which has been adopted for this work we welcome contributions from the community, and invite the open critique, adaption and development of this paper. In turn drawing from those new, additional perspectives it is our intention to continue to maintain communication, and to keep the conversation growing.

In thinking about the future of design and technology, whatever form it may take, we propose a working model for discussing the tensions between activity and intentions (Figure 9). In particular, we challenge the community to transcend current and historic understandings of design and technology.

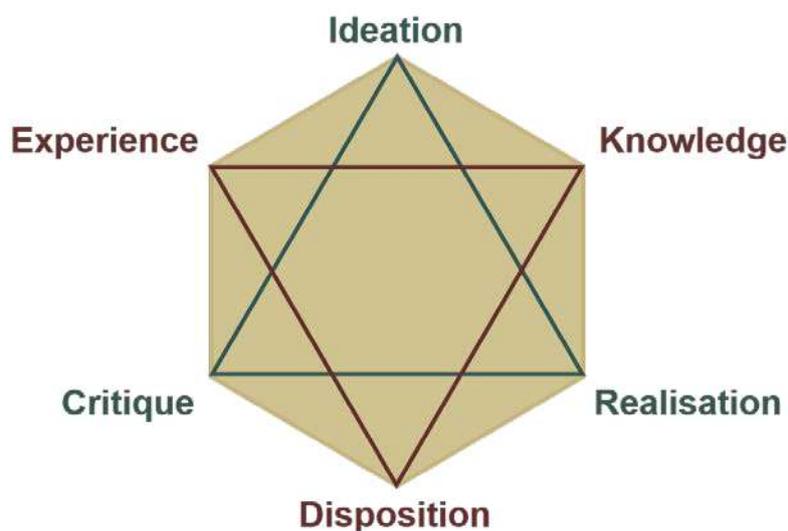


Figure 9

Challenging current and historic understandings of design and technology: a working model

Acknowledgement

We would like to thank all of those who responded to our call for their perspectives on the future of design and technology education. Without the community's full engagement this starting point for further discourse would not be possible, hence the support and encouragement received from the community has been very much appreciated.

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