STRUCTURAL CONCEPTS’ INSTRUCTION MODEL FOR ARCHITECTURE STUDENTS REGARDING MOTIVATION AND CREATIVITY PROMOTION

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ABSTRACT

In addition to different factors, industrial revolution and its consequences as a huge event caused separation between architecture and civil engineering. This status influenced architecture instruction schools too, and caused the arising of technical schools, which resulted in separate instruction of civil engineering. In France, two kinds of activities arose at Paris Fine Art School, which was trying to separate architecture from life and at Polytechnic school which caused the unity between science and life. This issue clearly shows the gap between architecture and structure art (Mozayani, 2011). Lack of our understanding from structure’s basic principles prevents creativity at designing (Namara & collaborator, 2010). Teachers declare fear and discouragement of architecture students for structural lessons. Often, students think about structural lesson as boring exercises with a lot of mathematics (Slattery, 2000). Regarding that, this article aims to present an instructional model which can reduce above mentioned problems to the minimum level. Used research method for this study is structuralism grounded theory. So, instead of using existent theories as theoretical, the researcher seeks to give an autonomous theory based on field data. For this purpose, needed data were collected from different sources by using theoretical sampling method. For data collecting, various techniques were used, including interview, documents and articles collection. So in this point, all data were coded by triple coding instruction sets, i.e. open, axial and selective. Eventually, 203 concepts and 32 categories were derived from data midst, and various solutions for arising motivation as the central category were specified. After that, by using paradigmatic model, autonomous theory resulting from data midst are represented as
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story and pictorial model. Finally, the study is assessed by answering seven questions of Strauss and Corbin.

Keywords: instruction, implementation, structure in architecture, creativity, motivation, grounded theory

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1. INTRODUCTION

Structure’s importance in architecture is defined as this: structure is the main and unique tool of creating form and space in architecture. Because of this feature, structure is the most basic tool to form material environment for human. Structure is dependent on systematic order influenced by natural science rules. Therefore, among constituent elements of architecture design, structure is considered as an absolute norm (Engel, 2007). Also a designer architecture should know about structural systems, as it affects aesthetic side of design (Moore, 1999). Structure in its relation with architecture form, takes different status in terms of being in purview. Structure can be hidden completely by the form of construction, also it can be the construction’s form, i.e. the architecture, itself. Structure gives identity to designer’s creative purpose in unifying form, materials and powers. Therefore, structure presents a tool based on aesthetics and creativity for any kind of construction (Engel, 2007). Lack of attention to structure instruction itself can cause fading out of architect’s role. During designing and construction, if architect cannot use his/her structural knowledge interacting with structural engineer optimally, he/she wouldn’t be able to adjust space’s concept with structural developments and most of activities would go to engineers district, especially in structure and construction fields, which itself would result in undesirable consequences including separation between structure and space (Zarkesh, 2005).

Although the common program of representing structure lessons and their sequence as physics, statics, strength of materials, analysis and designing may appear to be reasonable from information intuition, practically, students would remain on primary levels of components’ analysis. They completely would recede from designing course, so basic and necessary principles wouldn’t convey to them, therefore they wouldn’t be able to use this instructions after graduation, and soon they forget about what have been learned (Vasigh, 2005). One of the most important sources of above mentioned problems and gaps, is structure instruction to architecture students, which includes lack of extension for structural subjects in architecture designing, lack of structural concepts and subjects’ stability, discouragement for learning structural lessons and lack of structural creativity in architecture. So, the purpose of this study is to represent a structural concepts’ instruction model which can result in promotion of creativity, motivation and stability.

2. LITERATURE REVIEW

Hamer implemented an experiment on two groups; teaching in one group was done by lecturing method, and in the other several active methods of teaching was used in which students were active in class. Studies’ results showed that students had better learning by active teaching method, and notable point was that this learning difference was much more among normal and weak students. About this Hamer states “in active teaching methods, weak students have more chance to think about subjects they haven’t comprehended” (Hamer, 2000). Zürich ETH architecture university department was designed for structural analysis of
structures’ maquette lessons, so that students can face it directly in class, and some of these maquettes included plain beam, plain frame, arches and truss. Although showing structural behavior with maquettes is very useful, there are several limitations for it; first, experiment diversity on maquettes is limited. Second, needed time for making any maquette and experimenting it is excessive, and finally students may be inactive during experiments (Kuenzle, 2008). At Jaume I university of De Castellón, Spain, an instructional project was designed for structural analysis lessons, in which students designed a wooden frame and loaded it up to disconnection level. Then, they analyzed their own structural model with SAP2000 and according to concluded results, they modified the model by changing number of parts, shape section and geometry and the winner was the group which made the most resistance to burden ratio. Obtained results in this project were both positive and negative. On one hand students became interested in structural components and real world searching such as for bridges, industrial buildings, etc. If they have properly understood structure theoretical principles, they could use them in their experiences; also they would learn team working during construction of a structure and how to explain their ideas, especially when describing it for other students. On the other hand, among this instructional project limitation was time consuming aspect of Marquette’s setup. Besides, used materials including wood and plastic are partly non-realistic, while practically steel, aluminum, and reinforced concrete are used. Finally, using professional ASP2000 software can be very difficult. In fact, this software is designed for practical engineering problems, so it is not proper for instructional purposes (Pedron, 2006).

In a study limited components analysis software was used for structure instruction to architects. Results of study show that architecture students considered structure, by making construction model in this software parallel with architectural design, and this promoted quality of architecture process. Also, as this software is of engineering type, architects can communicate easily with engineers during professional working (Azici & Yazici, 2013). In other study, by making a graphic software called “interactive structure” for statics and resistance of materials instruction, Vasigh showed that the main cause of using this software is to create an instructional tool which can make a strong connection between concepts and experience by presenting figures and animations. This was done especially for architecture students who are interested in visual and graphical methods. Also, using computerized simulation results in promotion of students’ interest and excitement level (Vasigh, 2005). In other multi-media program called “Gizmo”, which was designed for structural concepts instruction to architecture students, visual intuitive aspect was very paid attention and it was implemented in Illinois institution classes. Results of this study showed that visual intuition can’t help with computational knowledge of students, and just develop their structure’s comprehension, so both theoretical knowledge and understanding of structures’ behavior should be considered in structure analysis lessons. Also, this program developed material understanding of students so they could know which materials must be used (Abdelmawla, Elnimeiri, & Krawczyk, 2000). Results of field study in Mazandaran University which had used the nature for instruction of statics concepts to architecture students, showed that using the nature increases learning level of statics concepts significantly (Shahroudi, Golabchi, & Arbabiyan, 2007).

3. RESEARCH METHOD
This study searches for answer the question by qualitative approach. Qualitative study is a series of explanatory technics which looks for description, decoding, translation and perception of social environment phenomena’ concepts (Lindlof & Taylor, 2011). Qualitative approach, includes different viewpoints and school of thoughts and grounded theory is one of them (Flick, 2006). In two recent decades, different grounded theory styles were presented,
insofar as they are called family of grounded theory (Bryant & Charmaz, 2007). As a result of
grounded theory development, beyond being a research method, it can be considered as
viewpoint for scholars. (Glaser, 1999)

Among the important grounded theory, is structuralism grounded theory. Structuralism
grounded theory was mostly developed by Kathy Charmaz and Antony Bryant, and it is in
contrast with positivist aspects of primary grounded theory. This style is affected by
structuralism theories development in social sciences and a there is structuralism view to
activists. In a classification, classic and modern types of grounded theory are divided in two
categories as objective and structural. This study is categorized as structural grounded theory
(Bryant & Charmaz, 2007).

Grounded theory is considered as an attempt to find a theory which is achieved posteriori
from phenomenon study and represents that phenomenon. In grounded theory, the theory
itself must be discovered and it must be proved from ordered collection of information and
data analysis resulting from it (Strauss & Corbin, 1998). In other words, in grounded theory,
study is never started from a specified theory that is to be proved then, but the study is started
from a field of study and results from that study’s midst. In fact, researcher goes to the field of
study midst and extracts the theory from data midst.

In grounded theory, after specifying the study question and reviewing literature is done,
sampling is the first step for entering to field of study. Unlike quantitative
methods in which
probable sampling methods are used, qualitative methods use qualitative sampling (Goulding,
2002). In grounded theory, theoretical sampling is used and samples are selected for study
purpose. In this method, samples number is not specified before, and adding them continue up
to theory saturation level.

In grounded theory method, collected data are coded in three steps. During these three
steps and by data coding, concepts are extracted from codes; categories from concepts; and
theory from categories (figure1). Open coding, axial coding and selective coding are three
steps of coding in grounded theory. During this process, the researcher must record work
progressing events and details as memo writing.

In the final step of coding, i.e. selective one, axial category is selected among from
categories and concerning it a theory is presented from study midst. Resulted theory of data
amidst, is drawn around axial category as a story and pictorial model. The story is “a
descriptive narration about the main phenomenon.” (Strauss & Corbin, 1998) To make a
connection among categories, suggested paradigmatic model of Strauss and Corbin was used.
This paradigmatic model, classifies categories into six groups or boxes. If this model isn’t
used, the resulted theory may lack needed accuracy and complication (Strauss & Corbin,
1998). These parts include: casual, context condition, core condition, intervening conditions,
strategies and consequences.
4. RESEARCH DATA

During grounded theory process, data are collected by different methods and they are coded, and analyzed by operating instructions to produce the final theory. In this study, different technics including interviews, and documents collection are used. During study process, data collection continued up to theory saturation. Used data in this research are categorized into four groups, as it is shown in table (1).

<table>
<thead>
<tr>
<th>Number</th>
<th>Kind of data</th>
<th>Count</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Exclusive interview with structure instruction teachers</td>
<td>10</td>
</tr>
<tr>
<td>2</td>
<td>Exclusive interview with instruction teachers</td>
<td>3</td>
</tr>
<tr>
<td>3</td>
<td>Exclusive interview with engineers and architects</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Documents and articles</td>
<td>20</td>
</tr>
<tr>
<td>5</td>
<td>Scholar’s memo writings of process and observation during research</td>
<td>4</td>
</tr>
</tbody>
</table>

**Table 1**

**Primary findings (extracted concepts and categories from data)**

Three steps coding results of collected data with different methods were extraction of 203 concepts and 32 categories. According to cognition method process which was described earlier, during three steps of open, axial and selective coding, related codes to subject were specified first; then a concept was extracted from several codes by regular comparison method and so other codes were converted to concepts similarly, till finally 200 concepts were achieved. Although in the next step concepts were categorized as one group, so that 32 categories was extracted from this research. Among these 32 categories, one was appeared as central category, so with other 31 categories, grounded theory components of research were formed. Central category in this study is various schemes of motivation creation, and other articles are defined in connection with it.

Categories are divided in five following groups to present pictorial model:

- Context (4 categories)
- Intervening condition (7 categories)
- Casual condition (7 categories)
- Strategies (8 categories)
- Consequences (5 categories)

Four categories, “instructor-dependent evolutions”, “society evolutions”, “family dependent influences” and “university and college limitations” are categorized in context group. “Instructional technologies and facilities”, “student’s area of interest changing in future”, “time controlling in instruction”, “teacher conditions”, “professional work barriers”, “variety of student’s learning style”, and “university-mate influences” form intervening condition categories. In casual condition categories part, “creating negative viewpoints in students”, “instruction of structure generalities”, “making positive thinking”, “using in different situations”, “producing question for students”, “learning continuity” and “team working activity” were included.

Strategy categories includes “representing basic concepts”, “necessity representation”, “case studies representation”, “learning by implementation”, “discovering”, “small successes”, “instruction to classmate”, and “experiencing designing by concepts”. Finally, consequences categories are formed of “motivation”, “creativity”, “durability”, “structure intuition”, and “discouragement and disappointment”. 
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Constitutive concepts of these categories are shown in table (2). Because of limitations of content in this study, in following only two categories and their constitutive concepts are described here. Samples of related codes are represented.

**Table 2** Extracted concepts and categories from codes

<table>
<thead>
<tr>
<th>Number</th>
<th>Concepts</th>
<th>Category</th>
<th>Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Extravagance in calculation, saying whatever is known, lack of attention to learning styles diversity, lack of grounding, arbitrary instruction</td>
<td>Instructor-dependent evolution</td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>Clarity of career status, lack of connection between university and industry</td>
<td>Society evolution</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Genetic traits (intelligence), physical weakness, educational gift, following up children’ education, supporting</td>
<td>Family-dependent influences</td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>Score-based education, lack of practical Syllabus, instructors’ audit, adjusting content with Iran’s conditions</td>
<td>Limitations of university/college</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>Laboratory, structure workshop, visiting the project, communication with professional engineers</td>
<td>Instructional technologies and facilities</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>Interested in other career, tendency to civil engineering</td>
<td>Changing of student’s area of interest in future</td>
<td></td>
</tr>
<tr>
<td>7</td>
<td>Lack of time, time consuming aspect of experiencing, limitation for lessons during a term, theory and practice combination</td>
<td>Time controlling during education</td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>Instructor’s knowledge level, instructor’s personal tastes, instructor’s thought about teaching for architects, using instructional tools</td>
<td>Instructor’s conditions</td>
<td></td>
</tr>
<tr>
<td>9</td>
<td>Career prospect, income, architect’s duties in project, verbal learning of civil engineering</td>
<td>Professional work barriers</td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>Comprehensive instruction, attention to students’ conditions</td>
<td>Diversity of students’ learning style</td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>Camaraderie among students, noticing information from seniors, helping each other</td>
<td>University mate’s influence</td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>Lack of practicality, mathematics-dependence being, stating details, unilateral process, extravagance in instruction method</td>
<td>Creating negative viewpoints in students about structure lessons</td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>Intuitive interpretation, general instruction of intuition cause, comprehension reach, history of structure, experience in nature</td>
<td>Instruction of structure’s generalities</td>
<td>Casual</td>
</tr>
<tr>
<td>14</td>
<td>Communication, reconciliation with topic and lesson, aesthetic approach, stating structure’s application, lack of analysis for complicated structures, intuition about structure</td>
<td>Creating negative thoughts</td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Using durability element, converting quality to design, converting theory to implied knowledge, skill achievement, quality and quantity combination, power transmission path in architecture, structure of a tool,</td>
<td>Using structure in different statuses</td>
<td></td>
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<td></td>
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<tr>
<td>---</td>
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<td></td>
</tr>
<tr>
<td>16</td>
<td>Practices, institutionalization by practice, from practice to skill, seeking, analysis, interaction with students, question making, challenge, question and durability, creating concern, question making, critic student, reviewing</td>
<td>Creating question for students</td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>Connection among lessons, requiring from students, forming of theory and design relation, repetition</td>
<td>Continuity of structure’s learning</td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>Architecture as a team work, interaction, communication, sympathy in instruction</td>
<td>Team working activities</td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>Motivation by case study, question resulting in motivation, active instruction, diversity of instruction styles, experiential instruction, modeling, team working as motivation element</td>
<td>Various schemes to create motivation</td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Structure’s theory, theory generalizations, form finding, skill sciences, primary basics, power transmission path, design chart, approximate calculation</td>
<td>Representing basic concepts</td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>Necessity of learning, changing of mind, element structure in architecture, economy, form following the structure, structure’s position, cause of structure learning, context making, mental stability for students, the reason of connection with topic’s application, architect’s duties, importance of structure in designing, is architecture art or engineering?, combination of art and engineering</td>
<td>Representing necessity</td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>Practicing by case study, observing samples, case study resulting in creativity, structure becomes architecture, verification, instruction by case study, important role of architect in project, works of famous architects, observation, studying architecture works, surveying influences of structure innovation</td>
<td>Representing case study</td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>Working on model, representing theory by model, construction and durability, bilateral process, natural question making, practical measure, real world experience, experience and construction, implementation, placing in real status, touching, observation, using, laboratory, personal experience, active instruction, practical achievements, comprehension by observation and touching</td>
<td>Learning based on experiencing/implementation</td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>Hierarchy, parameter making, converting complication to simplicity, finding form from structure, analysis, challenge based, diagram, discovering durability agent, instruction’s purpose, producing content, active instruction</td>
<td>Discovering</td>
<td></td>
</tr>
</tbody>
</table>
### 5. CONCLUSION: REPRESENTING GROUNDED THEORY FROM DATA

According to resulted concepts and categories and after connecting them by focusing on central category, grounded theory resulting from data can be represented. This theory is represented in two ways, i.e. story and pictorial (figure 1) and they show relationships among categories. The story of this theory is as following:

Statics instruction to architects was developed in a background which was accompanied by various barriers for applicability of topics and connection with professional working. As the addressees of structure instruction are architecture students who often selected this field of study to be able to do designing than complicated calculation, problems in statics instruction for architects, originate from three agent, i.e. university, teacher and student. About university problem, lack of adequate facilities can be mentioned, which includes instructional workshops, auxiliary instructional tools and preparing adequate time for structural lessons. About teacher problem, lack of adequate knowledge in architecture designing area and lack of architectural knowledge cause problems such as teaching whatever the teacher wanted without representing useful and applicable topics in architecture and also excessive calculation which results in negative viewpoint of students about structure. Among other problems relating to teacher, is instruction method and the way they teach as they want and without attention to students’ learning style, which the biggest consequence of it is discouragement of students who don’t learn anything from current method of teacher.
About student problem which interferes with instruction less than two other problems, is internal events the student is involving with. For instance they doubt if he/she wants architecture or other field of study, so he/she may lack of adequate motivation for following class. Or by attention to work market of his/her field of study, he/she is always thinking why should he/she study this much when his/her friends have no job yet? Its consequence is students’ discouragement for continuing the education. Of course the university and especially teacher can decrease this internal challenge so much. Many of teachers of structure instruction to architects are civil engineering educated and most of them believe that calculations must be instructed to students without any modification and applicability of topics is less important. Teachers who are more knowledgeable about architecture state that calculations must not be omitted, but they must be instructed at least in a level which can help structural concepts’ conveying.

About method of teaching, it is better to apply various methods than just a method. One of the most important and influential elements to promote motivation is making students involved with topic. To do this, a bed must be prepared in which student is exposed to doing and solving problems. Also, solving problem causes the feeling of discovering and promotes motivation. In next step, observing discoveries is among architecture’s verifications which in higher level, improves motivation and willingness for continuing. Because student comes to this belief that his/her discoveries were not vain, and they can be used in construction designing.

![Figure 2 Chart of the impact of categories on each other.](attachment:image)

**REFERENCE**


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