TEACHING CONCEPTUAL DESIGN

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ABSTRACT
This paper presents the first observational study of an ongoing research project.
The research focuses on 'teaching conceptual design' and on the investigation of new teaching methods and strategies. Presently, in the commonly established educational setting, students practice the role of designing during design exercises while being tutored by a design teacher. In these circumstances, teacher and student interaction is of paramount importance. However, it is very difficult for teachers to effectively guide students during conceptual design, even though various idea-generation techniques are available. What's more, studies have centred mainly on the student, resulting in a lack of studies on the teacher's role. As such, we focused our pilot-study on the teacher's role as he interacts with a student during the conceptual design activity of a design project.
The study was conducted in a real-class setting, with seventeen 2nd year design students. The observations were meant to be as unobtrusive as possible; we used a small audio-recorder to record the teacher/student conversations, and there were no direct interventions from the researcher. The audio recordings' content was then categorized and encoded in order to facilitate the data analysis.
The analysis of the observations was highly fruitful. The model we developed for the analysis proved to be valuable and the results allow us to build upon what was done onto further empirical inquiry. In general, our findings indicate that this setting has potential to provide insight into the way design conceptualizing unfolds in an educational setting.

Keywords: Design education, conceptual design, observational study.

1 INTRODUCTION

The focus of the research is on 'teaching conceptual design'. From scientific literature there is general agreement that *conceptual design* is crucial for the final outcome of the design process. However, there is a lack of studies approaching the question of what it means to 'conceptualize'. And parallel to that fact is the observation that 'teaching and learning' methods on how to attain and conceptualize good ideas are almost completely missing.

1.1 Design education

The design studio setting is heavily based on close-tutoring, i.e. students practice the role of designing during design exercises, while being tutored by a design teacher.[1] This places a set of difficulties for design education. First, designing is about creatively solving open-ended challenges for specific situations. Therefore, there are no prescriptive guiding models that can be applied. Much like any other creative endeavour [2], there is more than one possible approach in design problem solving. Second, the teaching/learning situation is determined by the interaction between teacher and student [3] when factors (personality, teaching style and so on) involved in this interaction are incompatible. There is a disjunction between the two, resulting in adverse consequences in the learning process.

If we go back into the origins of design education, we can observe that the established 'learning by doing' paradigm follows from the tradition of guilds in medieval Europe where the 'master-(journeyman)-apprentice' model was in use to educate craftsman. It was partly based on this model, that, in the twentieth century, the theory of constructivism was introduced. Of course, in its most general assumption, it states that knowledge and meaning are generated by our experiences. [4] [5]

This education philosophy is the blueprint of design education; D. Schön (1987), [3] in his studies on 'reflection-in-action' emphasized the importance of 'dialogue' (expressed verbally or visually) between coach and pupil in the design studio. Previously J. Dewey (1933) [6] also established the importance of reflection in the learning process.

Therefore, the design-studio setting has ancient roots. Designing is supposed to be learned by giving the students the possibility to do it themselves, while the 'teacher' assumes a tutoring role that guides the student through the process. For the most part, we observe that studies have centred on the student [7], resulting in a lack of research that addresses the role of the teacher. In our research we aim to find methods that improve that role and contribute to a more efficient tutoring.

1.2 Conceptual design

By conceptual design we mean the part of the design process in which ideas are conceptualized. There is a consensus among the literature that conceptual design has a crucial importance for the development and outcome of the design process. [8] Furthermore, conceptual design is usually understood as part of a sequential process. [9] However, when dealing with the ill-definedness of design problems [10] [11], it is difficult to describe conceptual design as a 'phase' with clear boundaries. On the contrary, there are strong indications that conceptual design is an ongoing activity, which drives the process since its beginning (problem setting) until advanced detailing stages.

Considering this stance on conceptual design, we should point our studies at initial stages of the design process, when there is a high level of instability. It is easier for a teacher to guide a student in later stages when the attention is focused on detailing instead of idea generation and development.

1.3 The setting

The theoretical research we presented above has led us to define a very precise setting on which to undertake our empirical studies: On the one hand, we recognize the importance of conceptual design activity for the design process; on the other hand, we have seen how the teacher/student interaction is determinant in design education. Thus, we decided to explore the teacher and student interactions during the student's conceptual design activity.

2 THE STUDY

The study we are presenting here is a first explorative pilot study.

The objectives of the study are twofold: firstly we aim to describe and understand what happens in the teacher/student interaction during conceptual design activity, with a specific emphasis on the role the teacher plays in this setting. Secondly, to test the efficacy of the study methodology itself – in the final part of this paper we will elaborate on what needs to be changed in our inquiry methodology.

The study was conducted in a real-class setting during a normal session of a design course in a design faculty in Portugal. Seventeen 2nd year design students and one teacher were present for the session. The students were working on an early stage of their projects (second week.) The brief challenged them to create a space (a pre-defined parallelepiped cube) using several elements (mainly colour, light, communication graphics and objects), so their interventions ranged between architecture, product and graphic design. The brief left the definition of the space's purpose open for the students to decide.

The observations were meant to be as unobtrusive as possible; we used a small audio-recorder to record the teacher/student conversations, and there were no direct interventions from the researcher.

The session lasted approximately nine hours; the class-session is scheduled from 09h00 to 18h00 with a lunch break of one hour. We had only a rough idea of how the teacher conducted the class, which resulted in unanticipated problems that had to be dealt with on the spot. These were mainly due to the somewhat organic nature of the session – the teacher moved around very often making short interactions with the students, which made it difficult for the researcher to keep track of all the interactions.

2.1 Methodology

Every student signed a written consent that explained the nature of the study. A code was assigned to each student to ensure anonymity: S1, S2, S3 and so on. The same goes for the teacher which was assigned the code "T1."

The study was divided in two distinct phases: (1) the data collection and (2) the data analysis. During the first phase the focus was solely on recording the individual conversations between teacher and students. The observations proceeded as such: the researcher followed the teacher as he moved around the classroom, either addressing or being approached by the students as they worked on their projects. In order not to lose track of the proceedings, we kept an individual file for each student (identified by his code), where we marked the time of the interactions and observations we considered relevant.

The conception of the teacher/student interaction as a *dialogue* should, of course, be understood in a broad sense and include verbal as well as non-verbal communication. We had planned to register the non-verbal elements (drawing, demonstrations, and so on) using a digital camera; unfortunately, these moments were observed but not registered, due to the aforementioned difficulties that arouse from the dynamic nature of the session. We intend to anticipate and improve this aspect in our following studies.

For the second phase we developed an analysis model (explained in detail in point 2.1.1) to encode and interpret the data. Prior to this, all the interventions were transcribed and translated (from Portuguese to English.)

Our emphasis is placed primordially on the teacher.

2.1.1 Analysis model

In "Educating the Reflective Practitioner" Donald Schön (1987) presents a description of the teacher and student *dialogue*. Even though his work was heavily focused on *reflection-in-action*, the general framework described in his work seems adequate as a basis for our first pilot-study. We view his model as a foundation to build upon.

According to the author we can divide both teacher and student's actions in two general categories: (1) telling/listening and (2) demonstrating/imitating (descriptions or demonstrations, in other words, telling or showing). Furthermore, Schön divides the first category in the following actions: question, instruction, advice and critique.

We have structured and expanded these descriptive categories and built an analysis model (Table 1) which was used to analyze the teacher's discourse in the transcripts:

Table 1. Analysis model

Teacher	
TELL	SHOW
Advice	Draw
Criticism	Examples
Instruction	
Motivate	
Question	

As we will see in the results, it is not possible to make the same approach for the student. Any attempt to apply a similar categorization to the student's actions falls short, since the student's discourse is consistently unstructured, and could be best described as *thinking aloud randomly*. The only exceptions to this behaviour are short statements regarding specific actions or when referring to exterior examples.

2.1.2 Mutual understanding and breakthrough

When we analyzed the transcripts, we frequently observed that there was an absence of effective communication. The dialogue unfolded much like Schön described: teacher and student struggle to find a common language, their discourses are dramatically opposed. One the one hand the teacher portrays a structured and rational discourse while the student entangles his by verbalizing a myriad of thoughts with no guiding thread.

As such we made two additions to the analysis model and examined the transcripts for moments of *mutual understanding* and *breakthrough*. Here we are not dealing with teacher or student actions but rather with the presence of successful communication between the two.

Mutual-understanding – when teacher and student communicate easily, finishing each other's sentences or leaving sentences unfinished.

Breakthrough – when the teacher communicates successfully with the student. The fundamental difference with *mutual-understanding* is that *breakthrough* functions "one-way," the teacher addresses the student and the student acknowledges it.

2.2 Results

We will present parts of the analysis of one of the students (S2). After close examination of the data, S2 emerged as the participant with the higher number of interactions (12). He was also a prototypical participant in the session.

S2's idea for the space was a subway station.

2.2.1 Transcripts

In order to clarify the existence of the categories we have set *a priori*, we have selected nine fragments of transcripts to present here. We will provide an interpretation of these in the conclusions.

To distinguish between student and teacher transcripts we highlighted the student's by setting them in *italic*. Whenever we identify an action as suitable to be categorized according to our model we marked it with the corresponding initial in uppercase bold: Instruction (I), advice (A), motivate (M), criticism (C), question (Q), draw (D) and example (E) for the teacher; thinking aloud (TA), question (Q) and stating (S) for the student; and mutual understanding (MU) and breakthrough (B).

Transcript 1

T -maybe it is a bit irrelevant if you find the answer to that question or not. **C/A**

S2 -*Yes that's it, that's it... so I think the question of the length, so...it would be more the dimension of the whole train...and not the carriage...* **TA**

T -Then...you try it... **M**

S2 -*perhaps, I think...* **TA**

T -keep working on it... **M**

S2 -*that's it*

T -keep working... and keep working already on your box and the space...**M/I**

S2 -*that's it, that's it...*"

Transcript 2

T -work from a top view perspective! **I**

S2 -*yes*.

Transcript 3

T -don't forget to place the cardboard on the side... **I**

S2 -*yes...yes...*

T -because it's completely different to see the carriage above the horizontal plane. **A**

S2 -*Exactly!*

Transcript 4

T -and here you get more depth... **I**

S2 -*right*

T -a certain height which allows you to have more space to experiment more things... do you understand what I am telling you? **I/Q**

S2 -*Ah! so it doesn't end here?***Q**

T -this point... **D**

S2 -*hum hum*

T -this edge... **D**

S2 -*hum hum*

T -connect with the height of this plane... **D**

S2 -*hum hum*

T -everything goes up... **D**

S2 -*ah ok*

T -and you support this there. Which means you get this extra space here. **D**

S2 -*exactly!*

T -...in order for this to go to the ground... **D**

S2 - *ah ok now I get it!* **B**

T - … you build there... as if it was the pit... **D**

S2 -*exactly.*

T -... of the rails right? **D**

S2 -*Exactly. ok. ok.*

T -you need to cut more cardboard. **I**

Transcript 5

T -have you noticed the new pt-blue station in Lisbon? Have you noticed, they seized the station using only light and colour. **E**

S2 -*Yes, yes, yes...*

Transcript 6

T -you have to learn to manage your reaction time and learn how to do something very important which is to balance your expectations. Because it is complicated to have thousands of ideas and then... you have to actually make them! The problem is not developing great skills but realize our limitations. **A**

S2 -*Ok. great! Thank you!* **B**

Transcript 7

S2 - *ah! because what I was about to do was: take out this wall and replace it with see trough paper... and then light it from inside.* **S**

T -ok! **M**

Transcript 8

S2 - *teacher, it's going to be more or less like this.* **S**

T -hum hum

S2 -*with a... with a...*

T -with vertical facets? **MU**

S2 -*Yes.* **MU**

Transcript 9

S2 -*I was thinking... can I have movement?* **MU**

T -that's exactly what I was going to tell you next! **MU**

In Table 2 we present all the teacher's actions (30) we identified during S2's interactions.

Table 2. Teacher's actions

Tell		Show	
Advice	7	Draw	1
Criticism	0	Examples	2
Instruction	5		
Motivate	4		
Question	4		
Criticism/Advice	3		
Criticism/Motivate	2		
Motivate/Advice	1		
Motivate/Instruction	1		

3   CONCLUSIONS

The teacher opted for verbal explanations for the vast majority of the time. Regarding the teacher's role, it is relevant to highlight one aspect: *criticism*s never occurred without being followed by either *advice* or *motivate*; which made for nearly half of the observed actions of the teacher. Taking this into consideration we can safely say that the teacher's feedback was mainly a positive one.

We observed two moments of *breakthrough* with S2. Taking into account that the teacher opted mainly to "tell" instead of "show" it is interesting to note that one of these moments happened after the teacher chose to demonstrate something by drawing.

Mutual understanding was observed 6 times with S2. These moments are not possible to identify based solely on the audio-recordings; note-taking on site is here crucial to detect them. In this study we did not identify any pattern that might have lead to *mutual understanding*.

We can affirm that the teacher and student's discourse is contrasting, to say the least. There is a clear difference between the teacher's coherent verbalizations and the student's chaotic attempts to express himself with words.

Regarding the effectiveness of the model, we are encouraged with its start. The model is now very general in its descriptive ability, and yet, we can already derive some conclusions concerning the teacher's role for example.

The methodology will be fine-tuned for future studies. Namely, we will focus on only part of the students instead of trying to capture all participants in a class. This way, our data collection can be more thorough and include records of non-verbal communication as well. Furthermore we intend to

expand the categories and search for patterns of positive (or negative) effect on the conceptual design activity of the students. It is crucial that we are able, in future studies, to identify the effects of the identified teacher's actions on the conceptual development of the student's project. If we can detect, describe and ultimately understand the teacher's input on the result of the students, then it becomes possible to search for ways to improve it.

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