Paper 31. A practical focus on identity development in learning to design for sustainability

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Abstract

This paper reports on a study of essential challenges students face in learning to design for sustainability. The investigation centres on the development of core support for problem-based learning in design projects, based on work with undergraduate students and tutors during successive years of a sustainable design module. The focus is the development of an effective pedagogic design aimed at improving students' learning in line with the module teaching aims. This addresses fundamental barriers to sustainable design practice, which must resolve problems that lack determinate solutions, are compounded by equity issues, and entail design processes that can draw effectively on diverse resources.

Taking a social perspective on learning emphasises the central role of *identity* development in learning through practice. This is recognised to be important to the growth of designers' abilities in resolving complex problems, as part of a lifelong process of developing design expertise. Social psychological perspectives on identity highlight self-evaluation as a key dimension, offering an important basis for investigating the ability of sustainable design education programmes to enable effective independent learning. The role of identity development in design project work is potentially of central importance in increasing the relevance and effectiveness of education in design for sustainability.

The focus of this paper is on the development of an effective learning support for a conceptual design project which forms the major assessed component of the two-semester module. During this project, undergraduates tackle product design briefs set by external organisations, and they are partly supported by a series of tutorials providing an opportunity for discussion and feedback on the production of project work. A related practical approach to improving their sustainable design learning is discussed.

1   Design for sustainability

1.1   Complex problems and design resolutions

Sustainable designers are particularly called upon to address the sorts of complex challenges that Rittel & Webber (1973) termed *wicked problems*. In such thoroughly problematic situations, the designer's judgement becomes highly significant in assessing how change should occur. The process of problem resolution is open-ended, significantly influenced both by the problem's context and perspectives taken on it, and relies on the designer's appreciation of the situation in negotiating significant equity issues. This leads to their conclusion that the real challenge is in *formulating* the problem; a feature also highlighted in Lawson's (2006) model of the design process. Formulation centres on the distinctive way designers *frame* the design situation, a concept Schön (1983) used to draw attention to the ways in which practitioners in relevant fields *construct* problems in order to solve them, through

salient features derived from personal and professional experience. In this way, Schön suggested, "Their frames determine their strategies of attention and thereby set the directions in which they will try to change the situation, the values that will shape their practice." (p. 309). Faced with problems for which a complete formulation is not possible, experienced designers increasingly use a *solution-focused* approach, developing and testing speculative solutions rather than proceeding through problem analysis (Cross 2007; Lawson 2006). This entails partly subjective design strategies or *moves*, such as the use of *primary generators*, simplifying views which help frame the problem, often in line with the designer's own practice values (Lawson 2006; Darke 1984). As Lawson notes, primary generators play a central role in guiding the entire design process, through the evolutionary development of ideas or by more fundamental restructuring where a solution possibility proves unsuccessful.

For Rittel and Webber (1973) the evolving process of formulation necessarily becomes "an argumentative process in the course of which an image of the problem and of the solution emerges gradually among the participants, as a product of incessant judgment, subjected to critical argument." (p. 162). This discursive activity is apparent at different levels within the design process. In the analysis of an architectural design process by Schön & Wiggins (1992), it is shown that a designer can *move* to a new vantage point on the design situation through producing their own visual representation of important features, after which reflectively seeing the implications of this for the design problem may lead to a further design move, and so on until a resolution is achieved. Repeating these activities gives rise to a 'reflective "conversation" with the materials of a design situation' (p. 135).

Schön & Wiggins's account indicates the usefulness of drawing within design processes, and it is included in a related review by Purcell & Gero (1998). Focusing partly on *sketching*, which is "relatively unstructured and ambiguous … occurring early in the process." (p. 389), their review covers several analyses of designing, highlighting how drawn representations may give rise to productive reframing of the design situation. The idea of reinterpretation is central, as is the concept of *imagery* connecting the imaginative development of ideas to experience across the visual and other modes. Scope for recognition of problem features and for reinterpretation is seen across a range of types of drawing, suited to different purposes or stages of a design process. Specific advantages of sketching in design conversations are identified, including the integration of conceptual and perceptual features of a design; and with Schön & Wiggins, that they may enable a designer to draw on an increased range of resources, often of unanticipated usefulness – the more so as design experience increases areas of potential connectivity. Whatever their precise nature, routes through simplifying representations play a key role in the formulation of complex design problems. However, a general ability to create such pathways, should be developed in conjunction with essential aspects of an ability to design sustainably.

1.2   Design for sustainability

The formulation of a problem is a basis for the designer to identify which fundamental principles may be most useful to the ultimate resolution of the problem (Cross 2007). However, in sustainable designing core principles take on additional significance in influencing the way that problems are formulated. The significance of the creative role designers play in this process, underlines the importance of their sound grasp of principles that underpin ways to design for sustainability.

Essentially these principles follow from Brundtland's (WCED 1987) belief that "Humanity has the ability to make development sustainable to ensure that it meets the needs of the present without compromising the ability of future generations to meet their own needs" (unpaged). This brings into question the prevailing view that, "human activities and their effects were neatly compartmentalized

within nations, within sectors (energy, agriculture, trade), and within broad areas of concern (environment, economics, social). These compartments have begun to dissolve." (unpaged). These *Interlocking Crises* suggest a *triple bottom line*, and a core aim to reconcile *socio-centric*, *eco-centric*, and *techno-economic* concerns (Dodds & Venables 2005). This aim can be represented in diagrammatic form as in figure 1, following similar representations given by Dodds & Venables. In the first instance, *sustainability* is found at the overlap of the Earth's capacity to support human activities, societal needs and aspirations for development, and the abilities of designers to design within a real-world economic context. The second diagram shows *sustainable development* as a redefining of these domains, such that the *socio-centric* and *techno-economic* domains become more consonant, and both fall within the scope of the *eco-centric* domain.
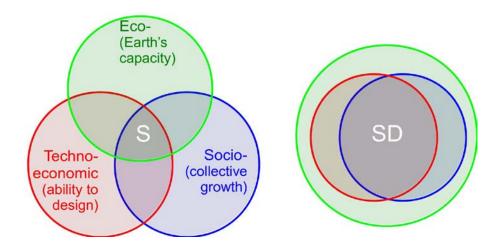

Figure 1: Sustainability and sustainable development, after Dodds & Venables (2005)

Design for sustainability aims toward this fundamental alignment of key areas of concern. It suggests a direction of learning toward an ability to design sustainably, in which the essential nature of learner development becomes more consistent with that of sustainable development. Core abilities to design must become better aligned with the need for collective growth, and more compatible with natural resource constraints.

1.3   Learning to design for sustainability

In developing their practices, designers are found to generate their own *guiding principles* through reflection on the process of designing, and these evolving sets of particular design practice values or contextual philosophical frameworks, are a significant source of primary generators in the formulation of design problems (Lawson 2006). This mode of practice development underlines the significance of design experience as the basis for coming to terms with disparate problem areas and generating new solutions. Archer (1984) also drew attention to this in discussing industrial design as an "art of reconciliation" (p. 60), in which designers must develop their viewpoints by drawing on "rich, wide and fruitful experience … as well as the capacity for flexibility and fantasy in thought." (p. 77). Cross (2007) similarly notes the significance of breadth of engagement in the problem solving of expert designers; and this is reflected in an emphasis on the broad scope of learning experiences in design education, including in engineering design for sustainable development (Cruickshank & Fenner 2012).

So the ability to reflect and develop principled approaches across the breadth of experience relevant to designing and learning to design for sustainability is clearly important. Such reflection on and beyond

design practice must accommodate a wide range of activities, materials and experiences, and should therefore be defined in a sufficiently open way (Boud 2010). This highlights a tension between transferably teachable design approaches and principles, and supporting the learner's own developing capacity to create meaningful change; a property which, for example with Asch (1987), may be viewed in terms of a learner's "capacity to grasp the structure of social relations [which] permits them to sense requirements." (p. 357). Lave & Wenger (1991) offer a useful *situated learning* perspective on social practices such as designing, and its relevance to design expertise has previously been recognised, for example, by Lawson and Dorst (2009). In this, the role of *identity* development is highlighted as a key facet of the learner's unfolding engagement with relevant practice learning communities.

Identity is also a central concept in social psychology, which offers potential insights into identity development as a pathway toward expertise. While identities are partly fragmentary, an individual's effective functioning rests on creating a coherent self-view, supported by core roles and 'autobiographical' narratives (Hogg & Vaughan 2011). This reflexive process provides an important perspective on process reflection in design learning. Self-narratives in identity development aligned with sustainable development, should support appropriate engagement with the necessary range of resources, including different perspectives, experiences and relevant key principles, to enable the sound formulation of complex problems.

A fundamental challenge in achieving this sustainable alignment, concerns *self-evaluation*, in which *self-motives* play a key role (Sedikides & Gregg 2003). *Self-enhancement* is a dominant self-motive, which can raise *self-esteem*, but as Sedikides and Gregg point out elevated self-esteem has negative implications if it is not also of a high quality. This seems especially relevant as students in recent generations may face increasing challenges in building self-esteem of a sound quality, as is indicated in a large scale study by Twenge et al. (2012). Their analysis centres on responses to a set of questions asked of American freshmen across many universities since the 1960's, in which they find distinct trends that correlate with low quality self-esteem. Of potential concern for the development of design expertise, the largest fall was found in students' interest in developing meaningful personal philosophies, an issue which appears directly relevant to the key reflective process of developing guiding principles. Another important decline related to students' concern for the environment. Moreover, these trends in student preferences, consistent with a general weakening in the process of sound identity development, are indicative of a decline in what Twenge et al. term *community feeling*, defined with Kasser and Ryan (1996) as "helpfulness and wanting 'to improve the world through activism and generativity' " (p. 1046). Their findings underline the potential significance of improved self-evaluation to the development of sustainable design expertise.

2   Study of undergraduate design learning

2.1   *Study context*

The study focuses on a two-semester undergraduate sustainable industrial design module, which aims to develop relevant awareness and strategies, introducing core principles as well as a range of tools to more systematically design for sustainability. The conceptual design project which concludes the module entails responses to quite open design briefs set by external companies, and is essentially an instance of *problem-based learning* which approaches the complexity of real-world designing. It "begins when students are confronted with an open-ended, ill-structured, authentic (real-world) problem and work in teams to identify learning needs and develop a viable solution, with instructors

acting as facilitators rather than primary sources of information" (Prince & Felder 2006, p. 128). The project runs throughout the second semester of the module, during which group support is provided through workshops, followed by a series of tutorials in the final few weeks of the module. One distinction from a problem-based approach as just defined is that the teamwork element is quite minimal and students work largely independently to develop their own sustainable product concepts. In doing so they are expected to draw on a range of resources including the lecture and workshop materials, recording their research and design development work in project logbooks. These are shown at tutorials and handed in for final assessment along with electronic presentation boards showing their final design concept.

2.2   Summary of findings from the previous year of the module

During the previous year of this study, the module tutorial discussions during the final weeks of the project were observed and recorded for two small groups, of five and six students respectively. A thematic coding structure was developed partly inductively from the data obtained, and partly based on established self-enhancement strategies termed the *self-enhancing triad* (Sedikides & Gregg 2003). These three dimensions of self-enhancement formed the top level categories in the coding structure, summarised in table 1.

Table 1: Main categories for thematic coding.

Category	Description
Above average effect	assumption that one has greater competence than relevant others
Illusions of control	assumption that one has more influence over outcomes than real constraints allow
Unrealistic optimism	assumption that one will tend to be more successful than relevant others

The study showed that students did self-enhance in ways consistent with the self-enhancing triad, and those who tended to do so across more categories while showing the opposite tendency across fewer, achieved grades below the average across the two groups. Those for whom this pattern was reversed achieved above average grades. So in the present module, success in sustainable designing was found to be aligned with the quality of self-evaluation.

2.3   Pedagogic intervention and study during the present year

A practical perspective was taken on improving students' ability to overcome relevant challenges in successfully reflecting on design processes. The pedagogic intervention was based around a module workshop session part way into the conceptual design project in the present year, but a few weeks before the first of the series of four module tutorials. The intervention highlighted the importance of students' elementary thinking concerning their approaches to designing, with a focus on the use of relevant resources in the development of work in their logbooks. It included a short presentation to the whole module group of around forty students, followed by a small amount of time for them to reflect on an aspect of their project work and to ask questions. A short handout provided a slightly expanded introduction to the idea of reflecting on design processes, and drew attention to some possible issues and potential resources to reflect on. The issues included the use of drawing, highlighting the possibility of different forms, and emphasising sketching in forms expected to be of value in idea generation and development.

Following the intervention, discussions between students and the tutor were observed at the four tutorials, for two groups, one of 4 and one of 6 students. Students worked essentially individually, but each group tackled the same sustainable design brief set by an external company. A digital video camera mounted on a tripod was used to record most of the tutorial activity, which involved discussions around work brought to each tutorial – pages shown from project logbooks, and any associated materials (figure 2).

Figure 2: Video recording of materials and discussions during a design tutorial.

Following the final hand in of project work, the logbooks were available for fuller analysis, and interviews were also held with students to discuss their logbook work over the course of the project.

2.4 *Initial findings from the present study*

Analysis of the tutorial observations and interviews is in progress, and has indicated that in general, compared with the module tutorials in the previous year many students showed a larger volume of research and in some cases more design development work. The bulk of the work tended to be in the research element, with some students seemingly reluctant to properly begin the development of their design ideas. Differences from the previous year's study, which include both the students and the design briefs, mean the influence of the intervention on the quantity or thoroughness of student project research is not entirely clear.

While students seem quite prepared to reflect on issues directly relating to their design ideas, there seems limited evidence that reflection is occurring on the approaches taken to their design projects. This most obviously applies to explicit reflection in logbooks, but there seem few other clear indications that such reflection is occurring based on the work seen during the study. The general tendency appears to be to continue to work with a narrow range of approaches with which students are familiar and relatively comfortable – something particularly apparent in their use of sketching. Sketching is typically quite limited both in quantity and scope, and starts relatively late in the process. As in the previous year, there often seems a concern to produce logbook content that is of a presentable quality throughout. This may constrain the development of design ideas, for which the initial range is typically small, and limited evolution of forms, themes and emphases is seen in what follows, still less any radical changes of direction. It would appear that further development of the

pedagogic design is needed to induce students to take a more reflective and proactive approach to improving fundamental aspects of their design processes.

3   Conclusions

Finding resolutions to complex challenges in design for sustainability, requires the reflective development of the ability to formulate problems effectively and appropriately. Work in the previous year of this study supported the idea that this is consistent with the development of an ability to self-evaluate effectively. However, based on the analysis of data from the present year of the study, a related pedagogic intervention appears in general to have failed to create an observable change in students' ability to reflect on and improve their processes of designing. Given the centrality of this ability to the lifelong development of expertise in design for sustainability, if the initial findings are confirmed then further work to develop a relevant pedagogic approach is needed.

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