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Presenting a Model for the Evaluation of Architectural Design Courses Using the Analytic Hierarchy Process (AHP) Technique

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ABSTRACT

The evaluation of students' architectural designs is one of the main elements considered to investigate how learning is in architecture education. Nowadays, the design evaluation has caused students to be dissatisfied with education, and most students believe that this is not carried out rightly or there are no proper evaluation criteria, and professors evaluate students in the courses based on their tastes. Therefore, it seems necessary to examine the appropriate evaluation method that is agreed upon by architecture professors and in which the different dimensions of architectural design are considered. The present study aims to provide an applied method for the evaluation of architectural design courses. It seeks to answer two main questions: 1- What factors should be considered in the evaluation of architectural design courses? 2- What is the weight of each of the effective factors in the evaluation of architectural design courses? This is descriptive-analytical survey research. The required data are collected through library studies, interviews, and questionnaires. The design course evaluation criteria and indicators are weighted by surveying experts (Delphi technique) and using the analytic hierarchy process (AHP) technique in EC software. The results indicated that both continuous evaluation and end-of-semester evaluation must be carried out to fully evaluate architectural design courses. A pairwise comparison between them also shows that continuous evaluation (with a weight of 0.645) is much more important than the end-of-semester evaluation (with a weight of 0.335). Among the sub-dimensions of continuous evaluation, academic achievement (with a weight of 0.345), and the observance of ethics and discipline (with a weight of 0.293) obtain the highest weight, respectively, and among the sub-dimensions of end-of-semester evaluation, attention to the "meaning" dimension, i.e. the idea and the degree of success in transforming it into a form and the responsiveness of the design to the user's mental-psychological needs, (with a weight of 0.445) is identified to be more important than other sub-dimensions (form and function of the design).

Keywords: Continuous Evaluation, Final Evaluation, Architectural Design, Analytic Hierarchy Process.

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1. INTRODUCTION

Design methods are changing according to the cultural needs of society. In the past, they changed orally by transferring professors' experiences, and today, they are changing using technologies and new educational tools (Faizi 2008). In addition to the content of design and teaching methods, how to evaluate students' designs is another important factor playing a role in education at universities, which unfortunately is one of the main problems in most architecture schools. There are various factors disrupting evaluation. The evaluation must show the academic and practical abilities of students. However, it sometimes causes them to lose their spirits (Litkouhi 2013). If the student evaluation tools are not known, criticism and judgment will not be done correctly, leading to the entry of personal interpretations or demands unrelated to the educational goals, and thereby incorrect judgments and students' deteriorated achievement.

Various higher education institutions consider various units in architecture curriculum for the bachelor and master programs, the most important and the largest number of which include "architectural design" courses. As a result, how these courses are evaluated is very important for students and they expect the referees to consider precise criteria and judge accurately. However, there are generally no fixed criteria for evaluating architectural design courses and human factors also influence the adjudgment of designs. Choosing evaluation criteria with a purposeful framework and introducing them to students in the lesson plan make them know different dimensions of evaluation, and enable them to evaluate their performance by themselves. Since architectural design courses are based on the students' practices and student-professor interaction, and they require students to spend a lot of their time (in architectural ateliers), presenting a proper model agreed upon by professors for grading students in architectural design courses would result in students' satisfaction with justice by professors and motivate them for doing more class activities in ateliers.

The present study seeks to answer two main questions: 1. What criteria should be considered in the evaluation of architectural design courses? 2. What is the weight of each of the effective criteria in the evaluation of architectural design courses? To this end, it was attempted to provide and weight rational and clear criteria for a more complete evaluation of architectural design courses by reviewing evaluation criteria predicted in previous research for design courses and interviewing architectural experts. It should be noted that due to the qualitative nature of evaluation and the role of human factors in judgment, it is not possible to introduce definite and fixed criteria for the evaluation of these courses. However, it was attempted to provide applied and agreed criteria by surveying and interviewing twenty architecture professors.

2. RESEARCH BACKGROUND

The evaluation of architectural design courses faces certain complexities since they are taught with a structure different from those used for teaching other university courses, and each instructor evaluates these courses with his own criteria and methods. Reviewing the research background indicates that several studies have addressed the importance of evaluation and its role in education so far, but there are a few studies investigating the criteria for evaluating architectural design courses, some of which are mentioned below.

Litkouhi (2013), in her study entitled "Analyzing the relationship between students' educational background and their final projects' evaluation", has addressed the significance of the relationship between students' final design grades and their other architectural design grades and GPAs, and emphasized the role of students' academic background in the evaluation of their final projects. She has also investigated the different evaluation criteria in different architectural education centers in foreign universities. However, it is not clear whether there is an agreement on the criteria and what the contribution of each criterion is in the evaluation of design courses.

Mir Riahee (2014), in his research, has assessed and evaluated the architectural education system with an emphasis on team-based learning and peer assessment. In their study in the same area, Izadi and Sameh (2014) have proposed a suitable mechanism for evaluating and judging designs in architecture education and determined the judgment tools in two areas: 1. process evaluation indicators (monitoring by the professor and experts) 2. Design evaluation criteria (control by students and peers). They have also acknowledged that, due to the limited sample population, this research should be repeated or conducted with a larger sample size to be generalizable. Moreover, determining the impact of each criterion will also be useful in design evaluation.

Rezaei Ashtiani and Mahdinjad (2018) have also emphasized the mutual student-professor interaction as a powerful learning tool. They have presented and weighted five criteria of critical explanation, development of the selected idea, concept, design solution, and final design (presentation) to propose a model for design evaluation in architectural ateliers. It seems that determining the indices of each of the above 5 criteria could enhance the applicability of this research. In addition, it would be better to consider experts' opinions in determining the criteria, in addition to weighting, and it is necessary to mention the number of experts to enhance the validity of weighting.

Utaberta and Hassanpour (2012) have emphasized the critical approach and presented a model for evaluating architectural design courses. In this model, the four

criteria of critical explanation, logical development, proposal and recommendation, and oral and graphic presentation were considered with a percent weight of 40%, 30%, 20%, and 10%, respectively. In this research, it was not explained how the percent weight of each criterion was estimated and how the indices of each criterion were determined.

Finally, Ahadi (2018), in her study, introduced twenty criteria for scoring in two dimensions of the design process and design product, and the criteria were weighted. In conclusion, the effect size of the design process evaluation criteria was estimated as 0.51 and the effect size of the design product evaluation criteria was estimated as 0.49. This research is more similar to the present research in methodology than the other reviewed research, with the difference that the present study applies the AHP method to weigh the criteria. Using this technique, the possibility of inconsistency between the data is examined by estimating CI (Consistency Index), so, it is more reliable.

In most reviewed studies on the architectural design course evaluation criteria, one can see some of the following defects: the incomprehensiveness and incompleteness of the introduced criteria, failure to examine the agreement on the introduced criteria, incomplete identification of indices, and lack of weighting of criteria and indices. What distinguishes the present research from the previous studies is that it attempts to completely introduce the criteria and indices of the architectural design course evaluation, examine architectural experts' consensus on the identified criteria and indicators, and weigh them.

3. METHOD

The present study is descriptive survey research. The required data were collected through library studies, interviews, and questionnaires. The design course evaluation criteria, sub-criteria, and indicators were obtained from the abovementioned sources and weighted by surveying experts (Delphi technique) and using the analytic hierarchy process (AHP) technique in Expert Choice (EC) software. To ensure the validity of the criteria, the opinions of 20 experienced architecture professors were considered. To achieve a coefficient of concordance above 0.7, feedback was given to the respondents and the questionnaire was tested two to three times. The overall inconsistency coefficient of 0.06 also indicates that the judgments in the hierarchical analysis are reliable. Figure 1 shows the research model.

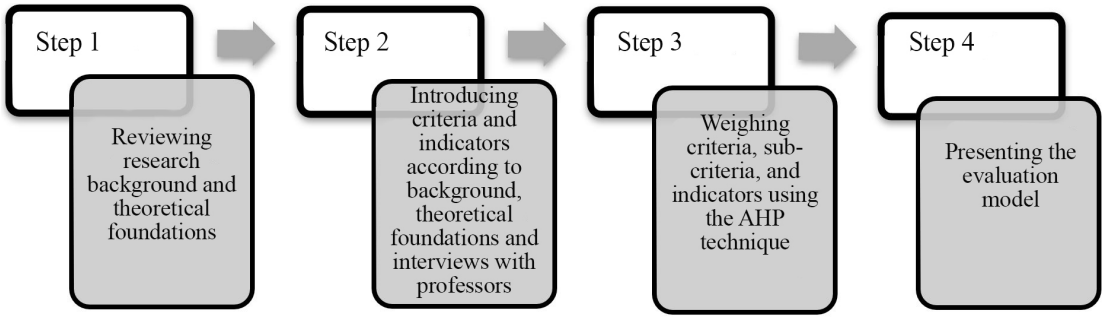

Fig. 1. Research Model

4. EVALUATION AND ITS IMPORTANCE

According to different dictionaries, the word evaluation means to find the value of something, and it is interchangeably used with the word valuation. In research related to education, other words are used as equivalent to evaluation. These words including assessment and measurement have different meanings. When a characteristic is measured, it is not aimed to determine value but it is aimed to show a situation as it is while evaluation is a process that includes measurement and possibly testing, and it also encompasses the concept of value judgment (Lotfabadi 2013). The word assessment also has a more comprehensive and broader concept and it includes a complete process composed of testing, data analysis, and prediction about a person (Hassanzadeh and Maddah 2009). The present study aims to investigate the criteria for the "evaluation" of architectural design courses, so, various tools and tests may be used.

Evaluation plays different roles in the education of students: feedback (feedback to professors about the efficiency of their teaching ways), motivating, guiding (how the nature of evaluation influences students' studying and learning and the ways teachers teach), and communication (between university, social organizations, and families) (Rezaei Ashtiani and Mahdinjad 2019).

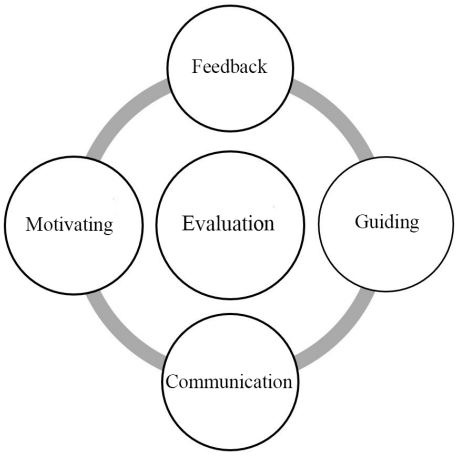

Fig. 2. Evaluation Roles
(Rezai Ashtiani and Mahdinjad 2019)

Considering the importance of evaluation in education since long ago, professors have used quantitative evaluation to determine how much their students have understood the lesson. But there are many differences between architecture education and other disciplines and practical practices play a prominent role in architecture. Architecture students spend most of their time in ateliers and do design practices. However, like other disciplines, evaluation is of great importance in architecture. If the designer knows that his design will be finally evaluated, he always self-evaluates critically from the beginning. In this case, evaluation is considered one of the steps of the designer's thinking process, a prelude to professors' decision-making, and a prerequisite for evaluating students by peers. The evaluation of students' designs in architecture is of great importance because design courses are the manifestation of to what extent students learn the lessons taught and therefore, students' grades are important to them and their professors. However, the evaluation of architectural designs is qualitative in itself, and the referees evaluate the students' designs based on their tastes (Nadimi 2010). If a systematic method is proposed for this evaluation, the influence of the referees' tastes on the evaluation will automatically decrease.

5. DESIGN PROCESS

Many scholars have addressed the nature of the design. Roozenburg and Eekels considered analysis, synthesis, and evaluation as the three stages of the design process (Roozenburg and Eekels 1995). Other contemporary designers have proposed different classifications of design process stages, as presented in Table 1.

Table 1. Stages of the Design Process from the Point of View of Different Researchers

Contemporary Scholars	Design Stages
(Christopher Alexander, 2017)	Analysis/Synthesis
(Lawson, 2011)	Preliminary Insight/Preparation/Incubation/Intuition/Verification
(Mahmoudi, 2018)	Preparation/Incubation/Intuition/Negation and Verification
(Markus, 1969)	Analysis/Synthesis/Evaluation/Decision-making

Examining the types of design models shows that the design process includes 4 main stages (Fig. 3).

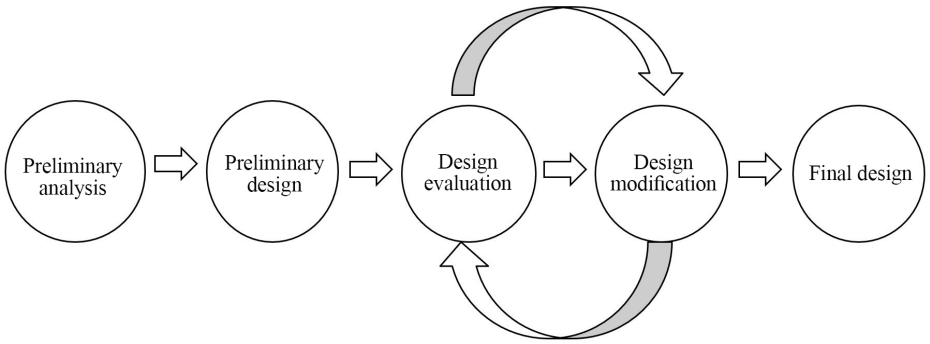

Fig. 3. Design Process

- Preliminary pre-design analysis: It includes various types of measures taken by the designer to obtain adequate information for the design. This step prevents future mistakes and makes the design process progresses correctly.
- Preliminary design: It includes the presentation of different ideas to the employer by the designer. They enter the evaluation stage after being approved.
- Evaluation of the preliminary design: It includes the investigation of all aspects of the design.

- Modification of the design: The designer modifies his design after his preliminary designs are evaluated, and puts it back into the design cycle. This step is repeated until the final design with the highest efficiency is obtained.

Although the output of architectural design courses is generally a set of documents representing an architectural work, and the designs are evaluated according to these documents, as mentioned, architectural design is a reciprocal process and the student needs preliminary analysis, preliminary design, evaluation, and modification of the design to reach the final design. Reviewing the research background and analyzing the interviews with 20 experienced architecture professors in different universities, who ha a relatively long teaching experience (10 to 15 years) in architectural design courses, using an open questionnaire also imply the fact that considering architectural design course education structure, the design process, in addition to the architectural product, plays a significant role in the evaluation. The following sections describe the components effective in the continuous evaluation and the final evaluation.

5.1. Continuous Evaluation

Tridane et al. (2015) believe that the appropriate continuous evaluation design can help professors to solve the problem of final evaluation that cannot alone represent students' progress, and control and monitor them. Continuous evaluation is an inseparable part of the student's learning process and it refers to getting continuous feedback on what the professor teaches his students to improve his teaching method if needed (Black and Wiliam 2009). Gholami et al. (2018) also mention four main differences between continuous evaluation and final evaluation from the point of view of the learner as follows: 1. Final and continuous evaluations don't apply the same validity and reliability indicators; 2. Dissatisfaction with the quality of professors' teaching; 3. Individual factors; 4. There is a difference between them in the amount of exam content.

Considering the nature of design courses, the majority of architectural experts believe that the evaluation of students during the academic semester takes a significant share of the overall evaluation, and the student's academic achievement and learning during education are more important than their documents delivered at the end of the academic semester. The analysis of the findings from the professors' opinions and experiences reveals that the main criteria of continuous evaluation in architecture courses can be categorized into several categories:

Effective attendance, studies and their application, academic achievement, extracurricular activities, and observance of ethics and discipline.

- Considering the nature of design courses in architecture and the necessity of passing the defined processes in architectural design, "effective attendance" is one of the important factors in continuous evaluation. Architectural design courses cannot be completely learned in a short period, and different tools are used for education, which requires continuous attendance and participation in class programs, including activities in ateliers, sketches, scientific visits, virtual classes, and other designated programs. Also, in architectural design courses, learning with a student-centered teaching approach (versus professor-centered) is emphasized and the student is directly involved in the learning process and uses his initiative and creativity to go through the learning course. This is implied by frequent corrections carried out during the semester in architectural design courses. Therefore, according to the professors, the number of corrections, the time allocated to them, the spirit of questioning and scientific demands, and the proper homework completion, indicate the student's effective attendance and result in his gradual achievement. The professors' other expectation of the students during the semester is their active participation in the ateliers and the evaluation of the students by each other (peer evaluation) in various exercises. This helps the evaluation of the projects to be more accurate. In other words, when students are both evaluating and being evaluated, their learning will be enhanced, bringing teachers' support, the practice of criticizing and evaluating others' activities, and accepting reasonable suggestions and criticisms for students.
- The evaluation of preliminary studies, which is a necessary part of the design process, can be examined with indicators such as proper data collection and the ability to analyze them, teamwork (interaction with other students), appropriate oral and written presentation of studies, and appropriate use of studies in design.
- The student's academic achievement during the semester can be evaluated based on the comparison of the student's status with the assessment of his initial status (through the pre-test, academic records, and the opinion of other professors about the student), the quality of interim acceptance, the relevance of the design to the research (the course of the research to the design and the level of adherence to a specific design process).
- The other criterion considered in continuous evaluation by professors is students' extracurricular activities. According to professors, the indicators of this criterion are the student's information, research activities related to the design, and participation in voluntary collective activities such as scientific associations and circles formed in the university.
- Considering the type of student-professor relationship in the field of architecture, especially in design courses, the observance of ethics is one of the other important issues considered in the continuous evaluation of students by professors. The effect

of observing or not observing ethical values on evaluation is a challenging issue. On the one hand, its effect on evaluation may lead to pretense and hypocrisy, which is itself a form of denial, and on the other hand, the educational duties of professors prevent them from being indifferent to the observance or lack of observance of ethics and discipline.

Considering the comprehensive influence of the environment and spaces designed by designers on the spirit and culture of society, they are required to observe ethics and the first step should be taken in architecture education. The presence of futtowat-namehs (the books of chivalry) in various guilds in the past indicates the importance of observing moral and humane principles in various professions. In the past, architecture education in Iran mainly took place in the form of apprenticeship, and a person was accepted as an apprentice if he had the required competencies. The teacher's behavior and character and the transfer of professional skills based on spiritual and religious foundations were also of great importance in this method to the extent that it was proposed as an educational institution. In this method, the student not only learned the basic principles of architecture, but also learned the relevant moral principles, and the teacher was also responsible for the spiritual education of the student. The importance of this aspect of education decreased over time due to the forgetting of the abovementioned teaching method and applying new education systems, and the moral education of students was separated from their professional education. However, according to many architecture professors, students are required to observe ethics and it is considered in the evaluation of courses, although lower-quality criteria are considered, including observing discipline, attending class on time, observing politeness, avoiding insults, etc., and religious beliefs and spiritual conditions of students are not given much attention.

5.2. Final Evaluation

Finally, architectural designs are presented using various methods and tools. The way of design presentation has changed a lot from the beginning of human creation until today and it can be divided into four independent periods: the emergence of technique, design with hand drawings, systematic design, and modern design. At first, artisans constructed their works using basic tools. In this case, what was made by humans directly originated from his mind, and was never recorded and evaluated anywhere. With the advent of the Renaissance, hand drawings became very popular and designers used simple drawing tools to draw their works before they were constructed. With the ever-increasing development of technology, humans felt the need for higher speed in the design process and decided to apply the systematic design method to make it possible for several designers to work on a single design at the same time. Finally, in the present era, with the advance of technologies, different designers have introduced different methods for their designs by carrying out numerous studies (Jones 1970). In architecture design courses, the final design evaluation includes two main dimensions:1. Written evidence or presentation quality; and 2. The content presented or design quality.

- Presentation quality: it is easier to evaluate the presentation quality. It refers to whether the presented documents (designs, views, sections, site, animation, maquette, etc.) are complete or not. Are the principles of drawing followed or not? Presentation graphics can also be found by investigating the architectural presentation of documents (composition, scale, etc.), and using appropriate tools or software in 3D presentation. According to some professors, it is necessary to provide the possibility to defend the designs. This makes the evaluation of the presentation quality more complete.
- Design quality: To make the evaluation of the quality of the final design presentation more accurate, the dimensions of the architecture can be determined to evaluate student learning and activity in these dimensions. Different architects have provided different categorizations of the dimensions of architecture. Some of them, such as Noghrekar, Naghizadeh, and Nasr, have divided the dimensions of architecture into two parts: form and meaning; Ardalan considers the matter, surface, space, shape, and color as dimensions of architecture (Memarian 2014). Capon (2013) introduces the dimensions of form, function, and meaning based on the Vitruvian theory. According to Kanter and Panter's model, the dimensions of architecture include form, activity, and meaning, which refer to imagination, perception, and concept (Golkar 2000). According to Pakzad (2006), the dimensions of architecture include form, function, and meaning. Reviewing different architects' opinions on the dimensions of architecture indicates that classifying the dimensions of architecture into form, function, and meaning is accepted by most architectural experts and can be used in the final evaluation of design courses.

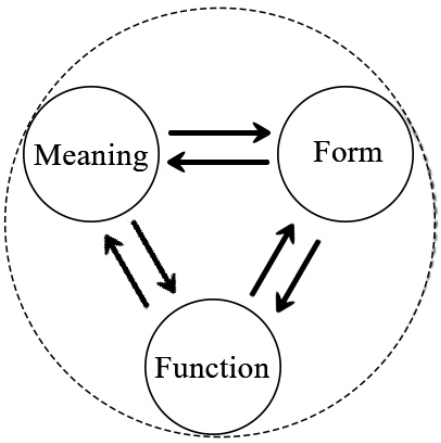

Fig. 4. Different Dimensions of Architecture

According to the respondents, form evaluation indicators include giving a response to the design problem (correct understanding of the design problem, how to respond to the problem, to what extent the problem is met, creativity and innovation, etc.), proper volume composition, design site considerations (compliance with the design criteria and site constraints, climatic measures, cultural, social, and economic issues, etc.), and executive knowledge (attention to technical, structural, and facility principles, the introduction, and rational use of materials). A design problem is solved in all three dimensions (form, function, and meaning). Appropriate functional spatial organization is an indicator considered in function evaluation, and the indicators considered in the meaning evaluation include meeting the users' mental and psychological needs, the suitability of the idea or concept with the design theme, and the degree of success in transforming the idea into a form.

6. FINDINGS

According to the abovementioned, to answer the first research question, one can say that the evaluation of architectural design courses is carried out in two main dimensions: continuous evaluation and final evaluation. Continuous evaluation includes the examination of effective attendance, studies and their application, academic achievement, extracurricular activities, and observance of ethics and discipline. In the final evaluation, the presented documents and the quality of the final design product are considered. Figure 5 shows the indicators of each of the abovementioned dimensions.

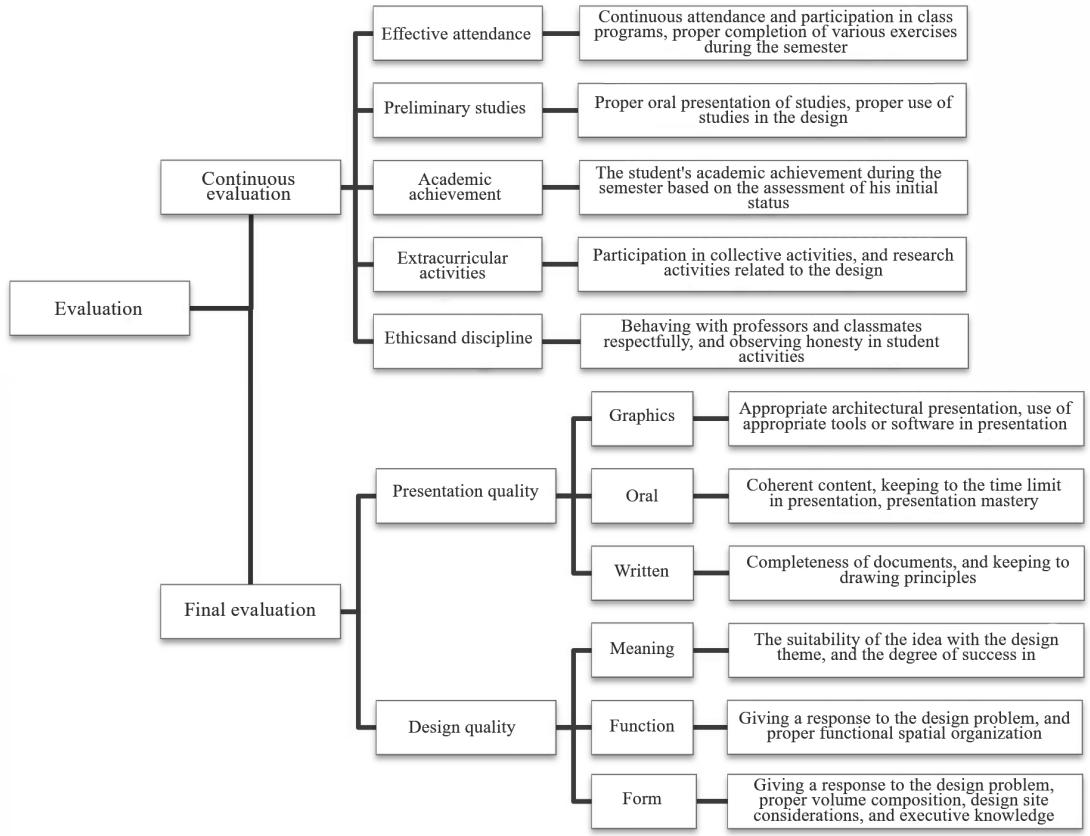

Fig. 5. Dimensions, Sub-Dimensions, and Indicators of Architectural Design Course Evaluation

In the next step, to answer the second research question, the introduced dimensions and sub-dimensions were weighed using the Delphi technique (surveying 20 experienced architecture professors), and comparing the identified dimensions and sub-dimensions against each other in pairs to determine the importance coefficient of each of the dimensions and sub-dimensions. The comparisons were made based on Saaty's 9-point ratio scale using the Analytic Hierarch Process (AHP) technique in Expert Choice (EC) software to obtain the final weight of each indicator based on experts' opinions (The final weight of each indicator was obtained by multiplying the weight of each dimension by the weight of each sub-dimension). It should be noted that to achieve stability and consensus in the received answers to the questionnaire (concordance and agreement on the indicators and variables in question), the questionnaire was sent to some participants two to three times until Kendall's coefficient of concordance was obtained to

be over 0.7. In the pairwise comparisons, the overall inconsistency coefficient was obtained to be 0.06, indicating high consistency in pairwise comparisons[1]. The pairwise comparison of the "continuous evaluation" and "final evaluation" dimensions shows that the participants believe that in the evaluation of architectural design courses, the importance coefficient of continuous evaluation is 0.645 and the importance coefficient of the final evaluation is 0.355, implying the higher importance of continuous evaluation.

The pairwise comparison of the sub-dimensions of continuous evaluation (Fig. 6) also indicates the highest importance coefficient of the student's academic achievement, i.e. What path the student follows during the academic semester, and how his knowledge of the design topic change. Moreover, the "observance of ethics and discipline" sub-dimension obtained a higher importance coefficient than other sub-dimensions, studies and application of them, effective attendance, and extracurricular activities.

Fig. 6. The Weights of Sub-Dimensions of Continuous Evaluation

Comparing design quality and presentation quality also shows that the importance of design quality with a weight of 0.861 is much higher than the presentation quality with a weight of 0.139. Figure 7 shows the final weight of each of the sub-dimensions of presentation quality and design quality, which was obtained by multiplying the weight of each sub-dimensions by the weight of each of the "presentation quality" and "design quality" dimensions. The weights imply that in architectural design, the concept and ideas are the most important among the sub-dimension of the design quality, followed by function and form, respectively. among the sub-dimensions of presentation quality, the completeness of the documents, along with observing technical points, is considered more important than the way of presentation and defense of the plan.

Fig. 7. The Weights of Sub-Dimensions of Design Quality and Presentation Quality

Figure 8 presents the final weight of each sub-dimension proposed for the evaluation of architectural design courses in order of priority. It should be noted that the weight of the indicators was considered to be identical to facilitate the evaluation, and the indicators were not compared against each other in pairs.

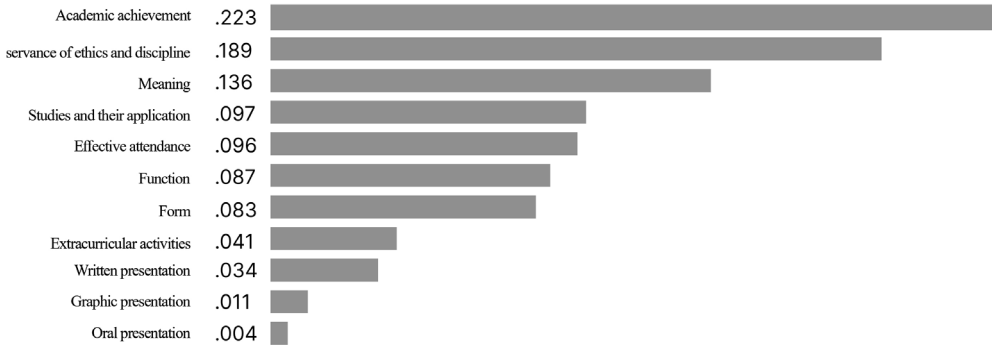

Fig. 8. The Final Weights of All the Design Course Evaluation Sub-Dimensions

7. PRESENTATION OF THE EVALUATION MODEL

Considering the importance of evaluation in the process of architecture education, the present study, first, identified the effective criteria in the evaluation of architectural design courses (through library studies, interviews, and questionnaires), and then, the

criteria identified were scrutinized and modified by 20 experienced architecture professors. In the next step, each of the introduced criteria was weighed using the AHP technique, and the final weight of each indicator was obtained to evaluate architectural design courses (Table 2)[2]. For the evaluation of architectural design courses, each of the indicators is scored on a Likert scale (from 1: very poor to 5: very good). Next, each score is multiplied by the weight of that indicator and the final score is the sum of the scores of different indicators. This model was programmed with Excel software and can be used by architecture professors[3].

Table 2. Dimensions, Sub-Dimensions, and Indicators of Architectural Design Course Evaluation and Their Weights

Dimension	Sub-Dimension		Indicators	The Final Weight of Each Indicator (×100)
Continuous Evaluation (0.645)	Effective Attendance (0.148)		Continuous attendance and participation in class programs, including activities in ateliers, sketches, scientific visits, virtual classes, and other designated programs (0.2)	1.90
			The number of corrections, and the time allocated to them (0.2)	1.90
			Presenting the design to other students (peer evaluation) (0.2)	1.90
			The spirit of questioning and scientific demands (0.2)	1.90
			Proper completion of various exercises during the semester (0.2)	1.90
	Studies and Their Application (0.15)		Proper data collection and the ability to analyze them (0.25)	2.42
			Teamwork (interaction with other students) (0.25)	2.42
			Appropriate oral presentation of studies (0.25)	2.42
			Appropriate use of studies in design (0.25)	2.42
	Academic Achievement (0.345)		The student's academic achievement, based on the assessment of his initial status (through the pre-test, academic records, and the opinion of other professors about the student)	7.41
			The quality of interim acceptance (0.333)	7.41
			The relevance of the design to the research (the course of the research to the design and the level of adherence to a specific design process) (0.333)	7.41
	Extracurricular Activities (0.063)		Student's information (0.333)	1.35
			Participation in collective activities (associations, circles, etc.) (0.333)	1.35
			Research activities related to the design (0.333)	1.35
	Observance of Ethics and Discipline (0.293)		Behaving with professors and classmates respectfully(avoiding insults, boldness, obscene words, etc.) (0.5)	9.45
			Observing honesty in student activities (avoiding cheating, copying other's activities, etc.) (0.5)	9.45
Final Evaluation (0.355)	Presentation Quality (0.139)	Written presentation (0.692)	Completeness of documents (scenarios, diagrams, ideas, plans, views, sections, site, animation, moquettes, etc.) (0.5)	1.71
			Keeping to drawing principles (0.5)	1.71
		Oral Presentation (0.084)	Coherent content (0.2)	0.08
			Logical and scientific defenses of the design (0.2)	0.08
			Creativity in presentation (0.2)	0.08
			Keeping to the time limit in presentation (0.2)	0.08
			Presentation mastery (0.2)	0.08
		Graphic Presentation (0.224)	Appropriate architectural presentation (composition, scale, etc.) (0.5)	1.10
			Using appropriate tools or software in presentation (0.5)	1.10

Dimension	Sub-Dimension		Indicators	The Final Weight of Each Indicator (×100)
Final Evaluation (0.355)	Design Quality (0.861)	Form (0.271)	Giving a response to the design problem (correct understanding of the design problem, how to respond to the problem, to what extent the problem is met, creativity and innovation, etc.) (0.25)	2.07
			Proper volume composition (0.25)	2.07
			Design site considerations (compliance with the design criteria and site constraints, climatic measures, cultural, social, and economic issues, etc.) (0.25)	2.07
			Executive knowledge (attention to technical, structural, and facility principles, the introduction, and rational use of materials) (0.25)	2.07
		Function (0.284)	Giving a response to the design problem (correct understanding of the design problem, how to respond to the problem, to what extent the problem is met, creativity and innovation, etc.) (0.5)	4.34
			Appropriate functional spatial organization (0.5)	4.34
		Meaning (0.445)	Giving a response to the design problem (correct understanding of the design problem, how to respond to the problem, to what extent the problem is met, creativity and innovation, etc.) (0.25)	3.4
			The responsiveness of the design to the user's mental-psychological needs (0.25)	3.4
			The suitability of the idea with the design theme (0.25)	3.4
			The degree of success in transforming the idea into a form (0.25)	3.4

8. CONCLUSION

Considering the nature of the architecture discipline, the criteria used to evaluate designs are not fixed and unchanged. Among various factors, human factors play an undeniable role in the evaluation of designs, and no type of evaluation alone can meet all the requirements of a complete judgment. However, this does not imply that it is unuseful to attempt to achieve the agreed effective criteria for the evaluation of architectural design courses. As an output of this research, a program was presented in Excel software, in which the architectural design course evaluation dimensions, sub-dimensions, and indicators are weighted. This program can be used by architecture students and professors. However, it should be noted that the effort made in this research is not perfect, and it is required to repeat the same research with a survey of experienced professors as well as students and graduates to add more indicators to the program and reach a more comprehensive agreement on the effect of each of them in the evaluation. According to the research findings, the following results were obtained to apply in the teaching and evaluation of architectural design courses:

1. Both continuous evaluation (of the design process) and final evaluation (of the design product) must be carried out.
2. The continuous evaluation must be considered more important than the final evaluation.
3. Since students are different in abilities, their academic achievement should be considered in continuous evaluation and they must not be evaluated by just their final design products.
4. Ethical issues and knowledge of professional ethics should be given serious attention in the education of students.
5. It should be attempted to enhance students' critical views and questioning spirit by providing suitable conditions in the ateliers and peer evaluation.
6. Students' participation in extracurricular activities such as scientific associations should be given importance.
7. In the end-of-semester evaluation, the design quality must be considered more important than the written evidence, and in design quality, more attention should be paid to the "meaning" dimension than other dimensions of the design (i.e. form and function).

ENDNOTE

1. Regarding pairwise comparison, if criterion A is more important than criterion B and criterion B is more important than criterion C, criterion A should be logically more important than criterion C, but it is not always the case and there is a possibility of lack of concordance in judgments. Therefore, it is necessary to find an index representing the degree of inconsistency of judgments, which was called "inconsistency index" by Saaty. If this index is less than or equal to 0.1, the consistency in the judgment is accepted, otherwise, the pairwise comparison matrix should be re-formed (Zebardast 2001).
2. To make reading numbers and making calculations easy, the final weight of each item is multiplied by 100.
3. The program developed to evaluate architectural design courses based on the results of the present research is available through the link below.

   https://s16.picofile.com/file/8425248400/%D986%%D985%%D8%B1%D987%_%D8%AF%D987%%DB%8C_%D8%A8%D987%_%D8%AF%D8%B1%D988%%D8%B3_%D8%B7%D8%B1%D8%A7%D8%AD%DB%8C.exe.html

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