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An overview of research methods in visual communication design education.

The article presents a review of studies done on research in visual communication design education. It examines the use of research in postgraduate and undergraduate programmes, and evaluates the debate over research methods applicable to the field. The article includes an overview of commonly-used methods for visual communication design education such as Action Research and Reflective Practice, and an outline of research emphasis in visual communication design at postgraduate level, as well as a brief overview on the need for early training in the research discipline for visual communication in undergraduate studies.

Keywords: research methodology, design research, art & design education, visual communication design.

Introduction

There is consensus amongst educational researchers on the growing importance of research in higher education in the field of art and design (Mimoso, 2011; Yee, 2010). Yee (2010) states that the emergence of “a number of major international conferences dedicated to doctoral research reflects the growing interest in the nature of research and practice of the field” (p. 2). The understanding and application of research theory, and research methods, have become essential elements in research-based design management universities (Kennedy, 1997). This shift from an emphasis on training in traditional vocational courses to a focus on research being integral to the course, signalling a transformation in higher education in design. The design practice in visual communication design education has become more reflexive and multidisciplinary, in the sense that it now seeks an understanding of research

methodologies, in both classical disciplines and cultural studies, as one of the key components that allows creativity to flourish (Bennett, 2006).

Concurrently, the challenge for design education is to move the teaching of practical design skills only to equipping a graduate with lifelong learning skills to succeed in the ever-evolving design industry. As Tim Brown (2012) said, “the world’s problems have become more complex, the traditional design process has been challenged” (p. 18). Brown goes on to emphasize that designers need to learn scientific methodology because it enables designers “to ask more of the right questions, come up with better hypotheses, design effective experiments and most importantly, share our learning” (p. 20).

One possible way to enhance design practice is to provide the know-how of conducting research, as a positive addition to the design students’ skill set, research study also “enhances their physical output as it expands their creative freedom” (Bennett, 2006, p. 13). As defined by Khoury and Khoury (2009), “research is an insightful method for the generation of meaningful design” (p. 837). This further supports the rationale that our future designers need to be equipped with research knowledge to be innovative in design.

With the increase in the number of students opting for courses in art and design (Hockey and Allen-Collinson, 2000; Newbury, 1995; Yee, 2010) it is important to inculcate in the students the value of research study and its relevance to the design field. With reference to the intake of art and design students, Newbury (1995) mentions that “certainly in the United Kingdom . . . the number of research students registered for higher degrees has more than doubled in the last five years” (p. 53). The art and design departments in universities have also expanded rapidly in recent years, certainly in the United Kingdom (Newbury, 1995, p. 53) and in Singapore, the

knowledge and skills to conduct research have become necessary components in undergraduate and graduate programmes (Bennett, 2006). Hence, this article seeks to provide an overview of the use of methods in research projects in the field of design education, particularly in visual communication design and highlight their importance to this field.

A brief definition of visual communication design

The definition of visual communication design is subject to various interpretations as it is often used interchangeably with terms such as graphic design and graphic communication. McCoy (1998) describes the birth of visual communication design as “a spontaneous response to the communication needs of the industrial revolution in capitalist market-based economies” (p. 3). As technology changes, so does the application of visual communication design in tandem with technological advancement, which broadly encompasses art and design, from typography and illustration to motion graphics and web design. According to Swanson (1998), visual communication design “should be about meaning and how meaning can be created... it is about expression and the mass dissemination of information (p. 27).

For practitioners (i.e., graphic designers, advertising designers, art directors, and visual artists), visual communication design is framed around the creation of meaningful imagery that conveys ideas and messages to a specific audience or the general public through a variety of visual technologies (often combined), - whether for reasons of persuasion, entertainment, information, or enlightenment (Meggs, 2005).

Research methods in visual communication design education

Overview of research methods in visual communication design education

One might consider research in design education to be part of an inherent set of questioning processes; Friedman (2003) describes research as simply a way of asking questions. According to Durling, research seeks to “ask questions, select appropriate methods, test the questions, analyse the results, and disseminate the conclusions unambiguously” (2002 p. 81). Yee (2007) counters that the process of asking questions in design is often hidden, carried, and adapted, whereas research has to be open, rigorous, and replicable. Instead of focusing on the differences, Newbury (1996a) lists four common criteria of research that apply to any field of study, including art and design. He asserts that regardless of the academic discipline, research ought to be systematic, rigorous, critical, reflexive and communicable. Yee (2007) affirms this by referring to Archer’s (1995) definition of research as a “systematic enquiry whose goal is communicable knowledge” (p. 6), before going on to identify suitable methods for practice-based research such as Action Research (McNiff, 1988) and Reflective Practice (Schön, 1987).

Action Research

The introduction of Action Research is widely attributed to Lewin (1946), whose formula encompasses a cycle of planning, acting, observing, and reflecting. By applying this method to real-life situations in which the researcher becomes an involved participant, the solutions are assessed for the results they produce, allowing the researcher sufficient scope to analyse and revise the plan to improve the situation, and then start the process all over again in a continuous spiral (Charles & Ward, 2007).

100 In data-driven Action Research, generation, intervention, and testing of theory
101 coexist in an iterative circle (Checkland, 1991). In contrast, theory-driven research
102 “becomes a process of extending, refining or challenging existing knowledge” (Yee,
103 2007, p. 5) by allowing existing literature and knowledge to generate creative ideas.
104 Hart (1998) and Swann (2002) propagate an imaginative approach to research.
105 According to Hart (1998), it entails “having a broad view of a topic; being open to
106 ideas regardless of how or where they originated; questioning and scrutinizing ideas,
107 methods and arguments regardless of who proposes them; playing with different ideas
108 in order to see if links can be made; following ideas to see where they might lead” (p.
109 30).

110 Action Research “underpinned and guided the research processes” (Saikaly,
111 2004, p. 9) of various proposed alternative research methods (e.g., Findeli, 2008;
112 Findeli et al. 2008; Marshall & Newton, 2000; Sevaldson, 2000). The “action” usually
113 occurs in the course of producing the creative output. And art and design researchers
114 have either renamed Action Research (Findeli, 2008; Sevaldson, 2000) or presented it
115 as alternative methods (Marshall & Newton, 2000) for design research. These are
116 highlighted below:

- 117 1. Findeli (2008) described Action Research as “project-grounded research”. It stems
118 from projects that implement a systematic process aimed at seeking and acquiring
119 knowledge of the world we live in by looking through ‘designerly’ lenses.
- 120 2. Sevaldson (2000) brought forward a generic model for design research, the
121 “integrated conglomerate approach”. The “action” happens in the course of
122 learning through doing and exploration through practice.
- 123 3. The “grounding research in practice” approach of Marshall and Newton (2000)
124 asserts the necessity for research to exist in the context of practice for the purpose

of refining the activity based on the tested propositions, wherein the engagement is more concerned with practical considerations rather than the rigour of the research methods used.

4. Jonas and Chow (2008) also mention that Action Research is usually known as “research through design” elsewhere in design research.

Reflective Practice

Nickols (2000) concluded that there are three distinct types of knowledge: explicit, implicit, and tacit. Explicit knowledge is ‘existing’ knowledge that has already been expressed through words, data, formulae, specifications and other tangible means (Lee, Foo, & Goh, 2006). Knowledge that has not been articulated but can be identified and expressed by observing the behaviour or performance of someone who is competent is implicit (Nickols, 2000). Tacit knowledge, however, is a kind of inherent knowledge gained from experience, intuition, or emotions that cannot be articulated. Polanyi (1997) simply explains it as that scenario in which “we know more than we can tell.” Examining the diverse definitions of tacit knowledge by various authors on the subject, Haron (2005) found that the “concepts of personal, experientially acquired, goal attainment values and collective” were the most commonly associated with this kind of knowledge.

Design, as a practical discipline, often produces tacit knowledge. Schön (1987) describes this as ‘knowing-in-action’, which a professional performs intuitively and can be observed from the patterns of his/her behaviour. Schön also recognises the use of ‘reflection-in-action’ as a thought process of professionals where they stumble upon an unpredicted outcome in the middle of a task, become aware of it, analyse its effect and respond by making changes to their actions. Rust (2004) had linked tacit knowledge with research by illustrating how tacit contributions to design

inquiry can help to create knowledge and establish a research model for both design and natural sciences.

The current trend seems to favour “reflective enquiry into practice” (Yee, 2007) for the study of visual communication. Loughran (2002) puts reflective enquiry into practice in the context of “purpose, framing, and articulation”. By distinguishing a problem or situation that forms the purpose of the research at the onset, students can frame (and reframe) the issue as their perspectives change in the course of the design process, all the while recording their thoughts and decisions for further and deeper reflection. Schön (1992) observes that “the designer *constructs* the design world within which he/she sets the dimensions of his/her problem space, and invents the moves by which he/she attempts to find solutions” (p. 142). With greater reflection being put into words, there is a lot more knowledge that can be gleaned from the design practice, as “designers put things together and bring new things into being, dealing in the process with many variables and constraints, some initially known and some discovered through designing” (Schön, 1987, p. 41–42).

Glanville (2003) and van Schaik (2000, 2003) claim that Reflective Research is an effective approach for design research, as it requires students to reflect on their research process through “abstraction of themes, testing and re-abtracting—a distillation” (Glanville & van Schaik, 2003, p. 37). Also, by reflecting on their own work, students can not only understand how they themselves do things, but also magnify their knowledge and ability through a line of questioning that probes deeper into their area of research and helps them crystallise their thoughts. Through Reflective Research, Glanville and van Schaik are more concerned about the “how” than the “what” of a research process, as they find that design is a process more than an outcome, and therefore is more revealing when studied throughout its various

stages of activity. Similarly, Yee (2007) has used Reflective Research to understanding her own practice, especially on research projects that involved multi-disciplinary research teams.

Research emphasis in visual communication design at postgraduate level

Since the late 1990s, there have been several studies on research methodology in art and design education. However, these studies have been conducted mainly in Western countries and at master's or doctoral levels. According to the reviews, most of these studies focused on developing appropriate models of practice in research education and training. The proposed models included imaginative approach, reflective practice or enquiry, 'designerly' method, design as research, interpretation approach, bricolage method, and visual research methods¹. Mimoso (2011) states that, as the research training in 'art and design is at a formative phase' (p. 4), there is a need to devise alternative methods for art and design research, especially since it is practice-led. She further urges that it is important to develop a language of research for communication between researchers in art and design disciplines, as well as to demonstrate their research process and findings to other academic disciplines.

¹ The imaginative approach, also known as research imagination, is about having a broad view of a topic; being open to ideas regardless of how or where they originated; questioning and scrutinizing ideas, methods and arguments regardless of who proposes them; playing with different ideas in order to see if links can be made; following ideas to see where they might lead (Hart, 1998, p. 30).

The reflective practice or enquiry involves thoughtfully considering one's own experiences in applying knowledge to practice while being coached by professionals in the discipline (Schön, 1996). It focuses on design as enquiry rather than design as problem solving.

Designerly method refers to the practice-based research procedures conducted by designer, which the mode of problem solving is 'solution-focused', and the mode of thinking is 'constructive' (Cross, 1982).

Design as research is a research process initiated for the purposes of enriching or modifying aspects of a particular profession. The process is influenced by Schön (1992), where he observes that "the designer constructs the design world within which he/she sets the dimensions of his/her problem space, and invents the moves by which he/she attempts to find solutions" (p. 142).

Interpretation approach employs interpretation as a method to build a new rationality: constructing material culture, holding as a reference the user, ultimate recipient for the projected product. Specifically, understanding (material or immaterial culture) through dialectics among and within all players (people, context, culture, complexity of factors, time) and abduction (logical inference, reasoning to evaluate and explain through the process of attribution of Meaning) (Soares and Pombo, 2010, p. 1).

The bricolage method consists of combining methods from the social sciences, humanities, and hard sciences to derive a suitable model of inquiry (Yee & Bremner, 2011).

Visual research methods is a form of research that uses drawings, photography and other visual forms to produce visual representations (studying society by producing images), to examine pre-existing visual representations (studying images for information about society), or to collaborate with social actors (people) in the production of visual representations (Banks, 1995).

191 Allison (1992) sets out seven general categories of research methods used in
192 art and design: historical, philosophical, experimental, comparative, descriptive,
193 naturalistic, and practical. Yee (2010) and Gray and Malins (1993) identify the first
194 four as being “classic” research methodologies widely accepted in the research
195 community, whereas the last three are more closely related to artistic practice than
196 scientific research.

197 Unlike science, the humanities often refer to metaphysics (such as theology,
198 philosophy, and ethics) and the arts (such as literature, art, and music). Noting the
199 subjective nature of the arts, Archer (1995) outlines the value of art research as
200 “expression in appropriate media; creative reflection on human experience; the
201 qualitative interpretation of meaning in human expression; judgements of worth; the
202 exploration of truth values in text; the categorisation of ideas, people, things and
203 events; and the tracing of, and commentary upon, the provenance of ideas, people,
204 things and events” (p. 8). Some of the common qualitative methodologies used by
205 social science researchers that are also appropriate for art and design researchers are
206 phenomenological, hermeneutic, axiological, ethnographic, holistic, naturalistic,
207 descriptive, experiential, and dialectical strategies (Gray & Malins, 1993).

208 *The alternative research methods*

209 An emergent trend in design research draws from visual anthropology,
210 ethnomethodological and other sociology methods. This includes approaches wherein
211 the researcher creates visual representations to study society, examines current images
212 that provide information about society, and collaborates “with social actors in the
213 production of visual representations” through stills or film cameras (Banks, 1995).

214 While other researchers developed technological tools to supports the
215 emerging concept of design thinking. For example, Jonas and Chow (2008) propagate

the use of an integrated knowledge and communication platform for Research Through Design, which led to the development of MAPS (Matching Analysis Projection Synthesis), an instrument that supports both scientific and 'designerly' methods. It is designed to help researchers create a suitable interface combining appropriate practice-led design, innovation, and research processes through the generic process of analysis, projection, and synthesis, geared towards producing artefacts and new knowledge as research outcomes.

This is similar to the pick-and-mix concept of bricolage (Yee, 2010), which requires a greater awareness and understanding of different kinds of research methodologies. The concept of bricolage, which was coined by Levi-Strauss (1966), is described by Yee and Bremner (2011) as “making-do” and “a bricoleur (someone who employs the bricolage method) is described as a resourceful and creative ‘fiddler or tinkerer’, and one who out of necessity uses available materials to create new objects from existing ones” (p. 3). Gregory Bateson (Kanu, 2009) uses the analogy of a pair of binoculars to explain the concept, likening it to looking at the same thing through different lenses, giving the subject a wider range of perspectives.

However, there is another camp of research scholars (Jones, 1980; Lawson, 1990) who are against borrowing existing research methodology from the sciences and humanities. As Cross (1999) puts it, “we do not have to turn design into an imitation of science, nor do we have to treat design as a mysterious ineffable art” (p. 7). Gray and Malins (1993) have identified distinct research procedures used in the design field that can be seen as rigorous—invention, selection, synthesis, analysis, development, refinement, and resolution. They observe that most design methods are based on a structure that broadly covers “collection of data (visual, written, oral), selection, analysis and synthesis, testing against known visual and performance

norms, human reactions and responses, and compromise with regard to context, function, ergonomics, manufacturing & material constraints” and still leaves scope for “human intuition, emotion and invention” (p. 8).

Summary of approaches to design research

Recent studies outlined by Saikaly (2003, 2004) suggest that there are three approaches to design research in an academic context:

- The sciences and humanities approaches, which are “the systematic and methodical approaches to research”. These approaches can be described as academic research with a planned procedure and are commonly used in social sciences, the arts, and humanities research. They come in the format of a formal research procedure: identification of a problem area or topic; a review of literature; a detailed plan of research design; a process of collection and analysis of data, reports, and discussion of the findings; identification of limitations; and proposal of future research direction.
- The practice-centred approach, in which the development of design projects are considered a form of research. In this approach, creative design methods and practical design activities are used as the fundamental tools of the research.
- The practice-based approach, in which the development of design projects is not the objective of the research but a means to knowledge. This approach is comparable to Action Research and it employs discovery through action (design practice) to seek new knowledge.

Various studies consider the first approach of sciences and humanities inappropriate for conducting design research, largely because it appears alien to many designers and artists (James, 2003) and lacks design practice components such as the

making process and the creative output (Franz, 2000; Saikaly, 2003, 2004; Siu, 2007; Yee, 2007, 2009, 2010).

The second approach, the practice-centred approach, is the newest and most debated approach. Two design professors, Anthony Dunne at the Royal College of Art in London and Fiona Raby at the University of Applied Arts in Vienna, in particular have experimented with these unorthodox design methodologies to produced provocative design responses.

The third approach, the practice-based approach, is the most commonly used in art and design research (e.g., Findeli, 2001; Franz, 2000; Glanville & van Schaik, 2003; Marshall & Newton, 2000; Sevaldson, 2000; Sheth, 2000; Yammiyavar, 2000). This is mainly because this approach uses design practice to discover and seek new understanding and the “research processes are iterative, reflective, interpretive and dialectical” (Saikaly, 2004, p. 9). A good example are the “cultural probes” by Gaver, Dunne and Pacenti (1999), a creative method for doing research through design that enables the researcher to look for ways to open new spaces for design.

However, the legacy of Strand’s position (1998), which reported that design research is not considered a genuine research activity because it lacks “original and systematic investigation” and is not “verifiable publicly through publication and peer review” (p. 7), although much improved is still an issue. So in order for design research to gain recognition from the academic body, the focus should not be only be on what type of research methods are more suitable for the domain of design research, but also on knowing how to conduct formal/academically valid research procedures (the “how” of design research) so that “original” ideas can be derived from the research process and subsequently used to produce the creative output.

289 *The nature of the problem in visual communication education*

290 Presently, majority of undergraduate and postgraduate core courses in visual
291 communication are project-focused and students are not necessarily taught research
292 methodologies as part of the discipline. Khoury and Khoury (2009) attribute the
293 reasons for the lack of knowledge and skills in research methods to the following
294 situation. Even though undergraduate students are currently being taught numerous
295 artistic and technical skills, there is often a lack of emphasis in teaching visual
296 communication students how to conduct research, analyse data, interpret results, and
297 write reports.

298 This observation is supported by various studies that illustrated the lack of
299 appropriate models of practice in research and education in visual communication
300 (Mimoso, 2011; Newbury, 1996b; Strouse & Arnold, 2009).

301 – Mimoso (2011) found that “many students did not have skills in information
302 retrieval and management, the lack of which can frustrate the development of a
303 research project” (p. 5).

304 – Newbury (1996b) contended that “a more systematic and rigorous approach
305 [is needed] to understanding and referring to previously completed research,
306 and to communicating research findings to the field” (p. 216).

307 – Strouse and Arnold (2009) based on Tornello (2003) reported that “the
308 majority of design programmes in the United States expect students to experiment
309 and innovate their own methods and approaches without equipping those students
310 with fundamental knowledge about research” (p. 1135).

311 Many researchers have also noted the importance of teaching research
312 methodology. Coumans (2011), Hockey and Allen-Collinson (2000), and Strouse and
313 Arnold (2009) agree that, to contribute to the design process as well as to produce a

more robust design practice, it is essential that students are well aware of the origins of the methodologies being used as well as the kind of data that can be obtained and how it applies to their study. Heller (1998) reinforces the importance of teaching research methods by stating the possibility of negative effects on the lack of knowledge and skills in research methods:

- Students who focus on the acquisition of technical skills tend to adopt a surface approach to learning, rather than lifelong self-initiated learning.
- Students who regard education as a passive process may be discouraged from further growth in a challenging graduate study environment.

Conclusion

The purpose of this article is to provide an overview of research methods in visual communication design education, and the debates on the research methodologies most suited for communication design education. The review of research methods in visual communication design education identified three key tenets:

- Knowledge and skills in research can be viewed as a key intangible asset for design practice (Glanville & van Schaik, 2003; Schön, 1983, 1987; Yee, 2007).
- Design research i) has to be systematic as it is carried out in a methodical and organised manner; ii) should be rigorous as it is carried out in a domain that requires the application of precise and exacting standards, and iii) is an enquiry as it is to determine facts or to seek answers to questions (Coumans, 2011; Cross 1984; Hockey & Allen-Collinson, 2000; Strouse & Arnold, 2009).
- Design education is filled with many alternative research methods because several researchers found it necessary to propose their “own” approaches while doing design research. This led to considerable confusion in design research (Camino,

2010) since “the research tradition in this field is very young” (Sevaldson, 2000, p. 163).

The above indicates that the knowledge and research skills at all levels of communication design education should start from the basics i.e. how to conduct research in a step-by-step manner with precision and rigour. Design students should not be overwhelmed with different research approaches, either traditional or alternative methods. Papastergiadis (2002) has also stated “the main problem with developing a research culture in an art school is not to do with the angst of creativity, but with the structure of research” (p. 9).

Further, Saikaly (2003) has stated that contributors from other scientific disciplines, such as Herbert Simon, have led to the reconsideration of the epistemological and methodological issues of design research (p. 10). Thus, further studies in this field should focus on the main steps of research—such as identifying research topics and research questions, selecting relevant contexts and subjects, collecting relevant data, analysing and interpreting data and discussing and presenting findings—to seek an understanding on whether the process of research can influence students’ achievement in terms of creative output and design process.

In addition to enhance creative output and design process, user-centered design that characterized as a multi-stage problem solving process is another possible area for future study in design research. User-centered design whether done for users, by users, or with users (Norman & Draper, 1986) is a design philosophy and approach that places users at the center of the design process from the stages of planning and designing the system requirements to implementing and testing the product (Baek et al, 2008). User-centered design approaches including Participatory Design (inspired by Cooperative Design) which all stakeholders such as users are actively involved in

363 the design process as co-designers by empowering them to propose and generate
364 design ideas that addresses their specific needs (Schuler & Namioka, 1993); and
365 Contextual Design is another user-centered design process which incorporates
366 [ethnographic](#) methods for gathering data from users that is relevant to the design of a
367 system or a product (Beyer & Holtzblatt, 1998). Above all directions that proposed for
368 future studies, the process of research needs to be continually and systematically
369 investigated and studied as being fundamental to conducting design research.
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References

- Allison, B. (1992). *Allison research index of art & design*. Leicester: Leicester Expertise.
- Archer, B. (1995). The nature of research. *Co-design: Interdisciplinary Journal of Design*, 6–13.
- Baek, E-O., Cagiltay, K., Boling, E., and Frick, T. (2008). User-Centered Design and Development. In J. M. Spector, M. D. Merrill, J.J. van Merriënboer M. F. Driscoll (Eds), *Handbook of research on educational communications and technology* 3rd ed., (pp. 659–670). Lawrence Erlbaum Associates.
- Banks, M. (1995). Visual research methods. *Social Research Update*, 11. Retrieved from <http://sru.soc.surrey.ac.uk/SRU11/SRU11.html>
- Bennett, A. (2006). *Design studies: Theory and research in graphic design*. New York: Princeton Architectural Press.
- Beyer, H., and Holtzblatt, K. (1998). *Contextual Design: Defining Customer-Centered Systems*. San Francisco: Morgan Kaufmann.
- Brown, T. (2012). From Blueprint to Genetic Code: The Merits of an Evolutionary Approach to Design. *Rotman Magazine Spring*, 16–21.
- Camino, M. (2010). An examination of the journal used as a vehicle to bring about a synthesis between theory and practice in art and design higher education. *Journal of Writing in Creative Practice*, 3(3), 317–340.
- Charles, L., & Ward, N. (2007). *Generating change through research: Action research and its implications*. Retrieved from <http://www.ncl.ac.uk/cre/publish/discussionpapers/pdfs/dp10.pdf>
- Checkland, P. B. (1991). From framework through experience to learning: The essential nature of action research. In H. E. Nissen, H. K. Klein, & R. Hirschheim (Eds.), *Information Systems Research: Contemporary Approaches and Emergent Traditions* (pp. 397–403). Amsterdam: Elsevier.
- Cross, N. (1982). Designerly ways of knowing. *Design Studies*, 3(4), 221–227.
- Cross, N. (1984). *Developments in design methodology*. Chichester, NY: John Wiley & Sons.
- Cross, N. (1999). Design research: A disciplined conversation. *Design Issues*, 15(2), 5–10.
- Coumans, A. (2011). Muscular design. *PreDesign Forum*. Retrieved from <http://www.predesignforum.net/view.php/page/musculardesign>
- Durling, D. (2002). Discourses on research and the PhD in Design. *Quality Assurance in Education*, 10(2), 79–85.

- Findeli, A. (2008). Searching for design research questions: Some conceptual clarifications. In *Questions & Hypotheses* (pp. 286-302). Berlin: DRN Learning Conference.
- Findeli, A., Brouillet, D., Martin, S., Moineau, C., & Tarrago, C. (2008, May). *Research through design and transdisciplinarity: A tentative contribution to the methodology of design research*. Presented at the Swiss Design Network Symposium, Berne, Switzerland.
- Franz, J. (2000). An interpretative-contextual framework for research in and through design. In *Proceedings Doctoral Education in Design: Foundations for the Future*. La Clusaz, France: OUTEprints. Retrieved from <http://eprints.qut.edu.au/7804/1/7804.pdf>
- Friedman, K. (2003). Theory construction in design research: Criteria, approaches, and methods. *Design Studies*, 24, 507–522.
- Glanville, R. (2003). An irregular dodekahedron and a lemon yellow Citroen. In L. van Schaik (Ed.), *The Practice of Practice* (pp. 258–265), Melbourne: RMIT Press.
- Glanville, R. & van Schaik, L. (2003). Designing reflections: Reflections on design. In *Proceedings of the 3rd Doctoral Education in Design Conference* (pp. 35–42), Tsukuba, Japan: University of Tsukuba.
- Gaver, B., Dunne, T., & Pacenti, E. (1999). Design: Cultural probes. *interactions*, 6 (1), 21–29.
- Gray, C., & Malins, J. (1993). Research procedures/methodology for artists & designers. In *Principles and Definitions: Five Papers by the European Postgraduate Art & Design Group*. Winchester: Winchester School of Art & Design.
- Hart, C. (1998). *Doing a literature review: Releasing the social science research*. London: SAGE.
- Haron, H. (2005). Conceptualization of tacit knowledge dimension. In *Proceedings of the Postgraduate Annual Research Seminar* (pp.12–17). Johor Bahru: Universiti Teknologi Malaysia.
- Heller, S. (1998). *The education of a graphic designer*. New York: Allworth Press.
- Hockey, J., & Allen-Collinson, J. (2000). The supervision of practice-based research degrees in art and design. *Journal of Art & Design Education*, 19(3), 345–355.
- James, D. D. (2003). A working model for postgraduate practice based research across the creative arts. In *The Third Doctoral Education in Design Conference (DED3) proceedings* (pp.15–24). Tsukuba, Japan: University of Tsukuba.
- Jones, J. C. (1980). *Design methods*. NY: John Wiley & Sons.
- Jonas, W., & Chow, R. (2008). *Far Beyond Dualisms in Methodology – an Integrative Design Research Methodology Medium*. Paper presented at DRS conference Undisciplined!, UK, Sheffield.

- Kanu, Y. (2009). *Curriculum As Cultural Practice: Postcolonial Imaginations*. Toronto: University of Toronto Press.
- Kennedy, M. (1997). Connection between research and practice. *Educational Researcher*, 26(7), 4–12.
- Khoury, M. P., & Khoury, T. E. (2009). Writing & research for graphic design within undergraduate studies. In *International Association of Societies of Design Research: Proceedings of the 3rd IASDR World Conference on Design Research* (pp. 839–846). Seoul: Society of Design Science.
- Lawson, B. R. (1990). *How designers think*. London: Butterworth Architecture.
- Lee, C. K., Foo, S., & Goh, D. H. (2006). On the concept and types of knowledge. *Journal of Information and Knowledge Management*, 5(2), 151–163.
- Lévi-Strauss, C. (1966). *The savage mind*. Chicago: University of Chicago Press.
- Lewin, K. (1946). Action research and minority problems. *Journal of Social Issues*, 2(4), 34–46.
- Loughran, J. J. (2002). Effective reflective practice: In search of meaning in learning about teaching. *Journal of Teacher Education*, 53(1), 33–43.
- Marshall, T., & Newton, S. (2000) Scholarly design as a paradigm for practice-based research. In *Working Papers in Art and Design, 1*. Retrieved from http://sitem.herts.ac.uk/artdes_research/papers/wpades/vol1/marshall2.html
- McNiff, J. (1988). *Action Research: Principles and Practice*. Basingstoke: Macmillan Education.
- McCoy, K. (1998). Education in an adolescent profession. In S. Heller (Ed.), *The Education of a Graphic Designer* (pp. 3–12). New York: Allworth Press.
- Meggs, P. B. (2005). *History of Graphic Design* (4th ed.). Revised by Alston W. Purvis. NY: Wiley.
- Mimoso, C. (2011). The Research Training in Art and Design. In *Conference Proceedings of Doctoral Education in Design Conference*. Hong Kong: Hong Kong Polytechnic University.
- Newbury, D. (1995). A journey in research, from research assistant to Doctor of Philosophy. *Journal of Graduate Education*, 2, 53–59.
- Newbury, D. (1996a). Knowledge and Research in Art and Design. *Design Studies*, 17(2), 215–19.
- Newbury, D. (1996b). A journey in research, from research assistant to Doctor of Philosophy. *Journal of Graduate Education*, 2(2), 53–59
- Nickols, F. W. (2000). The knowledge in knowledge management. In J. W. Cortada and J. A. Woods (Eds.), *The Knowledge Management Yearbook 2000–2001* (pp.12–21). Boston, MA: Butterworth-Heinemann.

- Norman, D. A., and Draper, S. W. (1986). *User centered system design: New perspectives on human-computer interaction*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Papastergiardis, N. (2002). Melancholy moments and the art of research. *Campus Review*.
- Polanyi, M. (1997). Tacit knowledge. In L. Prusak (Ed.), *Knowledge in Organizations*. Butterworth-Heinemann: Boston.
- Rust, C. (2004). Design Enquiry: Tacit Knowledge and Invention in Science. *Design Issues*, 20(4), 76–85.
- Saikaly, F. (2003, April). *Design re-thinking: Some issues about doctoral programmes in design*. Paper presented at the Techné: Design Wisdom: 5th European Academy of Design Conference, Barcelona.
- Saikaly, F. (2004). Approaches to design research: Towards the designerly way. In *Design Research Society International Conference 2004 – FUTUREGROUND*, Australia: Monash University
- Schön, D. A. (1983). *The reflective practitioner*. London: Temple Smith.
- Schön, D. A. (1987). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. Jossey-Bass Higher Education Series. San Francisco; London: Jossey-Bass.
- Schön, D. (1992). Designing as reflective conversation with materials of a design situation. *Research in Engineering Design*, 3, 131–147.
- Schon, D.A. (1996). *Educating the reflective practitioner: Toward a new design for teaching and learning in the professions*. San Francisco: Jossey-Bass, Inc
- Schuler, D., and Namioka, A. (1993). *Participatory Design: Principles and Practices*. New Jersey: Lawrence Erlbaum Associates.
- Sevaldson, B. (2000). The integrated conglomerate approach: a suggestion for a generic model of design research. In *Doctoral Education in Design Conference, La Clusaz, DRS* (pp.163–170). Tsukuba: University of Tsukuba.
- Sheth, S. (2000). Refocusing praxis: The problem for design research. In S. Pizzocaro, A. Arruda, & D. De Moraes (Eds.), *Design plus Research, Milano, 18–12 May 2000* (pp. 366–369). Milano, Italy: the Ph.D. programme in industrial design, Politecnico di Milano.
- Siu, K. W. M. (2007). Balance in Research and Practice: the Reform of Research Studies in Industrial and Product Design. *Global Journal of Engineering Education*, 11(1), 15–28.
- Soares, L., and Pombo, F. (2010). Interpretation as a design method. In Durling, D. (Ed.), *Design & Complexity. International Conference of Design Research Society (DRS)*, 7–8 July (pp. 1–8). Canada: Université de Montreal.
- Strand, D. (1998). *Research in the creative arts*. Canberra: DETYA.

- Strouse, R., & Arnold, J. (2009). Design research in undergraduate design education: Relevance and implementation. In *International Association of Societies of Design Research: Proceedings of the 3rd IASDR World Conference on Design Research* (pp. 1134–1144). Seoul, Korea.
- Swanson, G. (1998). Liberal arts and graphic design: Six cautionary questions. In S. Heller (Ed.), *The Education of a Graphic Designer* (pp. 23–29). New York: Allworth Press.
- Swann, C. (2002). Action research and the practice of design. *Design Issues*, 18(2), 49–61.
- Tornello, M. (2003). Practice and education: Benchmarking user-centered research in industrial design. *Unpublished Design Research*, ASU, Tempe, AZ.
- van Schaik, L. (2000). Interstitial modernism—“Second order” or meta modernism at RMIT. In L. van Schaik (Ed.), *Interstitial Modernism*, Melbourne: RMIT Press.
- van Schaik, L. (2003). The practice of practice: Practice based research in architecture. In L. van Schaik (Ed.), *The Practice of Practice*. Melbourne: RMIT Press.
- Yammiyavar, P. (2000). Is industrial design research really different from other research? In S. Pizzocaro, A. Arruda, & D. De Moraes (Eds.), *Design plus Research, Milano, 18-12 May 2000* (pp. 251–257). Milano, Italy: the Ph.D. Programme in Industrial Design, Politecnico di Milano.
- Yee, J. (2007). Connecting practice to research (and back to practice): Making the leap from design practice to design research. *Journal of Design Principles and Practices*, 1(1), 81–90.
- Yee, J. (2009, June). *Capturing tacit knowledge: Documenting and understanding recent methodological innovation used in design doctorates in order to inform postgraduate training provision*. Presented in Experiential Knowledge Conference, UK, London
- Yee, J. S. R. (2010). Methodological innovation in practice-based design doctorates. *Journal of Research Practice*, 6(2), Article M15. Retrieved from <http://jrp.icaap.org/index.php/jrp/article/view/196/193>
- Yee, J. S. R., and Bremner, C. (2011). *Methodological bricolage—What does it tell us about design?* Presented in Doctoral Education in Design Conference, China, Hong Kong.