Design Epistemology and Curriculum Planning

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Dividing a curriculum into subjects is never going to make it easy to develop effective strategies for design education. In the English National Curriculum design appeared in the documentation in two places; in association with technology (as D&T) and art (as A&D), but some have argued that it has not actually appeared in practice in either. Curriculum politics is interesting, but D&T seems to attract more than its fair share of 'special pleading'. A curriculum derived from the lobbying conducted by special interest groups and selective curriculum development projects tends to be something of a patchwork and lacks a core disciplinary strand. When it comes under challenge there is a serious risk of fragmentation and the whole looking rather less than the sum of the parts, and, at least to some extent, that is the position that D&T in the English National Curriculum now finds itself in.

Essentially, at the root of the current dilemmas lies the question: What is the knowledge base of design? It was the perceived weakness of the epistemological basis of D&T by the 'Expert Panel' that was the focus of its critics. There are two commonly held views concerning design epistemology. The first is that the knowledge base of design is unbounded because the nature and scope of design problems is not definable in advance of designing, and the second holds that there is a fixed core of knowledge that enables designing to take place. The first position leads to the recognition of heuristic-thinking and values that reduce the search space for the resolution of the design. The corresponding pedagogical positions relate to the application of knowledge drawn from across the curriculum and accessing knowledge at the 'point of need'. The second position, which is more commonly associated with technical matters, is much more comfortable if you need to write easily interpreted statements in a 'Programme of Study'. It leads to pedagogical positions associated with the need for sequenced learning prior to designing and hierarchies of concepts for which it is more straightforward to show progression. So it is not really surprising if challenges to the D&T curriculum lead to the emergence (re-emergence) of engineering systems terminology (structural, mechanical, electronic etc). These are of course concepts from the epistemology of engineering, where the essential language is mathematics, so there are inevitable tensions for those who hold to the first position concerning design epistemology. Aesthetic, economic, moral and technical values for designing (as they were once classified by the Assessment of Performance Unit for Design and Technology (APU) (Hicks et al, 1982:26), and hedonic values, which featured in the Annex to Tender invitation for the APU study (Roberts, 1981), are not generally expressed mathematically And so whilst these two positions remain disconnected, one group or the other will inevitably feel outside of their comfort zone. It is a problem exacerbated by the long-standing difficulties that individual English people seem to have in embracing both Science and the Humanities.

The reality of course is that neither of these epistemological positions is accurate in relation to the nature of the problems that designers address. The epistemology of design is actually of a more fluid nature. Roman Architects knew the principles embedded in Vitruvius' *De Architectura* which covered both aesthetic and technical matters. They were used to construct many successful buildings, although they might not be quite the same and have been so rigorously tested as those available to modern architects. Vincenti (1990) has provided a fascinating account of design knowledge derived from a study of aeronautical history: *What Engineers Know and How They Know it.* Vincenti's categories of design knowledge are: fundamental design concepts; criteria and specifications; theoretical tools; quantitative data; practical considerations and design instrumentalities. The whole of this book is central to informing the current debates, but in relation to 'D&T' the final two in this list are the most significant. Consider these quotations:

> 5. Practical considerations. Theoretical tools and quantitative data are, by definition, precise and codifiable; they come mostly from deliberate research. They are not, however, by themselves sufficient. Designers also need for their work an array of less sharply defined considerations derived from experience in practice, considerations that frequently do not lend themselves to theorizing, tabulation, or programming into a computer. Such considerations are mostly learned on the job rather than in school or from books; they tend to be carried around, sometimes more or less unconsciously, in designers' minds. Frequently they are hard to find written down. The practice from which they derive necessarily includes not only design but production and operation as well, though such practice may not – typically is not – by the designers themselves.
>
> (Vincenti, 1990: 217)

In relation to the APUs descriptions, Vincenti is referring to technical values.

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TECHNICAL values involve an appreciation and application of the following concepts: efficiency, and the ways in which input is compared with the resultant output; robustness; flexibility, and the ways in which the performance of a man-made object or system might be sensitive to change; precision, and the qualities of fit and of fitness to purpose, valued either for their own sakes or as a means to an end; confidence, and the ways in which the possible reliability or unreliability of information is taken into account.

<div align="right">(Hicks et al, 1982: 26)</div>

Regrettably, there seems to have been surprisingly little progress in defining this practical dimension of design epistemology since this APU study. Vincenti also moved deeper into this area through his consideration of design instrumentalites.

6. Design instrumentalities. Besides the analytical tools, quantitative data, and practical considerations required for their tasks, designers need to know how to carry out those tasks … the instrumentalities of the process – the procedures, ways of thinking, and judgmental skills by which it is done – nevertheless must be part of any anatomy of engineering knowledge. They give engineers the power, not only to effect designs where the form of the solution is clear at the outset, but also to seek solutions where some element of novelty is required.

<div align="right">(op cit: 219)</div>

[…and later in discussing these matters…]

Finally, designers need the pragmatic judgmental skills required to seek out design solutions and make design decisions. Such skills like visual thinking, call for insight, imagination and intuition, as well as a feeling for elegance and aesthetics in technical design.

<div align="right">(ibid: 222)</div>

From this brief overview, it is already evident that the two positions concerning design epistemology might turn out to be rather less distinct than their proponents would have you believe. Design problems are not really 'defined' or 'ill-defined' in some binary sense, but made up of a myriad of design problems, some more defined than others. Product design specifications (PDS) repeatedly demonstrate this. Design epistemology must embrace all aspects of the PDS, including the hedonistic concerns.

That sounds quite dramatic when you write it, but consider the APU's description of hedonic values

HEDONIC values, which might involve an awareness of:

1. the role of vision. hearing, smell, taste and touch in attaching value phenomena through their direct appeal to the senses;

2. the role of appetite, desire, pleasure, pain, etc. in the evolution of products and systems;

3. the demands made on the configuration of man-made things and systems by the physiology and psychology of people;

4. the importance of hedonic factors in all forms of design activity and an ability to take them into account when designing or evaluating things in the man-made environment.

<div align="right">(Roberts, 1981)</div>

To modernise this description 'man' would need to be deleted from 'man-made' which was an expression of its time, but surely these should be routine aspects of design epistemology by now. 'Design for function' and 'design for use' are now assumed to have been completed successfully in product design and manufacture (or customers would be entitled to refunds on products that were not fit for purpose). It is 'design for emotion' that distinguishes successful from unsuccessful products on the shelves of the 21st century. And in these terms, is it so hard to build bridges – to continue the engineering theme – between 'food' and some of the more technical design areas?

Design epistemology is clearly tricky, and it is no doubt a moving target, but there are some significant foundations already in place. Perhaps there are published reflections on Vitruvius' *De Architectura* from modern architects and Vincenti's *What Engineers Know and How They Know it: Analytical Studies from Aeronautical History* from modern aeronautical engineers. If not, developing an understanding of those elements that have stood the test of time and those that have evolved alongside the designing would be an excellent contribution to the literature. In the context of curriculum planning it is time that we had at least a temporary grip on design epistemology, because otherwise the debates become a hotbed of curriculum politics and design education is more important than that.

This issue contains four research papers that indicate the richness and complexity of the agendas that D&T educators must grapple with. The first paper by Vicky Lofthouse concerns social issues as an aspect of sustainability and

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how they can be made relevant and appropriate for undergraduate student designers. The task was not just to define the social issues, but to identify those that lie within the skill sets and sphere of influence of the undergraduate students. Workshops and design exercises were completed and the results were reviewed by academic staff. The key outcome of the project was a design tool for social sustainability. It may need adapting and re-evaluation for different age ranges, but it provides an excellent starting point for incorporating this important area of designing.

Gill Hope's paper explores the relationship between technological literacy and design capability. The exploration is conducted through examining core questions in three areas: firstly the meaning of literacy if the concept is being taken beyond the realm of language; secondly the relationship of technicity and technology; and finally considering the pedagogical balance between teaching about technology and through designing technology. The conclusions place these discussions in the context of design and technology education and illustrate some the complexities surrounding the definition of subject boundaries.

Xenia Danos' paper describes the importance of graphicacy (visual literacy) as a key communication tool in our everyday lives and within school curricula. The need for a new research tool is explained and the development of a new taxonomy of graphicacy is described. The tool is used to identify cross-curricular links involving different areas of graphicacy and consequential transfer opportunities. Hence it illustrates how the implementation of a curriculum policy for graphicacy could significantly influence students' learning. It is not a claim made in the paper, but, in my view, it also shows how one key aspect of design education – graphicacy – strongly influences teaching and learning in other subject areas.

The final paper by Farhat Ara, Sugra Chunawala and Chitra Natarajan investigates the images that Indian elementary and middle school students' have of designers. A 'Draw a designer at work' test was used with 511 students from Classes 5 to 9 from a school located in Mumbai. Findings from the study indicate that Indian elementary and middle school students, who had no experience in design and technology education perceived designers mostly as fashion/ dress designers or artists and designing was associated less with engineering and technology. Clearly there are important implications for curriculum design in India from this work, but the significance of their cultural context is an issue for all countries.

This issue also contains Richard Kimbell's Relection and a review by Torben Steeg of *Fostering Human Development*

Through Engineering and Technology Education (by Moshe Barak and Michael Hacker).

References

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Sophie Watson
If you have submitted a paper to this journal, then you'll already be aware of the careful and thorough approach that Sophie has brought to its administration. Sophie has been involved since Design and Technology Education: an international journal was launched in 2005 and when it went online in 2008. Sophie's contributions to managing communications with authors, the blind refereeing process, the Editorial meetings and the journal layout have been invaluable. All our thanks must go to Sophie – readers, authors, reviewers and editors – for all the work she has done in helping to establish the journal.

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John has been a long-serving member of the journal's Editorial Board and has now decided to step down from this role. One of the great pleasures of being Editor of this journal is to see the reviews of the research papers written by the referees and the responses of the authors to them. In my view, the standard of the feedback that is sent to authors from all the members of the Editorial Board is exemplary. It is detailed, supportive and constructive and the papers are subsequently improved, sometimes very significantly, as a result of this process. As it is a 'blind' process, I don't know which reviews were John's or who they went to, but on behalf of those authors and the journal, I would like to thank John for all his work and support.

EDITORIAL