Knowledge acquisition for design education

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Abstract
There is an ongoing debate on the relationship of environmental design research (EDR) to design education. Research producing substantial knowledge is conceptualised through positive approaches to design, whereas other phases of design including education usually utilise normative approaches. This study aims at examining the nature of substantial EDR knowledge used in design education through an empirical survey.

The survey, carried out with design instructors, aimed at determining the knowledge acquisition techniques utilised in design studios. Data were also collected on the personal background and attitudes of the participants, along with their prior design training, studio and professional design experience. The interviews were analysed to identify the types of knowledge sources and forms, the extent of reliance on external domains of knowledge, assumptions about the design process and the definition and use of substantial knowledge. Defining environmental design was found to be statistically different with respect to current position in the studio, as was assessing the knowledge sources for the studio with respect to years of studio experience. The evaluation on environmental design research was not independent of whether they currently do research or not.

1 Introduction

Design is concerned with the creation of representations of artefacts. Since these artefacts are for the use of human beings, a designer should focus on and resolve human-artefact interface problems. To accomplish this, he/she must understand and acknowledge the needs, characteristics, capabilities and limitations of the intended user and consider the interaction of the user with the environment. A reliable source for this lies in the utilisation of environmental design research (EDR) in design education and practice. Environmental design (ED) is clearly associated with the scientific field through substantive theory in architecture which "is concerned with *descriptions* and *explanations* of the physical nature of the built environment" as suggested by Lang[1] (p.73). EDR is intended to contribute to this substantive theory in architecture.

Langrish states that if research is an activity that advances public knowledge then it must involve and attempt to change other people's minds or at least to persuade people that they now know something that they did not know before[2]. One should note, however, that there are many different ways of defining research; Archer's definition of research as "a systematic enquiry whose goal is communicable knowledge" is taken as the basis for this study. Archer classifies research into five categories; namely, fundamental research, strategic research, applied research, action research and option research. In design education, fundamental research, strategic research and option research are the three categories that are widely utilised as sources of knowledge.

> Fundamental research is directed toward the acquisition of new knowledge, without any particular useful application in view. Strategic research is calculated to fill the gaps in fundamental research and/or to narrow the gap between it and possible useful applications. Option research knowledge is directed towards the acquisition of information calculated to provide grounds for decision or action[3].

Cross and Cross state that analysing and understanding the problem is an inevitable part of a design problem. In order to analyse the problem, information relevant to the task has to be gathered. In addition, relevant information has to be extracted from its source and shared with the design team. Errors may occur in understanding the design

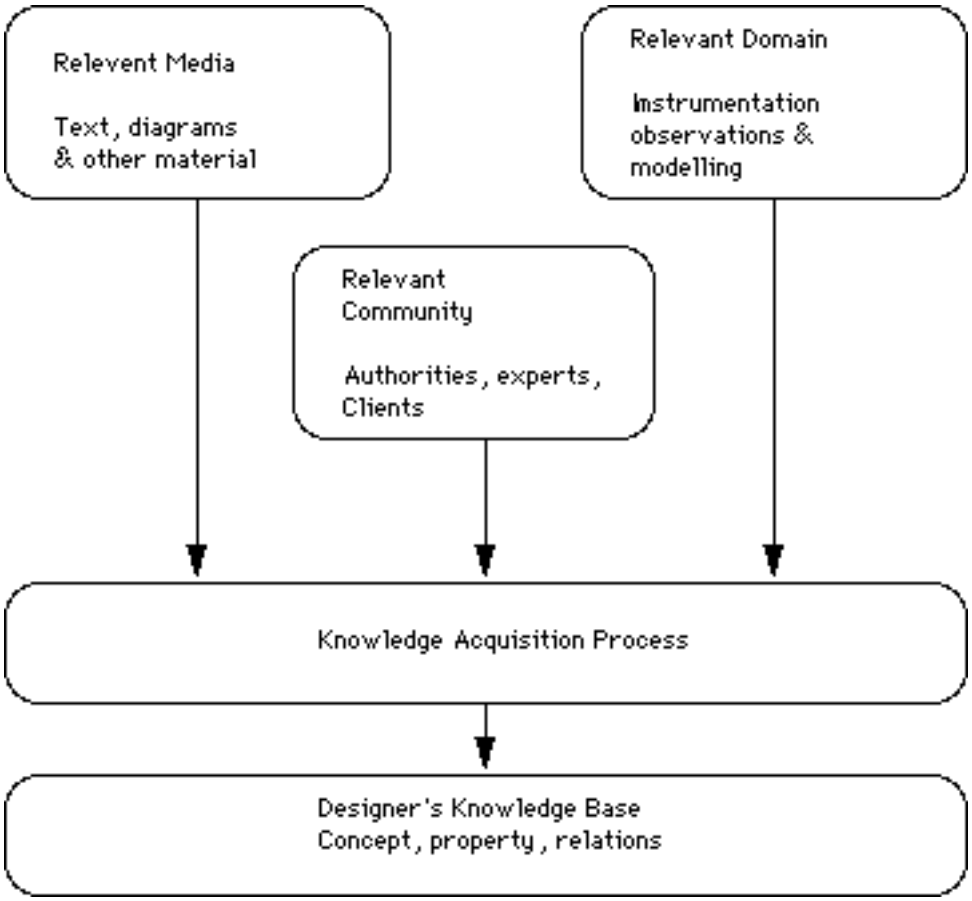

Figure 1 The knowledge acquisition process[7]

requirements. The authors point out that there may be misinterpretations of the information and some requirements may be forgotten [4].

In design education, both knowledge and design policies are stored in the memory of the instructor. Knowledge consists of truths or rules of thumb that usually do not change over time. The latter, however, can be modified according to the instructor of design[5]. Knowledge may be derived from different sources as seen in Figure 1. These sources comprise knowledge from media such as books, journals and videotapes; as well as observed cases. The latter constitutes the previous experience of the designer or others. A last source comprises the requirements stated by the authorities, experts or clients[6]. All the knowledge obtained from experts should be transferred to domain without distortion.

Within this framework, the research presented in this paper aims to investigate how and to what extent EDR is transformed into design knowledge as used in design education.

2 The methodology

A survey in the form of a semi-structured interview has been carried out with design instructors in the departments of Interior Architecture and Environmental Design (IAED), and Landscape Architecture and Urban Design (LAUD) at Bilkent University. The group interviewed consisted of 33 instructors teaching in design studios at various undergraduate levels. The purpose of the survey was to determine the knowledge acquisition techniques utilised in the design studios. Data were also collected to determine the personal background and attitudes of the participants, along with their prior design training, studio and professional design experience.

The first task of the research was related to defining the perceived boundaries of ED, as the conception of the environment changes from one designer to another. In addition to determining the discrepancies in definitions of ED, the perceived utility of the EDR in design education was also questioned.

A second task was to investigate the knowledge acquisition process of the instructors. Knowledge acquisition is a varied process in design and as yet, there are no formal methodologies that have proved to be effective. When the studio process is analysed, it is seen that the first phase consists of understanding the problem. In practice, this often means understanding the problem and assimilating it into a conceptual framework already held by the instructor. Thus, subjects were asked to compare the knowledge acquisition process in design with the other fields of social sciences, and their approach to knowledge acquisition for the topic in design studios.

The sources utilised during the knowledge acquisition process constituted a further aspect of this second task. These sources may be various published materials, such as books and journals, theses and congress reports as well as observation and site-visits. The internet forms a recent but potent means of knowledge acquisition. An instructor constructs a conceptual model of the artefact by abstracting knowledge from his/her previous experience and information. This abstraction process is aided by use of interpretation. The instructor determines his/her own priorities regarding the acquired knowledge. He/she recalls the analogies and forms a pre-solution model. These conceptual representations are linked with both the external forms of knowledge and the internal representations of the model.

The third task of the study was to find out whether or not the dissemination of EDR knowledge in the design field is considered satisfactory by the instructors. It is an implicit assumption of many researchers that the knowledge they produce will be used by the relevant professionals. ED researchers, designers and design instructors provide one such case of research producers and potential information users, respectively. Seidel states it is evident that there are differences in conception of information quality between researchers and designers[8].

The hypotheses used in the study were the following:

1 The background of a studio instructor (profession, previous studio and previous design experience) correlates with his/her approach to ED and EDR.
2 The current position in the studio (department of teaching and perception of his/her role in the studio) correlates with the instructor's approach to ED and EDR.
3 Experience with and the nature of previous or current research (research topics and research experience) correlate with the approach to ED and EDR.

Several variables were used to test these hypotheses. Personal information consisting of design experience, studio experience, current and/or previous research, background and current position in the studio were considered to be independent variables. The conception of ED by the instructors, the source of knowledge used in the studio, their means of access to EDR, their evaluation of EDR in general and of the dissemination of EDR, and their opinion regarding the utility of EDR in design studios were taken to be dependent variables.

All dependent variables were tested against all independent variables with the statistical analyses of chi-square and two-way-analysis of variance (ANOVA). The findings given below are a combination of descriptive statistics and the statistical analysis. Multiple responses were accepted for a number of questions; this necessitates a distinction between the number of responses and the number of people responding.

3 Analysis and Results

The background education of the surveyed instructors exhibits a variety of professions in the design field as can be seen in Table 1 over leaf.

Their departments and how they perceive their current role in the design studios can also be seen.

	IAED			LAUD			
Current Role / Background	Interior architect	Architect	Both interior architect and architect	Landscape architect	Urban designer	Both Landscape Architect and urban designer	Total
Architect	9	4	4	-	1	1	19
City planner	1	-	-	1	2	1	5
Industrial designer	3	-	-	-	-	-	3
Interior architect	3	-	-	2	-	-	5
Forestry engineer	-	-	-	1	-	-	1
Total	16	4	4	4	3	2	33

Table 1 Background education and current role of the instructors teaching design studio

Out of the 33 instructors who participated in this survey, 26 teach full-time and 7 part-time. They constitute a highly experienced group with an average design experience of 9 years and an average studio experience of 6 years. There is only 1 instructor without any design experience and only 4 are in their first year as studio instructors. Regarding their current research, only 10 can directly relate their research to design studios.

Among the responses regarding the access to knowledge sources for the studio topic (Table 2), personal experience (23 responses) and literature survey (22 responses) appear to be the dominant sources. These are followed by the utilisation of previous projects (14 responses) and site-visits (13 responses). There is a significant difference in the knowledge sources accessed with respect to the amount of studio experience (Calc $F_{3,18} = 7.73$, $p < 0.005$).

There is a near consensus that knowledge acquisition process is different in the design field from other fields of knowledge (27 favourable responses out of 33). As the reasons stated may be an indicator of the approach to EDR, they are shown in Figure 2.

The answers related to definition of ED are dominated by two categories as can be seen in Table 3:

1 The immediate (or near) surroundings at various scales, (from just outside of the building to urban landscape) (19 + 3 responses),
2 All surroundings of human beings at every scale (11 responses).

The only statistically significant difference found in definitions of ED was due to the current role of the instructors in design studios (Calc $F_{2,10} = 4.10$, $p=0.05$).

	x< 3	3≤x<6	6≤x<9	9≤x	Total
Literature survey	4	7	8	3	22
Personal experience	5	8	8	2	23
Discussion with studio team	1	3	5	-	9
Discussion with other colleagues	1	2	4	2	9
Utilization of previous projects	3	6	4	1	14
Site-visits	4	3	3	3	13
Others	-	1	-	-	1

Table 2 Knowledge sources accessed with respect to average studio experience years (X)

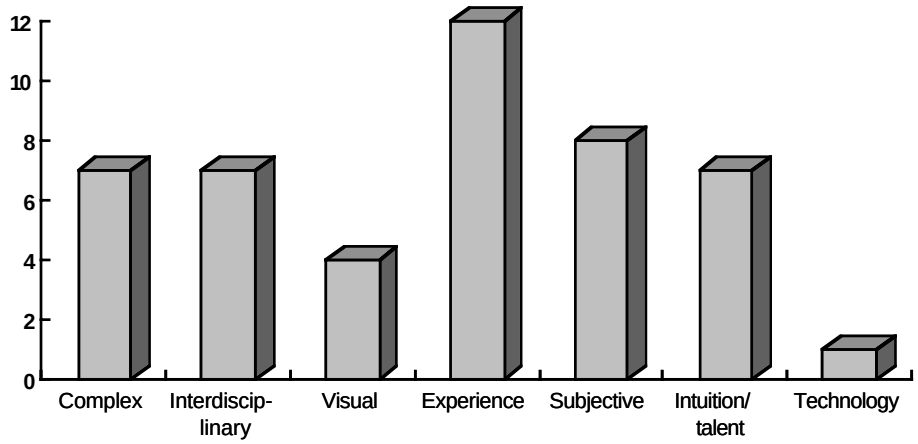

Figure 2 Reason stated for differences in knowledge acquisition process in design in comparison to other disciplines

Current role	All surroundings	Immediate surroundings to urban scale	Immediate surroundings	Total
Architect	-	4	-	4
Interior architect	8	5	3	16
Landscape architect	-	4	-	4
Urban designer	-	3	-	3
Both interior architect and architect	1	3	-	4
Both landscape architect and urban designer	2	-	-	2
Total	11	19	3	33

Table 3 Definition of ED with respect to current profession to the instructors

Almost all instructors (31 out of 33) stated that EDR is useful in the design studios for a variety of reasons such as providing a broader perspective and awareness, allowing better application or better evaluation. Only 3 instructors mentioned abstraction and systematisation as reasons for the usefulness of EDR in design studios. This supports the conception of a different character of design as compared to other fields of knowledge.

With regard to means of access to EDR, it was found that use of written sources is still dominant (29 responses), as can be seen in Figure 3.

Evaluation of EDR falls into a few categories as can be seen in Table 4. Five instructors find EDR easily understandable and useful, whereas 12 evaluate the content of EDR as either too specific or simplistic or not specific enough. Five state terminological and 3 ideological problems. In addition to 2 people who can not evaluate EDR globally, 6 have no idea about EDR. The evaluations of EDR was found to be statistically not independent of whether they currently carry out a research in the field or not ($X^2_6 = 14.98$, $p<0.025$).

Dissemination of EDR was evaluated as sufficient by 11 and insufficient by 20 instructors. The reasons given were general dissemination problems (10 responses), specific conditions of Turkey (8 responses), ignorance of designers and design educators (6 responses), and characteristics of the field (6 responses). However, no statistically significant difference was found between the evaluations of dissemination and any of the independent variables.

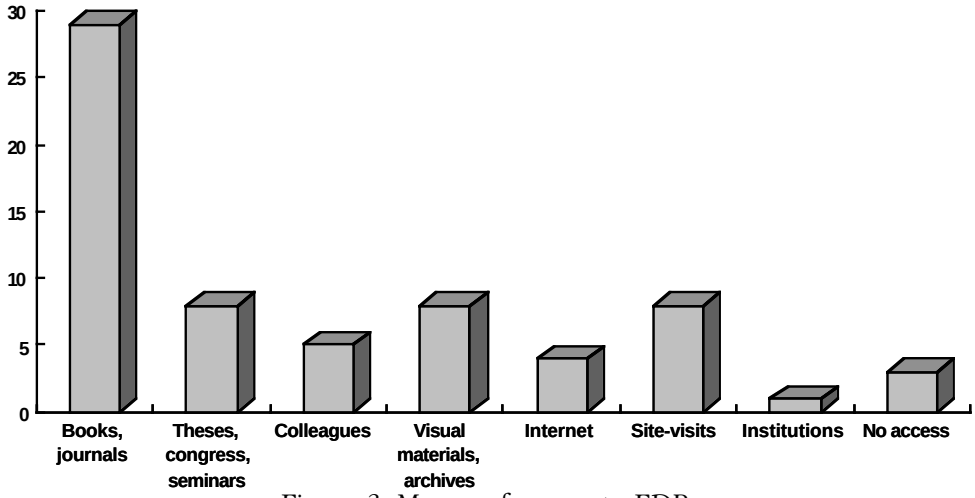

Figure 3 Means of access to EDR

Current Research	Easily under-standable, usable	Content is difficult	Too specific or simplistic	Not specific enough	Termino-logy is complex	Ideologi-cally biased	Have no idea
Yes	1	1	6	-	2	-	-
No	4	-	2	3	3	3	6

Table 4 Evaluation of EDR with respect to current research in the field

The instructors were also asked whether they can relate their previous research to the design studio in a way that may explain the utilisation of EDR in design studios. Twenty-three of the instructors can relate their previous research to design studio either directly (12 people) or indirectly (11 people) whereas only 5 see no relation. Yet, 27 claim that they are willing to participate in a research which could be directly utilised in design studios and 23 give priority to research on design methodology and education when they are asked about their research needs during their studio experience. This may indicate a need for strategic research for design studios.

4 Discussion and conclusion

This study analysed the relationship between EDR and design education through a survey with design instructors. Statistically significant differences were found in the following: Defining ED with respect to the current (perceived) position in the studio, and knowledge sources accessed with respect to the amount of studio experience. Also, it was found that the evaluation of EDR is not independent of whether they currently do research or not.

As Rapoport claims, *environment* is a term which is too broad to be used successfully. He proposes that "the environment can be seen as a series of relationships between things and things, things and people, and people and people" and goes on to state that in ED "four elements are being organised: (1) space, (2) meaning, (3) communication, and (4) time"[9] (p.11). The conception of these components as constituents of ED differs obviously according to the current profession of the instructors. Although planning and design at all scales -from urban to furniture- can be seen as the organisation of spaces, the great variety of understandings introduced especially by communication and time make the definition of ED highly variable. This premise was supported by the survey.

Reasoning with and based on cases is a traditional and proven method in architectural design. The number, complexity and sophistication of the cases increase with experience of the designer. He/she deduces

the findings from personal experiences as well as from other colleagues' works. The form of knowledge facilitates cognitive processes that support designing by providing a collection of selected cases, represented in complete and discrete form. The areas of access to knowledge sources are dependent on these circumstances, as found in the survey.

It was found that 11 of the instructors evaluated EDR with respect to its content, as being too difficult to understand or too specific and simplistic or not specific enough. These evaluations are not independent of whether they currently do research or not. This implies the importance of strategic research in design education. Also, the willingness of the instructors to participate in a design related research points to a strong potential of participation (27 favourable responses). However, the possible distinction between attitude and behaviour should be noted. The number undertaking design related research currently by the sample group (10) supports this belief. Still, when evaluations of EDR and suggested research priorities for design studios are considered, a willingness for the utilisation of EDR in design education is observed. Together with the strong belief on the usefulness of EDR for design education, the willingness to participate in a relevant research may be interpreted as the studio instructors' need for an easier access to more direct sources in EDR. Thus, strategic research could be instrumental in increasing the contribution of EDR to design education with appropriate means of access and communication.

Due to the group character of the sample (e.g. LAUD consists of only 9 studio instructors), a bias might occur both in terms of studio groups and departments; responses might, therefore, be coherent within the departments. Hence, this survey should be supported by further research on student evaluations, and should be extended to other design related departments and a larger sample chosen from a greater population.

Acknowledgements

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