

“Education-Based Research”

The Academic Design Project as a Source of New Knowledge

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Abstract: This paper lays out a concept of education-based research—the production of research knowledge within the framework of tertiary design education—as an integration of problem-based learning and research-based education. This leads to a critique of reflective practice as the primary way to facilitate learning at this level, a discussion of the nature of design problems in the instrumentalist tradition, and some suggestions as to how design studies curricula may facilitate education-based research.

Key words: *Design education; research-based education; problem-based learning; project-based learning; practice-based research; reflective practice; design problems.*

1. Introduction

This format is to be used for submissions that are published in the conference proceedings. Research-based education with problem-based design projects as its core activity is currently becoming ever more widespread among higher education design schools around the world. The aim of this development is that students should not only develop traditional design competencies and basic academic competencies but indeed that they should be able to synthesize the two in terms of new design competencies where research methods and design methods inevitably become more and more integrated. The vision of the design graduate of the future is a candidate whose professional competencies is characterized by his/her ability not only to master the knowledge and techniques that form part of a given design discipline but also the ability to understand and reflect upon own and others' design practice in the context of design history, the history of ideas (e.g. aesthetics, culture, communication, epistemology), new trends in design research, and other relevant fields of contextual knowledge. What is crucial in this development is that design education succeeds in developing an academic language among design graduates that both reflects basic academic skills as well as a specialized knowledge of a given design practice so that the design candidate is able to share his/her reflections with professionals outside his/her own discipline and thus is competent to draw upon published research and take part in interdisciplinary professional environments as well as debates in an enlightened public sphere. In these terms, communicating (by) design means that the designer is able to communicate issues pertaining to design practice and designed artifacts with a common academic language to the well-educated public sphere.

Research-based education typically means not only that teaching is based on research publications and undertaken by practising researchers, nor that teaching takes place in an environment where research is also conducted, but indeed that students should learn how to think and work academically with research as their

primary model and field of reference (Laursen, 1998). Research-based education implies that learning orients itself towards recognised basic research questions and that learning is based on proper research methods, that is, in addition to other design methods as far as design education is concerned.

However, what is often overlooked when institutions introduce research-based and project-based learning in their educational systems is that students may actually produce new knowledge which may be of value to design practice as well as design research. Although students at post-graduate level who are pursuing their masters degree are generally not expected to contribute to research but only to identify research issues in their practical work, the implementation of the most advanced principles of research-based education does ideally introduce an element of “education-based research,” that is research that is based on design practice undertaken within the controlled learning environments of design schools. Along with the pervasion of research-based education, design schools should not overlook this resource and leave research to staff-members with research obligation. The pursuit of new research knowledge should thus form out a common institutional goal in the same terms as the pursuit of new design concepts, new design solutions, and new form.

Two important problems in this regard are 1) that dominant design methods may not necessarily cater for systematic knowledge production oriented towards the design research community, and 2) that design schools often cater for of very different traditions (e.g. craft, industrial design, communication design) that may interpret problem-based learning in very different ways, make use of very different methods, and orient themselves toward very different research communities (if any at all—so some local traditions do of course not orient themselves towards any research community in the strict sense but share other types of knowledge in other ways).

This paper seeks to address the two problems above in the following terms. First it discusses the introduction of established formats for reporting research knowledge in the higher education design curriculum. This discussion is based on experiences at The Danish Design School in Copenhagen, where a design theoretical assignment invites students to use the long and short conference paper format to conduct research in connection to their project work. Secondly, the paper discusses the relation between education-based research and various approaches to and understandings of design problems with reference to the concept of problem in problem-based learning. First, however, I would like to develop my concept of education-based research further by contextualizing this term with reference to related concepts such as problem-based learning, research-based education, reflective practice, and practice-based research; all of whom are pivotal for the way contemporary design schools seek to develop higher design educations.

2. From Problem-Based Learning to Education-Based Research

Education-based research should be seen as the most advanced continuation of the principles of problem-based learning (PBL) which has been introduced to the design schools during the last two decades. Problem-based learning has for obvious reasons been particularly appealing to modern design education since the modern concept of design very much is about solving problems. However, whereas institutions offering higher education programs are typically expected to base studies on local research practice, many design schools lack resources as well as motivation to establish research. Design schools are often small institutions with a tight budget where it is difficult to find the resources to establish a research group with reasonable funds. Moreover it is often difficult for design schools to attract research staffs with a doctoral degree, since qualified candidates are still few in number. Finally, many design schools are still dominated by traditions according to which research in the strict sense is not seen as necessary in order to offer advanced design studies.

In this chapter, however, I would like to demonstrate how the most advanced levels of research-based and problem-based learning not only should support each other but indeed that the integration of the two in tertiary education may lead to the unleashing of unexpected resources by means of research knowledge produced by students. Education-based research may in this sense not only form out the argument to establish research but

also suggest how research strategies based on the principles of education-based research may lead to the strongest research cultures in tertiary education and the most efficient use of funding spend on research.

Problem-based learning, as it was originally developed by McMaster University, implies a shift of focus from the lecturer to the student; from the proper representation of established scholarly subjects' bodies of knowledge to the individual responsibility to make systematic use of a learning environment. Teaching basically the students to "learn how to learn", problem-based learning seeks to develop candidates that are able continuously to develop their competencies after leaving tertiary education and thus to meet the challenges of ever changing professional environments. Problem-based learning is thus usually not only implemented in tertiary education but in entire national educational systems and sets off from the liberalist idea that Man's well-being and functionality in modern rationalist, democratic societies depends on a systematic facilitation of his curiosity; his desire to know more.

Problem-based learning sets off from the idea that knowledge is learned and applied most efficiently if the learning subject acquires knowledge in order to solve practical problems. Education should thus make available learning environments where such practical application could be simulated. In such environments, theoretical knowledge is supposed to be given primarily in order for the student to solve problems better. The teacher should thus not primarily function as a lecturer but as a facilitator of learning. The educational goals are in turn not only formulated in terms of understanding but also applying knowledge and mastering collective learning processes where the solution of practical problems requires the students collectively to acquire, construct, develop, and communicate (new) knowledge. In problem-based learning, knowledge thus has an interesting, double status as a "tool" as well as an "outcome". Whereas it is true that knowledge is supposed to be secondary to the ability to learn, and knowledge production is supposed to be secondary to problem-solving, knowledge still attain a primacy in problem-based education in the sense that in education problem solving serves as a framework to learn and apply knowledge. Knowledge production moreover attains a sense of primacy if it proves relevant to future learning; not least that is if it proves relevant to the learning environments of educational programs. This of course requires knowledge to be constructed, recorded, made available before and assessed by a community of learning—in other words, it requires practical experience to be developed in terms of recognized research knowledge. According to common standards for educational accreditation, the most advanced level of problem-based learning in tertiary education should thus be supported by research practice so that research may serve as the model for students' learning by means of empirical research methods, the construction of knowledge by means of academic writing, and the ethical dimension of producing and sharing knowledge.

Laursen (1998) has observed a widespread confusion as regards notions of research-based education at the universities. Whereas it is generally held that in tertiary education, teaching should be based on research, it is often not clear exactly what is meant by these terms. In times, where competition among institutions offering higher education is becoming ever more acute and where the national states—not least in Europe due to the emergence of EU reforms—are formulating still more advanced demands for higher education programs to be accredited and funded, it is crucial for the institution to reach to a more precise definition and practice as concerns the implementation of research-based education.

According to Laursen, research-based education may thus be interpreted in four very different ways. The first, least advanced interpretation of research-based education is that teaching should represent up-to-date

research knowledge. Teaching may not necessarily be executed by a practicing researcher, but the students should at least be presented with proper research knowledge. Although this interpretation may lead institutions to save resources for teaching, it does imply some considerable weaknesses. For instance, if the teaching does not train the students to approach research knowledge critically, the students will not be able to draw on relevant knowledge in their own work.

The second interpretation of research-based education implies that teaching is undertaken by practicing researchers, but not necessarily that it represents the lecturer's own research nor indeed that teaching goes beyond mere representation of existing knowledge. The weakness of this interpretation is that the students do not critically train themselves in testing how the research results have come about nor that empirical work may lead to other findings.

The third interpretation suggests that teaching should be executed in an environment that also caters for research practice. In such environments, the students may develop their competencies in a culture where research is seen as a central value in their professional culture and they may even learn how to approach problem-based projects with proper research methods. However, this interpretation does not necessarily imply that the students move beyond problem solving in their design work.

In the fourth, most advanced interpretation, however, students should as Laurson points it "learn to think and act like a researcher". This does not mean that students pursuing their master's degree are expected actually to produce new research knowledge in their projects but they should learn to apply research methods and identify interesting research questions that may be actualized in their own work. And this does mean moreover that the students' work will make out a considerable resource for research. If a supervisor identifies findings in a student's work that would be relevant to submit before a research community, he/she may thus either suggest that the student develop it in form that is eligible to present in this community, e.g. by means of a conference paper, suggest the student to develop it after the completion of the exam, or assist the student in completing, say as co-author. Such possible education-based research should be taken into account when design schools consider if and how to spend more resources on research.

From Reflection to Thesis: The Case of the Danish Design School

The integration of problem-based learning with research-based education in its most advanced version is not a straight-forward matter; and certainly not so in higher design education where research traditions generally speaking are weaker and more heterogeneous than at the universities. In the following I would like to address two basic problems as regards this integration, namely: 1) How do higher education design curricula support education-based research as the most advanced development of problem-based learning and research-based education, and 2) How should we perceive design problems on this level.

In higher design education, problem-based learning has been accompanied by a focus on written reflection. Following Schön's (1991) seminal work on the interplay between reflective practice and professional knowledge after the decline of technical rationality, design education has adopted the unstructured reflection-in-action approach to facilitate understanding and learning as self-regulated processes that are situated in actual design practice. This move has been an important first step in the development of training students

systematically to verbalise thoughts that are tied up with (creative) practice—and a step away from traditional subject-based education based on the application of scientific principles or on the apprenticeship model.

However, although the development of a process-oriented, interdisciplinary language has proven extremely helpful for the students' acquisition of a written, verbal language and their development as integrated, (ever) learning subjects, published experiences demonstrate that reflective practice approach in turn implies some important problems as regards the implementation in higher design education as research-based, structured learning environments. Although reflective practice certainly is necessary in its own rights in design practice within as well as beyond higher education, the semi-structured approach does not fit well to the rational and structured way of learning that still for good reasons dominates higher education. Rationality should not be confused here with Schön's diagnosis of so-called technical rationality (1991, 21ff.), which suffers not from rationality but from the idea that problem solving should consist in applying scientific principles onto practical problems disregarding the inherent complexity of most design problems and the fact that such complex problems can be dealt with much more effectively—and indeed rationally—by means of interdisciplinary efforts.

In the following I would like to demonstrate how higher education design studies curricula can cater for a structured, systematic approach to the production of knowledge by means of the design project and the construction of a design theoretical thesis. Two recent studies on the application of semi-structured reflection on design practice further addresses some issues regarding the application of reflective practice in higher education. James' (2007) study of the perception of reflective practice among students and staff at the London College of Fashion shows that both groups of informants 'offered extremely varied interpretations of what constitutes reflection' and that students 'do not like engaging in reflective practice, that they find it a "turn of f" and irrelevant to what they have come into HE [higher education] to do, namely study fashion through diverse rounds and get a job afterwards.' (190-191, my bracket). In James' study, students' and staffs' perception was assessed in the course of a systematic use of various structured approaches to reflection in action. In a similar study at The Danish Design School, Kjølse et al. (2008) found that students were confused as to how to understand and benefit from the "written reflection" format that formed part of the students' project work at the institution. Here students were required to write 2-5 pages on reflections on an executed design project; typically by means of a personal narrative on the design project as a learning process that sat off from own interests and motivation.

However, the findings of the study at The Danish Design School has led to an adjustment in the curriculum so that the "written reflection" is now substituted by a more extensive "project report" where the students are supposed systematically to reflect their project work in terms of its:

- (a possibly adjusted) program/brief incl. problem formulation, motivated choice of method, project plan, reflections on expected results, etc.)
- pre-study research
- argumentation of choices made during concept development and implementation
- assessment of method and result

The project report should oblige to common standards for academic writing incl. a systematic and exhaustive system of references and should lead to a systematic condensation of what the student has learned. Setting off

from the study by Kjølseth et al., a set of guidelines was prepared by the Board of Studies (Johansson et al., 2008) with the participation of the colleagues that took part in Kjølseth's study. Here, reporting was laid out in terms of "tidying up the studio" in such a way that "no mess was left behind", i.e. that the report should be both coherent and exhaustive as regard the student's main experiences from the project. In another study, we have laid out this tidying up as a retrospective organisation of a progressive way of creative thinking. (Johansson et al., 2007) In this manner, the aim of the guidelines is to train the student's ability to analyse, interpret, communicate, discuss, and assess the experiences of his or her own work and thus to understand and use the design project as a framework for learning.

Whereas the adjustment of the curriculum has just been implemented, we have only got a very limited material of experience regarding the use of the project report format. However, what we do expect the students to do is to demonstrate that they are able not only to produce convincing design solutions but also—and this is equally important—that they are able to use the design project as a framework for learning by means of a systematic, rationally structured project report. However, whereas project reports should construct knowledge based on a singular case without any attempts to generalise findings, the curriculum in design studies features another format which is more suitable for the facilitation of education-based research as the integration of problem-based learning and research-based education on the highest level, that is, the design theory thesis. At the Danish Design School, the thesis in design theory should be used for the student to demonstrate that he/she is

- 'able to compare, understand, and assess own and contemporary design practice in the context of relevant social, cultural, and historical contexts.
- 'able to undertake advanced theoretical problem analysis, concept development, theory construction, and reflection upon method—primarily with reference to own design practice and specialisation; i.e. current, past, or future design projects.' (of the curriculum in design theory, post-graduate level, The Danish Design School, 2008)

Contrary to the project report, the design theory thesis is not supposed to be a report on actual project work. It could of course include it, but the main point of the task is to be able to construct an argument by means of a problem-based analysis, interpretation, and discussion of two pieces of relevant theoretical works (i.e. two research articles or book chapters and a total of 400 pages of contextual literature. The design theory thesis is expected to be relatively short, that is, 10 pages, corresponding to the typical long paper format for conferences and journals. The problem should not be a design problem as such but rather the theoretical aspect of a design problem. In this manner, the institution seeks to provide the student with a framework by means of which he/she can unfold his/her argument that fits directly in to the research community. Moreover, the thesis can be developed into a chapter of the final thesis project's project report which leads to the completion of the master's degree (30 ECTS). Design theory theses may be written in connection with a course or as an independent theoretical project. In both cases, individual supervision (the thesis could be completed in groups of up to four authors) constitutes the main pedagogical framework. Thesis supervision should be performed by an experienced senior researcher who is able to assist the student in his/her work with theory development, search of literature, methodology, and the construction of an argument with adequate references, etc.

Whereas on graduate level, the 10 page design theory thesis rather provides the student with a form by means of which he/she critically can demonstrate knowledge and understanding within a particular pre-defined subject (design history, aesthetics, methodology, cultural studies, etc), students should use the post-graduate thesis optimally to demonstrate that he/she can identify issues that are interesting to contemporary design research in the field. This achievement will typically lead to a top grade. However, we now experience an increased number of theses that do not only address such issues but also contribute to research by producing new research knowledge. In these cases, students have been encouraged to submit their work to recognized conferences or journals, and some have indeed been accepted by peer reviewed media. In this way, students may contribute significantly to an institution's production of research knowledge and thus realise the potentials of integration problem-based learning and research-based education on the most advanced level.

Discussion: The Design Problem—from Problem Solving to Research Problem

In this final part I would like to discuss the concept of design problem implied in problem-based learning with reference to research-based education at its highest level. Whereas I am advocating for a rational, research-oriented reporting and thesis construction, I would like to stress that my concept of problem should not be seen as being limited to problem solving in the rationalist sense suggested by Simon (1969). On the contrary, recognizing the research knowledge as a framework for identifying and developing design problems I suggest that in tertiary education and indeed in research, it makes more sense to define design problems in terms of learning rather than solving practical problems. Dorst's recent studies (2003, 2006) on Simon's definition of design problems and subsequent attempts to establish a typology of design problems show that as far as problem solving is concerned, it is hardly possible to avoid what Simon designated as "ill-defined" problems. First, according to Dorst, the 'the design problem is not knowable at any specific point in the design process' since actual problems should be seen as complex wholes of which the designer forms part (2006, 16). Secondly, this goes for the temporal dimension as well; the 'design problem is hard to identify because it evolves in the design process.' (ibid.) Thirdly, Dorst admits, the 'connotations of the very concepts that are used to describe a design problem are shifting as a part of the design effort.' (ibid.) Following Dorst, we could say that the basic design problem is the designer's 'paradoxical problematic situation' in any problem solving design activity since the designer will always have to seek to satisfy potentially or actually conflicting interests or views. According to Dorst, the primary design problem should in this sense be seen as a conflict of discourses; conflicts that not necessarily should be solved in terms of "getting rid of" but be developed in such a way that the discourses may meet, co-exist, on a higher level in the actual situation. This work requires an analytical approach to the discourses in questions; it makes a theoretical problem formulation indispensable when we are to define any design problem. In this sense, the primacy of knowledge in higher education learning environments is matched by a parallel primacy of discourses in the field of design. Practical design problems without a complexity of discourses and situated involvement do in other words makes little sense.

Setting off from the idea that design problems are either defined in negative terms as "something that doesn't work" (e.g. dysfunction, inaccessibility, damage to environment, etc.) or in positive terms, that is, as "something that does work" in respect of conceptual or formal possibility (e.g. the creative use of a decorative pattern, a new material or technology, a new managerial principle, a philosophical concepts, etc.), one could suggest that design problems in the paradoxical sense evoked above in principle necessarily always should be interpreted in positive

terms as possibility—possible configurations of discourses—but on a more abstract level than that of form. Seeking to resolve conflicting discourses in the design process and in the situated field of intervention, the informed design approach would be looking for possible ways to make these discourses co-exist on a concrete as well as an abstract level. Problem-based learning in these terms should not (only) be seen as specific knowledge pertaining to the solution of a practical problem but a constant report to a general body of discourse-based knowledge. Accordingly, it would argue that problem-based learning should set off from the most advanced level where students are expected to be (equally) constantly reflected as regards this report rather than from the most basic level, where a practical problem is sought to be resolved entirely by means of systematic progression without any regards to inherent complexities.

Conclusion

In this paper I have developed a concept of education-based research in order to capture the integration of problem-based learning and research-based education on the most advanced level in tertiary education, that is, more specifically, studies that lead to the completion of a masters' degree. This leads to a critique of reflective practice as the primary way to facilitate learning at this level, a discussion of the nature of design problems, and some suggestions as to how design studies curricula may facilitate education-based research. Whereas the production of research knowledge by design candidates within the framework of higher education is actually not something that should be expected from the students, it is paradoxically at this level that the concepts of design problems, problem-based learning, and research-based education truly make sense. Design schools are thus challenged by the temptation to include students' research-oriented design projects while admitting that such activities go beyond the typical aim of design studies for the masters' degree.

Table 1. Sample

Sample1 Sam	ple2	A	B	Std.	Differences	Others
Title 1	Design	0	0	0	0	Hongik University of Design and Science
	Design 0		0	0	0	
	Design 0		0	0	0	
Title 2	Design	0	0	0	0	Hongik University of Design and Science
	Design 0		0	0	0	
Title 3	Design	0	0	0	0	Hongik University of Design and Science
	Design 0		0	0	0	
	Design 0		0	0	0	

Figure.1 Sample

4. Conclusions

It is important that you write for the IASDR 2009 audience. Please read the *Proceedings* of previous years to understand the writing style and conventions that successful authors have used. It is particularly important that you state clearly what you have done, not merely what you plan to do, and explain how your work is different from earlier published work, i.e., what is the unique contribution that your work makes to the field? Please

consider what the readers will learn from your paper, and how they will find your work useful. If you write having these questions in mind, your work is more likely to be successful, both in being accepted to the Conference, and in influencing the work of our field.

5. References and Citations

Use a numbered list of references at the end of the article, ordered alphabetically by first author, and referenced by numbers in brackets [2,4,5,7]. For papers from conference proceedings, include the title of the paper and an abbreviated name of the conference. Do not include the location of the conference or the exact date; do include the page numbers if available. See the examples of citations at the end of this document. Within this template file, use the References style for the text of your citation.

6. Examples Citations

- [1] Brussard, M. (2004) Problem-Based Learning in Arts Education—from Lecturer to Student-Centred Education, in A. Coumans (ed.), *The Reflexive Zone*, Utrecht School of the Arts.
- [2] Dorst, K. (2003) The Problem of Design Problems, Proceedings from the 6th Design Thinking Research Symposium, University of Technology, <http://research.it.uts.edu.au/creative/design/papers/23DorstDTRS6.pdf>, accessed January 10th, 2008.
- [3] Dorst, K. (2006) Design Problems and Design Paradoxes, *Design Issues* 3 (22), Summer Issue.
- [4] James, A. (2007) Reflection Revisited: Perceptions of Reflective Practice in Fashion Learning and Teaching, *Art, Design, and Communication in Higher Education*, 3 (5), pp. 179-196.
- [5] Johansson, T.D., Kallesøe, E., Sommer, A.-L., Hansen, M.-A., Hauchrøg, E., and Heegaard, U. (2007) Forwards and Backwards: Documentation in the Practice of Design and Research,' in Proceedings from the 2007 Conference of the International Association of Societies of Design Research, Hong Kong Polytechnics. CD-Rom.
- [6] Johansson, T.D. et al. (2008) Vejledning til udarbejdelse af programmer og projektrapporter, Studienævnet (The Board of Studies), The Danish Design School.
- [7] Kjølse, T., Sommer, A.-L., Galle, P. (2008) Written Reflection—Enhancing the Curriculum in Design Education. A Case Study from The Danish Design School, Paper for the 4th International Conference, Centre for Learning & Teaching in Art and Design (CLTAD).
- [8] Laursen, P.F. (1998) Forskningsbaseret undervisning - og læring, in T.S. Gabrielsen and P.F. Laursen (ed.), *At undervise i Humaniora*, Samfundslitteratur, pp. 93-109.
- [9] Schön, D. (1991) *The Reflective Practitioner*, Arena.
- [10] Simon, H. (1969) *The Science of the Artificial*, Harvard University Press.