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Embedding Threshold Concepts into First Year Design History: Can we transform students understanding and way of seeing?

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ABSTRACT

This paper considers the idea of a 'threshold concept' by arguing from the premise that students who are learning design history in higher education need to develop and practice particular skills before certain concepts can be learnt. Recent research has demonstrated that first year design students lack the visual literacy skills needed to identify key characteristics of a historic design style even after instruction has taken place (Rourke & O'Connor, 2009a, 2009b, 2010). It is argued that if instruction included prototypical exemplars, semantic cues and practice exercises that utilise visual literacy, learners could acquire some key threshold concepts in design history so that individual creativity and confidence may flourish.

Introduction

"Threshold concepts" has become quite a prevalent term in education since being introduced by Meyer and Land (2003) and applied to economics by Davies (2003) that same year. Meyer and Land offered a viable method for describing different levels of understanding of a subject that has been adopted across a variety of disciplinary areas. Threshold concepts according to Kiley and Wisker (2009) assist toward identifying core learning outcomes that represent seeing things in a new or transformed way. This paper will argue firstly that in order to view design examples in a new or transformed way, educators should utilise design prototypes as part of the curriculum and that these represent key concepts for learners; secondly, semantic cues should be included in instruction in order to assist students to recognise the key points of a design prototype.

According to Solso (2003), prototypes are utilised in art or design to assist with the recognition of central visual characteristics of a work. They are the abstractions of stimuli against which patterns are judged. According to Solso (2003) it is believed to be possible and more economical to store impressions that embody the most frequently experienced features of a class of objects when learning art or design imagery. For example if teaching a design style such as Art Nouveau, a prototypical example will have an organic free flowing form, sinuous curving lines, floral abstraction, and flat patterns with often asymmetrical lines. To learn a key threshold concept in design history, this paper argues that it is necessary to expose students to a number of design prototypes that encapsulate a body of knowledge, and to provide learning activities that assist them towards understanding the disciplinary knowledge and language.

One method educators can adopt to assist the learner with recall is to use retrieval cues. There is some evidence to suggest that these cues should be provided when the material is first presented to the learner (see for example, Perkins & Salomon, 1988; Tulving & Osler, 1968). Semantic cues in

particular could be used to direct the viewer's attention to key ideas, which can assist with retrieval of information from long-term memory by linking prior knowledge to the information to be learnt. As art educator, Cunliffe points out, "We achieve understanding of the world through actively finding meaning which we test against our existing schemata" (1992: 143). These semantic cues may be used to infer a metaphor in art and design and the role of the educator is to use semantic cues to provide better access to the meaning of the work to eliminate confusion and misunderstandings. However, in order to understand what it is that students need to learn it is first necessary to define what is meant by a "threshold concept".

What is a threshold concept?

It seems appropriate to consider some views on the idea of a "concept" in education for there are differing opinions regarding definitions. In cognitive science for example, concepts are viewed as word-like mental representations (Pinker, 1994). Perkins (2006: 41) stated that, "fundamentally, concepts function as categorisers"; however Dummett (1993) and Brandom (1994) put forward the view that concepts are abilities. Grasping a concept can also happen intuitively in one discipline whereas in another it could be considered a complex learning process.

To understand what is meant by a threshold concept, it is informative to catalogue the five concepts put forward by Meyer and Land (2003) and then apply these to the teaching of design history. The first characteristic of a threshold concept according to Meyer and Land (2003) is that they are core concepts that once understood, transform perception of a given subject, involving a transformed way of understanding, interpreting or viewing something, which may happen suddenly or take time. Meyer and Land (2003) describe this as "liminality" (the period that precedes the actual crossing), where students mimic the language required of them prior to understanding. Secondly, they should be "irreversible", in that once a learner's perspective is transformed they cannot understand in a less conceptually complex manner (Meyer & Land, 2003). In other words, once the learner has begun to perceive the world in terms of a threshold concept it is often inconceivable that they would go back to their previous way of thinking. Thirdly, a threshold concept is "integrative", which according to Meyer and Land (2003) is where the concept has the capacity to expose the previously hidden interrelatedness or connections of something. Fourthly, a threshold concept is "bounded" as it assists in the definition of the boundaries of a subject area, and threshold concepts have borders that, when crossed, can open to other conceptual developments.

Finally, a threshold concept may be "counter-intuitive", involving knowledge that is often inherently foreign to the learner. Perkins (2006) added another characteristic to the Meyer and Land (2003) list of threshold concept characteristics, stating that they could be "troublesome" for they usually require the learner's grasp of conceptually difficult knowledge. Novice learners in higher education, who have not studied design history in secondary education, can find it an extremely complex process to recognise and comprehend key design examples. Students need to acquire skills of recognition of design prototypes as threshold concepts in order to apply the body of knowledge that is known as "design history".

Threshold concepts and learning design history

In teaching design history in higher education there is pedagogical value in considering threshold concepts as described by Meyer and Land (2003, 2005) and Meyer, Land and Davies (2006) in relation to teaching novices some of the distinctive characteristics of a design style or movement. Although there is considerable debate in the literature by design historians to move away from this approach (see Margolin, 2005), this paper argues that when the learner has acquired this knowledge educators then have a definable base of understanding upon which they can build. There is also the well-rehearsed position that curriculum content should not privilege a Western design narrative as this

detracts from the broader cultural forces that design history might provide (see Gieben-Gamal, 2005; Cooper & White, 2005). While the content of design history changes to meet student learning needs in different locales and contexts, what does not change is that learning to differentiate one designer's work from another can be a difficult process for novice learners. This process of differentiation calls for the retrieval of key schemas (or building blocks of knowledge) from long-term memory encapsulating a whole body of knowledge. The pedagogical process of identifying a designer or design style involves an understanding of historical periods, cultural contexts, available materials, stylistic influences and politics. In other words understanding the key concepts required to identify a designer's work can unlock (and link to) a whole body of knowledge that is constantly being acquired, synthesised, reflected upon, engaged and applied.

How can design educators support this learning?

Design educators can assist with this process by breaking down the content of such learning into manageable chunks and by mapping the content into a learning journey, which each student presents visually through their own mind maps. The educator first provides an example of a design history mind map to assist the students' understanding of their usefulness as a learning tool or methodology. The students then map their own learning and thought processes. These mind maps can be used subsequently for tutorial class discussions, group activities and to assist students to complete assignments. Software such as Freemind[1] also assists students to graph their design history learning visually in an organised way. Freeman & Jessup (2004) suggest that graphic organisers are useful in enhancing learning as they assist students in retention and organisation of information. On these mind maps each week students add any new themes, theories, concepts, designers and influences as well as their own perspectives, studio focuses and outside interests to encourage interdisciplinary links. This method can be particularly productive for students when asked to provide, in essays or presentations, comparisons and contrasts between designers as well as design movements. It is also an effective pedagogical method for allowing the educator to progressively pick up on any student misunderstandings of course material. Mind maps can be used also as a tool for encouraging students to engage more actively with the course material and to assist them towards developing a sense of ownership of the learning processes.

To scaffold students' learning in design history, educators can use prototypical exemplars and key concepts learnt as a basis, and link these to lesser-known examples to provide a wider cultural, political and historical context to assist learners to see the bigger picture. Below is a section of a first year design student's mind map (see Figure 1) that charts the characteristics and influences of two nineteenth century, design movements. Students are shown how to add other layers to their mind maps in order to expand on, and build further understanding of the key words. In lectures throughout the semester, the lecturer provides further key words, designers, influences and theories to add to the mind maps. They also ask students to add from their research any Pdfs of relevant journal articles, key quotes and references as well as visual examples.

Greene and Land (2000) examined the role of instructional scaffolding to support pre- service teachers in their construction of internet-based lessons. They discovered that procedural scaffolding further assisted students to focus and develop their course projects when working on the World Wide Web as a resourced based learning environment. Once students have grasped the disciplinary knowledge through learning key concepts of prototypical design examples it is imperative that further learning activities are designed to encourage students to ask questions, debate opinions and critically analyse the works shown. Part of the aim for scaffolding of this learning process is to have students work towards producing their own mind maps that provide a basis for answering essay questions as well as to provide a visual map of their own thought processes that can be discussed with both the teacher and the class. This approach utilises the model of procedural scaffolding, a Constructivist learning theory based upon Lev Vygotsky's (1978) premise that "cognitive development can be encouraged through stimulating environments and attention to the role of
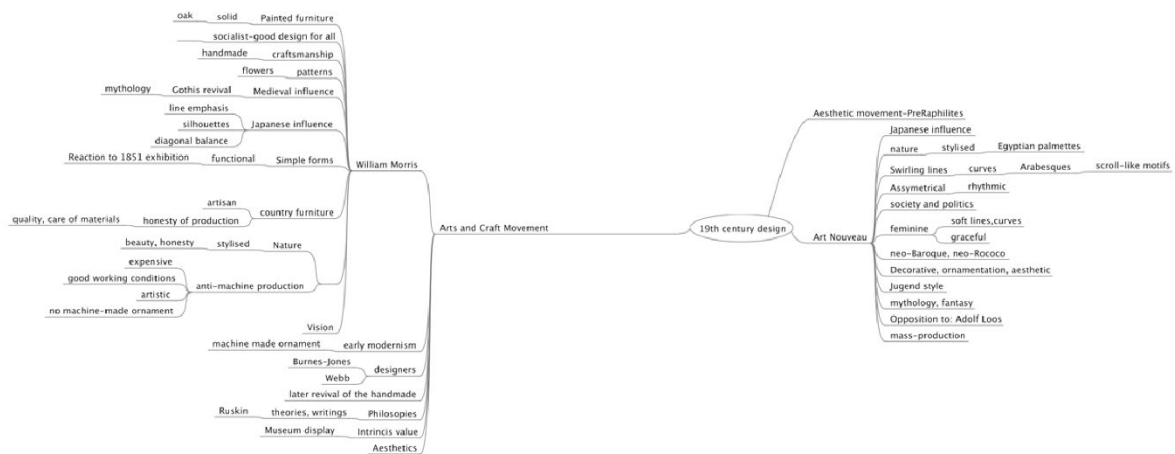
Figure 1. Example of a section of a first year design students mind map using freemind software.

social factors" (Santrock, 2005: 130). This learning theory advocates that language and learning are inextricably interwoven. Vygotsky (1978) suggests also that in the learning process learners are encouraged to complete more advanced tasks with assistance from an experienced person, such as the instructor or a peer.

Using this approach to learning the teacher models to the class various methods for utilising visual material in tutorial activities, thus demonstrating the link between key concepts or features in a design example. By showing students the key concepts in a design example and identifying how to recognise these concepts in a direct manner, the teacher demonstrates a way of expressing such understanding, which may then assist students in their own presentations. In their future design professions one of the required key skills is to be able to communicate clearly an understanding of the historical, social, philosophical and political contexts of design in order to place their own practice into specific and wider contexts. Hence being able to identify as well as read the semiotic cues in a design work will assist towards gaining this understanding, as discussed later in this paper. Karjalainen (2007: 67) also reinforces that students need to be provided with analytical methods to identify designs: "To be better prepared to face the challenges of design practice, design for visual brand recognition is a theme that needs to be embraced by new approaches also in design education".

Davies and Mangan (2006) suggest that threshold concepts could be embedded into the curriculum firstly as pedagogical principles then as learning activities, which would break down the complexity of the knowledge to be learned. They state, "if the theory of threshold concepts (Meyer & Land, 2003) is to be useful in guiding teaching and improving student performance, it must be translated into principles that can inform the design of teaching and the curriculum" (Davies & Mangan, 2006: 2). Students learn the practical application of design elements and principles in their studio classes and can utilise this knowledge in design history classes to hone their disciplinary language.

Added to this is the acquisition of visual literacy skills and disciplinary language (beyond just understanding elements and principles of design) that aid the learner to comprehend what they see and to communicate this understanding to others in words, written or auditory. Ausburn and Ausburn (1978) suggested that visuals have their own vocabulary, grammar and syntax and that a visually literate person should be able to read and write visual language, decode (interpret) visual messages successfully and encode (compose) meaningful visual messages. The process of communicating an understanding of design styles and forms can be expressed through visual communication involving a deeper conceptual understanding of how to apply disciplinary language beyond simple mimicry. In fact it could be argued that acquiring visual literacy skills and

grasping specific disciplinary language can be an identified threshold concept as once obtained one will see the world visually in a new and transformed way that could be described as irreversible. The learner will then acquire a more conceptually complex way of comprehending the visual world.

This also fits the integrative characteristic of threshold concepts as the learner is able to see the connections between design examples and coherently express this link. The boundaries of the threshold concept become apparent when parameters are set, in this case by the requisite knowledge for identifying a particular historical design style such as when learning about designs from the German Bauhaus school of art and design, in a timeframe from 1919 to 1933, and the philosophies of its leader Marcel Brauer and his colleagues. Further conceptual outcomes can occur when the learner questions these boundaries and reinvents new boundaries or parameters that could require developing a new set of threshold concepts. As Davies and Mangan (2006: 3) concurred, "this assumption of 'irreversibility' does not mean that further change is not possible. Acquisition of further threshold concepts will again transform thinking". This is not to suggest, however, that what has been grasped previously is lost, as the learner builds upon their cognitive architecture linking past knowledge to new knowledge as new threshold concepts transform thinking processes.

Another pedagogical factor of threshold concepts is that they can be seen as "troublesome" for the learner, as they usually require a learner to grasp conceptually difficult knowledge as previously mentioned. Many novice learners find visual examples in design history difficult to comprehend unless they have previously studied design history or are mature age students who have worked in the field. An example of this is when teaching the topic of "modernism", for example, to first year students in design history, the educator would try to illustrate the meaning of various terminologies such as "form follows function". The modernist design of the LC1 armchair designed by Le Corbusier, Pierre Jeanneret and Charlotte Perriand, for example (see Figure 2) expresses this principle, because the shape or form of the chair with the tubular steel frame and leather strapping is designed to support the body for the function of sitting. To explain this concept it is important not to overload the learner with superfluous information but instead coherently and concisely explain what needs to be learnt and provide visual examples that do not confuse but reinforce this principle point. This provides a solid foundation that can be built on, not only by the teacher in a lecture situation, but also by providing class activities utilising visuals to encourage students to express their own views and understanding.

Rowbottom (2007) put forward some valid criticism of Meyer and Land (2003) threshold concept characteristics that are worth considering. He argued that threshold concepts "had been defined in such a way that it becomes almost impossible, even in principle, to empirically isolate them" (Rowbottom, 2007: 263). This is especially pertinent in courses where there are many ways of viewing a topic or theme such as in learning design history where the educators themselves cannot often agree on the boundaries, content and future direction of the discipline. According to Doordan (1995: xi-xii), "Design history, like other areas of historical inquiry, is constantly reconfiguring itself, reformulating its subject-matter, and redefining its methods in order to contribute in a vital way to the discussion of contemporary issues and opportunities".

Rowbottom (2007: 263) also argues that "concepts are not reducible to abilities, that acquisition of a given concept may be necessary, but not always sufficient, for the possession of an ability" and that what is a threshold for one learner is not necessarily so for another. This is something educators have to grapple with, for previous knowledge cannot be assumed when courses in higher education become more accessible to a wider variety of students. Students also have different learning styles that need to be taken into account and in a rationalised model of education this can be problematic particularly when the economical way of teaching large classes in higher education is via a lecture format that does not always encourage active and engaged learning.

There is also the concern that it is difficult to judge whether a concept has been learnt especially in courses where there are many interpretations of a subject and where there is not an exact science

Figure 2. LC1 armchair (1925-28)
Leather on seat, back and arms, chrome plated steel tube frame.
(photographed and owned by author).

of wrong or right answers. Rowbottom (2007) questioned the possibility of testing for concepts, and noted that there "is more than one possible conceptual route to the same ability" (2007: 263). To further explore Rowbottom's (2007) criticism of threshold concepts this discussion has isolated a specific acquisition of knowledge, that of identifying a designer's style. However it must be emphasised again that it is imperative when teaching design history to continue developing a student's visual literacy skills or abilities as these are interlinked with the threshold concept as previously discussed.

Rowbottom (2007: 263) claimed that, "concepts are not reducible to abilities", however it could be argued that when teaching design history to future designers that concepts and abilities become intrinsically linked. Rowbottom's suggestion that, "a threshold for one learner is not necessarily for another" (263) is a useful premise when considering a novice learner who is learning new material where it is a question of whether they have or have not grasped the concept. Rowbottom's question, "how is it possible to test for concepts, rather than abilities?" (263), is relevant particularly in the case presented here, where "the concept" and "the ability" are interlinked. "How can we tell if there is more than one possible conceptual route to the same ability?" (Rowbottom, 2007: 263). Frequently

threshold concepts in design and art can have a flexible metaphoric interpretation that allows for experiential learning to take place and enables the introduction of various viewpoints.

Hayes (2008: 26) suggests that the "challenge is to accept and understand that the real world is an uncertain place open to interpretation". Taking this view into account, it seams imperative that educators not only teach disciplinary knowledge but also ensure students gain practice skills that are transferable to other courses as well as other situations outside the university world. Particularly, in the case of teaching design history, students need to be given learning opportunities that help them see the relevance of the subject to their future professions as designers. This is particularly pertinent in this field of education, as many students do not make links between their studio and design history course content. One method to start teaching novices both the disciplinary knowledge and language, and to begin reinforcing the links between design history and studio practice is to utilise typical design prototypes in instruction and classroom activities, considered in the next section of this paper.

Utilising design prototypes to test the threshold concept

Recent research has demonstrated that first year design students at the University of New South Wales (UNSW) lack the visual literacy skills needed to identify key characteristics of historic design styles (Rourke & O'Connor, 2009a, 2009b) even after receiving instruction on the material to be learnt (Rourke & O'Connor, 2010). This research recommends that students need to be provided with more learning activities in class to develop their visual literacy skills and that instruction should utilise multiple, key, visual, prototypical exemplars in instruction. To further improve visual literacy skills, educators could ask students key questions about design prototypes to identify if they have gained the threshold concepts required to comprehend a design style or movement or designer.

Art and design appreciation and criticism is often taught in higher education using problem-solving strategies that require the student to provide their own solutions to open-ended questions on specific design examples, with little guidance or input from the tutor during this process. Davies, Conneely, Davies and Lynch (2000: 122) suggested that, "spontaneity is useful for what educationalists call 'discovery learning', in which students generate and internalise their own way of understanding concepts and principles". Some advocates, particularly in art education, support the theory that discovery learning is an effective learning strategy (Dorn, 1998; Jausovec, 1994) arguing that discovery learning is a reaction against the instructional textbook method based on facts and memory. For students who have domain specific knowledge, discovery learning can be an effective learning strategy, however for students without such knowledge, supplying appropriately worked examples consisting of the visual with a list of significant features, as the Rourke (2006) study discovered, could be more effective. With this approach examples provide factors for learners to utilise in practice exercises. The argument for using worked examples in instruction for teaching design history is based on the view that critiquing art and design is a problem-solving activity for novice learners. In order to further explain their purpose, the definition of "worked examples" needs to be discussed. A worked example can be defined as: an instructional method that provides a domain specific example to follow and study a problem that includes a worked-out solution (often in steps). A large number of studies on instructional design have examined learning from worked examples, particularly in the fields of mathematics, physics and computer programming (e.g. Ward & Sweller, 1990; Paas & van Merriënboer, 1994; Carroll, 1994; Tuovinen & Sweller, 1999).

A study by Rourke (2006) tested these methods of instructional design in the area of teaching design history, testing in a real situational format of lecture followed by tutorial, the effectiveness of worked examples compared to completing problem-solving tasks. This study was divided into three stages conducted over a three-week period of a university semester at the College of Fine Arts, UNSW. Stage One was a lecture with prototypical visual examples on five designers from the Art Nouveau or the early Modernist period in Western design history (approximately 1880-1914)

emphasising key characteristics of each design style. In Stage Two the class was divided up into two groups (n:55 Experimental and n:57 Control group), with each group being given ten different practice exercises using chair examples. The Experimental group received five worked examples (visual with list of key characteristics) and five practice exercises (applying learnt characteristics to different prototypical examples) and the Control group received ten problem-solving tasks (prototypical examples to write about with no information provided). In Stage Three both the Experimental group and the Control group completed a three-page test. The first page of the test asked students to match the designer to the chair, the second page had other design examples (not chairs), and the third page had short answer questions asking about key characteristics of the designs from page two.

In the Stage Two practices that used visuals of chairs, the Experimental group scored on average 41.25% better than the Control group after studying worked examples compared to completing problem-solving tasks. In the Stage Three test where students were required to match a chair to a designer, the Experimental group scored on average 15.4% better than the Control group. On the second and third page of the three paged, Stage Three test, students were required to match the designers from the practice and page one of the test, to non-chair examples to test their transfer skills. In this section of the Stage Three test the Experimental group on average scored 25% better than the Control group and when required to list the characteristics of each design, the Experimental group scored on average 6% better than the Control group. The principle conclusion drawn from this experiment was that novice learners, who have a moderate level of visual literacy skill, are more successful at identifying a designer's work, after studying worked examples, than novice learners who are provided only with problem-solving tasks.

The premise behind this example was that recognising a designer's style requires students to have an understanding of design prototypes, which, as mentioned, is a complex cognitive process that requires mastery of deliberate practice, visual literacy skills and disciplinary knowledge. By providing students with activities that test their knowledge and understanding of design prototypes educators are able to identify areas of misunderstanding or lack of confidence. For as Cousin (2006: 5) suggests, "it is difficult for teachers to gaze backwards across thresholds", as a result "they need to hear what the students' misunderstandings and uncertainties are in order to sympathetically engage with them".

Another study by Rourke and O'Connor (2010) investigating students' preference for the use of visuals in instruction discovered that a large portion (64%, n:296) preferred to have relevant features in visual examples pointed out by the lecturer. If students do prefer explicit instruction then it seems imperative that design educators do not presume their students know what to look for in a visual example in order to comprehend it. Following this logic it then appears appropriate that teachers first let students know what factors of the visual example they need to remember.

Interestingly it was revealed through this study that less than half the participants (46%) preferred visual examples coupled with detailed discussion by the lecturer, suggesting they preferred that only key factors are pointed out. This supports Miller's (1956) suggestion that working memory has a limited capacity for simultaneously holding large amounts of novel information. In particular, it would suggest that as novices lack the necessary schemas (or building blocks of knowledge) in their long- term memory to identify design prototypes, it seems appropriate to limit the amount of information novices are expected to absorb. One method for achieving this and for assisting students towards learning key threshold concepts in design history would be for educators to provide verbal and visual semantic cues that point to key information that needs to be learnt.

Utilising the method of semantic cues to teach threshold concepts

In order for educators to use visual exemplars effectively, it "requires sufficient understanding of how the human cognitive systems interact" (Schnotz, 2002: 114) with the visual stimuli. A number

of studies have ascertained that instructional design that includes both verbal and pictorial information should be presented in a coherent manner with some semantic overlap (e.g. Carney & Levin, 2002; Mayer & Gallini, 1990). Well-designed instructional material should provide interconnection between verbal and visual information so that they enter working memory simultaneously (Schnotz, 2002). According to Koroscik, Short, Stavropoulos and Fortin (1992), one method that assists with this process is the use of semantic cues, which can facilitate transfer by assisting the viewer to find connections between the characteristics of the artworks (or design works) and the viewer's prior knowledge. Semantic cues are hints that assist the viewer to understand the content or meaning of a visual example. Design history teachers can use verbal, written or visual language to draw the learner's attention to these hints to assist them towards an understanding of design history. In design this can often mean understanding symbols that denote or represent something. According to Cunliffe (1992: 149), what "is required when reading and making works of art is to try to understand the visual code that is being used and how this relates to the purpose or function of the work of art", and this could also be applied to comprehending design examples.

Koroscik, Short, Stavropoulos and Fortin (1992) hypothesised that verbal cues might assist students to connect the characteristics of an artwork with their own previously acquired domain specific knowledge. Their study investigated the contextual variables that influenced the comprehension of a work of art. This study utilised the verbal contextual conditions of cues and non-cues to demonstrate whether students required explicit verbal prompts to discover relationships among works of art. Using both a multiple-choice matching test and an open-ended writing task, the results showed that verbal cues prompt students to elaborate on possible art meanings.

Meyer and Land (2003) suggest that one of the characteristics of a threshold concept is that there is a period of "liminality" that precedes the actual crossing where students move from mimicking to understanding a subject. It could be argued that to achieve this aim educators need to provide students with learning activities that allow them to mimic and practice the disciplinary language, as well as link and apply new knowledge to previously acquired knowledge. Students then need to be provided with learning opportunities to acquire the attributes needed to reach a level of critical understanding in order to grasp the threshold concept. If educators give clear indication of the points to be learnt of a prototypical example they also provide the learner with opportunity to acquire the knowledge needed to understand other similar examples.

One method for achieving this is for educators to provide semantic cues that clearly indicate the important points that students need to learn. The Charles Jencks tea and coffee Piazza service designed for Alessi (see Figure 3) is prototypical of postmodern design. In this example educators would point out to the students the obvious historicism (fluted columns), whimsical satirical motifs (rose capitals) and non-functional form. Using key visual examples to represent each of these features students would be asked to discuss the links between each visual example and apply these to a list of wider historical, cultural, theoretical, ethical concerns.

As the study Koroscik et al. (1992) discovered, students who were provided with an art context by the teacher scrutinised the artworks for common features to discover comparative relationships between the works. They also found that students who were given verbal cues synthesised their ideas better and constructed more elaborate meanings about the artworks, than those who were not cued. The students who were given the verbal cues also had fewer misunderstandings about the artworks. The students who were not given the verbal cues used broader search strategies, which proved to be a less effective approach than the teacher directed method. In this study the teacher verbally directs students to see the works through the teacher's eyes; but it needs to be acknowledged here that students without direction from the teacher may have seen the work from a more personal or broader perspective. Both teacher- directed and student-centred learning can be problematic, particularly when there is a tension between educators wanting to facilitate students towards gaining knowledge and understanding of specific course content within a

Figure 3. Charles Jencks Tea and coffee Piazza service,
printed with permission from Di Palma Associati International Press Agency for Alessi,
http://www.alessi.com/en/3/1415/silver-objects/tea-and-coffee-service.

semester timeframe, and the need to promote students to self-direct their learning in order to gain a sense of ownership of the learning process.

A study by Warren and Horne (1982) discovered that students' comprehension of pictures could be influenced by contextual cues. However, in order for learners to make use of their cognitive resources, they need to discover meaningful connections between their existing knowledge and whatever they are attempting to understand (Prawat, 1989). Thus educators need to provide learning activities that utilise visual examples previously explained in a lecture, to reinforce not only key points to be learnt, but also guide the learner towards making sense of new material. Then once the learner has grasped the foundational knowledge of a design period, theme, theory or issue then the contextual cues from the teacher could be lessened and replaced by verbal and visual prompts that encourage the learner to explore their own interpretations and ways of viewing design. Following the Constructivist principle of removing the scaffold as students strengthen their knowledge base and visual literacy skills, the initial support system is removed gradually as the learner develops the skill set required.

One approach for further engaging students with the course material after acquiring the key threshold concepts for recognising a designer's work is to provide a variety of visual examples of different designs and then separately provide key philosophical statements from each designer. Then students are to match the statements to each design and explain or justify their selections. Undertaken individually or in groups, this can be an effective way of engaging the class in discussion on the connections between a designer's philosophy and their designs, and also a useful method for mapping out various historical periods and cultural, social and economic factors, which influence each design and designer's philosophy.

Utilising semantic cues effectively in teaching takes the guesswork out of learning, which could provide an easier path for the learner in mastering the threshold concept needed for identifying designers and design styles in design history. As Cunliffe (1992: 145) states, "finding ways for students to acquire new schemata should be seen as the purpose of art education". These "schemata are associated with numerous layers of complementary information about traditions, environments, and sociopolitical and other contexts" (143). Cuncliffe (1992) urges that art may be understood by

its own special symbolic contextual codes, and to gain aesthetic understanding of art and art making, students should be taught how to read symbolic codes that embed art within its contexts, a concept that could also be applied to teaching design history. Providing access to comprehending pictures via semantic cues is one method of demystifying the complex images of art and design, which should assist the learner to acquire schemas. Semantic cues can also be utilised in other disciplinary areas where the visual example requires further verbal explanation that cannot be represented frugally by visual form alone.

Conclusion

Demonstrating to the twenty-first century design student that the threshold concept of learning the necessary knowledge and skills to recognise a designer's work or a design style has any relevance beyond just the acquistion of disciplinary knowledge is one of the great challenges for design educators in higher education. Utilising prototypical design examples and semantic cues to assist students to recognise a designer's work or design style has many benefits for the learner as this paper has argued. Students adopt different learning styles and learn at different paces, with some preferring experiential activities while others prefer more teacher-directed instruction. The approach to teaching novices how to recognise design styles and their specific differences, as canvassed in this paper, is just one method for scaffolding learning of design history, the philosophy being that through this pedagogical procedure students gain some foundational knowledge and skills that they can build upon in future learning enterprises.

It must be acknowledged that meaning related to specific designs cannot always be reduced to characteristics or design elements in a didactic way, for meaning according to Hodder (1998) can often remain tacit and implicit, not part of conscious analytical thought. As Lave and Wenger (1991) emphasise, learning always involves a process of "becoming" that is never reducible to cognitive or technical processes. However as argued in this paper, educators might consider the multiple ways of simplifying many of the complex concepts we teach in higher education to enable students to grasp the essential threshold concepts of a discipline in order to allow for individual creativity and confidence to flourish.

Note

1. Freemind software used to design the mind map in this paper can be downloaded from http://freemind.sourceforge.net/wiki/index.php/Main_Page

References

Ausburn, L. & Ausburn, F. (1978). Visual Literacy: Background, theory and practice. *PLET*, *15*(40), 291-297.

Brandom, R. (1994). *Making it Explicit: Reasoning, representing, and discursive commitment.* Cambridge, MA: Harvard University Press.

Carney, R. N. & Levin, J. R. (2002). Pictorial Illustrations still Improve Student's Learning from Text. *Educational Psychology Review*, *14*(1), March, 5-26.

Carroll, W. M. (1994). Using Worked Examples as an Instructional sSupport in the Algebra Classroom. *Journal of Educational Psychology*, *86*(3) 360-367.

Cooper, R. & White, D. (2005). Teaching Transculturation: Pedagogical processes. *Journal of Design History*, *18*(3), 285-292.

Cousin, G. (2006). An Introduction to Threshold Concepts. *Planet*, *17*, 4-5.

Cunliffe, L. (1992). Why a Theory of Symbols is Necessary for Teaching Art. *Journal of Art and Design Education,* *11*(2), 143-153.

Davis, M. (2003). Barriers to Reflective Practice: The changing nature of higher education. *Active Learning in Higher Education*, *4*(3), 243-255.

Davies, P., Conneely, J., Davies, R. & Lynch, D. (2000). Imaginative Ideas for Teaching and Learning. In Booth, A. & Hyland, P. (Eds.), *The Practice of University History Teaching*. Manchester and New York: Manchester University Press.

Davies, P. & Mangan, J. (2006). Embedding Threshold Concepts: From theory to pedagogical principles to learning activities, *Threshold Concepts within the Discipline Symposium*, 30th August-1st September, University of Strathclyde, Centre for Academic Practice and Learning Enhancement, Glasgow.

Doordan, D. (1995) (Ed.). *Design History, An Anthology*. Cambridge: The MIT press.

Dorn, C.M. (1998). *Mind in Art: Cognitive foundations in art education*. Mahwah, N.J.: Erlbaum.

Dummett, M. (1993). *The Seas of Language*. Oxford: Oxford University Press.

Freeman, L. A. & Jessup, L. M. (2004). The Power and Benefit of Concept Mapping: Measuring use, usefulness, ease of use and satisfaction. *International Journal of Science Education*, *26*(2), 151-169.

Greene, B. A. & Land, S. M. (2000). A Qualitative Analysis of Scaffolding used in a Resource-based Learning Environment Involving the World Wide Web. *Journal of Educational Computing Research*, *23*(2), 151-180.

Gieben-Gamal, E. (2005). Diversifying the Design History Curriculum: A review of recent resources. *Journal of Design History*, *18*(3), 293-297.

Hayes, J. M. (2008). Thresholds and Transformation. *European Journal of Management*, *8*(3), 24-46.

Hodder, I. (1998). The Interpretation of Documents and Material Culture. In Denzin, Norman K. & Lincoln, Yvonna S. (Eds.), *Collecting and Interpreting Qualitative Materials* (pp. 110-129). Thousand Oaks: SAGE Publications.

Jausovec, N. (1994). Problem Finding and Empathy in Art. In M. A. Runco, (Ed.), *Problem-finding, Problem-solving and Creativity*. Norwood, N.J.: Albex.

Karjalainen, T. M. (2007). It Looks like a Toyota: Educational approaches to designing for visual brand recognition. *International Journal of Design*, 1(1), 67-81.

Kiley, M. & Wisker, G. (2009). Threshold Concepts in Research Education and Evidence of Threshold Crossing. *Higher Education Research & Development, 28*(4), 431-441.

Koroscik, J. S., Short, G., Stavropoulos, C. & Fortin, S. (1992). Framework for Understanding Art: The function of comparative art context and verbal cues. *Studies in Art Education*, *33*(3), 154-164.

Lave, J. & Wenger, E. (1991). *Situated Learning: Legitimate peripheral participation*. Cambridge: Cambridge University Press.

Margolin,V. (2005). A World History of Design and the History of the World. *Journal of Design History*, *18*(3), 235-243.

Mayer, R. E. & Gallini, J. (1990). When is an Illustration Worth Ten Thousand Words? *Journal of Educational Psychology, 82*(4), 715-726.

Meyer, J. & Land, R. (2003). *Threshold Concepts and Troublesome Knowledge: Linkage to ways of thinking and practicing within the disciplines, ETL project*, Occasional Report 4, Coventry & Durham: University of Edinburgh.

Meyer, J. H. F. & Land, R. (2005). Threshold Concepts and Troublesome Knowledge (2): Epistemological considerations and a conceptual framework for teaching and learning. *Higher Education, 49*(3), 373-388.

Meyer, J. H. F., Land, R. & Davies, P. (2006). Implications of Threshold Concepts for Course Design and Evaluation. In J. H. F. Meyer & R. Land (Eds.), *Overcoming Barriers to Student Understanding: Threshold concepts and troublesome knowledge* (pp.195–206). London & New York: Routledge

Miller, G. A. (1956). The Magical Number Seven, Plus or Minus Two: Some limits on our capacity for processing information. *Psychological Review, 63*, 81-97.

Paas, F. & van Merriënboer, J. (1994). Variability of Worked Examples and Transfer of Geometrical Problem-solving Skills: A cognitive-load approach. *Journal of Educational Psychology*, *86*(1) 122-133.

Perkins, D. (1999). The Many Facets of Constructivism. *Educational Leadership*, *57*(3), 25-37.

Perkins, D. (2006). Constructivism and Troublesome Knowledge. In J. H. F. Meyer & R. Land (Eds.), *Overcoming Barriers to Student Understanding: Threshold concepts and troublesome knowledge* (pp.195–206). London & New York: Routledge.

Perkins, D. N. & Salomon, G (1988). Teaching for Transfer. *Educational Leadership*, *46*(1), 22-32.

Pinker, S. (1994). *The Language Instinct: The new science of language and mind*. London: Penguin.

Prawat, R. S. (1989). Promoting Access to Knowledge Strategies and Disposition in Students: A research synthesis. *Review of Educational Research*, *59* (1), 1-41.

Rourke, A, J. (2006). *Cognitive Load Theory and the Use of Worked Examples in Design History to Teach Novice Learners to Recognise the Distinctive Characteristics of a Designer's Work*. Unpublished EdD thesis, Kensington: The University of New South Wales.

Rourke, A. & O'Connor. Z. (2009a). Look Before you Leap: Testing assumptions on visual literacy and predominate learning style modalities of undergraduate design students in Australia and New Zealand. *International Journal of Learning*, *16*(8), 33-46.

Rourke, A. J. & O'Connor, Z. (2009b). Investigating Visual Literacy Levels and Predominant Learning Modality among Undergraduate Design Students in Australia: Preliminary findings. *Design Principles and Practices: An International Journal, 3*(2), 17-28.

Rourke, A. & O'Connor, Z. (2010). Visual Literacy Levels and Predominant Learning Modalities among First Year Design Students: The influence of teacher intervention, *Design Principles and Practices: An International Journal, 4*(1), 347-360.

Rowbottom, D. P. (2007). Demystifying Threshold Concepts. *Journal of the Philosophy of Education*, *41*(2), 263 - 270.

Santrock, J.W. (2005). *Adolescence*, 10th Edition, New York: University of Texas. McGraw Hill.

Schnotz, W. (2002). Towards an Integrated View of Learning from Text and Visual Display. *Educational Psychology Review*, *14*(1), March, 101-120.

Solso, R.L. (2003). *The Psychology of Art and the Evolution of the Conscious Brain*. Cambridge: MIT Press.

Tulving, E. & Osler, S. (1968). Effectiveness of Retrieval Cues in Memory for Words. *Journal of Experimental Psychology*, *77*, 593-601.

Tuovinen, J. & Sweller, J. (1999). A Comparison of Cognitive Load Associated with Discovery Learning and Worked Examples. *Journal of Educational Psychology*. *91*(2) 334-341.

Vygotsky, L.S. (1978). *Mind and Society: The development of higher psychological processes*. Cambridge, MA: Harvard University Press.

Ward, M. & Sweller, J. (1990). Structuring Effective Worked Examples. *Cognition and Instruction*, *7*(1) 1-39.

Warren, L. R. & Horne, J. W. (1982). What Does Naming a Picture do? Effects of prior picture naming on recognition of identical and same-name alternatives. *Memory and Cognition*, *10*(2), 167-175.