

# EXPLORING THE EFFECTIVENESS OF DESIGN EDUCATION IN IRAN USING PROTOCOL ANALYSIS

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## ABSTRACT

This paper examines the effects of design education on performance of undergraduate Iranian design students. The study intends to evaluate the potentials of design education in Iran using empirical data through protocol analysis study.

The study is staged with first and last year students and young graduate professionals with two years of effective experience. The attendants were given an assignment for designing a vertical sliding window opening aid system for elderly. According to protocol analysis the attendants were asked to think aloud throughout design activity, while the entire session was recorded. Using the Function-Behaviour-Structure (FBS) coding scheme, the transcribed activities were coded and fed to Linkoder analysis tool. The analysis results were then cross checked and observed differences between first and last year students and professionals were put to discussion in conclusion.

*Keywords: Design education, Iranian design studies, protocol study, function-behaviour structure, education effectiveness*

## 1 INTRODUCTION

Design education in Iran, as an academic discipline in universities started in late 1960's with "industrial design" together with other visual arts disciplines and "Architecture" under a common academic programme. With the general discretion of professions in effect, from 1970's at the first step, industrial design, sculpture, graphic design and painting became separated from architecture and clustered as "visual arts", and eventually since 1984, these disciplines, and amongst them industrial design, have become distinct academic programmes.

There has been a recurring concern amongst students and academic staff with the quality of 'design education' and now after three decades of having 'industrial design' as an academic discipline, the need to evaluate the design education's efficacy and understanding its shortcomings in professional environment is highlighted very much. This study shall be considered as a preliminary but essential step in this regard [1].

## 2 STUDY OBJECTIVES

The main objective is to investigate the effect of current design education system in the development of students from the first year of entry to graduation. It is strongly believed that design graduates continue to receive training in professional environment. There, they figure out their strength and weaknesses that oblige them to modify their skills accordingly.

It is also important to see how differently graduate design professionals would handle design problems as a matter of their built up experience in post academia 'professional education'. Analysing the observed differences can identify the areas of weaknesses in design education system and thus, could be used for making improvement in educational curriculum.

In general any educational system is established on four pillars [1]:

- Production of "knowledge" and ways of transferring it to students
- Fostering "Creativity" and "creative thinking"

- “Inductive and deductive reasoning” and “rational thinking”
- Exploring the “unknown” and discovering new “facts” and “ideas”

However the scope of this study is not wide enough to explore and identify all the measures that could improve the constituent pillars of education. Therefore the final discussion would be on improvements that findings of this study can support.

### 3 STUDY METHOD

#### 3.1 Protocol analysis

Protocol analysis is a method for eliciting the cognitive activities of designers [2], which usually manifests itself in form of oral conversations and body gestures, using recorded sessions and verbal transcript extraction [3, 4]. Protocol analysis is consisted of seven stages [3];

1. Developing the FBS coding system
2. Recording the design session
3. Extracting the transcript of the session
4. Translating the verbal transcript of designers to codes
5. Code analysis
6. Creating the map of conceptual links between the codes
7. Analysing the visualised links

##### 3.1.1 Function-Behaviour-Structure (FBS) coding system

FBS coding system is a re-usable ontology based design activity coding scheme that is chosen to be used for the protocol analysis in this study for its utility and coverage in other studies [3].

The definition of the codes in FBS design ontology is accordingly represents Functions, Expected Behaviours, Structures, Structural Behaviours, and Documents. The design process is defined as an activity that develops and transforms functions into structures and finally produces documentation of this transformation [5]. In the Design Process, the designer judges and deduces the expected behaviours from Functions and Requirements in Formulation 1. The transformation of expected behaviours to structures is done in the part of the process known as Synthesis 2. Then designer Analyses 3 the behaviour observed in the structure. Then the observed structure behaviour would be evaluated 4 against expected behaviour. Documentation 5 is producing external presentation material. Reformulation 6, 7, 8 is the process of changing the space of possible design by changing the structures, behaviour or functions [3] (figure1).

Each coded activity extracted from transcripts is referred as a segment that would be the scaling block of the software program that would be used to analyse the experiment. The transitions that between these ‘segments’ could be measured either according to the sequential transition to the adjacent segment known as “syntactic mode”, or the “semantic connection” that exists between segments known as “semantic mode” [6] [4].

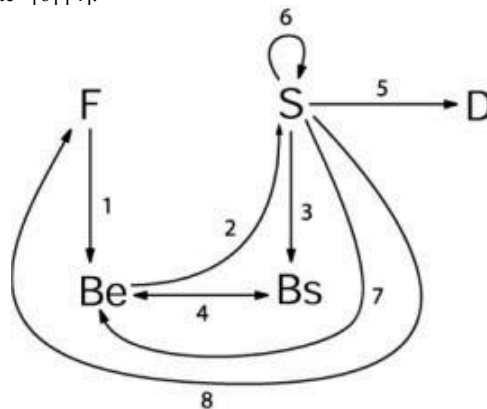


Figure 1. design issues and the map of transition processes [5]

### **3.1.2 Linkoder Software Program**

To be able to make a comparative analysis, the resulted coding needs to be standardised. This is done with LINKODER software, which is designed to be fed with FBS design issues codes [3]. LINKoder is a software tool that aims at automating the calculations in design protocol analysis and hence reducing the cost and time for doing such studies. It has been implemented using Processing Java IDE and is based on the FBS design issues coding scheme. In similar protocol analysis tools the coding scheme needs to be entered into the tool before it can carry out any analysis on the input data. LINKODER has been developed on the foundation of the FBS design issues coding scheme and allows the researcher to initiate the analyses of data directly. The software carries out a series of general and tabular statistics, probability analysis, and finally draws the linkograph and the subsequent charts.

### **3.2 Supporting interview**

Although utilising protocol analysis is certainly useful for studying a design process and therefore, also in an implicit way is used for the evaluating the efficacy of current design education system, it lacks the supportive addition of the opinions of the involved individuals. An open interview is therefore entailed the main experiment to actively elicit the major concerns of the test subjects, i.e. design students and young professionals to see if the findings would reveal any meaningful correlations. The interviewed students and professionals respectively mentioned the following items as their major concerns in the current design educational system.

1. A weak or non-existent link between industry and educational institutions would deprive the students of the essential practical experience that they are so desperate to get during the educational curriculum.
2. because of imposed blockade on certain and mostly high technologies (due to variety of reasons such as embargos) the industry is much more conservative in adopting and implementing innovation and more prone to follow the simplest and safest way, which is copying or importing proven solutions. Therefore, the design skills are not really that sought after amongst industry as something that can have any added value.
3. Asymmetric development of technology in different sectors reduces the number of opportunities that industrial designers can find a job.
4. Deficiency in supportive regulations that enforces intellectual rights of designers discourages their creativity.
5. This education is relatively young in Iran and the trained professionals and highly qualified academic individuals are still scarce.
6. There were severe skirmishes and disagreements amongst the very few academicians that were responsible for the development of design education, which hampered the timely development of this major.

## **4 EXPERIMENT SET UP**

As mentioned, for assessing the design education effectiveness, an experiment was conducted with a typical design problem that can initiate a design process.

### **4.1 Design assignment**

The assignment subject, “designing a concept for vertical sliding window opening aid for elderly” was deliberately selected to be a simple, tangible yet realistic problem. The participants were asked to propose their ideas without any time constraint. However, despite expressing that no time constraint is applied for the experiment, all of the participants autonomously put themselves in a time constraint of approximately one hour.

### **4.2 Participants**

The design experiment staged with 17 individuals; 6 first year students, 6 last year students and 5 young graduates. The participants voluntarily attended the experiment. There were no gender, ethnic, and/or academic performance selection criteria considered for choosing participants.

### 4.3 Potential Bias

There were certain factors that potentially could introduce bias in retrieved information. These factors were:

#### 4.3.1 Experiment environment

Because of the geographically disperse location of graduate participants, it was not possible to stage the experiment in the same location. This meant that observers should have staged the experiment, for graduate participants, in their work or living place. In a particular case, while presence of a sliding window assisted the student group in explaining their ideas, the graduates did not use such elements for explaining their ideas, even if a sliding window happened to be present in their location.

#### 4.3.2 Confidence

The first year students were concerned with their limited design skills and often refused to take part in the experiment unless they were allowed to participate in groups of two. This was clearly a departure from the other two groups' single participant attendance and could bias the results. Therefore, this study is not a peer to peer analysis that can compare the skills development of individuals from first year to last year and to graduate level.

#### 4.3.3 Coding bias

In practice, the coding of transcribed sessions was proven to be a delicate task that required having a number of iterations. To assure the accuracy and impartiality in coding, Delphi structured communication method [6] was utilised with two detached coders reviewing and coding sessions and then cross checking the results. Should there were any conflicts, the conflicting items were discussed to reach a decision and if they could not settle the argument, the verdict of a third person (usually a more senior and experienced supervisor) was accepted.

## 5 RESULTS

The obtained results of the analysis were the general and tabular statistics data spread sheets, the syntactic dynamic issues plot, dynamic processes plot, and Markov models' issue occurrence probability matrix [7]. An example of the acquired results in LINKODER software interface is displayed hereunder, in Figure 2.

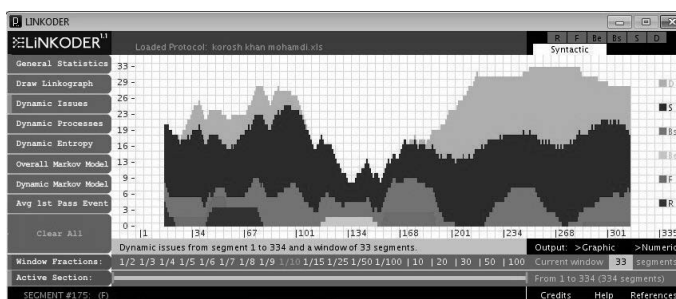


Figure 2. Linkoder software interface displaying the 'dynamic issue plot' of a last year student

Using the general statistics data, the average percentage of time dedicated to each issue (red columns), and the mean number of times each issue was addressed (blue columns) for each group of participants is demonstrated using the bar charts, Figure 3. This means that for instance, amongst the young graduate professionals the average number of times they addressed the issues related to 'structure' tops the chart with more than 35 times of being mentioned.

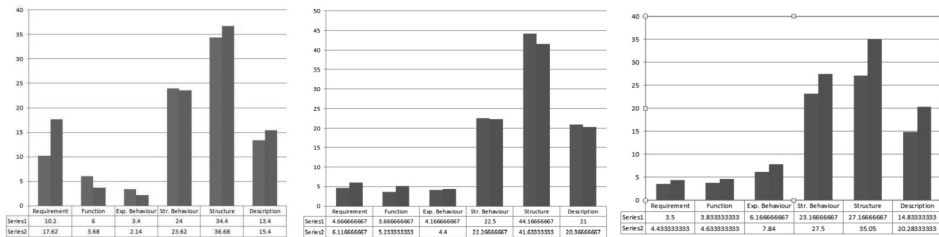


Figure 3. from left to right mean values for design issue statistics of 'graduate young professionals', 'last year student' and 'first year student' groups respectively

Comparing the results of each groups' mean value statistics for design issues reveals that the first and last year student do not tend to allocate as much time on requirements, design brief, or problem definition, as graduate group did. All groups almost unanimously spent little time on issues such as 'function' and 'expected behaviour', but considerably more time on 'structure behaviour' and 'structure'. Although any further interpretation requires very much attention to the spread of data and possible anomalies in an individual's results, which can lead to misinterpretation. For instance, by comparing the dynamic issues plot of first year students it was noticed that two students (result plot on left column in figure 4) spent considerably more time on the assignment and documented almost the entire process. Further inquiry on their background revealed that they have attended mechanical engineering bachelor's programme before attending the industrial design bachelor's degree programme. The increased grain in the dynamic plot of the aforementioned students represents elongation of the experiment sessions for them. Such drastic differences might dilute the consistency of the results.

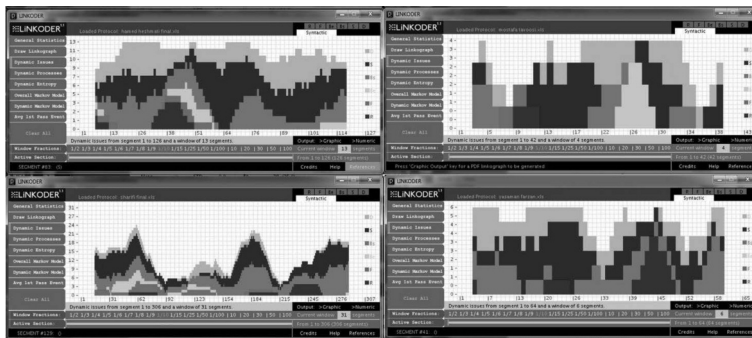


Figure 4 dynamic issue analysis plot of first year students

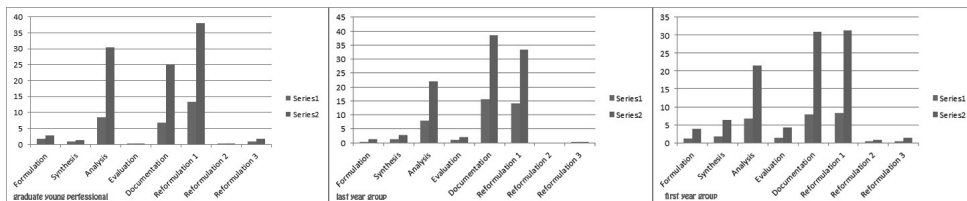


Figure 5 from left to right the mean value for design process distribution syntactic statistics for 'graduate young professionals', 'last year students', and 'first year students'

The mean value design process distribution statistics bar chart (figure 5) reveals that despite clear differences such as time spent on 'analysis', there are intriguing resemblances that interestingly sets them apart from last year students. Namely, the time spent on 'formulation' of a design problem decreased from first year to last year students but increased again in young professionals.

Another observable trend could be noticed in the amount of time spent on 'evaluation' and 'synthesis' amongst the students that has clearly decreased from first year to last year students and continued this trend even to young professionals.

## 6 DISCUSSION AND CONCLUSION

The fact that graduates spend more time on 'requirements' than students on both first and last years, which spent approximately similar time on this issue, can suggest that the professional work experience inclined graduates toward spending more time on 'formulation' of the problem and the 'requirements'. This can hint that the educational curriculum of industrial design does require more emphasis on developing the 'formulation' skills and structured thinking in design process.

The observed results of design process distribution syntactic statistics also can suggest that certain trends such as decreasing 'formulation' skills during design process from first to last year students clearly contradicts the educational skill that the job market demands. Also the decreasing 'synthesis' process might implicate decreasing creativity as a central element in this process. Again this doesn't follow the designated general objective of an ideal system of education. These interpretations somewhat correlates with the insight that the points made in interview with test subjects indicates.

As a preliminary effort, the scope of this study was limited to relatively small groups of students and doing the protocol analysis with one design assignment. Also the interpretation of the acquired results was carried out with dynamic issues and processes results. Certainly, the FBS coding scheme and LINKoder software is a far more potent tool for conducting more in-depth studies, for which the involved student researchers are aiming for.

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