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Teaching Methodology for Master of Architecture Students
(Research Methodology Course)**

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ABSTRACT

The importance of research in architecture is not something new. This kind of research plays a very crucial role in success and survival of architecture. It can be pursued for either personal interests or common purposes. Architecture research requires learning of various applied sciences, theoretical approaches and dominance over different mental models and assumptions. Therefore, the researcher has to master and apply a wide range of physical and chemical properties of materials, as well as visual perception principals. The only course of architecture that uses research is “research methodology” in post-graduate and doctorate levels, meanwhile students and instructors of architecture do not consider it as basic course. Research methodology has been of great importance in developed countries and they present new strategies to teach the course. In this intervening study, students of architecture engineering were selected from Islam Azad University and Farabi Campus (affiliated to University of Tehran) in the first and second semesters of educational years 2014-2015, 2015-2016 and 2016-2017. Three groups in each university were thought separately in research method course, using theoretical and workshop methods. The final term scores of subjects were recorded in the three groups and the statistical independent T-test was applied to analyzed data. The confidence interval was 95% and the study deviation was $p < 0.05$ in SPSS software. The results of this analysis revealed no significant difference in the student's scores between theoretical and workshop methods at University of Tehran in one of the semesters, and in the other semester, there was a significant difference between the two teaching methods, also a significant statistical difference was observed in Islamic Azad University. In addition, at the end of semester some questionnaires were designed based on the Likert's scale, and distributed among the subjects, in order to evaluate their satisfaction of the two teaching methods. The research experts and instructors confirmed the questionnaire's validity, and its reliability was calculated based on the Cronbach's alpha as 0.84. Analysis of the independent T-Test showed that the mean scores of student's satisfaction were higher for workshop method.

Regarding the development of the architecture-related sciences and the required basics derived from research methodologies in designing, the efficient teaching of “research methodology” course should be considered more seriously and make students interested in the course, using workshop-teaching method. In this way, one may expect profound changes in teaching research methodology.

Keywords: Architecture, Research methodology, Satisfaction, Theoretic, Workshop.

Introduction

Today, the importance of research in the field of architecture is known to all the architectural engineering professors and postgraduate students, and involvement of students in research practices has led to a breakthrough in their research performance, providing them with the ability to analyze architectural studies. Research in the field of architecture requires the acquisition of various practical sciences, theoretical views and knowledge of different mental patterns and ideas (Vial and Salan, 2015, 60). Therefore, architectural researchers need to recognize a wide range of physical and chemical properties of materials as well as principles of visual perception and use them when necessary (Heidari, 2014, 99). Therefore today, unlike the old times, great importance is attached to research methodology and extensive studies have been conducted on the effective teaching of this course all round the world. And since this lesson is taught to create a positive attitude toward students in science, to improve their job abilities and to better understand the place of research in different sciences. Teaching of this course plays a significant role in creation of a positive attitude toward science, improvement of their job abilities and recognition of the research position in different sciences (Vujaklija et al., 2010, 285). On the other hand, the teaching of this course has always been challenging and several strategies have been proposed to improve the teaching quality. These strategies include enhancement of students' perceptions of research by introducing research projects that students are interested in, and inclusion of research in the curriculum (Edmunds, 2005, 863). In addition, Murdoch et al. investigated self-assessment of the ability of students in various fields of research, and concluded that only 13% of students are sufficiently capable in all four areas: research methodology, data collection, evidence evaluation and statistical analysis of data, while others are only capable in some specific areas, he stated that although students know the benefits of research, they do not have a proper understanding of the research process (Murdoch-Eaton et al., 2010, 152). In Another study on approaches of teaching research methodology to dentistry students at Isfahan University, the author made some suggestions for teaching the basics of research methodology to M.A students in preliminary and advanced workshops and establishment of executive and managerial bodies to monitor students' small-scale research projects (Iranmanesh et al., 2015, 67).

Various studies on research methodology teaching in different disciplines show that the traditional and theoretical approach of methodology teaching is associated with low learning and satisfaction levels, and teaching approaches should be designed in such a way to increase student involvement and arouse interest in students (August-Brady, 2005, 520). The research methodology teaching through active participation of students during the teaching process and integration of theoretical and practical teaching approaches can have a significant positive impact on students learning (Riley et al., 2013, 230; Arias et al., 2007, 487-92).

According to Confucius, "I hear and I forget. I see and I remember. I do and I understand" (Poornemati, 2012, 51) therefore, in case this course is

taught in a research-based manner and Along with practical work of research, students can definitely have a better understanding of that. This methodology has been studied in the research of two lecturers at the University of Purdue, Indiana, USA. In this research, three strategies have been simultaneously used in the research methodology teaching process. These strategies include: 1- holding workshop on research methodology 2- inviting researchers involved in qualitative research and explaining the practical challenges to the students. 3- Introduction of a quantitative approach to research and inviting researchers involved in this field and study of the challenges they faced in this process. The data analysis results showed that these strategies have a positive effect on student learning and, finally, leads to increased students' satisfaction with teaching methodology (Pfeffer and Rogalin, 2012, 368-376).

Also, in a research conducted at the University of Alabama in the United States, research methodology was taught in a research-based manner and it was concluded that research-based teaching has a positive effect on students' learning and the publication of their papers in valid journals. The research-based approach in this research was actually a five -stage teaching planning: in the first stage, topics such as research questions, hypotheses, variables, and other concepts ... are taught to students and then, some hypotheses or questions are assigned to each student in accordance with their interests. In the second stage, the theoretical foundations of the research, the review of literature, research methodologies, etc. are taught and the students are asked to apply the taught materials to their selected hypotheses. In the third stage, important data collection issues are presented and each student collects the required data through field study and observation, interviews and questionnaires or library studies and document reviews depending on their research approach(qualitative or quantitative). At this stage, students get to know about the data collection problems objectively and gain a better understanding of the data collection process. In The fourth stage, the students mainly deal with data analysis and each student is required to select an appropriate data analysis method that fits their hypothesis. In the fifth stage, which is the last stage, the students are provided with a specific format for paper writing and are asked to set their findings in accordance with the scientific -research format. In this research method, 9 out of the 14 students managed to complete their paper by the end of the semester and 7 Out of the 9 papers were published, which indicates improved ability of students in paper writing and the effectiveness of this teaching approach Compared to the theoretical research methodology teaching approaches (Aguado, 2015, 251-260). In Iran, research methodology in the field of architecture is usually taught theoretically and recently some extracurricular paper writing workshops are held in some architectural engineering faculties. The academic sources used in these workshops include “Research Methodology in Humanities” by Hafeznia, and “Architectural Research Method” by Dr. Shahin Heidari, which has been set out in ten chapters and is considered to be a good source for research methodology teaching at faculties of architecture. “Architectural Research Method”, by Linda Grotte and David Wang, translated by Dr. Alireza Einifar, is another

source that specifically deals with research methodology in the field of architecture, and is mostly used by undergraduate students.

This research seeks to answer the following questions: "does the research-based methodology (as compared to the theory-based methodology) leads to any improvement in academic achievement of undergraduate architecture engineering students?" And, "how satisfied are students with theory-based and research-based research methodology teaching techniques?" Accordingly, the research process is based on the comparison of academic achievement and the satisfaction of the architecture engineering students with different research-methodology teaching methods. Therefore, drawing on the literature, two teaching methods, including theory-based and research-based teaching approaches practiced at two universities are investigated and the results, as well as the positive and negative points associated with each approach are evaluated.

Research Method

In the present study, two research methodology teaching approaches practiced in post-graduate level (architecture engineering) at Farabi campus in University of Tehran and Islamic Azad University are investigated for several successive years. The duration of research methodology courses during one semester, the general syllabus and the total duration of teaching during the semester were the same in all the groups.

In the first method, the students of two universities received purely theoretical instruction, and at the end of the semester, students' grades were recorded and some questionnaires were also given to them at the end of each course to assess the satisfaction of students with teaching techniques including benefits of architectural research, the necessity and applications of research methodology for the architecture engineering students. In the second research method, which was taught by the same instructor (author) at the same universities, a new research-based approach was used to teach the research methodology to architecture engineering students. And students' grades and their satisfaction with teaching techniques were recorded and measured at the end of the semester. Next, the data were recorded in SPSS software. Independent T test was used for statistical analysis of grades in pair groups (A1 and B1, A2 and B2, and A3 and B3) according to Table 1. In the next step, the five-point Likert scale Teaching Satisfaction Questionnaire (totally agree (point 5), totally disagree (point 1)) was graded and the Data were analyzed by SPSS software. Independent t-test was used for data analysis. The mean score of total satisfaction with teaching approaches was also calculated. The validity of this questionnaire was confirmed by experts and its reliability was obtained 0.84 from Cronbach's alpha.

Table 1. *Specifications of the Groups Examined*

Group name	Number of student	Teaching method	Grade	Academic year	University
A1	16	Theory-based method	Master of science	First semester 2014-2015	Farabi campus, university of Tehran
B1	7	Research-based method	Master of science	First semester 2015-2016	Farabi campus, university of Tehran
A2	20	Theory-based method	Master of science	First semester 2014-2015	Islamic azad university
B2	18	Research-based method	Master of science	First semester 2015-2016	Islamic azad university
A3	8	Theory-based method	Master of science	First semester 2016-2017	Farabi campus, university of Tehran
B3	8	Research-based method	Master of science	Second semester 2016-2017	Farabi campus, university of Tehran

Teaching Research Methodology to Architecture Engineering Students in a Theory-based Method

Today, the expansion of disciplines associated with architecture and the need for foundations derived from targeted research in the design processes is one of the most important areas of architectural research. Architectural research takes some strategies and measures from other disciplines and uses them to describe the applications of the man-made environment for human growth (Groote and Wang, 2005, 23). Therefore, teaching research methodology to the post-graduate architecture engineering students is of great importance and should receive special attention. In the theory-based teaching method, which was used by the author in the Farabi campus of Tehran University and Islamic Azad University in the first semester of the academic year 93-94 and 92-93, the materials were derived from the “research methodology in humanities” (Hafeznia, 2010), the research methodology in psychology and education disciplines (Delavar, 1391), as well as research methodology pamphlets obtained from Iranian Research Institute for Information Science and Technology. The materials were prepared in PowerPoint format and taught by the lecturer in different sessions. Table 2 shows the materials discussed in the classroom in this method. In the middle of the semester, the students sat a mid-term exam that accounted for a part of the final semester score (2 points). Also, 2 points were assigned to the students

who showed up in all sessions. As for the classroom project, which accounted for some part of the final grade (4 out of 20), students were asked to choose their favorite architectural subjects and, conduct a research on the subject according to the fundamentals of research taught during the course and finally submit their work in PowerPoint format at the final session (Table 3). Then, students were asked to formulate and present their research within a proposal framework which was already described in the class. The students were required to hand in their proposals on the final exam day. Considering the fact that more students (20 students) participated in this course in Islamic Azad University, and given that they were seemingly reluctant to write proposals, about 14 low-quality proposals were submitted and this indicated that despite the content provided to the students in the classrooms, students were still unable to write proposals and present them in the requested format.

In the Farabi campus of Tehran University in the first semester of 2014-2015, 10 proposals were too poor to be presented at the classroom. At this university, only 3 out of 8 students managed to hand in proposals based on the precise principles of proposal writing during the first semester of 2016-2017.

Table 2. *Describing the Topics Taught by the Author in the Teaching-based Method*

sessions	Topics taught in sessions
First session	Architecture research: definitions and objectives
Second session	Theoretical view in architectural research
Third session	Variable meaning: a variety of research methods based on the purpose
Fourth session	The concept of hypothesis, society and sampling methods
Fifth session	Methods of writing a questionnaire and other field study method
Sixth session	Architectural research based on quantitative and qualitative data
Seventh session	A survey of various parametric statistical tests
Eighth session	A survey of various nonparametric statistical tests
Ninth session	Proposal and dissertations
Tenth session	Setting up scientific articles and introduction to scientific information database
Eleventh session	PowerPoint presentation of students
Twelfth session	PowerPoint presentation of students
Thirteenth session	PowerPoint presentation of students
Fourteenth session	A question and answer session

Based on the sources of research method in the humanities (Hafeznia, 2010), the method of research in psychology and education (Delavar, 2012), as well as the pamphlets of the training courses of the Institute of Science and Technology Iran Information Technology.

Table 3. *How to Divide the Score into a Training-based Approach*

Assigned score(based on twenty score)	Items
Graduation exam	12
Midterm exam	2
Class project	6

Teaching Research Methodology to Architecture Engineering Students in a Research-based Method

Considering the importance of the research methodology in the field of architecture and the great shortcomings that can be seen in research methodology teaching at the faculties of architecture engineering, the author realized that the traditional and purely theory-based research methodology teaching techniques are boring for the architecture engineering students who are mainly interested in practical projects and Workshop. He also realized that after completion of this course, the basics of this lesson are quickly forgotten and are only used by a limited number of students interested in architectural research. Even the small number of talented students did not have the ability to grasp the presented materials, and this was evident in the papers written and presented by them in the next semester. Therefore, after consulting Latin papers, studying other research methodology teaching approaches in other countries, and consulting colleagues who had the experience of teaching this course at the Architecture faculties of Florida and Kentucky universities, the author decided to provide a new research methodology teaching method. In this approach that was applied to the students in the first semester of the academic year 1993-94 in Farabi campus of university of Tehran and Islamic Azad University and also to a second group of Farabi campus architecture engineering students in the first semester of 92-93. This course was research-based. A variety of research methodology content was taught to students and they were asked to carry out research exercises in a step-by-step manner at the same time.

The first two sessions of the class were devoted to theoretical discussions, such as architectural research and its theoretical perspectives, and “an introduction to architectural research” (Heidari, 2014) and the research methodology in humanities (Hafeznia, 2010) were used as instruction Sources. At the third session, the concept of variable and its types, hypothesis and its types were discussed and students were asked to consider a hypothesis for their topics of interest, then, the selected variables and hypotheses were modified with the help of the instructor and the students got to know about the type of their hypothesis (descriptive, correlative, distinctive and causal). An example of hypotheses presented by students in both universities is as follows:

- Red is a highly popular color (from children point of view) in design of a kindergarten.

- Formal or functional use of indigenous and traditional elements, have a direct impact on the increasing utility of cultural buildings.
- Climate-friendly materials play a more effective role than commonly-used materials (in a given climate) in creation of a sense of belonging. (Desert climate)

Two sessions of the class were spent on formulation of independent and dependent variables and hypotheses, because this stage was very important, and the topics that the students were interested in were unorganized and included many variables. The hypotheses were modified and the broad independent and dependent variables were limited with the help of the instructor. Although the instructor had better consider several hypotheses for each research, he preferred to assign one hypothesis to each student to increase their learning and provide them with enough time to analyze the hypotheses. However, at this stage, the students were told that in case they are interested in continuing with this topic in their dissertation, they need to expand the variables. By doing so, the students' motivation for learning the research methodology was increased because the instructor sought to focus on the student's topic of interest, and some students chose subjects related to the subject matter of their BA thesis or some new subject that they intended to work on in their master's thesis. In the next three sessions, the data collection methods that fit students' hypotheses, including library and field studies, as well as review of literature were discussed and each student was asked to collect the required data depending on the subject of the study. In this process, the author directed each student to use a data collection method according to the variables, and proper referencing methods, etc. (in library studies) were also taught in these sessions. In this way, students who worked on qualitative studies were present at the correction sessions held for students working on quantitative research, and got to know about the research conducted by others, therefore the class was entirely organized as a workshop. The advantages of this approach include: students got to know about and data collection and database access challenges in the quantitative and qualitative research, and they had the opportunity to ask the instructor about their problems in the next sessions so that they can understand the subject matter more easily.

During these sessions, the students who worked on quantitative studies got to know about questionnaire formulation methods, statistical population and sample size, and they were asked to formulate a questionnaire and to modify it in consultation with the author. In research projects that required an "interview," the interview structure was described and the students were asked to conduct the interview within the deadline set for them. Due to the importance of "observation" in architectural research, this factor was completely taught, especially to students who worked on qualitative research. Then, students were required to use one or more data collection methods according to their subject matter. So questions and answers class sessions were held to help students solve their problems, and in some cases, it was necessary to hold longer sessions and students paid close attention to the discussions and

did not complain of long sessions. In the next three sessions, the data analysis methods were introduced to the students and the parametric and nonparametric statistical tests were taught. During these sessions, students were given the opportunity to collect data and ask the instructor for help in case they had any problem, then the data analysis method that fitted the hypothesis of each student was determined in consultation with the instructor, and in case the research was of quantitative type, The statistical test was also determined and the students analyzed the data with the help of a statistic expert in SPSS software. Depending on their subject of study, Students who worked on Qualitative research also described, explained and interpreted the samples in consultation with the instructor. So, at the beginning of the eleventh session, students' research were completed at the same time as the main subject of the lesson, and a sample of the scientific research paper format was provided to students at this session, and students were required to formulate their findings in the desired format and submit them in the twelfth session. The 12th session was spent on correction of student papers, and students got to know about potential problems in data analysis, writing, and referencing, and some solutions were provided to these shortcomings. The thirteenth and fourteenth sessions were spent on other issues such as the choice of the journal, the submission of papers and discussions on the writing of the dissertation, the research proposal, and so on. In this process, students received training on research methodology in a research-based manner, and the theory-based teaching approach was replaced with research-based teaching approach (Table 4). Due to the importance of research in this method, the mid-term exam was cancelled and a greater score was assigned to paper writing. Hence, the theoretical test score (in the first semester, the research methodology pamphlet was given to the students) and paper writing score accounted for 12 and 8 points of the total score in this course (Table 5).

Table 4. *Description of the Topics Taught by the Author in the Research-based Method*

Topics taught at sessions	sessions
First and second sessions	Theoretical topic: research in architecture and its theoretical perspectives
Third and fourth sessions	Compilation of research variables and student hypotheses
Fifth, sixth and seventh sessions	Determine the research method Method of data collection and research background Method of using scientific databases and compiling a questionnaire The interview and observation method based on the qualitative and quantitative research of the students
Eighth, ninth and tenth sessions	Data analysis based on data Teaching the statistical test and determining the required test Data entry in the software with the help of statistics expert (for students who have selected quantitative research) Description and interpretation of qualitative data (for students who have selected qualitative research)
Eleventh session	Provide an academic-research paper format for students to provide their information in the specified format
Twelfth Session	Solving Student Problems in Analysis, Writing and Referral
Thirteenth session	Methods of selecting a journal and submitting a paper Important points to write dissertation and research design
Fourteenth session	Important points to write dissertation and proposal

Table 5. *How to Divide the Score into a Research-based Approach*

Assigned score(based on twenty score)	Items
Graduation exam	12
Paper presentation	8

The Results Obtained from Comparison of Theory-based and Research-based Methods

At the end of the semester, all the groups sat a theoretical test. The test included 12 one point questions and 2 questions were assigned to each section of the course. Of course, the diversity of questions was observed in two universities and in different semesters, and attempts were made to formulate questions with similar content. The distribution of the questions in the final exam is presented in Table 6.

Table 6. *Categorization of the Topics of the End-of-term Questions and the Amount of Score Assignment to Each Topic*

Questions in exam	Number of questions from each topic
Definitions and objectives of research in architecture	2
Variable, hypothesis, types of research methods	2
Methods of data collection and field survey methods	2
Society, sample and sampling methods; Research based on quantitative and qualitative data	2
Types of parametric and nonparametric statistical tests	2
How to set up proposal; Referral and scientific databases	2

After the theory test, students' grades were recorded in both universities and in different groups. Independent T test with significance level of 0.05 was used to answer this question "is there any significant difference between the mean scores of students in the theory-based and the research-based teaching method?", the grades of students in groups A1 and B1, A2 and B2 and finally A3 and B3 were compared according to Tables 7, 8 and 9 respectively and the test results were separately presented for the University of Tehran (Farabi campus) and Islamic Azad University.

Table 7. *Independent t-test Results from the Farabi Campus Students' Grades in A1 and B1 Groups*

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
					Lower
Normal	Equal variances assumed	.078	-1.03125	.55707	-2.18974
	Equal variances not assumed	.025	-1.03125	.42583	-1.91730

The interpretation of the test shows that at the significance level of 0.05, there is no significant difference between the scores of the Farabi campus students in group A1 (theory-based) and group B1 (research-based method) (Sig = 0/07). Therefore, the use of the traditional and new teaching approaches in the Farabi campus of Tehran University did not make any significant difference in the student's theoretical test scores. However, as for practical assignment and paper writing in Group A1, each student was required to submit their topic of interest in PowerPoint format and prepare a proposal on the same topic by the end of the semester. After the students' scores were

recorded, student’s proposals were not used and were just archived. However, in group B1, since the paper writing techniques were purposefully taught from the very beginning of the semester, and the students applied the relevant trainings to their chosen topic after each session, 7 papers (one paper per student) were submitted and 2 papers were accepted and published in scientific - research journals after being expert judged and modified. This indicated the paper writing ability and skills of students who have received training at workshops.

Table 8. *Independent t-test Results from the Grades of Azad University Students in Groups A2 and B2*

		t-test for Equality of Means			
		Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference
					Lower
Nomte	Equal variances assumed	.024	-.87222	.36939	-1.62138
	Equal variances not assumed	.022	-.87222	.36310	-1.60980

On the other hand, the interpretation of the t-test results obtained from the scores of the Islamic Azad University students shows that at the significance level of 0.05, there is a significant difference between the students' theoretical test scores in both the traditional and the new teaching models. (Sig = 0.02). Therefore, this significant difference indicates a significant growth in the learning of students who received training in the research-based approach. In addition, although the number of students in the Islamic Azad university was higher than the number of Farabi campus students, 18 students of group B2 submitted 18 papers at the end of the semester, 2 out of the 18 papers were accepted at internationally recognized conferences and 2 other papers were published in a Science promotion Journal. In group A2, only one student managed to extend his proposal after the end of the course in consultation with the author and submit it in the paper format. Finally, the paper was accepted in the poster exhibition section of one of the national conferences. Therefore, in both Farabi campus and Islamic Azad University, the workshop approach proved to have more significant impact on paper presentation and publication, the results also showed that this approach provides students with a better understanding of research approach and improves their paper writing skills. The statistical tests showed a significant difference in the final test scores of Azad university students and showed that students get a better understanding of the course contents in the workshop framework and manage to correctly answer the questions in the exam.

Table 9. *Independent t-test Results from the Grades of Farabi Campus Students in Groups A3 and B3*

		t-test for Equality of Means		
		Sig. (2-tailed)	Mean Difference	Std. Error Difference
Nomre	Equal variances assumed	.019	-2.37500	.90015
	Equal variances not assumed	.021	-2.37500	.90015

The interpretation of the results obtained from the scores of groups A3 and B3 was similar to those obtained from groups A2 and B2 in Islamic Azad University and a significant difference was observed between the research-based and the theory-based teaching approaches (Table 9). Meanwhile, 1 out of the 8 papers submitted by students of the second group (research-based) was published in a scientific research journal and 2 others were published in a science promotion journal. In the first group, however, no paper was accepted or published in any journal.

Evaluation of Students' Satisfaction with the Two Teaching Approaches

In order to determine how satisfied are the students with the theory-based and research-based teaching method, a five-point Likert scale questionnaire consisting of 9 items about the benefits of the research methodology courses, the necessity and applications of the course, satisfaction with the teaching method, and paper writing ability and motivation was designed and made available to all groups of students in both universities. After collecting the required data, independent T test was used to compare groups A1 and B1, A2 and B2 and finally A3 and B3 in terms of satisfaction with the teaching methods. The mean score of students' satisfaction, the significance level, the test value, as well as the mean score of total satisfaction with teaching approaches are presented in Tables 10, 11 and 12.

Table 10. Comparison of the Mean Score of Teaching Satisfaction in Groups A1 and B1

Questions about the satisfaction of teaching	T Test	Sig	Average	
			Group B1	Group A1
1- The steps and methods of teaching the research method facilitated learning.	-2/266	0/034	3/28 ± 0/75	2/31 ± 1/01
2- The teaching volume of the research method was proportional to the students' abilities	-1/91	0/07	4 ± 0/81	3 ± 1/26
3- Supervisor and continuing teacher assistance in learning research method is essential	-3/44	0/002	4/14 ± 0/69	2/68 ± 1/01
4-I have been able to write an article on my favorite topic	-4/13	0	4/28 ± 0/48	2/75 ± 1/29
5- In this tutorial, I have gained the ability to apply scientific research methods in architecture	-2/56	0/01	4 ± 0/81	2/87 ± 1/02
6- Learning research method to enhance research and design skills in architecture is essential.	-1/14	0/26	3/57 ± 0/53	3/12 ± 0/95
7- Student's duties are taught in the course of teaching the research method in accordance with its capabilities	-2/42	0/02	4 ± 0/81	2/81 ± 1/16
8- The time required for the teaching activities of the research method was appropriate	-2/75	0/01	3/28 ± 0/75	2/37 ± 0/71
9- The research method has increased interest in the research methodology in architecture	-2/16	0/04	4 ± 1/15	2/87 ± 1/14
Average total grade of teaching satisfaction	-6/77	0	34/57 ± 3/40	24/81 ± 3/29

Table 11. Comparison of the Average Grade of Satisfaction with Teaching in Groups A2 and B2

Questions about the satisfaction of teaching	T Test	Sig	Average	
			Group B2	Group A2
1- The steps and methods of teaching the research method facilitated learning.	-2/266	0/03	3/50 ± 1/09	2/70 ± 1/08
2- The teaching volume of the research method was proportional to the students' abilities	-1/91	0/004	3/72 ± 0/82	2/65 ± 1/22
3- Supervisor and continuing teacher assistance in learning research method is essential	-3/44	0/04	3/55 ± 0/61	2/90 ± 1/25
4-I have been able to write an article on my favorite topic	-4/13	0/01	3/44 ± 0/61	2/75 ± 1/01
5- In this tutorial, I have gained the ability to apply scientific research methods in architecture	-2/56	0/41	3/61 ± 1/03	2/95 ± 0/88
6- Learning research method to enhance research and design skills in architecture is essential.	-1/14	0/05	3/33 ± 0/84	2/70 ± 1/08
7- Student's duties are taught in the course of teaching the research method in accordance with its capabilities	-2/42	0/01	3/88 ± 0/67	3/10 ± 1/11
8- The time required for the teaching activities of the research method was appropriate	-2/75	0/01	3/05 ± 0/63	2/45 ± 0/82
9- The research method has increased interest in the research methodology in architecture	-2/16	0/02	3/38 ± 0/84	2/65 ± 1/08
Average total grade of teaching satisfaction	-6/77	0	31/50 ± 3/12	24/85 ± 3/36

Table 12. Comparison of the Average Grade of Satisfaction with Teaching in Groups A3 and B3

Questions about the satisfaction of teaching	T Test	Sig	Average	
			Group B3	Group A3
1- The steps and methods of teaching the research method facilitated learning.	-2/30	0/03	3/75 ± 0/88	2/62 ± 1/06
2- The teaching volume of the research method was proportional to the students' abilities	-2/39	0/03	3/87 ± 1/12	2/75 ± 0/7
3- Supervisor and continuing teacher assistance in learning research method is essential	-2/92	0/01	3/87 ± 1/12	2/37 ± 0/91
4-I have been able to write an article on my favorite topic	-2/07	0/05	3/75 ± 0/88	2/75 ± 1/03
5- In this tutorial, I have gained the ability to apply scientific research methods in architecture	-2/26	0/04	3/50 ± 1/19	2/37 ± 0/74
6- Learning research method to enhance research and design skills in architecture is essential.	-1/82	0/09	2/50 ± 0/94	1/75 ± 0/7
7- Student's duties are taught in the course of teaching the research method in accordance with its capabilities	-6/85	0	4/37 ± 0/51	2/25 ± 0/7
8- The time required for the teaching activities of the research method was appropriate	-1/04	0/3	2/87 ± 1/12	2/37 ± 0/74
9- The research method has increased interest in the research methodology in architecture	-3/47	0/004	4/25 ± 0/7	3 ± 0/75
Average total grade of teaching satisfaction	-10/79	0	32/75 ± 2/05	22/25 ± 1/83

Table 10 shows Comparison of satisfaction with research-based and theory-based teaching approaches in groups A1 and B1 at Farabi Campus of Tehran University. The table shows that students in this university are more satisfied with the research-based teaching approach except in the 6th item. Also, the high mean value of the total score of B1's satisfaction with the teaching approach was significantly higher than mean value of the total score of A1's satisfaction with traditional teaching method. According to Table 11, which compares groups A2 and B2 in terms of research-based and theory-based teaching approaches in Islamic Azad University, a statistically significant difference is observed in all cases, except for items 5 and 6. In addition, in the Islamic Azad University, the mean value of the total score of satisfaction with the research-based approach is higher than that in theory-based approach. No significant difference was observed between groups A3 and B3 in items of items 4, 6 and 8. However, as in the previous groups, the total score of satisfaction with teaching approach in the research-based approach was higher than that in the theory-based approach. Therefore, this assessment demonstrates the greater satisfaction of students with research-based approach has compared to the theory-based method, and students believe that the new teaching approach provides them with higher paper writing skills approach and facilitate their learning. Item 6 was the only item that did not show any significant statistical difference between students' responses. This

item refers to the necessity of learning the research methodology to enhance the research and design skills in architecture. The insignificant value of this item suggests that architectural engineering students believe research methodology has nothing to do with their design skills and this can be attributed to lack of awareness of the importance and necessity of architectural research. However, a high percentage of professional architectural practices require means and conditions beyond the expertise of architects and a professional mindset, and this shows increasing importance of architectural research and the need to learn it. For example, the needs of a multi-purpose complex can be sophisticated and therefore, research in this area may lead to solutions for appropriate design of such a complex. Cases such as application of non- common aesthetic principles or projects for specific groups such as the design of space for disabled individuals may also require research, and it is the task of architectural instructors to explain the importance of architectural research methodology to students.

Conclusions

The results obtained from the independent t-test ($P < 0.05$) showed a significant difference in learning growth among students who have received training in research-based approach. This means that In the latter approach, students had a better understanding of the architectural research methodology, and the mean value of the total score of satisfaction with teaching approach (in the research-based approach) in both universities and in all groups is significantly higher than that in the theory-based teaching approach. Even in groups A1 and B1 of Farabi campus where the scores are not significantly different in both teaching methods, the means score of satisfaction with the new teaching approach is higher, indicating that students who have receive training in the new approach are more satisfied with this teaching method. In addition, considering the greater number of students (20 students) participating in this course In Islamic Azad University, and their reluctance to write proposals, about 14 low-quality proposals were submitted and this indicated that despite the content provided to the students in the classrooms, students were still unable to write proposals and present them in the requested format. Despite more corrections sessions held in the Farabi University of Tehran University (due to the lower number of students (16) in the first semester of 93-94, 10 proposals were of low quality. At this university, only two out of the 8 proposals submitted by the first group (in the first semester of 92-93), enjoyed an acceptable quality. But in the research-based teaching approach applied at Farabi campus, since the paper writing techniques were purposefully taught from the very beginning of the semester, and the students applied the relevant trainings to their chosen topic after each session, 7 papers (one paper per student) were submitted and 2 papers were accepted and published in scientific - research journals after being expert judged and modified. This indicated high paper writing ability and skills of students who have received training at

workshops. In the Islamic Azad university, 18 papers were submitted (by 18 students) at the end of the semester, and 2 out of the 18 papers were accepted at internationally recognized conferences and 2 others were published in a Science promotion Journal. Such a result, however, was not achieved in the theory-based teaching approach applied at the Islamic Azad University. In the academic year of 93-92, 3 out of the 8 papers submitted by students who received research-based training at the Farabi campus of University of Tehran were published in scientific-research and science promotion journals (Table 13). Therefore, the research-based teaching approach has had a significant impact on the paper-writing ability of students. The noteworthy point in this approach is that it is advisable for instructor to hold classes with small number of students in order to achieve a better result. Because the experience of the author at Farabi campus and Islamic Azad universities showed in case more than 10 students attend the class, the instructor will not have any opportunity to correct students papers or guide them, and execution of this approach necessarily requires a class with small number of students. Moreover, in case too many students attend the class, it is advisable for the instructor to divide them into two groups and assign separate instruction times to each group. In addition, due to the investigative nature of the research methodology course, the importance of this course is still unknown to the architectural engineering students, and this indicates that most of the architecture instructors do not take architectural research seriously and do not care about learning the relevant techniques in this field, therefore, they don't pay enough attention to this course in the teaching sessions. The architectural research methodology, however, is one of the basic and important courses in the architectural engineering faculties of the developed countries, and new approaches have always been used for teaching this course in these countries. The significance of this course becomes twofold when we realize that architectural research is used to review, describe, analyze and deduce hidden points from architectural works and to conduct studies that require recognition of architectural design processes at the same time. Therefore, due to the development of disciplines associated with architecture and the need for research methodology fundamentals in the design processes, it is necessary to pay a special attention to the effective teaching of this course in the field of architecture and to apply research-based approaches on this course in order to provoke students to conduct research in this field and consequently bring about considerable developments in the research methodology teaching approaches.

Table 13. *Comparative Study of Theory-based and Research-based Teaching Approaches in Terms of the Number of Papers Published in Recognized Scientific Journals*

Teaching method	The total number of proposals and articles submitted by the students	The number of articles published in valid scientific research and promotion magazines	Specified groups
theory-based	10	0	A1
	14	0	A2
	8	0	A3
research-based	7	2	B1
	18	4	B2
	8	3	B3

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