APPLICATION OF TOTAL QUALITY MANAGEMENT AS A MEDIATOR TO ENHANCE THE EFFICIENCY OF LANDSCAPE DESIGN PROCESS

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ABSTRACT

Abstract – In the last few Decades, a great attention has been devoted to researches concerned with functional issues and quality related to the design process. This approach can refer to many international and regional researches. The main idea of quality, development, and quality management has become one of the important approaches to enhance and insure the quality of the design process, including every details and complexity within this process. This research is offering an insight focus, not only on the design process in general, but also, on the landscape design process specifically, due to the variety of inputs, references, stockholders, and variables affecting the design process, thus to insure the process and the design quality that reflects the importance of design quality which enhance the urban spaces and landscape products, creating an overall development in the urban environment and human life. The main aim of this research is to offer a model that studies the nature of the interactive relation between the quality of landscape design process, the working environment variables and Total Quality Management (TQM), evaluating this approach through an empirical study to define the relation between variables and elements that concludes the nature of effective regulations of landscape design as an approach towards a more efficient landscape design process aided by understanding the principles of the total quality management. This analysis has proved the relation between the main dimensions of study; the design quality of landscape, variables of the working environment, and the total quality management, in addition to their sub-criteria.

Keywords – Landscape Design Process, Total Quality Management, Working Environment Variables

Abbreviations – Total Quality Management (TQM), Structural Equation Modelling (SEM), Malcolm Baldrige National Quality Award (MBNQA), Software Package for Statistical Analysis (SPSS 20.0).

INTRODUCTION

To get know the impact of strengthening total quality management by variables of working environment upon the landscape design process in a practical, real framework, this paper was based on an empirical study which aims to offer a model verifying the nature of overlapping between landscape design process, variables of working environment and total quality management. Structural equation modeling (SEM) was used as a statistic tool to determine the relation between variables and elements that concludes the nature of effective regulations of landscape design as an approach towards a more efficient landscape process aided by understanding the principles of the total quality management.

The problem of this research is concentrated in that in spite of the multiplicity of efforts made to verify the landscape design process, as the designer must be aware enough of inputs, parties and total variables influencing this design process, it can be monitored some shortcomings concerning the efficiency of final designed product, also concerning the client and his satisfaction

The main objective of this research is to offer a model that studies the nature of the interactive relation between the landscape design process, and the working environment variables and total quality management (TQM), as this paper is based on three main approaches which build the hypotheses base; the first approach: seeks to identify the nature of the relationship between the variables of working environment and quality of landscape design. The second approach: aims to explore the impact of application of total quality management (TQM) on the quality of landscape design. The third approach: try to figure out the indirect impact of the variables of working environment

on quality of landscape design through its direct impact on total quality management (TQM). Using Structural equation modeling (SEM) the research hypotheses was tested.

HYPOTHESIS

This study aimed to investigate the relationship between Landscape Design Quality, the Working Environment and Total Quality Management. Based on the previous findings, the research hypotheses are built as follows:

First hypothesis: Total quality management represents a mediator variable between the variables of working environment and design quality, which means that the variables of working environment has a direct impact on the design quality, and an indirect impact on the design quality through its direct impact on total quality management.

Second hypothesis: There is a positive impact of the variables of working environment on the design quality, which means that whenever the value of the working environment have risen over time, led to maximize the design quality.

Third hypothesis: There is a positive impact of Total quality management on the design quality, which means that whenever the value of the Total quality management have risen over time, led to maximize the design quality.

1. QUALITY OF LANDSCAPE DESIGN

Many interventions and variables affect the efficiency of landscape design process, once the contract is signed with the client; the design process starts, which is based on three main themes: location, program and project budget [10]. It begins by gathering legal, planning, environmental, visual information, project budget, project program and time schedule, passing through of conceptual idea, development stage, construction drawings and finally maintenance [8]. These stages involve many interventions that may affect the cost factor and the design process and project time, which will be reflected on design and quality of performance. we can draw major factors affecting the quality of design process as: 1 / Design Efficiency which includes: cost, time and function, 2 / Relevant Elements to design process which include: client participation, Design outputs, Design elements and the end of the process.3 / customer satisfaction. [10;11;8].

1.1. Variables of Working Environment

The working environment meant here is the architectural office, which take the form of governmental sector or private sector, whether was only a company, institution or practitioner. The sole owner of office is the principal Contact Person out, bear the burden of responsibilities and administrative staff, while the big companies follows the caste system with the development of specifications for the job "Job Description" and pay the employees' salaries [7]. The architectural office have different specifications of employees including architects, planners, engineers, economists and researchers Sciences (ecologists and soil scientists) as well as their number, which may range between 20 to 100 employee. Some offices restrict the size and business type on one specialty, such as: design golf courses, design therapeutic and preserve the historic, The selection of projects targeted by the Office include: geographical location, the client and / or the goal of the office and his philosophy background where most institutions or offices traces the selection of projects as part of a strategic plan that defines its objectives in order to sustain and grow their business [14]. The most important variables in the work environment could be: 1 / office experience.2 / size of the work of the Office and 3/ qualifications working in the office.

2. TOTAL QUALITY MANAGEMENT AS AN APPROACH TO IMPROVE DESIGN PERFORMANCE

Total quality management can be defined as a "strategy to help organizations commitment to improve customer satisfaction through the development of procedures which enhance external quality " [6]. Total quality management has become a global strategy that allow the goals of power and multiple benefits such as improved satisfaction customers, raise the efficiency of workers, work on their development, reduce waste, improve the

performance and the final output [16]. Total quality management is made up of a group of elements known as 'Critical Success Factors' which are the primary strategy to gain access to the outstanding performance of the institution [7], which has acknowledged of many previous literature [4;2;1]. The main components of total quality management are mainly based on the approved Malcolm Baldrige National Quality Award (MBNQA) classification [12], which came as follows: strategic planning, leadership, human resource management, operations management, information and analysis and customer focus, also the quality culture has been added as a seventh component due to its importance [13]. A study entitled "Identification of critical factors of total quality management" admitted that the application and adaptation of total quality management is relevant to enterprise culture [3].

3. LANDSCAPE DESIGN - TOTAL QUALITY MANAGEMENT: A PROPOSED MODEL

Based on the above concentration of concepts relevant to the offering theoretical study a model was suggested to test and develop the relationship between the three variables of the study which are: 1.*Design Quality* which includes: a/ design efficiency consisting of (cost, time and function), b/ elements relevant to the design process consisting of (customer participation, design output, design elements and end of the process), c/ customer satisfaction. 2. *Variables of Working Environment* which include: Office experience, the size of the office work and the qualifications of Employees. 3. *Total Quality Management* which includes: strategic planning, leadership, human resource management, operations management, information and analysis, customer focus, and quality culture. The research model is based on the assumption that the variables of working environment have direct positive impact on both total quality management and design quality as well as having a direct positive impact for TQM on design quality and finally there is an indirect impact of the variables of working environment on the design quality through their direct impact on the total quality management; that total quality management has a Mediator role. Using Structural Equation Modeling (SEM); hypotheses was tested to get into the research results, Fig. 1.

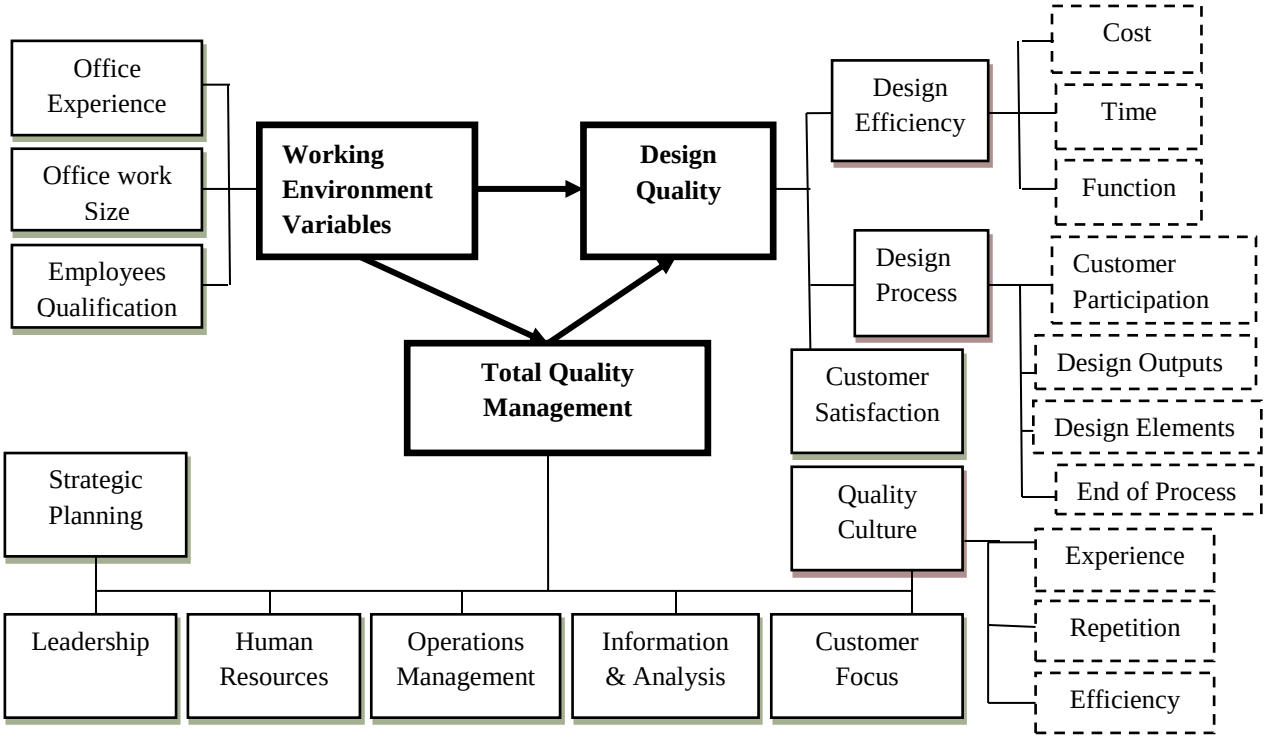

Figure 1 indicates to the proposed research model.

4. METHOD

4.2. Study Sample

The sample consisted of 168 architects, 99 males and 69 females, from different consultant bureaus. The researcher used the preview class style, where the selected offices and companies specialized in the design and implementation of landscaping projects, and distributed in a disproportionate customization manner (based on the number of employees in the Greater Cairo / Number of branches in Greater Cairo), and due to the lack of a specific framework to this community; the sample has been taken in error limits of 10%, and 90% confidence coefficient, and the proportion of the availability of the required characteristics studied in the community 50%, a sample size of 168 list was reached.

4.2. Mechanism - Goal

The objectives of the study is determining the nature of the relationship between the variables of working environment and the landscape design quality, explore the impact of the total quality management on the landscape design quality and find out the indirect impact of the variables of working environment on the design quality through its direct impact on total quality management; and as the quantitative studies are based on the digital expression of the variables, each variable of the study has been expressed by a series of questions using a questionnaire to measure the variables. The questions has been relying on the Likert scale to convert the quantitative statement to qualitative statement to can deal with it statistically, thus this study can be described as a quantitative study. Questions has been developed in a positive direction of measuring the position and had weight, for example: (Strongly disagree = 1, Disagree = 2, Neutral =3, Agree =4, Strongly agree = 5).The distributed questionnaire was split into three sections: the first and the second from the list includes questions of direct relevance to the subject of the research, The third section contains some questions related to Architectural office. The researcher used so-called closed questions because it is easy to answer this kind of questions, the analysis test was run by SPSS software.

4.3. Procedure

A questionnaire was distributed among the architects. The questionnaire form had 6 pages. The first page described the purpose of the study indicating that the investigators were conducting a study define the relation between variables and elements that concludes the nature of effective regulations of landscape design as an approach towards a more efficient landscape process aided by the understanding the principles of the total quality management. It indicates that the respondents would be answering 78 questions representing the three variables. The questionnaire assured the respondents of confidentiality and indicated that no right or wrong answers. In the same page, requested background information, age, gender, highest level of education and experience. The next 5 pages included 78 questions and asked the respondents to answer 45 questions representing the first variable (total quality management), 5 questions representing the second variable (the working environment) and 28 questions representing the third variable (design quality).

4.4. Testing the proposed model – Results and Analysis

Two steps were followed to test the proposed model. The first step was encoding the main variables and its sub-components, Table.1. The second step was the interpretation of the proposed model relationships through both confirmatory and structural models.

Table 1. Encoding the Main variables and its sub-components.

Variables	Code	Variables	Code	Variables	Code
End of process	**Z24**	Experience	**Y71**	Experience of office	**X1**
Culture of quality	**Y7**	Repetition	**Y72**	Size of office work	**X2**
Design efficiency	**Z1**	Efficiency	**Y73**	Employees qualifications	**X3**
Design process	**Z2**	Cost	**Z11**	Strategic planning	**Y1**
Customer satisfaction	**Z3**	Time	**Z12**	Leadership	**Y2**
Working environment variables	**FX**	Function	**Z13**	Management of human resources	**Y3**
Total quality management	**FY**	Customer participation	**Z21**	operations management	**Y4**
Design quality	**FZ**	Design outputs	**Z22**	Data and Analysis	**Y5**
Errors	**Ei**	Landscape elements	**Z23**	Customer focus	**Y6**

4.4.1. Testing Model Reliability

To evaluate the reliability of measurement for each variable, a reliability analysis test was run by SPSS software. The average value of reliability coefficients was 0.941. Thus, reliability of measurement seems adequate.

4.4.2. Confirmatory Model / Structural Model: Verify Model Relationships

Structural Equation Modeling (SEM) has been choose as a statistical method to test the proposed model, using (AMOS 20.0) as a statistical tool to explain the relationship between the main and sub-variables, which is a multivariate statistical analysis techniques, assumes that the relationship between the variables take linear shape. structural equation modeling method (SEM) is based on the analysis of the matrix taking into account the measurement and indirect relations mistakes. The main model is composed of two sub-models, the first so-called Measurement Model which represent the relationship between the Manifest Exogenous Variables and the Latent Variables and is sometimes called Confirmatory Model. The second so-called Structural Model, and expresses for causal relationships between Exogenous and Endogenous variables [5;15]. The Confirmatory Factor Analysis have been used to test the model composed of the three variables of the study, and in the light of the discretion of each of: regression coefficient, regression coefficient standard, and error standard; the P Value – have been calculated and compared to the one identified in the framework of the current research problem which is 10%, all transactions were statistically significant at the level (0.10) which showed the sincerity of these axes in the measurement.

A. Structural Model

By reaching a better quality of the confirmatory model, a structural model is translated, where structural model includes significant relations demonstrated by confirmatory model, which means that the structural model Contains only the significant relations between variables of proposed model. After reaching the final structural model, its quality must be tested by a set of standards quality indicators.

B. Testing Structural Model

The structural model have been tested using the structural equation modeling method, the test track transactions in the model taking into account the measurement errors and indirect relations; it have been make sure that the quality of the model came first then confirm the proposed structural model which explains the relationship with a high degree and can be relied upon in the interpretation of the model. It is clear from the results of table 2. indicators total compatibility quality of the model structural, that all the indicators reflect a high quality compatibility which means a strong internal coherence. Fig 2. Shows the proposed model standard transactions.

Table 2. Quality indicators of compatibility of the measurement and structural model

Quality Indicators of Compatibility	Value
Chi-Square ($X^{2)}$	360.819
Degrees of Freedom (DF)	126
P-Value	0.000
Normed Chi-Square	2.864
Goodness-of-fit-index (GFI)	0.847
Comparative fit-index (CFI)	0.897
Root Mean Square Residual (RMR)	0.031
Root Mean Square Error of Approximation (RMSERA)	0.106

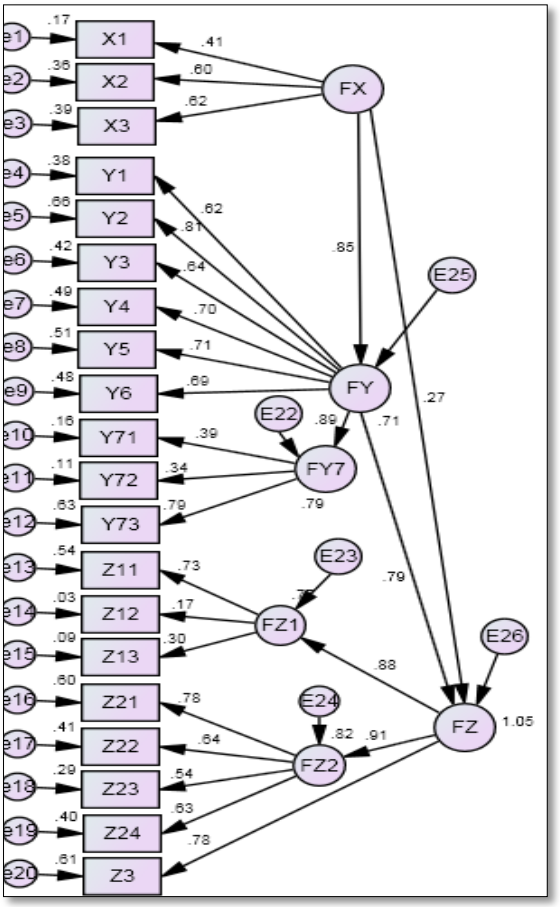

Figure 2. The proposed model standard transactions

5. RESULTS

Figure 2 illustrates a group of direct and indirect relationships, where the most important of these relationships are as follows:

5.1. The relationship between the working environment variables FX and total quality management FY: Figure 2. indicates to the total positive impact of the working environment variables on total quality management TQM worth (0.846), which can be ascribed to the direct impact of the working environment variables on total quality management TQM.

5.2. The relationship between the working environment variables FX and Design Quality FZ: Figure 2. indicates to the total positive impact of the working environment variables on Design Quality worth (0.936), which can be ascribed to the direct impact of the working environment variables on Design Quality worth (0.265),) added to the indirect impact through a mediator variable which is the Total Quality Management TQM overall value of (0.670), which is a product of the impact of Working Environment Variables on total quality management TQM worth (0.846), times the impact of total quality management TQM on the design quality worth (0.793).

5.3. The relationship between Total Quality Management FY and Design Quality FZ: Figure 2. indicates to the total positive impact of the total quality management TQM on Design Quality worth (0.793), which can be ascribed to the direct impact of total quality management TQM on the Design Quality.

6. CONCLUSION

The findings of this research suggest that variables of working environment have positive impact directly on both total quality management and design quality as well as having a direct positive impact of TQM on design quality and finally there is an indirect impact of working environment variables on the design quality through their direct impact on total quality management, Finally it was found the follows:

6.1. Concerning the first hypothesis that there is an indirect impact of the working environment variables on the design quality through total quality management; the results of statistical analysis showed the presence of an indirect impact of the working environment variables on the design quality through a mediator variable which is total quality management TQM worth (0.670) , which is a product of the impact of Working Environment Variables on total quality management TQM worth (0.846), times the impact of total quality management TQM on the design quality worth(0.793),thus the first hypothesis have been accepted.

6.2. Concerning the second hypothesis that there is a direct positive impact of the working environment variables on the design quality; the results of statistical analysis showed a direct positive impact of the variable of the working environment variables on design quality worth (0.27), which means that whenever the value of the working environment variables have risen over time, led so to expand the design quality, thus the second hypothesis have been accepted.

6.3. Concerning the third hypothesis that there is a direct positive impact of the total quality management TQM on the design quality; the results of statistical analysis showed a direct positive impact of total quality management TQM on design quality worth (0.793), which means that whenever the value of the total quality management TQM have risen over time, led so to expand the design quality, thus the third hypothesis have been accepted.

REFERENCES

1. Saraph, J. V. et al. (1989), "An instrument for measuring the critical factors of quality management", *Decision Science*, Vol. 20, No. 3, Pp. 810–829.
2. Flynn, B. B. et al. (1994), "A framework for quality management research and associated measurement instrument", *Journal of Operations Management.* Vol. 11, Pp. 339-366
3. Black, S. And Porter, L. (1996), "Identification of critical factors of TQM", .*Decision Sciences*, Vol. 27, No. 1, Pp. 1-21.
4. Ahire, S. L. et al. (1996), "Development and validation of TQM implementation constructs", *Decision Science*, Vol. 27, No.1, Pp. 23–56.

5. Gill, J., (2001). "Generalized Linear Models: A Unified Approach", *Thousand Oaks, CA: Sage Publications*. Series: Quantitative Applications in the Social Sciences, No. 134.
6. Harvey, D.F.& Brown, D.R.(2001) "An Experimental Approach to Organization Development" , p:366, upper saddle river , *NJ: Prentice Hall*.
7. Garmory, N. et al., (2002). " professional Practice For Landscape Architects", *Architectural Press* , Linacre house, Jordan hill, oxford .UK .
8. Thomas, B. (2006), "Landscape Design Documentation. Strategies for plan checking and Quality Control", *Wiley & Sons, Inc*. Hoboken, New Jersey. USA.
9. Abas, Z. & Yaacob, Z. (2006), "Exploring the relationship between total quality management (TQM), strategic control systems (SCS), and organizational performance (OP) using a SEM framework", *Journal of American Academy of Business*, Cambridge, Vol. 9, No. 2, Pp. 161-166.
10. Box , H.(2007), "Think Like An Architect", *The University of Texas Press*.USA.
11. El Messeidy, R.,(2007), "Site Landscaping and Reflections on Urban Communities; Special reference to upper Middle Class Housing in Egypt", *Cairo University*, Egypt.
12. Shenawy E E, Baker I, Lemak D J(2007), "A metal-analysis of the effect of TQM on competitive advantage"**,** *Int. J. Qual. Reliability Mange*. Vol. 24, No.5, Pp. 442-471
13. Yong, K.T&Pheng ,L.S (2008), "Organizational culture and TQM implementation in construction firms in Singapore", *Construction Management and Economics, Vol.*26, Pp.237–248 , Taylor & Francis Ltd .
14. Foster, K.(2010). "Becoming A Landscape Architect . A Guide To Carrers In Design", *John Wiley & Sons, Inc*, USA.
15. Arbuckle, James L. (2011), " Amos 20.0 User's Guide", Chicago, IL: SPSS Inc.
16. Ravikumar ,K. P. et al., (2011), "Implementation of TQM Techniques in TPM", *he IUP Journal of Science & Technology*, Vol. 7, No. 2.

A 3D SIMULATION GAME TO PRESENT CURTAIN WALL SYSTEMS IN ARCHITECTURAL EDUCATION

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ABSTRACT

The computer aided simulation concept comes in to human life with evolution of computer technology, has been an inspirational resource to several projects and studies. Because of improvement of computer technology day by day, simulation had been started to efficiently use in architecture, sport, medicine, arts, entertainment and education.

Adapting various systems and phenomenons concerning the real world to virtual world via computer technology becomes a revolutionary method to simulation which aims to gather achievements about these systems and phenomenons. Therefore it begins computer aided virtual reality methods take place of traditional methods in simulation projects.

Computer aided simulation is widely used in various disciplines to improve empirical education and training. Also it has really great potential in architectural education and training, it seems there are still not enough works about usage of simulation in this discipline. In building construction class supporting lecturing with simulation games can be used to improve learning and teaching experiences of students and lecturers. In this context a 3D simulation game had been created to use in building construction class.

The aim of this study is to evaluate usability of simulation game application developed to get building construction class more interesting and funny in architectural education. Therefore in construction building class, after a topic was presented trough simulation game, a survey had been performed to students to gather feedbacks for improving usability and quality of game application. As results of survey study, it was observed that the simulation game increases clearness and attraction of subject and active participation of students to course.

Keywords: Simulation, Game, Architecture, Education, Building, Construction

INTRODUCTION

In architectural education, the weight of applied course is more compared to the education of any other disciplines. In applied courses; to make the students understand the topic better, the solution of the problem and enabling the students to think and perceive in a three dimensional way and have a chance to have an experience in point are important. In construction building class included in the schedule of department of architecture, various problems have been experienced. It is possible to see that students cannot correlate or perceive the technical knowledge as they don't have a chance to observe them on field. Because the building construction periods take long times, it is not possible that the students could observe all construction processes told on the field during a semester. Due to its danger showing the misapplications in the building sites and the results of these misapplications are not always possible. It is envisaged that these problems encountered in construction building class can be overcome with the use of simulation programmes which are often used in training, especially if the task is dangerous or involves expensive equipment (Becker & Parker 2012). By means of the virtual reality provided via simulation game, students will have a chance to experience all dangerous building construction process along a lesson time without receiving any danger or cost. As

the simulation game is instructive, interesting and funny, it is thought that the success of students in construction building class which is a difficult one will increase and the knowledge gained from this lesson will be long lasting.

The Simulation Game

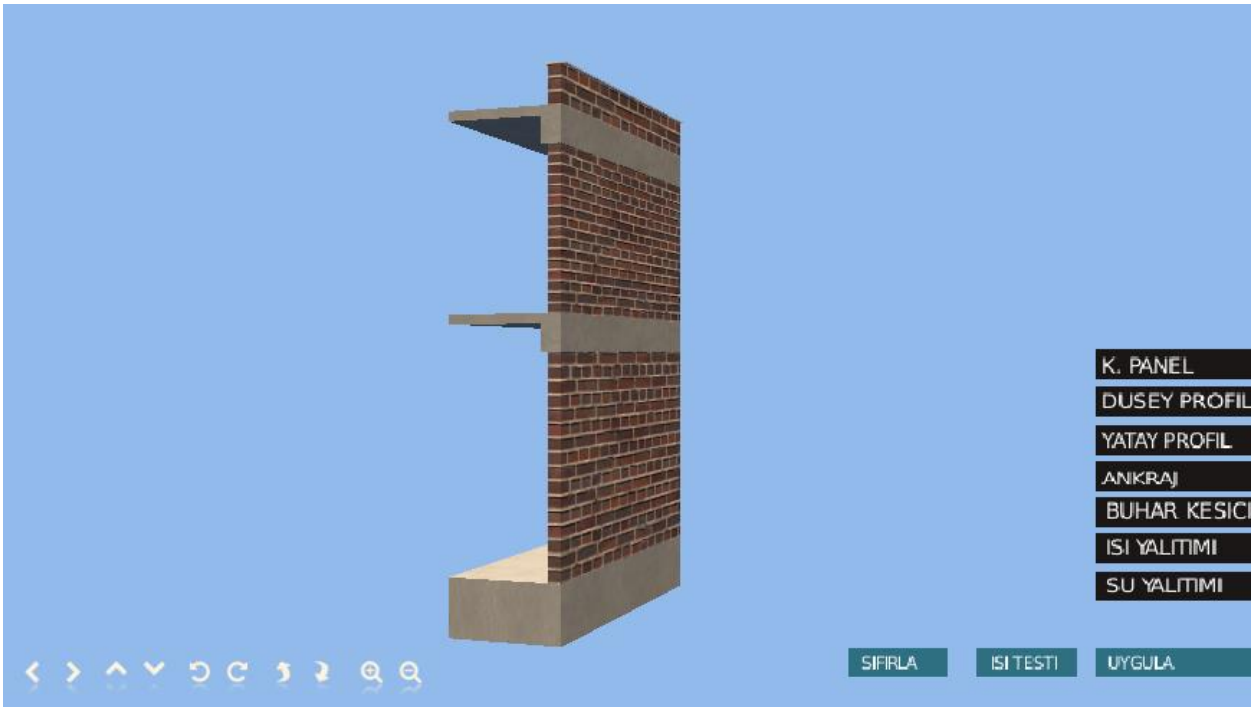
In Merriam-Webster dictionary simulation is defined as something that is made to look, feel, or behave like something else especially so that it can be studied or used to train people. According to Banks (2004) a simulation is the imitation of the operation of a real-world process or system over time whether done by hand or on a computer.

3D simulation games are simulation method which uses game and computer technology to imitate physical objects via 3D computer graphics. In other words, it is the process of creating and experimenting with a computerized mathematical model of a physical system (Chung, 2004). Fujimoto (2000) defines two types of simulation as analytic simulation which is used for gathering information and virtual environment simulation which is used for training people. The simulation games are also included in latter.

Because games lower the threat of failure, foster a sense of engagement through immersion, sequence tasks to allow early success, link learning to goals and roles, create a social context are multimodal, and support early steps into a domain (Dibley & Parish 2007), the simulation game in this project, which can be categorized under the digital game based learning (Prensky 2001), developed as a 3D computer game to do thought experiments (Axelrod 2005) on architectural education.

Figure 1

The Simulation Game Screenshot



The game programme is designed compatible with desktops, laptops and tablets. The goal of the simulation game is training architecture students on curtain wall systems and functions of their components through virtual reality. The graphical user interface of this simulation game developed with an open source modelling and game development application named Blender Game Engine. The game scene includes a bare 3D wall cross-section and curtain wall system components modelled and textured in realistic shape to virtualize real objects to players as far as possible (see

Figure 1). The game has a basic scenario that players try to install curtain wall components to naked wall cross-section in correct order and technique. When the players finish their practice on wall system they can apply gravity and heat resistance tests as in real world to evaluate components' installation order and technique. If players make mistakes on installing components to wall surface, a funny game over sound is heard and a failing message is appeared.

Discussion of Evaluation Process

The aim of this simulation game is describing and analyzing the behavior of curtain wall systems through asking "what if" questions about the real system (Banks 2004) as; what if anchorage is not nailed to supports, what if heat insulation is not installed or what if components installed wrong order and etc.

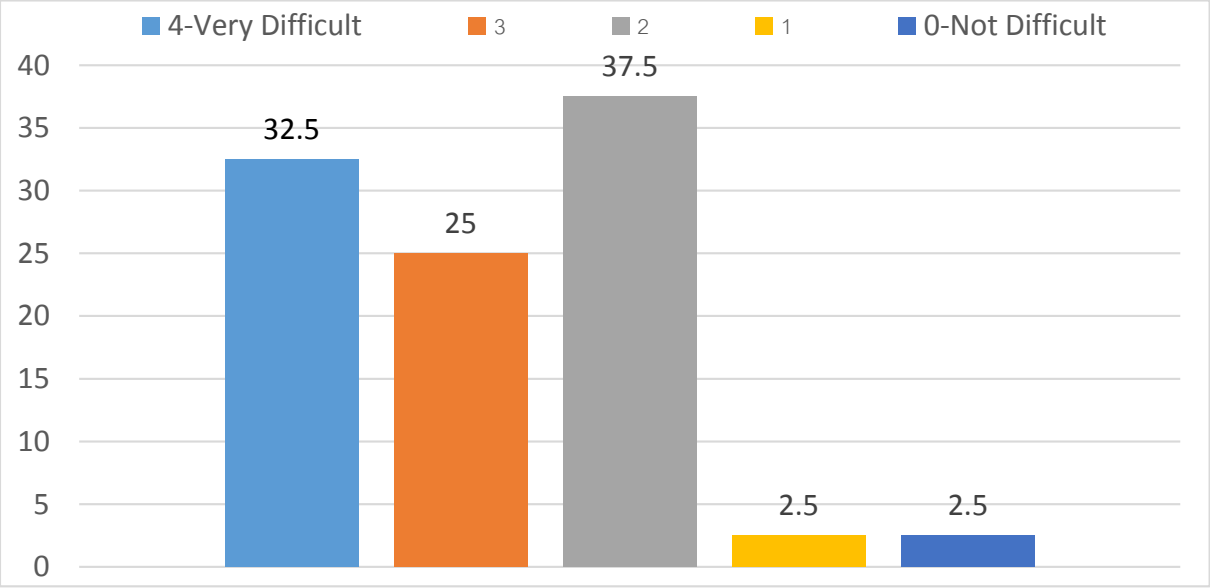
The simulation game used in building construction class to present curtain wall systems to Part 2 students in Department of Architecture at Karabuk University. On the purpose of reduce building construction class in more interesting and funny way, while presenting curtain wall systems with traditional method (as lecture notes and slides), students performed system procedures through simulation game on their notebooks and tablets to experience behavior of curtain wall systems in a funny way.

At the end of the evaluation a questionnaire was applied to analyze experiments and reactions of all students who played simulation game in class. A questionnaire survey (2 questions about building construction class and 6 questions about simulation game) in total 8 questions were asked to 40 students.

The results of the first question indicate that the most of students thought construction building class is a difficult lesson (see Figure 2). Only 2.5 percentage of students thought building construction class is not a tough lesson. These donnees explain why students thought building construction class is boring and they have difficulties to give their attention to lesson

Figure 2

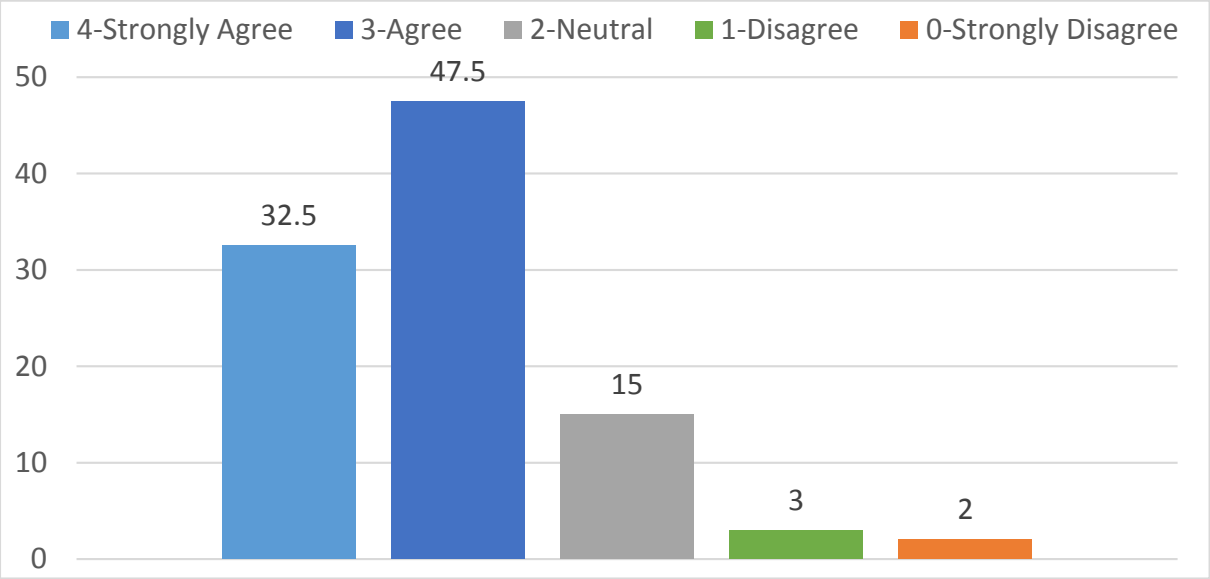
Question 1: Is Construction Building Difficult to Learn?



According to results of second question 80 percentage of respondents usually have difficulties on associate technical 2D drawings as plans, sections and details to real 3D objects (see Figure 3).

Figure 3

Question 2: Usually I Have Difficulties on Associate Technical Drawings to Real 3D Objects



The students also thought that the simulation game was helped them to understand fundamentals of presented topic. The 75 percentage of students thought the simulation game is effective on understanding the course. None of the students stated the simulation game is completely ineffective, but some of them commented that the game could be more effective (see Table1).

Table 1

The Questions about Simulation Game

		Strongly Agree (%)				Strongly Disagree (%)
No.	**Question**	**4**	**3**	**2**	**1**	**0**
3	The simulation game was helped me to understand fundamentals of presented topic	50	25	22.5	2.5	0
4	The simulation game makes course topic more interesting and funny	57.5	25	10	5	2.5
5	The simulation game provides keeping my attention alive in class	40	30	20	10	0
6	I found the simulation game helpful in building construction class	62.5	12.5	17.5	2.5	2.5
7	I prefer the simulation game used on presenting other topics of building construction class	72.5	7.5	15	2.5	2.5
8	The content and visual quality of game was good enough to present the topic	17.5	35	30	17.5	0

The results indicate that 82.5 percentage of respondents agreed the simulation game makes course topic more interesting and funny, 10 percentage of them is neutral and other 7.5 percentage disagreed.

As regards results of fifth question 70 percentage of students said the simulation game provides keeping their attention alive in class. This result tells that the simulation game could be a solution to keep students attention alive in the class which was normally a big problem for lecturers in construction building class.

The 74.5 percentage of respondents said they found simulation game helpful in construction building class on sixth question. The results of fifth question also show 80 percentage of respondents eager to see simulation game on presenting other topics.

Although the 52.5 of students said the content and visual quality of game was good enough on last question, the 30 percentage of students have no idea and the 17.5 percentage of students thought that the content and the visual quality of simulation game was not enough yet. As to these results the simulation game must be developed further on its content and visual quality in future.

CONCLUSION

In this study, how the simulation game is used to support traditional education methods in architectural education have been described. The results below were concluded in consequence of the survey to observe change of the student interests towards class, whether the game helps the topic to be understood and opinions of the students about the game.

- It was observed that the building construction class, which was previously assumed to be boring by the students, turned out to be more enjoyable and the activity of the students stayed alive by means of the simulation game.
- It was observed that the interests and concerns of the students towards class increased as a result of the use of the simulation game in class.
- It was seen that the students were highly eager to be used the simulation game in lecturing other topics of the building construction class.
- It was observed that the functions of the construction components, which especially encountered various difficulties on presenting, could be lectured more efficiently through simulation game.

When the conclusions are evaluated, computer aided simulation games are thought to be applicable methods for architectural education. This method is being planned to be used in further lectures of other topics of the building construction class.

REFERENCE

1. Axelrod, R. (1997), "Advancing the Art of Simulation in the Social Sciences", *Simulating Social Phenomena Lecture Notes in Economics and Mathematical Systems*, Vol. 456, No.1, 21-40.
2. Banks, J. (2004), "Discrete-Event System Simulation", 4th Edition, Prentice Hall, New Jersey, 3-21.
3. Becker, K. and Parker, R.,J. (2004), "The Guide to Computer Simulations and Games", Wiley & Sons, Indiana, 3-51.

4. Chung, A. C. (2004), "Simulation Modeling Handbook: A Practical Approach", Editor: Hamid R. Parsaei**,** CRC Press, Florida, 16-17.
5. Dibley, J. & Parish, J. (2007), "Using Video Games to Understand Thermoregulation", *Science Scope*, Vol. 8, No. 1, 32-35
6. Fujimoto, M. R. (2000), "Parallel and Distributed Simulation Systems", Editor: Albert Y. Zomaya, Wiley & Sons, New York, 4-10.
7. Prensky, M. (2001), "Digital Game Based Learning", McGraw-Hill, New York, 1-18.
8. www.merriam-webster.com