Graphic design pedagogy: Employing reflection to support the articulation of knowledge and learning from the design experience

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Abstract
This paper describes the methodology for an ongoing PhD study that explores how reflection supports articulation of design knowledge by the tertiary graphic design student. The study seeks to make connections between the reflective process and the articulation of knowledge inherent in the design experience, leading to the transfer of that knowledge to future problems.

A case study strategy of inquiry has been employed, which draws on a mixed methods research approach, framed by cognitive psychology theory. An intervention in the form of a structured critical reflective learning framework has been developed and applied. To analyse the outcomes emerging from the learning framework, a taxonomy identifying levels of cognition evident in student reflective reports has been developed. The rationale for this methodology is discussed, along with how the approach was implemented.

Preliminary findings from the case study are reported. Initial observations suggest that structured critical reflection can play an important supporting role to encourage enhanced cognitive engagement and to support articulation and knowledge transfer by the design student.

Keywords
Design pedagogy, reflection, design knowledge, cognition, knowledge transfer, research methodology.

Introduction
This paper describes an on-going PhD study investigating how structured critical reflection can support the graphic design student articulate knowledge and learning from the design experience, in a manner that encourages knowledge transfer.

Traditionally, graphic design education has drawn on the principals of studio-based learning, project-based learning, and public critique (Davies & Reid 2000). This reflects the general approach in the graphic design program at the University of Wollongong, Australia, where this study is situated. Guided by feedback from teachers and peers, these learning approaches typically engage students in authentic learning environments with increasingly more complex design projects as
they advance through the course. This learning-by-doing approach reinforces a traditional pedagogical belief in design curricula that the best way to learn about design is through the act of designing (Dorst & Reymen 2004). This seems on the surface to be an effective way to approach the complex and ill-structured nature of design problems, however, on close examination this may not be the most effective way to teach or learn, and opportunities for learning may be missed. In the traditional pedagogical model the final design artefact is the primary measure of learning, which has the effect of focussing students on the outcome of the project rather than the process by which that outcome is achieved (Kvan 2001; Lawson 2006). It is seldom clear what the student has actually learnt as the new knowledge is bound within the artefact and the context in which it was developed.

To address these limitations, a revised pedagogical approach has been developed that seeks to: support cognitive engagement through reflective practice, encourage abstract levels of cognition, and support articulation of generalisations from the learning experience. Through this process of generalisation, the aim is to assist the learner to articulate the knowledge represented in their design experience, establishing a platform to support transfer of knowledge to other situations.

**Methods used**

**Research design**

Cognitive psychology is the theoretical basis framing the intervention for this study, in particular the concepts of ‘high road’ and ‘low road’ transfer (Perkins & Salomon 1989). A primary aim of the intervention is to support the articulation of design knowledge in ways that would encourage the transfer of that knowledge to future situations. ‘High and low road’ transfer provide a means by which to conceptualise this process.

A case study strategy of inquiry was chosen, as the study is located in a single setting (a classroom), a specific bounded system, from which an in-depth understanding is sought. The research seeks to understand how one group of students enrolled in a single subject of study respond to a specific intervention.

Use of a mixed-methods approach allows a more complex picture of the case study to be developed. By employing both qualitative and quantitative methods it is possible to obtain a more comprehensive data set, thus enhancing the impact of the study.

**Theoretical framework: Cognitive psychology**

The primary aim of the intervention in this study is to encourage students to learn from the specific projects in which they engaged in ways that would allow them to use that knowledge in future situations. Put another way, the aim is to enable learners to ‘transfer’ their knowledge from their student projects to their future practice as designers. The phenomenon of transfer has been of interest in educational psychology for many years (Perkins & Salomon 1988); (Bransford & Schwartz 1999), and in particular the concepts of ‘high road’ and ‘low road’ transfer (Perkins & Salomon 1989).

‘Low road’ transfer occurs when skills and knowledge learned in one context can be readily applied to another similar context (Perkins & Salomon 1989). This process occurs with relative ease because the similarities between the learning context and the new context allow the learner to recognise which skills and knowledge are useful and how they should be applied. ‘High road’ transfer, by contrast, occurs when knowledge is used in a new context that is different to the learning context (Perkins &
Salomon 1989). This type of transfer is believed to rely on mindful, deliberate abstraction of principles, either in advance of its new application or by recalling past experiences in light of a new situation and abstracting relevant principles retrospectively.

In graphic design practice, new problems often bear little surface similarity to past experiences because the particularities of design problems are highly variable. Instead, graphic design professionals rely on ‘high road’ transfer to learn lessons from current projects that will be useful in future practice and to draw on past experiences when faced with a novel problem. Further, in graphic design education it is not possible for students to be introduced to every type of problem as part of their training. They must learn from a limited number of student projects, which may or may not closely resemble their future work as a designer. Therefore, the practice of high road transfer is essential to the preparation and practice of graphic designers.

For these reasons, teaching for high road transfer has been used as the theoretical basis for the intervention in this study. It should be noted that in order to manage the scope of the study, the researchers have been concerned with promoting abstraction through reflection as a precursor that supports transfer rather than attempting to measure transfer itself.

**Case study as a research strategy**

A case study approach departs from other traditions of qualitative research in that it focuses on a bounded system (the case) that is studied in depth (Creswell 2005). Yin defines a case study as “an empirical inquiry that investigates a contemporary phenomenon within its real-life context, especially when the boundaries between phenomenon and context are not clearly defined” (Yin 2003 p. 13). A case study approach is particularly suited when ‘how’ or ‘why’ questions are being posed and when the investigator has little control over events, and should be seen as a comprehensive research strategy that includes the logic of the research design, data collection techniques, and specific approaches to data analysis (Yin 2003).

This case study sets out to provide an insight in to how the implementation might enhance student learning. Case studies of this kind, in which the researcher develops and implements an intervention based upon instructional theory, offer a powerful means for investigating and furthering theories of instruction (Reigeluth & Frick 1999). This is because they can investigate the effects of an instructional intervention that operationalises particular theoretical principles in a natural setting. This has the strength of allowing a realistic assessment of a new instructional approach in combination with a comparison of the actual outcomes and experiences with those predicted by the theory. Thus the implementation of the intervention bounds the case and allows for in-depth investigation of the phenomenon.

**Mixed methods as a research methodology**

Social phenomena are complex and a range of research methods are needed to better understand these complexities (Creswell, Plano Clark, Gutmann & Hanson 2003). Whilst employment of mixed-methods approaches in social science research has been widespread (Maxwell & Looms 2003), as a research method it is still in its adolescence (Tashakkori & Teddlie 2003). By using more than one research method it is possible to obtain a more complex picture of human behaviour and experience, and increase the scope and comprehensiveness of the study (Creswell et al. 2003; Morse 2003; Mertens 2005).

This study has implemented a sequential mixed method approach (Creswell 2009) where qualitative methods are the primary method and supplementary quantitative data in the form of a survey to provides a more comprehensive picture of the case.
Qualitative methods suit research that is designed to provide an in-depth description of a specific program, practice, or setting and involves a set of interpretative material practices to reveal the world in which the research and observer are located (Mertens 2005); qualitative researchers “study things in their natural settings, attempting to make sense of, or to interpret phenomena in terms of the meanings people bring to them” (Mertens 2005 p. 229).

**Research context**

**The setting for the study**

This study was conducted with students enrolled in a core design subject in the final session/semester of the three-year Bachelor of Creative Arts (Graphic Design) at the University of Wollongong. Thirty-four students were enrolled in the subject. The student cohort consisted of a equal gender split, with approximately 75% of the cohort aged 18-22, 20% aged 23-30, and 3% 30 years and above.

**The Intervention**

**A structured critical reflective learning framework**

An intervention was developed to address the limitations regarding traditional approaches to graphic design pedagogy outlined in the introduction by formally engaging with the design process and the learning opportunities it presents. Through this approach the intervention seeks to support the learner to articulate their new knowledge in a generalised manner, decontextualised from the design artefact. The proposition is that supporting the learner in this way serves to unlock the knowledge bound within the design artefact, establishing a platform from which the learner can transfer this knowledge to other situations.

The intervention has been articulated in the form of a structured critical reflective learning framework. Structured reflection has been described as the process of “systematic reflection that is performed in a regular way during a design process” (Reymen, Hammer, Kroes, van Aken, Dorst, Bax & Basten 2006 p. 148). Critical reflection is defined as reflection that “necessitates a change to deep-seated, and often unconscious, beliefs and leads to new belief structures” (Kember, McKay, Sinclair & Wong 2008 p. 2).

**Background to the framework**

The framework builds on a foundation of studio-based and project-based learning, and engages with the principles of: reflective practice (Schön 1987; Valkenburg & Dorst 1998), problem-based learning (Koschmann, Myers, Feltovich & Barrows 1994), and experiential learning (Kolb 1984; Boud & Walker 1991). These learning approaches are briefly outlined below.

Project-based learning, a common practice employed in graphic design education (Pearson, Barlowe & Price 1999; Davies & Reid 2000; Ehmann 2004), has been described as a “comprehensive approach to classroom teaching and learning that is designed to engage students in investigation of authentic problems” (Blumenfeld, Soloway, Marz, Krajcik, Guzdail & Palincsar 1991 p. 369). By placing students in realistic, contextualised problem-solving environments, project-based learning can serve to establish bridges between knowledge gained in the classroom and real-life experiences (Blumenfeld et al. 1991 p. 369).
Studio-based learning is traditionally situated in a design studio environment under tutelage of a master designer (Lackey 1999). It encourages ‘learning by doing’ in a professional environment similar to one students would experience in industry (Carbone, Lynch, Arnott & Jamieson 2001). In the studio, the teacher engages the student in the activity of designing with the relationship between teacher and student framed by the master-apprentice approach (Kvan 2001). Kvan describes four fundamental steps in the traditional studio-based learning process: the formulation of the problem, the exploration of solutions through ‘action-based activity’, problem re-examination, and examination by jury. The exploration of solutions and problem re-examination steps are cyclic in nature with the student preceding to final examination once they are satisfied (or the deadline is reached) with their design solution.

Schön (1987) highlights reflection as a critical element of professional design activity. Describing the notion of the reflective practitioner, Schön articulates two types of reflection, reflection-in-action and reflection-on-action. Reflection-in-action takes place when the design professional is ‘surprised’ by, or experiences a unique situation during the development of the design solution. Reflection-on-action involves the review of actions from the recent past and has been described as the “process of making sense of an action after it has occurred and possibly learning something from the experience which extends one’s knowledge base” (Eraut 1994 p. 146).

Valkenburg and Dorst (1998) apply Schön’s reflective practice theory to outline the process of practice in an industrial design studio. They articulate the mechanism of reflective practice based on Schön’s reflective practicum in four stages: ‘naming’, in which the problem is articulated; ‘framing’, the context of the problem; ‘moving’, the design activity; and ‘reflecting’, in which the designer assesses the design development within the frame (problem context). The reflective stage is a “conscious and rational action” (Valkenburg and Dorst 1998, p. 254) that may guide the student towards re-framing the problem, further design activity, or addressing new issues that emerge through the reflective process. Valkenburg and Dorst conclude the descriptive method provides a framework that allows the breakdown of the design process for observation and discussion. They suggest this approach could be beneficial in the education environment as it provides a framework in which to articulate the activity of design.

Problem-based learning has been described as an instructional educational methodology in which students engage with contextualised problems and look to discover meaningful solutions (Rhem 1998). An essential aspect of problem-based learning is the use of ‘real-world’ problems to frame the approach to learning (White 1996). It is through this discovery that the students identify what they know and importantly what they don’t know, establishing a framework in which to approach the problem (Duch 1997; Major & Palmer 2001). Koschmann et al. (1994) describe five fundamental steps in problem-based learning:

1) problem formulation;
2) development of a solution through a self-directed learning approach;
3) a re-examination of the problem to test the proposed solution;
4) abstraction where the solution is contextualised with other known cases;
5) a final reflection stage where the students reflect and critique their learning process seeking to identify areas for future improvement.

Usually working in groups, the students circulate through the first three stages until a satisfactory solution is developed before moving to the stages of abstraction and reflection. The final two stages of problem-based learning, abstraction and reflection
provide a structure in which to approach the final stage of the framework devised for this study.

A common understanding of experiential learning is based on the work of Kolb (Moon 2004). Informed by the work of Dewey, Lewin, and Piaget, Kolb (1984) describes the cycle of experiential learning in four linked stages: concrete experience; reflective observation drawn from the experience; abstract conceptualisation which involves the development of general rules describing the experience, or the application of known theories to it; and active experimentation involving the formation of approaches to modify the next occurrence of the experience. Kolb (1984) states that learners might cycle through the four stages a number of times and may start their learning at any stage of the cycle.

Reviewing the literature, Moon (2004) observes that there are many criticisms of Kolb’s cycle including that it is overly simplistic and formulaic, does not adequately consider transfer of learning, is too focused on the notion of the experience as a phenomenon of the individual, and does not take into account tacit knowledge. However, Moon does suggest that these criticisms may have more to do with the way the cycle has been reinterpreted, rather than the cycle itself.

An important aspect of learning from experience is that an intervention in some form or another is required to facilitate the generation of knowledge from that experience. Criticos makes the observation “if experience in itself was so valuable, then humans who are enmeshed in experience ought to be more knowledgeable than they are. Sadly the only conclusion that can be reached is that we do not learn from experience" (Criticos 1993 p. 161). Criticos suggests that to generate knowledge from experience, some form of processing of that experience should take place.

**Framework described**

Drawing on elements of the learning approaches described above, the framework (described in figure 1) commences with an *authentic problem* or design brief, the frame or design context is established, learners then engage in a cyclic process of *design activity* and *reflection during the project*. Once the design solution is complete (or the deadline reached) the students submit the design artefact and then move to the final stage of *reflection on the project*.

The *authentic problem* or design brief can be structured or unstructured depending on the learning objectives and level of study, or even developed by the student themselves. More importantly, an authentic problem is established to drive the learning (Blumenfeld et al. 1991). The *design context* is then articulated with the extent of detail determined by the learning objectives and level of study. While the design context has been articulated separately to the design brief in this framework there is no reason it could not be included in the design brief. What is important is that the design context is separated from the design problem as this plays an important role in the later stages when the student is asked to make observations regarding their design outcomes in a decontextualised and generalised manner.

Once the problem and context are established the student enters the stages of *design activity* and *reflection during the project*, which occur in a cyclic manner within the *design context*. The *design activity* stage is the activity of designing or ‘learning-by-doing’ and is fundamental to the authentic learning environments of the learning models that have informed this framework. The *reflection during the project* stage draws on the principle of reflection-in-action from Schön’s model of the reflective practitioner (1987). During these two stages the *design context* and/or the original *problem* maybe re-examined.
Once the design solution is satisfactorily developed or the deadline is reached, the student enters the *design artefact* stage where they present their solution in the form of a physical artefact. What form this might take will again be influenced by the learning objectives and level of study, but also the time allocated to the project. Presenting the design solution in the form of a physical artefact is also fundamental to authentic learning environments.

Up to this point the framework would be very familiar to those educators following a traditional learning approach as the learning framework has close parallels with the fundamentals of project-based and studio-based learning. Where the framework begins to depart from these models is with the formalised articulation of reflective practice. While it could be argued that reflection is inherent or implicit in project-based and studio-based learning models, by formally articulating reflective practice, the new framework seeks to highlight for the student the role reflection plays in the learning process.

By breaking down the design experience for the student into discrete stages, provides points of reference for them to evaluate and analyse their design experience. This is formalised through the introduction of reflective assessment.
tasks. These tasks lead students through a series of learning prompts (Nuckles, Hubner & Renkl 2009) to document their design ideas and thinking, their research, and design process. Students also document the feedback they receive during formalised critique and importantly how they feel about that feedback. This serves to engage the student in the feedback process and the emotional aspect of their learning experience (Boud & Walker 1991).

The new framework departs from the traditional graphic design pedagogical approach with the inclusion of an additional stage after submission of the design artefact. This additional and final stage is identified as reflection on the project. The students are prompted: to stand back and distance themselves emotionally from the design artefact and process so they are better placed in which to observe and analyse their experience; to identify and analyse significant moments in the process and outcomes from the artefact; and to employ these observations to develop generalisations about their experience. The students express this in a written report guided by a series of learning prompts.

This stage is primarily influenced by the Schön’s notion of reflection-on-action and also draws on the principles of problem-based learning and experiential learning. This stage has similarities with the reflective stage of the competency centered and project-based curriculum developed in the department of Industrial Design at Eindhoven University of Technology (Gielen, Janssen Reinen & Dorst 2007).

Standing back from the design experience has parallels with the abstraction stage of problem-based learning. Abstraction provides “an objectivity in relation to the initial learning experience, which has the effect of clarifying it and fostering the ability to work with it, so the learner can draw out potential learning” (Walker 1985 p. 63). Once students are through the design artefact submission phase they are in a better position to distance themselves emotionally and look objectively at their solution. This is achieved by prompting the students to describe the design problem, their primary research, and their design process in a report format.

The students are then prompted to identify and describe what they believe are critical moments in their design process/outcomes and explain why. This aspect draws on critical incident analysis described by Tripp (1993) and Ghaye & Lillyman (1997). Tripp notes “incidents happen, but critical incidents are produced by the way we look at a situation, it is an interpretation of the significance of the event” (1993 p. 8). It is reflecting on and analysing these critical incidents that “assist the practitioner in moving their practice forward and obtaining expert status” (Ghaye & Lillyman 1997 p. 80).

Building on the observations that emerged from the critical incident analysis phase, the students are then prompted to; describe possible alternatives to their submitted design artefact, to identify and generalise what they learnt from their experience, and how they might approach a similar design problem in the future. This has parallels with the experiential learning stages described by Kolb (1984) of abstract conceptualisation involving the development of general rules describing the experience, and active experimentation involving the formation of approaches to modify the next occurrence of the experience. Figure 2 summarises the framework, key literary influences, and the learning supports described above.
**Data collection**

Multiple data sets are employed for the study in keeping with a mixed-methods approach and to assist in developing an in-depth picture of the case (Creswell 2007) and provide a triangulation strategy to enhance data dependability, credibility, and confirmability (Mertens 2005; Creswell 2009). Data includes a survey, semi-structured interviews, observation, a researcher’s journal, and participant artefacts.

A survey with quantitative and qualitative questions was applied to establish research participant background, their understanding of the design process, thoughts and opinions regarding reflection during the design process and on completion of the design artefact. Semi-structured interviews were conducted with nine volunteers at 3 points during the course of the study to provide in-depth individual cases within the broader case. This is described as a nested case study. An alternative person was commissioned to conduct the interviews to avoid a conflict of interest for the researcher (also lecturer for the subject).

A key feature of the data approach for this study is the collection and analysis of participant artefacts (written reflective reports). The reports were based on the reflective learning framework and were embedded into the subject curriculum in which the study was based. The reports took the form of assessment tasks including:

- Project-based learning
- Studio-based learning
- Reflection-in-action (Schon)
- Mechanism of reflective practice (Valkenburg & Dorst)
- Structured reflection (Reyman et al)
- Experiential learning (concrete experience, reflective observation)
- Reflection-on-action (Schon)
- Problem-based learning (abstraction, reflection)
- Experiential learning (abstract conceptualisation, active experimentation)

**Figure 2: Structured critical reflective learning framework with key literary influences and learning supports**
a 1200 word interim reflective assessment task repeated three times at significant points during the development of the design project, and a concluding 4000 word reflective assessment task completed after submission of the final design artefact that directed participants to look back over the whole project.

The reflective assessment tasks are structured in four key sections, describing the design process, summarising critique feedback, identifying critical incidents, and making observations about the design experience. The final reflective assessment task incorporates the same key sections, although omitting feedback (as no further feedback takes place once artefact submitted), but adding two new sections, identifying new learning, and how the experience could impact on future practice. The tasks guide the student to capture, in a formalised manner, their design experience and thinking during these key discrete stages.

**Data analysis**

Qualitative analytic strategies are being employed to analyse the data collected during this study including, coding, memoing, pattern identification, and the drawing of conclusions (Miles & Huberman 1994). Analysis to date has focused on coding the reflective written assessment tasks, which has involved the development of a taxonomy to identify and code the levels of cognition present, and also the use of the software program QSR NVivo for its data search options and ability to manage and map large volumes of data.

**Development of a cognitive taxonomy**

To identify the levels of cognition evident in the written reflective assessment tasks, a taxonomy was developed based on the work of Hatton & Smith (1995) and Bennett (2002). Hatton and Smith developed one of the best known frameworks describing levels of reflection (Moon 2004) which drew on experimental work from the reflective writing of teacher education students, and was developed into a tool for wider application.

Adapting the work of Hatton and Smith (1995), Bennett (2002) developed a cognition taxonomy to identify levels of reflective thinking evident in reflective writing of students in a Masters of Education. Bennett identifies and describes five levels of cognition: **reproductive description, summarising description, interpretation, judgement, and generalisation**. The levels of cognition with descriptors are outlined in Table 1. In collaboration with Bennett, these descriptors have been modified to allow application to this study. A sixth level of cognition has been added, described as **abstraction**, to differentiate thinking that moves beyond the context of the design project to address wider or future design practice from generalisations about the project context.

The aim is that the student demonstrates evidence of engagement with the **generalisation** and **abstraction** levels of cognition. **Generalisation** prepares the student for low road transfer and **abstraction** for high road transfer. A general observation or conclusion articulated within the context of the project (**generalisation**) prepares the student to transfer that knowledge to a similar context (low road transfer). By articulating a general principle or procedure that moves beyond the design project (**abstraction**), the knowledge is decontextualised from the learning situation. It is here that the new knowledge has the potential for high road transfer, that is, to be applied in a different context to the learning context (Perkins & Salomon 1989).
<table>
<thead>
<tr>
<th>Cognitive levels</th>
<th>Cognitive Descriptors</th>
</tr>
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<tbody>
<tr>
<td>Abstraction</td>
<td>Presents a general principle or procedure that moves beyond the design project to address wider or future practice</td>
</tr>
<tr>
<td>Generalisation</td>
<td>Presents a general observation or draws a generalising conclusion within the context of the project</td>
</tr>
<tr>
<td>Judgement</td>
<td>Goes beyond re-presenting or interpreting information to offer a value judgement or claim within the context of the project</td>
</tr>
<tr>
<td>Interpretation</td>
<td>Identifies and seeks to explain or make sense of an event or statement by interpreting information from the project</td>
</tr>
<tr>
<td>Summarising description</td>
<td>Descriptive response that summarises or recounts information presented in the project. This includes re-wording and re-structuring of a number of events into one statement</td>
</tr>
<tr>
<td>Reproductive description</td>
<td>Descriptive response that reproduces information directly from the case with no elaboration</td>
</tr>
</tbody>
</table>

**Table 1: Cognition taxonomy**

**Preliminary observations from the data**

This paper presents some preliminary results and observations from the study, however detailed analysis is still ongoing and will be reported more fully in future publications. The four reflective reports were coded in the QSR NVivo data analysis software program using the analysis framework. This was done by assigning individual sentences in each report to one of the levels. When assigning an individual sentence to a particular cognition level, the context of the sentence was considered, and if some doubt existed regarding levels placement, then the sentence was coded at the lower level.

The data from an individual participant is presented below (figure 3) to illustrate the data analysis approach and the nature of the results that can be derived. The figure shows the four reflective assessment tasks (identified as RT 1-4), divided into the key sections (as previously described) and coded using the six levels of the analysis framework (cognition taxonomy). The table beneath the graph indicates the percentages at each level for each section of an assessment task.

Focusing on the concept of high and low road knowledge transfer, which would be evident in the generalisation and abstraction levels of cognition, it was anticipated that engagement in these levels would occur across the key sections of Observation (RT1-4), New Learning (RT4) and Future Practice (RT4), and strengthen towards the later reports. This was due to the nature of the learning prompts for these sections and the effect of participants gaining familiarity with the nature of the tasks. While the example presented concords generally with this expectation there is a lack of higher level thinking within the Observation section of RT4, but stronger engagement in the New Learning and Future Practice sections. Also of interest is that thinking in the baseline category of reproductive description only occurs in the final reflective task (RT4). This may be due to the increased length of the final task, allowing the participant space to explore across the full range of cognitive levels.

Patterns present in the broader data set will reveal insights into how student engagement with reflection as a support mechanism impacts their levels of cognitive engagement.
Figure 3: Individual participant profile: Reflective tasks 1-4 coded to levels of cognition
Conclusion

Explored here is the notion that structured critical reflective practice has the potential to support enhanced cognitive engagement and transfer of knowledge in design education. The paper describes an ongoing PhD study that seeks to make connections between reflective practice, the articulation of knowledge inherent in the design experience, and how this might support knowledge transfer to future design problems.

This paper has focused in particular on the research methodology developed for the study. An important challenge has been to develop a methodology that would provide a sound academic basis in which to conduct the research. Utilising a case study strategy of inquiry, a mixed-methods research approach, and drawing on cognitive psychology theory, has provided an academically robust framework in which to undertake the research. This has the benefit of bringing credibility to the conclusions that are emerging from the study, and importantly, has also provided a structure to guide the development of the research method. This has allowed the case to be fully investigated and reported in a manner that will contribute to the body of research in design pedagogy. This is particularly evident in the manner in which the intervention for the study was developed and successfully implemented, and in the development and application of a taxonomy to identify and code the levels of cognition present in participant artefacts.

Based on the quality of data collected and preliminary analysis, the research methodology developed for this study has been successful in delivering tangible insights into the effectiveness of the intervention, from which credible conclusions may be drawn. The result is a research methodology that the authors believe is highly suitable to the conditions of the study and the type of research questions being asked, and is comprehensive and flexible, allowing a thorough investigation of the case. This methodology could justifiably inform future research in design pedagogy.

References


**Grant Ellmers** lectures in the Graphic Design program at the University of Wollongong, Australia and researches in the area of design pedagogy. He is undertaking a PhD in the Faculty of Education at the University of Wollongong that explores how reflection supports the articulation of design knowledge. The study seeks to make connections between the reflective process and the articulation of knowledge inherent in the design experience, leading to the transfer of that knowledge to future design situations. Grant was a University of Wollongong Teaching and Learning Scholar during 2005/6 where he investigated Art and Design assessment practices in higher education, specifically exploring approaches to assessing creativity. In 2008 Grant was one of fifty Graphic Design educators worldwide invited by Steven Heller, design critic and author, to contribute to the book, "Design School Confidential: Class Projects from International Graphic Design Programs", due for publication in 2009.

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