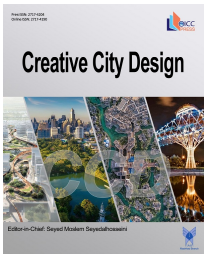

Volume 8, Issue 2, 082507 (1-10)

Creative City Design (CCD)

https://doi.org/10.57647/j.ccd.2025.0802.07

Analyzing the role of computer systems in improving the quality of architectural designs by third-degree undergraduate students

Babak Fadavi Akhavan, Shabnam Akbari Namdar*, Mir Saeed Moosavi

Department of Architecture, Ta.C., Islamic Azad University, Tabriz, Iran.

***Corresponding author:** namdar@iau.ac.ir

Original Research

Received:
14 April 2023
Revised:
23 May 2023
Accepted:
19 August 2023
Published online:
1 June 2025

Abstract:

Aims: Architecture, as one of the specialized academic disciplines, requires learning the necessary equipment, computer systems, and software. Most of the activities of students in this field during their studies take place in software environments, so the role of software in promoting architectural designs and projects should be considered. This study aimed to investigate the role of computers in improving the quality of architectural designs.

Methodology: The research was descriptive-analytical and inferential in terms of applied purpose and its nature. The statistical population of this study consisted of 86 undergraduate students who were studied in total. Data analysis using a factor analysis test led to a reduction of 25 variables to 12 variables, which could explain 88.82% of variance changes.

Findings: The results of the Pearson correlation test regarding these 12 variables showed that there was a significant relationship between the 12 variables studied and the quality improvement of Scheme 3 at the level of 0.000. Finally, to predict the changes between the independent variables (7 anthropological variables and 5 design environment variables) by improving the design quality (dependent variable), a stepwise linear regression test was used, which showed that the anthropological variables could explain 87.9% of variance changes and design environment variables could explain 79.6% changes, and in total, two groups of variables could explain 84.6% changes.

Conclusion: According to the findings, it can be said that the quality improvement of architectural designs is influenced by software and hardware, but this influence depends on many anthropological factors and the design environment.

Keywords: Architectural engineering; Education; Architectural designs; Quality improvement; Software

1. Introduction

Rapid developments have led to considerable public attention to the fact that the higher education system is incapable of properly preparing individuals for work in the new environment [1]. Contemporary architecture as a field of research, of course, faces differences and distances in and present form. The computer continues to play an unstructured role without a precise, clear, and efficient definition. A computer is an inseparable tool of the architectural design activity [2], but when it comes to the order in the design process, there is a lot of heterogeneity in the approaches of Iranian architects [3]. Those who have high expectations of the computer's role in the design process are dissatisfied with its current role, and those who consider it destructive to creative design activities are also dissatisfied with its presence [4]. The way to understand the role of the computer is to analyze architectural design to recognize the real role of the computer based on it [5]. Obviously, by accurately interpreting this role, we can help improve it. The consensus among them is that today the presentation of architectural design is incomplete without the use of computers [6], therefore, in-depth studies should be conducted to explore the importance and qualitative use of computers in the presentation of architectural designs, which has not been comprehensively studied so far. A study that exam-

ines issues such as the relationship between computers and students' creativity, the power of visualization, students' gender, the goals and needs of the labor market, the design environment, the relationship between computer systems, plans, and financial conditions governing the society, etc. cover, so far no research has been presented in this field. Therefore, this article studies the quantitative and qualitative presence of computers and computer software among students and users in the design process, then the formation of contemporary Iranian architectural works and the surface analysis of how Iranian architects interact with computers to help improve and organize this role; Therefore, it can be said that the main purpose of this research is to provide an answer to the question, what is the role of the computer in improving the quality of students' architectural designs?

2. Research background

Research by [7] investigating the difference between hand and computer architectural designs in the process of architectural design concluded that hand drawing is more efficient in the mental parts of design due to its direct connection with mental creative activity. Architectural software should also fill this gap. [8] believe that computers have provided many possibilities in the field of design and, if this software can take a step in the direction of improving the quality of designs, it can lead to tremendous progress in architecture. [9] know the architectural design tool and its place in the architectural design process; it is necessary to know its features and components. The design process is more important than its result. When design becomes a conscious act, knowledge, skill, follow-up, perseverance, and design tools all influence the process. Although design tools are mostly used to explain a specific action or verb, they actually include features that are closely related to architectural design. [10] found that each of the architectural design tools has specific capabilities in the mentioned process, considering their functional properties. In the architectural manual tool, the designer records their information and data through freehand drawing, manual sketches, making mockups, drawings, and manual rendering of design documents with different tools. In this way, their understanding of the problem describes the design and factors affecting the design. concluded that digital technologies are also a tool to help human efforts, and in this field of application software related to architecture, the possibility of preparing initial ideas, experimental designs, documents with dimensions and 3D, together with layers of materials, providing light, etc., based on the architect's mentalities in the virtual space. [11] entitled in their research, "Creativity and the Process of Concluded Creative Education in Architectural Design," that the use of computers can create a suitable platform and environment for the emergence of creativity. Furthermore, the results of the research showed that computer systems can enhance the role of computers in the design of architectural projects by simultaneously and interactively developing spatial intelligence and creativity. [12] entitled in their research, "Investigation of the Degree of Compliance of the Architectural Engineering Curriculum the Concluded Needs of the Labor Market in Iran", that the topics of the bachelor's degree in architectural engineering did not match the needs of the labor market. Furthermore, they noted that courses related to subsidized expertise and specialized software are of great importance to be included in the curriculum. [13] research entitled "The Iranian Role of Computers in the Architectural Design Process: A Comparative Comparison of Two Generations of Contemporary Concluded Architects" that two patterns, "Designer and Computer Situation Interaction Pattern" and "Designer Skill Acquisition Pattern," are the needs of contemporary architects that should be considered when designing with computers. [14] In research entitled "Analytical study of the effect of using digital software on the promotion of creativity in architectural design education" have concluded that the development of computer systems can promote creativity through the creation of dynamic and purposeful structures. Architecture education helps. The review of the conducted studies shows that despite numerous studies on the role of computers in architectural design, there is no coherent study in this field. In other words, no research examines the role of computers in the qualitative improvement of architectural designs and considers the various components that have an impact on this field; Therefore, it can be said that the current research is innovative both in terms of the subject under investigation and in terms of a comprehensive approach to the role of computers in improving the quality of architectural designs.

3. Theoretical framework

Architecture reflects the transfer of concepts and values that begins with education [14]. The interaction between the person and the architectural work takes place in the context of space and time, and this path requires appropriate tools to present the design process [20], in such a way that it can correctly express the values, concepts, and thoughts of the architect and present it [3]. Before the introduction of digital technologies in architectural education, architectural design, and its education were done in design workshops with manual tools [21]. However, with the development of these technologies, application software has entered various fields, including architectural design education [22]. This software is expanding every day and includes different types, and it raises challenges in the field of architectural design education [23]. Of course, it has been able to lead to new approaches in the education of this field. expressing the nature of creativity which has often been based on exploitation in the production of industrial products, an expert in design techniques and psychology, idea generation and idea generation, design process regulation and layering and design process strategies in a general way and typically in They have specially proposed architecture, which of course is often based on the data of behavioral sciences and psychology, and they can generally be considered the result of generalizing the results of research and commenting on these basic sciences [24]. The goal of researchers in this field is to understand the structure of the design process, design problems, and solutions, and design thinking to help design education and the development of computer-aided design techniques and software, which several architects, interior designers, industrial designers, engineers, urban

designers, and urban planners can be considered among these researchers [25]. Before any other architectural phenomenon, will benefit understanding the place of media in the architecture world of architectural design; for in the contemporary period, the last between medium man and reality, the computer, plays an important role in the most tangible manifestation of design activity, the design process [4]. The presence of a computer is a disadvantage for architectural design activities [18]. Today, architectural design, production processes, tools, ideas, theories, methods, and forms have been widely influenced by computers and communication technology. The increasing use of computers in the field of architectural and engineering design is considered one of the most important recent achievements of mankind in line with the design process and increased productivity in various stages of construction [6]. With this description, it should be acknowledged that among all the research about design, creative processes of design, and topics of creativity and creative thought, it has a definite, established, and completely central and key position. At the same time, it is the most ambiguous and perhaps the most important feature of the design process. Since they are still presented as uncertain and ambiguous issues, they need research [26].

4. Material and methods

This research is based on the purpose of applied research and, in terms of nature and method, is considered descriptive-analytical. According to the nature of the research hypotheses, the statistical population of this research includes undergraduate students studying in the architectural engineering field at Islamic Azad University and Tabriz University. The research is quantitative research that has been analyzed using five-choice questions and inferential statistical tests. According to the statistics obtained from the faculty's education department. About 86 students took Design Course 3 in three semesters. Due to the low number of students (the statistical population of the research), sampling was not done and the statistical population was selected as a whole. In other words, sampling was not done in this research. Due to the small number of students, all of them have been selected as the sample size. The validity of the questionnaire was confirmed by university professors, and the reliability of the questionnaire was obtained using Cronbach's alpha, separately for each of the different dimensions as shown in Table 1.

To identify the required variables for this research, a review and study of all types of internal and external written sources, including books, articles, treatises, reports, and other written research, was conducted. The general results of the studies indicated the existence of variables with various dimensions, including type of software, age, gender, educational level, previous design experience, free-hand skills, etc., in the field of quality improvement of the design. In total, the variables identified for the first hypothesis included 25 variables in the two dimensions of anthropological characteristics and the design environment (Table 2).

Analysis of the obtained data using statistical tests of factor analysis, Pearson correlation test, and stepwise linear regression test have been used.

The Kaiser-Meyer-Olkin method is (KMO) used for the appropriateness assess of the test. The statistic value of this test 0 1. ranges from If to the value of this statistic is less than 0.5, the data not factor is analysis, suitable for factor analysis. If its value is between 0.5 and 0.69, factor analysis can be done with caution. If the value of this statistic is more than 0.7, it can be said that the existing correlations among the data are suitable for factor analysis.

Pearson correlation test

Pearson's correlation test was introduced by Karl Pearson to determine the degree of relationship, type, and direction of the relationship (positive or negative) between two relative or distance variables or a combination of the two. The formula for calculating Pearson correlation is as follows:

$$r = \frac{\rho_{xy}}{\sigma(X)\sigma(Y)} = \frac{n\sum xy - (\sum x)(\sum y)}{\sigma(X)\sigma(Y)}$$

Multivariate regression (stepwise method)

Multivariate regression (stepwise method) is the analysis or analysis used to investigate and model the relationship between variables. The of using regression variance is a statistical method goal typically used to predict one or more criteria variables from one or more predictor variables. In the step-by-step method, the first predictor variable is selected based on the highest zero-order correlation coefficient with the criterion variable. Subsequent predictor variables are then included in the analysis according to their correlation coefficient. Generally, the order of entering the variables is not determined by the researcher [14]. In these statistical models, it is assumed that the relationship between independent variables and dependent variables is as follows:

$$y = a + b_1(X_1) + b_2(X_2) + \ldots + b_p(X_p)$$

The relationship between independent variables and dependent variables in multivariate regression test (stepwise method)

In this equation, the parameters b_1, b_2, b_p are partial regression coefficients and a is the value of the width from the origin, which is also called the regression constant value.

Table 1. Validity and reliability results of the research questionnaire.

Dimensions	validity	reliability
Anthropological	Approved in good condition	0.875
Design environment	Approved in good condition	0.902
Final	Approved in good condition	0.889

Table 2. Research dimensions and indicators.

dimensions	Index	References
Anthropological	Age	[14]
	gender	[4]
	Interested in architecture	[6]
	Interested in the subject of the project	[14]
	Approach and motivation to use the software	[6]
	Previous design experience	[14]
	Practice and repetition times	[14]
	The power of student visualization with project design	[6]
	Practice and individual software work during design	[6]
	Using self-learning resources in design (educational software, internet, mobile, etc.)	[4]
	Practice and software teamwork during design	[6]
Design environment	Software type	[15]
	The teacher's power of expression	[4]
	Design time	[4]
	Ambient light compatibility	[16]
	Compatibility of tables and chairs with architectural work	[14]
	atelier's temperature compatibility	[16]
	The elasticity of the labor market and the possibility of employment in the field of software	[17]
	Interacting with others while designing	[17]
	Type of computer system	[2–4]
	The number of corrections	[17]
	The degree of difficulty of the project	[4]
	The duration of experience working with the software	[2–4]
	Time limit for submitting the plan	[18]
	The degree of freedom of action of the student in ideation of the plan	[19]
	Teaching accessories (video projector)	[2–4]

5. Analysis of findings

5.1 Descriptive research results

Based on the obtained data, the statistical population of this research was 86 undergraduate students in the field of architecture of Islamic Azad University, Tabriz branch. Based on the results, 67% of the studied students are female students, and 33% are male students. Other descriptive data obtained are in the form of Table 3.

The results of the research findings in terms of four groups of descriptive variables (work history, choice of field, expertise in family members, and interest in the project subject) have been obtained in the form of figure 1.

Also, the results of the research findings in the field of two variables of the motivation to learn architectural software and the number of corrections are shown in Table 4.

The graph relating to the frequency of corrections during the semester reason for learning the software is shown in figure 2.

5.2 Inferential finding

Confirmatory factor analysis was used to determine and categorize the factors affecting the quality improvement of lesson plan three, and to summarize the number of variables. To determine the internal consistency of the data, KMO and Bartlett's tests were used to apply the factor analysis technique. The KMO value was 0.931, and the Bartlett statistic was 1.285, with a significance level of 0.000. Therefore, the available data were found suitable for factor analysis (Table 5).

Table 3. Frequency distribution of the community in terms of work experience, field, expertise in family members and interest in the subject.

Variables	frequency	Percent	Variables	frequency
Work experience in architecture	37	40.31	The existence of an expert in the field of architecture in the family	41
No work experience in architecture	59	60.68	Absence of an architect expert in the family	45
Choosing a field based on interest and knowledge	67	91.77	Interested in the subject of the project	61
Choice without interest and awareness	19	09.22	Lack of interest in the subject of the project	25

In the following, the 17 variables were analyzed using SPSS software, and the results obtained were presented in Table 6. The results of loading 25 research variables into the factor analysis model led to their reduction to 12 variables and 2 component groups: The first factor is comprised of interest in the field of architecture, interest in the project topic, previous experience working with software or project topic, student's visualization power, individual practice and work with software in design, gender, approach, and motivation to use the software. The sum of these variables with a specific value of 38.15 can explain 49.04 percent of variance changes. Based on the nature of the loaded variables, the title of the factor "Human Factors Affecting the Quality Improvement of the Project" can be chosen for it.

The second factor is composed of the variables of the frequency of corrections, the degree of difficulty of the project, the time limit for the presentation of the design, the degree of freedom of action of the student in the design process, and interaction with others during the design. According to the type and nature of these variables, the title of the factor "Effective design environment on the quality improvement of the design" was chosen. The specific value of this variable is equal to 31.14, which explains 39.78% of the variance changes. The total of 12 variables loaded in the factor analysis model explains 82.88% of the variance changes related to the quality improvement of the project of three undergraduate students of Islamic Azad University, Tabriz branch, and 11.18% of the variance changes are related to the remaining 13 variables. Due to the insignificant importance of these variables, they were removed by the factor analysis model.

In the following, with the aim of a more detailed examination of the degree of correlation between the 12 variables obtained from the factor analysis model (interest in the field of architecture, interest in the subject of the project, previous experience working with the software or the subject of the project, student's visualization power, practice and individual work With the software in the design process, gender, approach and motivation to use the software, correction frequency, degree of difficulty of the project, time limit for the presentation of the design, the degree of freedom of action of the student in the design process, interaction

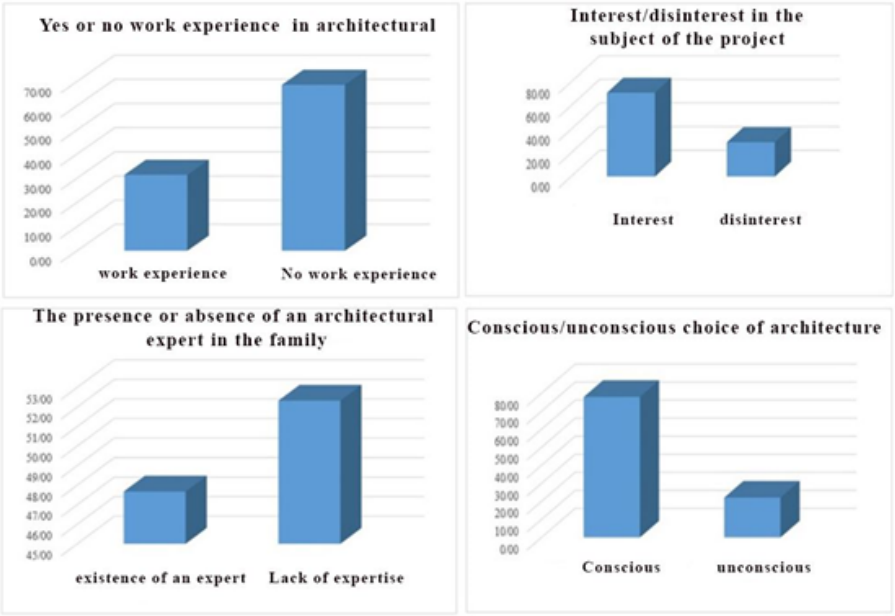

Figure 1. Diagram of variables of work experience, field choice, expertise in family members, and interest in the project topic.

Table 4. Descriptive findings regarding the variables of correction frequency during the semester and the reason for learning the software.

The reason for learning the software	Percent	frequency	Correction times	Percent	frequency
interest	31	4.36	Less than 5	5	81.5
class assignment	2	32.2	5 – 10	55	95.63
Deep learning	18	93.20	10 – 15	20	25.23
Earn money	26	23.30	15 – 20	3	48.3
Labor market needs	8	30.9	More than 20	3	48.3
Teaching others	1	16.1			

with others during the design (with the quality variable of architectural designs) Examined sample: Design 3) Pearson correlation test was used, and the results are shown in table number (Table 7).

In the continuation of the analysis of the results, using the multivariate regression test, the cause and effect relationship between the independent variables (cognitive human factors and design environment factors) and the dependent variable (quality improvement of student projects in project 3) has been investigated (Table 8).

The analysis of the information obtained about the variables related to individual capacities and the design environment with the variable of quality improvement of architectural designs (design 3) showed that almost all of the aforementioned 12 variables have a great influence on the dependent variable. In this regard, it can be said that relatively the

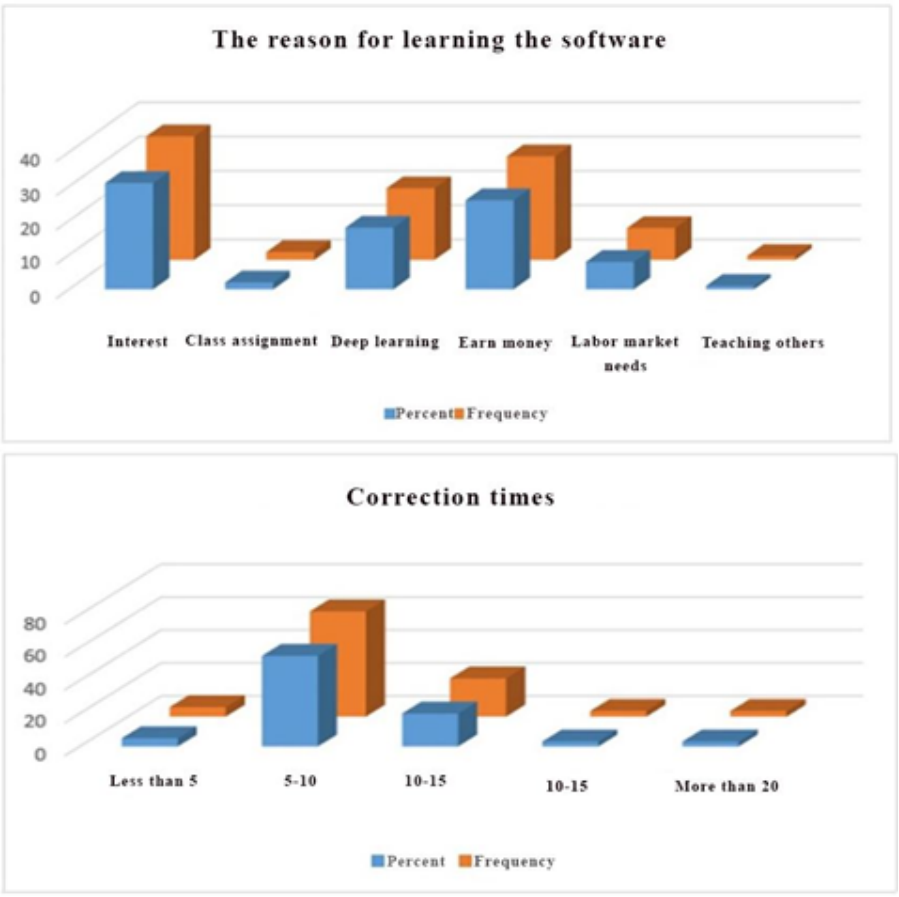

Figure 2. The graph showing the relationship between the of frequency corrections during the semester and the reason for learning the software.

Table 5. KMO value and Bartlett's test.

Sig	Bartlet test	KMO	Factor analysis
0.000	1.288	0.931	The role of computer in improving the quality of architectural designs

Table 6. KMO value and Bartlett's test.

Cumulative percentage	Percentage of variance	special amount	Sig	correlation coefficient	Variables	Factors
49.04	49.04	38.15	0.000	0.874	Interest in the architecture field (p = 0.921), interest in the project topic (p = 0.887), previous experience working with software or the project topic (p = 0.841), the student's visualization power (p = 0.817), individual practice and work with software in designing jeans (p = 0.796), gender (p = 0.776), approach and motivation to use the software (p = 0.761)	Human Factors
88.82	39.78	31.14	0.000	0.756	The frequency of corrections (p = 0.811), the degree of difficulty of the project (p = 0.799), the time limit for presenting the design (p = 0.750), the degree of freedom of action of the student in the design process (p = 0.737), and the interaction with others during design (p = 0.721)	Design environment

role of human variables (interest in the field of architecture, interest in the subject of the project, previous experience working with the software or the subject of the project, student's visualization power, practice and individual work with the software during design, gender, approach, and motivation to use of software) compared more to the variables related to the design environment (correction frequency, degree of difficulty of the project, the time limit for presenting

Table 7. Pearson correlation test results regarding the correlation between computer use and the quality of architectural designs.

Value (Sig)	Value (p)	Variables	component	Value (Sig)	Value (p)	Variables	component
0.000	0.742	Correction frequency	**Design Environmental**	0.000	0.895	Interested in architecture	**Anthropological**
0.000	0.541	The degree of difficulty of the project		0.000	0.847	Interested in the subject of the project	
0.000	0.567	The time limit for submitting the plan		0.000	0.810	Previous experience working with software or project topic	
0.000	0.504	The degree of student freedom of action in the design process		0.000	0.798	The power of student visualization	
0.000	0.607	Interact with others while designing		0.000	0.812	Individual practice and work with the software during the design	
				0.000	0.541	Gender	
				0.000	0.851	Approach and motivation to use the software	

Table 8. The results of the regression test regarding the relationship between the use of subsidies and the improvement of the quality of architectural designs.

f	Std. Error	Adjusted R-squared	R squared	R value	Sig.	Index	Group
31.730	0.60717	0.466	0.879	0.885	0.000	Interested in architecture	Individual capacities
41.202	0.64009	0.407	0.767	0.871	0.000	Interested in the subject of the project	
27.649	0.65577	0.377	0.791	0.826	0.000	Previous experience working with software or project topics	
54.746	0.55751	0.540	0.718	0.780	0.000	The power of student visualization	
53.176	0.52742	0.591	0.768	0.748	0.000	Individuals work with software during design	
24.042	0.54682	0.567	0.532	0.541	0.000	gender	
12.243	0.48321	0.648	0.841	0.851	0.000	Approach and motivation to use the software	
54.136	0.65485	0.741	0.796	0.810	0.000	Correction frequency	Design environment
35.362	0.74521	0.712	0.749	0.788	0.000	The degree of difficulty of the project	
55.654	0.56054	0.604	0.695	0.714	0.000	Time limit for submitting the plan	
46.632	0.65475	0.599	0.648	0.712	0.000	Degree of student freedom of action in the design process	
47.452	0.45698	0.598	0.664	0.691	0.000	Interact with others while designing	

the design, degree of freedom of action of the student in the design processes). In this regard, seven variables related to anthropology can explain 87.9% of the variance changes, and five variables related to the design environment dimension can explain 79.6% of the variance changes. In the meantime, the variables of interest in the field of architecture, interest in the subject of the project, and previous experience working with the software or the subject of the project respectively with regression values of $r = 0.885$, $r = 0$ .871, and $r = 0.826$ are higher than the rest of the variables, and also about design environment variables, the variables of correction frequency and degree of difficulty of the project with values of $R = 0.796$ and $r = 0.749$ are in the first and second priority, respectively. Finally, it can be said that the total of 12 variables examined in this research can explain 84.6% of the variance changes related to the quality of architectural designs in the design of 3 undergraduate students. Regarding the findings of the research, it can be said that the students who chose the field of architecture out of interest, the influence of anthropological variables and the design environment (design environment) was more than the students who chose this field without gaining sufficient knowledge and understanding. have chosen Meanwhile, students who have one of their family members who studied in the field of architecture and now has a job related to their field of study, have a higher degree of correlation than the rest of the students, also this group of students has the power More visualization is related to the project topic during design or before choosing the design topic. In other words, this group of students, while doing visualization for design before choosing the topic, during the design process, they have more visualization power about the design topic. Also, the obtained results show that the experience of working with architectural software, whether it is design or 3D software it has led to income in the past, or if the students are confident that in the future and after graduation, they have a source of income from software will lead to more efforts to improve the quality of the design. Based on the obtained results, this group of students who are interested in the field of architecture, choose the topic of their project based on their interest compared to the rest of the students. From the experience of working with architectural software, the experience of working in independent architectural offices and attending classes and training schools leads to motivation to improve architectural designs. Regarding the variables related to the design environment, it can be said that these variables are somewhat influenced by human cognitive variables. For example, students who have chosen the field of architecture and the subject of the project out of interest have a higher number of corrections. Because these students are more motivated to improve the quality of the project, they focus more on it both quantitatively and qualitatively, leading to the emergence of many questions.

6. Discuss and conclusion

Architecture, like other branches of science and human writing, has taken on goals and tasks, and for this purpose, it uses a set of sciences, techniques, methods and tools, and facilities to achieve them. In traditional systems, the designers prepared the initial designs on small scales by

hand or with a ruler. But today, due to the increasing complexities and development of science, it is necessary to use computer systems to design architectural plans and projects. As discussed in this research, computer, and software systems are a set of software and hardware facilities and tools that are used by individuals or engineering companies, organized according to their needs and requirements. The field of architecture also has much software that students and professionals in this field are required to learn during their education; among the most important software common in architecture are AutoCAD, 3D, V-ray, and Revit. Learning these software and carrying out quality architectural projects in the environment of these software depends on several factors that include a wide range of anthropological factors, software and hardware features, training, environment, and design platform, etc.; Therefore, the final quality of an architectural project depends on several factors, which were identified and categorized in this research for the first time with 25 variables affecting the role of computer in the quality improvement of architectural designs. The results of the research findings regarding these 25 variables showed that among these variables, 12 variables include the variables of interest in the field of architecture, interest in the project topic, previous experience working with software or project topic, student visualization power, practice, and individual work with software. In design, gender, approach, and motivation to use the software as the most important anthropological variables (students' characteristics) have been more important than other variables. Also, the variables of the frequency of corrections, the degree of difficulty of the project, the time limit for the presentation of the design, the degree of freedom of action of the student in the design process, the interaction with others during the design are variables related to the design environment and platform, which are more important compared to other variables. In this regard, the results of the research using the factor analysis test showed that these 12 variables in total can explain 82.88% of the variance changes related to the quality improvement of students' architectural designs in Design 3. In other words, 82.88% of the quality of drawn architectural plans depended on these 12 variables. In this regard, the results of the Pearson correlation test showed that there is a significant relationship between the twelve investigated variables and the three plan quality variables. Furthermore, the results of the research findings using multivariate regression tests showed that the total of twelve variables examined in this research can explain 84.6% of the variance changes related to the quality of architectural designs in the design of three undergraduate students. Examining and comparing the findings of this research with the results of similar research shows that no research has yet examined the variables used in the current research using the statistical tests employed. In general, the findings of this research, [7] regarding the role of computers in improving the quality of architectural designs, [27] regarding the role of computers and architectural software in creating new designs, and the findings of [14] are consistent with the role of architectural software in creating creativity in architectural designs. Also, the results of this research are consistent with the results of the findings of [8, 22, 24, 28] in the field of the moderating role of age, gender, skill, amount of light and type of software in the effectiveness of computers in students' learning. In addition, the results of the findings of this research are consistent with the results of the findings of [3] regarding the teacher's expressiveness, the amount of repetition and the type of architectural software. According to the findings of the present research, it can be said that the quality improvement of architectural designs is influenced by software and hardware systems, but this influences itself depends on many anthropological factors and the design environment. To improve the role of computers in improving the quality of student projects, it is suggested that in the first semesters of architecture students, the necessary information about the nature of the field, the courses to be studied, the software, and the horizons ahead of this field be presented to the students so that their knowledge of the field of architecture can be increased. According to the results, students who had a higher level of knowledge about their field had higher-quality designs. It is also suggested that students have more freedom of action in choosing the subject of the project, as having the freedom to choose the subject of the project has led to the presentation of quality designs using architectural software. Additionally, based on the results of this research, it is suggested that the presentation of plans in the software environment should be based on an interactive approach between students and professors. Furthermore, according to the findings of the research, it is suggested that in addition to the educational goals of presenting projects to students, the professors' approach should be based on market-oriented education, as the findings of the research showed that the motivation to earn money from the labor market leads to providing quality designs in the software environment.

Authors contributions
Authors have contributed equally in preparing and writing the manuscript.

Availability of data and materials
The data that support the findings of this study are available from the corresponding author, upon reasonable request.

Conflict of interests
The author declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

References

[1] M. Yazdani, A. Rezvani, M. vafamehr, and M. H. khademzade. "**Evaluation of Architectural Engineering Curriculum to Promote Vocational Education Based on Klein Model**.". *Creative City Design*, (1):45–61, 2022.
DOI: https://doi.org/10.30495/ccd.2022.689602.

[2] H. S. Salman, R. Laing, and A. Conniff. "**The impact of computer aided architectural design programs on conceptual design in an educational context**.". *Design Studies*, 35(4):412–439, 2014.
DOI: https://doi.org/10.1016/j.destud.2014.02.002.

[3] E. Brimondi and Y. Mohammadi Far. "**The quality of services received from Razi University and its effect on the level of students' satisfaction**.". *Iranian Higher Education Quarterly*, 11(3):101–126, 2018. URL http://ihej.ir/article-1-1273-fa.html.

[4] B. Eilouti. "**Concept evolution in architectural design: an octonary framework**.". *Frontiers of Architectural Research*, 7(2): 180–196, 2018.
DOI: https://doi.org/10.1016/j.foar.2018.01.003.

[5] A. J. Fletcher. "**Applying critical realism in qualitative research: methodology meets method**.". *International journal of social research methodology*, 20(2):181–194, 2017.
DOI: https://doi.org/10.1080/13645579.2016.1144401.

[6] I. Navarro, O. de Reina, A. Rodiera, and D. Fonseca. "**Indoor positioning systems: 3D virtual model visualization and design process of their assessment using mixed methods: Case study: World heritatge buildings and spatial skills for architecture students**.". *11th Iberian Conference on Information Systems and Technologies (CISTI), IEEE*, 2016.
DOI: https://doi.org/10.1109/CISTI.2016.7521532.

[7] A. Gharibpour. "**Analytical comparison of hand and computer drawing in architectural design process**.". *Fine Arts Quarterly*, 19 (1):14–5, 2013.
DOI: https://doi.org/10.22059/jfaup.2014.55370.

[8] N. Klini Mamqani and S. Azimi. "**The effect of freehand drawing (sketch) in the design process**.". *Fine Arts Journal*, 3(46):75–85, 2018.
DOI: https://doi.org/20.1001.1.22286039.1390.3.46.8.7.

[9] R. Naboni and I. Paoletti. "**Advanced customization in architectural design and construction**.". *Spriger*, 2015.

[10] S. Soliman, D. Taha, and Z. El Sayad. "**Architectural education in the digital age: Computer applications: Between academia and practice**.". *Alexandria Engineering Journal*, 58(2):809–818, 2019.
DOI: https://doi.org/10.1007/978-3-319-04423-1.

[11] M. Mahdavinejad. "**Creativity and the process of creative education in architectural design**.". *Fine Arts Journal*, 28(1):57–66, 2005. URL https://journals.ut.ac.ir/article_10726.html.

[12] V. Jamiri, J. Hatami, A. Fathi-Azer, and M. Pakdel Fard. "**Examining the degree of adaptation of the architectural engineering bachelor's curriculum to the needs of the labor market in Iran**.". *Higher Education Curriculum Studies*, 1(2):111–133, 2018.

[13] H. Naser Khaki. "**The role of computer in architectural design process; A comparative comparison of two generations of contemporary Iranian architects**.". *PhD dissertation, University of Tehran*, 2018.

[14] K. de Gaulmyn, C. nad Dupre. "**Teaching sustainable design in architecture education: Critical review of Easy Approach for Sustainable and Environmental Design (EASED)**.". *Frontiers of Architectural Research*, 8(2):238–260, 2019.
DOI: https://doi.org/10.1016/j.foar.2019.03.001.

[15] W. Mitchell. "**Computer-aided architectural design**.". *Cambridge, Mass, The MIT Press*, 2017.

[16] J. Torkzadeh, M. Shabani Far, J. Muammarhor, and A. Sinaii. "**Pathology of educational system in technical and professional university centers**.". *Iranian Higher Education Quarterly*, 9(4): 57–77, 2016. URL http://ihej.ir/article-1-1189-fa.html.

[17] N. Gislason. "**Architectural design and the learning environment: A framework for school design research**.". *Learning Environments Research*, 13(2):127–145, 2010.
DOI: https://doi.org/10.1007/s10984-010-9071-x.

[18] C. Argyris. "**A life of learning**.". *Journal of Organization Studies*, 24(7):1178–1192, 2003.

[19] D. Newton. "**Generative deep learning in architectural design**.". *Technology— Architecture + Design*, 3(2):176–189, 2019.
DOI: https://doi.org/10.1080/24751448.2019.1640536.

[20] M. Asefi and A. Imani. "**An analytical study of the effect of using digital software on the promotion of creativity in architectural design education**.". *Hovit Shahr Quarterly*, 11(4):79–92, 2016.
DOI: https://doi.org/20.1001.1.17359562.1396.11.4.7.5.

[21] C. de Gaulmyn and K. Dupre. "**Teaching sustainable design in architecture education: Critical review of Easy Approach for Sustainable and Environmental Design (EASED)**.". *Frontiers of Architectural Research*, 8(2):238–260, 2019.
DOI: https://doi.org/10.1016/j.foar.2019.03.001.

[22] C. F. Albrecht and L. D. Iulo. "**Healthful, Sustainable Design in Community-Engaged Architecture Education**.". *Educating the Sustainability Leaders of the Future*, pages 431–451, 2023.
DOI: https://doi.org/10.1007/978-3-031-22856-8_24.

[23] S. Arslan Selcuk and G. Mutlu Avinc. "**Natural language approach for bio-informed architectural education: a biomimetic shell design**.". *International Journal of Technology and Design Education*, 32(4):2297–2317, 2022.
DOI: https://doi.org/10.1007/s10798-021-09689-z.

[24] L. M. Khodeir and A. A. Nessim. "**Changing skills for architecture students employability: Analysis of job market versus architecture education in Egypt**.". *Ain Shams Engineering Journal*, 11(3): 811–821, 2020.
DOI: https://doi.org/10.1016/j.asej.2019.11.006.

[25] T. Abel. "**Design education: out of the studio and into the research lab**.". *Journal of Art and Design*, 1(1):10–16, 2013. URL https://www.ajindex.com/dosyalar/makale/acarindex-1423910424.pdf.

[26] E. M. A. Benzenberg. "**Exploring Design Process Evolution in Architecture and Interior Design Firms**.". *the Ohio State University*, 2011. URL http://rave.ohiolink.edu/etdc/view?acc_num=osu1313341550.

[27] R. S. Priya, P. Shabitha, and S. Radhakrishnan. "**Collaborative and participatory design approach in architectural design studios**.". *Social Sciences & Humanities Open*, 2(1):100033, 2020.
DOI: https://doi.org/10.1016/j.ssaho.2020.100033.

[28] F. Muzaffar and A. Ekhlasi. "**A new approach to teaching architectural design, providing an educational model based on CAAD-PBL**.". *International Journal of Industrial Engineering and Production Management*, 2017.