

The Effectiveness of Mental Simulation Training on Educational Performance and Creativity of the Architecture Students in Therapeutic Spaces Design

Marjan Sadeghi

University of Mohaghegh Ardabili

Hojjatolah Rashid Kolvir (✉ phd_rashid@yahoo.com)

University of Mohaghegh Ardabili <https://orcid.org/0000-0002-0317-5557>

Akbar Atadokht

University of Mohaghegh Ardabili

Hasan Akbari

University of Mohaghegh Ardabili

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Abstract

The purpose of this study is to investigate the effect of teaching mental simulation strategies on academic performance and creativity of architecture students of Mohaghegh Ardabili University of Ardabil in the design of health clinics lesson. The research method was quasi-experimental with pre-test and post-test design with both trial and control groups. The statistical population was composed of all seven semester students who were studying architecture in Mohaghegh Ardabili University in the first semester of the academic year 1396-1397 that they were divided into two groups (each group was 15) that were randomly selected as the trial group and the control group. Tools used in this research were a questionnaire of academic performance, which was adapted from the Performance Measurement Questionnaire (EPT) Pham and Taylor, and Creativity Questionnaire, adapted from the Schaeffer Questionnaire for creativity assessment. Mental simulation trainings were presented for 5 sessions of 3 hours for the trial group. The control group did not receive any training. To analyze data we used ANCOVA covariance from inferential statistics to test the research hypotheses. Findings indicated that training mental simulation strategies improved the academic performance of students under the motivating factor ($p < 0.05$), and on students' creativity have a significant effect under the factor of feeling of fantasy, so simulation strategies can be used to improve architecture students' academic performance and promote their creativity.

Introduction

The goal of educational technology is to facilitate learning and improve its performance. In this regard, educational simulations can serve this purpose as a method or as a suitable medium. Because one of its most important applications is in the field of teaching and learning (Johnson, 2006). During training activities and depending on the type of training, one of the brain hemispheres is forced into activity more than the other. Traditional methods of education emphasize more on reservations, while for optimal productivity, attention is paid to the full potential of students (Martize, 1994). Before language, the only way humans could think was imagination, but when the human kind became civilized through the use of language, the brain's visual capacity diminished. Similarly, children's visual capacities are often high, but they quickly learn not to use this type of thinking as they enter the education system. This system allows the left hemisphere to expand further. However, the right brain hemisphere is the center of our imagination that responds to exercise. As a muscle becomes stronger with motion, imaginative skills that have been lost due to not being used are re-trained with practice (Martize, 1994).

One of the features of the nervous system is that it does not distinguish the imaginary experience from the real and in both cases responds to information coming from the brain. Peripheral messages are transmitted to the brain through the nerve stimulation of various sensory organs, and after evaluating this nerve stimulation in the brain, we know it as an idea or mental image and react to it. People's actions and

feelings are not based on the actual shape of the objects, but on the image of these objects in mind (Maltz, 1996).

In the mental simulation method, person's creativity is emphasized. The left hemisphere is judging by logic and reasoning, and this may pose the biggest problem in the way of creativity, but the weak and inactive right hemisphere has tasks such as understanding music and visualization. In fact, mental simulation is a form of information representation that is highly structurally similar to real or imagined situations (Taylor & Schneider, 1989). A person who uses mental simulation retrieves their past experience stored in their memory to obtain the enjoyable, motivational, or informational characteristics they need (Dokic & Proust, 2002).

Researchers regard one of the very valuable benefits of mental simulation as its motivational and emotional aspect (McCaffrey & Orlick, 1989). Events are not merely cognitive events, but with them there are emotions as well. As events unfold in one's mind, emotions also change and the motivation for learning increases, and on the other hand, the endurance of adverse and traumatic events increases (Marx, 1999). Mental simulation can be used throughout life to achieve success and a sense of victory, so one of the most important uses of mental simulation and mental training is to treat certain diseases. Clinician help their clients visualize future challenging situations and use their mental training skills to successfully handle and manage these situations. Personality psychologists have also come to the conclusion that this strategy can be used to plan for future activities. In addition, it is used to reduce anxiety and tension (Ghazi, 1991). In the simulation, a hypothetical problem that resembles real-life realities is presented to the students and then they are asked to find solutions to the problem by applying educational rules. In cases where simulation is used, students often consider different solutions and recommend a particular solution by comparing them (Shifflet, 2006). In simulation, as far as possible, it seeks to draw real situations in such a way that the concepts learned and solutions prepared to the problems can be transmitted to real life and help to understand and perform tasks related to the simulation content (Keltner, 2007).

By reviewing the history of learning, we first notice its growing trend in the field of psychology, as it was previously considered inherited and natural talent (Torabi & Eslami, 2013). While with today's cognitive approaches, intelligent actions and behaviors can be learned and acquired (Mohebbi Tafreshi, 2006); secondly, in the past learning and application environment was the same and each person was trained by a professor, but now they are isolated and many people are trained by a professor (Nadimi, 1996). This has neglected the important role of learners (Ali Bavane et al., 2011). Learning is essentially an intrinsic act, but because it changes the behavior of the learner, it leads to extrinsic results that these extrinsic products are measurable (Cheragh cheshm, 2007). Simulation-based learning is defined as reproducing certain aspects of reality to understand better, manipulate or predict real behavior (Grant & Davis, 2007). In fact, simulation is a method which an artificial experience or sub-experience is created that engages the learner in an activity that reflects real-life situations without the dangerous consequences of a real situation (Murray, 2008). . Architectural design courses have a central role in the field of architectural engineering, and its importance is not hidden to anyone, either in terms of empirical knowledge or its

theories. Most of the architectural process requires creativity-driven initiative that requires cognition and education, because in architectural design workshops, the sciences learned in other courses are combined to help students identify creative responses (Sharif, 2014). Damir Khan and Damirbas (2007) find that learning in architectural design workshops is influenced by students' learning style. Design professors have tried to identify the characteristics of students' learning styles to enhance their performance in architectural design workshops (Seyed Abbaszadeh et al., 2010) and (Drmibas & Demirkan, 2003, Kvan & Yunyan, 2005); therefore, considering the importance of simulation In the Architectural Design section, the present paper seeks to explore the impact of teaching mental simulation strategies on the academic performance and creativity of architecture students in the design of therapeutic spaces.

One of the most fundamental questions in this research, with the aim of focusing on improving creative performance in architectural education that can shape research structure, is:

- Does mental simulation improve the academic performance and creativity of architecture students in designing therapeutic spaces?
- If the mental simulation is effective in improving the academic performance and creativity of the design students, what are the ways to improve the quality of these mental simulations?

Research Background

Unfortunately, there are no studies on the effectiveness of subjective simulation in learning science in the field of architecture, but there have been few studies in other sciences, some of them have been emphasized on examining the impact on student academic achievement, practical skills training for students, advances in the performance of athletes etc. In order to elucidate the mechanism of the effectiveness of mental simulation, a number of theories have been proposed, including James 1890's theory of the ideo-motor principle that based on this theory, only thinking about something increases the chance of occurring that thing. Also Bandura 1986 theory of self-regulation and self-efficacy enhancement, Feder 1982 theory of subjective likelihood or goal value, Gallowaatzter 1999 theory of goal setting and improvement of intention to initiate purposeful behavior, and Vallacher and Wegner 1985 theory of influence on the level of recognition of actions by individuals is also in this direction (Nematollahzadeh Mahani, Abbasnejad and Hassanzadeh, 2000).

Based on Fam and Taylor Research, 1999 on "Linking Thought and Practice" and Investigating the Effect of Mental Simulation on Academic Homework; Research by Rivkin & Taylor, 1999, 1998 about effect of mental simulation on coping controllable stressful events; Abdollahi Zarandi 2000 research about the effect of mental simulation on social anxiety; Nematollahzadeh Mahani et al., 2000 research about the effect of mental simulation on reducing educational anxiety in students and improving academic performance; Siavashi, 2006 study about effect of simple mental simulation in students' academic performance; and Singer et al., 2001 study about the effect of process and product goal orientation on students' writing skills and exam performance, may be expected that mental simulation have a beneficial effect on student performance.

Khalili Sharfe et al. In the fall of 2008, in a study entitled "The Impact of Simple and Process-and-Outcome Combined Mental Simulations on Students' Academic Performance and Progress" selected 104 talented first grade high school female students and 104 normal students. The findings showed that mental simulation improves students' academic performance in the sub-factors of self-efficacy, planning and motivation. But it does not affect students' academic achievements. This result is inconsistent with the findings of Fam and Taylor in 1999; Rivkin and Taylor in 1999 (Quoted in Derataj, 2004); Taylor, Fam, Rivkin and Armor in 1998; Nematollahzadeh Mahani et al., in 2000; Dertaj in 2004; Siavashi in 2006; and Singer et al., 2001 (cited by Wilson, 2005).

Also in another study, entitled "Simulation-Based Education" by Sajjadi et al., Published in the second semester of 2015-2016, it was found that finding the right combination of traditional method, simulation and real patient care experience, is a major challenge in education. In a study by Andrea Gaggioli et al., in 2013 entitled "The Benefits of Combined Mental and Physical Training in Learning Complex Motor Skills in Basketball", it was concluded that the learner can use mental simulation information to monitor and improve his physical performance and skill.

Dutch scientist Josephine van Meer in 2008, in a study entitled "Mental Simulation Training Programs" studying the relationship between earlier articles, explains the suitability of mental simulation to meet students' specific needs in learning skills as well as emotional and behavior skills. He also concluded that mental simulation, in addition to enhancing performance for a variety of skills, also had a motivational role. In 2009, Eduardo Salas et al., in a study entitled "Using Simulation-Based Education to Improve Management Training", concluded that subjective simulation is an effective way to increase student's performance, if student's performance is measured during the simulation. They found effective to combine mental simulation and performance. Chris Silvia, in a study in 2010 entitled "The Impact of Simulation on Higher Education" published in the journal of "Public Education" at the University of Kansas, conducted a study on 200 students showing the direct relationship between simulation and opportunity of high level education in students.

Research background suggests that engineering students can form learning groups to cover their learning differences (Chen & Ling, 2010) and use all the abilities needed to create a creative work in the direction of teamwork (Mozaffar et al., 2009). There has been research about the style of learning and academic performance since the late twentieth century. Cano Garcia and Hughes in 2000 conducted a study on 210 research college students entitled learning and thinking methods, analyzing the relationship between these two and their impact on academic success. The results showed a significant relationship between these two methods (Zahbioun and Ahmadi, 2009). In another study among female students of Yazd public and Azad universities, using three questionnaires of Sternberg-Wagner Thinking Styles Questionnaire, ASSIST Learning Strategies, and Dartaj's Academic Performance Questionnaire, thinking styles variables and learning approaches were examined (Bakhshayesh, 1391). Peter Honey has used the Creative Thinking Questionnaire to investigate the extent to which students use creative thinking and its relationship to academic achievement (Zahbioun & Ahmadi, 2009) and finally, Ned Herman, 1991, the father of brain dominance science, with a belief in the divided brain, and HBDI tools, divided learners into

four categories, based on brain's four quadrants: (A), (B), (C) and (D), respectively, external, procedural, interactive, and internal. Damir Khan and Demirbas in 2007 using the Kolb learning cycle, evaluated the relationship between learning styles and academic performance of architecture students.

Table 1: Some of the conducted research related to the article

Results	Title	Authors	Row
The appropriateness of mental simulation to meet the special needs of students in the field of learning skills as well as emotional and behavioral skills. Also mental simulation plays a motivating role in increasing performance for a variety of skills.	Mental Simulation Training Programs	Josephine Fanmer (2008)	1
Mental simulation improves students' academic performance under the factors of self-efficacy, planning and motivation. But it has no effect on students' academic achievement.	The effect of simple mental simulations of both process and product on the performance and academic achievement of students	Fatemeh Khalili Sharafeh et al. (Autumn 87)	2
Mental simulation is an effective way to increase student productivity as long as student performance is measured during the simulation. They found the combination of mental simulation and performance to be effective.	Using simulation-based training to enhance management training	Eduardo Salas et al. (2009)	3
There is a direct relationship between simulation and the possibility of students studying at higher levels.	The Impact of Simulation on Higher Education	Chris Sylvia (2010)	4
The learner can use mental simulation information to monitor and improve their physical performance and skills.	The Benefits of Combined Mental and Physical Exercises in Learning a Complex Motor Skill in Basketball	Gagioli et al. (2013)	5
Finding the right combination of traditional methods, simulating and experiencing real patient care is a major challenge in education.	Simulation-based training	6 Sajjadi et al. (94-93)	6
Mental simulation can affect the development of motor function.	The effect of mental simulation on the development of motor performance of aerobic athletes	Moghaddam Farmer et al (Autumn 92)	7

Based on research have been done in different fields, it seems that mental simulation can influence the academic performance and creativity of architecture students in designing therapeutic spaces. Therefore, considering the performance of architecture students in designing therapeutic spaces at Mohaghegh Ardebili University, the effectiveness of mental simulation on this process was investigated.

Research Method

The research method is quasi-experimental and has used one independent variable (training of mental simulation strategies) and two dependent variables (academic performance and creativity). The present

study was conducted with pre-test and post-test with control group so that after performing the pre-test, training of mental simulation strategies on experimental group was performed for five weeks and three hours a week. Then post-test was performed for both experimental and control groups (Table 2).

Table 2: Experimental research plan related to the research method

Post-test	Independent variable	Pre-test	Group
Q ₁	X	Q ₁	Experimental
Q ₂	-	Q ₂	Control

Implementation Stages: The subjects first received the necessary information about the study and the simulation tests and then responded to the test of academic performance and creativity. Subsequently, simulation training was performed on all subjects except the control group. These exercises were taught to the subjects for 5 sessions, once a week, and 3 hours a week. During the exercises, subjects were asked to concentrate, and sometimes with their eyes closed, to visualize the therapeutic environment in their minds using the explanations provided and perform simulation exercises. Also they were asked to repeat them at home.

Then the academic performance and creativity test was performed again (post-test). Finally, the obtained data were analyzed.

Population and Statistical Sample: The statistical population of this study included all undergraduate students of Architecture Engineering in the first semester of the academic year 1396-1397 who are taking 4th course of Architectural Design (Therapeutic Designing). The sampling method was a whole population. The two groups were selected from the same design class with the same teacher and randomly assigned to the experimental group and the other to the control group (Table 3).

Table 3: Description of statistical sample by group

Percent	Frequency	Group	
50	15	Experimental	A
50	15	Control	B
100	30	2	Total

Data gathering tool: In this research two data collection tools are used:

1. The tool for measuring students' academic performance used in this study is the academic performance questionnaire. This questionnaire is an adaptation of the Pham and Taylor (1999) questionnaire, in the research field of academic performance, and the validity and reliability of its subscales have been confirmed for Iranian society (Pham and Taylor, 1999, quoted in Dartaj, 2004). In this questionnaire, in 47 questions, 5 domains of academic performance were measured as follows: self-efficacy factor, emotional effects, planning, lack of outcome control, and motivation. Cronbach's alpha coefficient of reliability for this test was 0.74. Each of these factors is assigned a score that is 5, 4, 3, 2, and 1, respectively. Accordingly, a score below 53 indicates poor self-efficacy and a score above 85 indicates strong self-efficacy. A score of less than 28 indicates a weak emotional effect and a score of 53 or higher indicates a strong emotional effect. A score below 11 indicates poor planning and a score above 23 indicates strong planning. A score below 6 indicates poor outcome control and a score above 13 indicates a lack of strong outcome control. A score below 14 indicates a weak motivation and a score above 24 indicates a strong motivation. A score of less than 120 indicates poor academic performance and a score of over 175 indicates strong academic performance and a score between 211 and 174 indicates moderate academic performance (Dartaj, 2004).
2. The creativity assessment tool was a questionnaire adapted from the Charles Schaefer creativity questionnaire, which designed in 30 yes-no questions and each subject gave her agreement in the choice of YES and disagreement in the choice of NO. Of the 30 questions in this test, questions 3 and 13 are control questions and are designed to reduce the discovery of the nature of the research tool, meaning that in the final review, they won't be effective in any of the dimensions of creativity. Each of the other questions will be assigned a score of 1 if the answer is correct and a score of 0 if it is incorrect. In the end, given that each of the questions contains one of the five dimensions of creativity, the score will be calculated and tested. The aspects of creativity that are tested in Schaefer test are: confidence of beliefs, sense of imagination, freedom expression in thought, theoretical and aesthetic orientation, and desire for innovation.

Data Analysis Method: Descriptive statistics such as frequency, mean and percentage were used to analyze the data from the Academic Performance Questionnaire and the Creativity Questionnaire. Inferential statistics such as univariable analysis of covariance have also been used to test research hypotheses. The obtained data were analyzed by SPSS 20 software.

Findings

Table 4: Comparison of students' academic performance in the of control and experimental group in post-test

Standard Deviation	Mean	Number	Group
13.10	135.00	15	Control
18.15	139.60	15	Experimental
15.73	137.30	15	Total

The analysis of table 4 shows that the comparison of academic performance of architectural students in the design of therapeutic spaces in the control group and experimental group in post-test, the mean of the control group was 135.00 and the mean of the experimental group was 139.60. The mean of the control group was higher and the standard deviation of the experimental group was higher than the standard deviation of the control group.

Table 5: Comparison of dimensions of students' academic performance in the control and experimental group in the post-test

Dimensions of students' academic performance					Index	Group
self-efficacy	emotional effects	planning	lack of control	motivation		
57.93	34.26	15.40	8.53	18.86	Mean	Control
13.44	11.78	4.12	2.26	2.41	Standard Deviation	
15	15	15	15	15	Total	
66.80	29.66	18.53	7.93	16.66	Mean	Experimental
7.60	10.86	2.66	3.05	2.55	Standard Deviation	
15	15	15	15	15	Total	
62.36	31.96	16.96	8.23	17.76	Mean	Total
11.64	11.38	3.77	2.66	2.68	Standard Deviation	
30	30	30	30	30	Total	

The analysis of Table 5 shows that the mean of self-efficacy and planning dimensions in the experimental group were more than the control group and the effect of emotional effects, lack of outcome control and motivation in the experimental group were lower than the control group, and the standard deviation of self-efficacy in both groups was higher in comparison with other dimensions.

Table 6: Comparison of students' creativity in the control and experimental group in the post-test

Standard Deviation	Mean	Number	Group
4.05	18.13	15	Control
3.15	19.73	15	Experimental
3.65	18.93	30	Total

From Table 6, it can be deduced that in comparing the creativity of architecture students in designing therapeutic spaces in the two control and experimental groups in post-test, the mean of the control group was 18.13 and the mean of the experimental group was 19.73. Mean of experimental group was more than control group, and standard deviation of control group was more than standard deviation of experimental group.

Table 7: Comparison of students' creativity dimensions in the of control and experimental groups in the post-test

Students' Creativity Dimensions					Index	Group
beliefs	Imagination	freedom of thought expression	aesthetic orientation	tendency to innovation		
5.13	6.40	2.60	2.60	1.40	Mean	Control
2.13	0.63	1.18	1.18	0.73	Standard Deviation	
15	15	15	15	15	Total	
6.13	5.60	3.00	3.13	1.86	Mean	Experimental
1.24	1.29	1.00	0.91	0.83	Standard Deviation	
15	15	15	15	15	Total	
5.63	6.00	2.80	2.86	1.63	Mean	Total
1.79	1.08	1.09	1.07	0.80	Standard Deviation	
30	30	30	30	30	Total	

Table 7 shows that the mean dimensions of beliefs, freedom of thought expression, theoretical and aesthetic orientation, and tendency to innovation, in the experimental group were higher than the control group and the standard deviation of beliefs in general was higher than the other dimensions.

The main hypothesis: Teaching mental simulation strategies influences the academic performance and creativity of architecture students in designing therapeutic spaces. Since this hypothesis consists of two parts, the data were analyzed in each section.

1st Special Hypothesis: Teaching mental simulation strategies affects the academic performance of architecture students in designing therapeutic spaces.

Table 8: Results of covariance analysis test for architectural students in the design of medical spaces

Eta coefficient	P-value	Test statistics	average of squares	Degrees of freedom	Total square	Source of dispersion
0.53	0.00	30.77	3737.85	1	3737.85	Pre-test
0.19	0.01	6.59	801.46	1	801.46	Group
			121.47	27	3279.74	Error
				30	572715.00	Total

P-value of Levin test (0.258) is more than 5%. Therefore, there is no significant difference in the design of therapeutic spaces between experimental and control groups in variance of students' educational performance at 5% level. As shown in Table 8, the Eta coefficient of 0.196 indicates that about 19.6% of the observed differences in the academic performance of architecture students in the design of therapeutic spaces were related to simulation strategies training. On the other hand, because p-value is 0.016% ($P < 0.05$), so the research hypothesis is confirmed at 5% level and training of mental simulation strategies at 5% level has significant effect on the academic performance of architectural students in designing therapeutic spaces.

2nd Special Hypothesis: Teaching mental simulation strategies influences the creativity of architecture students in designing therapeutic spaces.

Table 9: Results of covariance analysis test of architectural students' creativity in designing medical spaces

Eta coefficient	P-value	Test statistics	average of squares	Degrees of freedom	Total square	Source of dispersion
0.13	0.05	4.11	48.78	1	48.78	Pre-test
0.07	0.14	2.21	26.22	1	26.22	Group
			11.84	27	319.88	Error
				30	11142.00	Total

P-value of Levin test (0.081) is more than 5% and indicates that the creativity variance of architectural students in designing therapeutic spaces was not significantly different between control and experimental groups at 5% level. As shown in Table 9, the Eta coefficient is 0.076, which means that about 7% of the observed differences in the creativity of the architecture students in the design of therapeutic spaces were related to the training of simulation strategies.

3rd Special Hypothesis: Teaching mental simulation strategies affects the academic performance dimensions of architecture students in designing therapeutic spaces.

Table 10: Results of analysis of covariance test in the dimensions of academic performance of architecture students in the design of medical spaces

Eta coefficient	P-value	Test statistics	average of squares	Degrees of freedom	Total square	Source of dispersion	Dimensions
0.75	0.00	83.89	2527.79	1	2527.79	Pre-test	self- efficacy
0.09	0.09	2.95	89.07	1	89.07	Group	
			30.13	27	813.54	Error	
				30	120619.00	Total	
0.54	0.00	32.13	1955.29	1	1955.29	Pre-test	emotional effects
0.05	0.21	1.64	100.10	1	100.10	Group	
			60.85	27	1642.97	Error	
				30	34413.00	Total	
0.56	0.00	35.12	191.85	1	191.85	Pre-test	planning
0.02	0.38	0.78	4.27	1	4.27	Group	
			5.46	27	147.47	Error	
				30	9049.00	Total	
0.04	0.27	1.22	8.77	1	8.77	Pre-test	lack of control
0.00	0.94	0.005	0.03	1	0.03	Group	
			7.18	27	193.89	Error	
				30	2239.00	Total	
0.35	0.001	14.80	67.28	1	61.28	Pre-test	motivation
0.16	0.02	5.28	21.88	1	21.88	Group	
			4.14	27	111.78	Error	
			61.28	30	9679.00	Total	

P-value of Levin test in some aspects of academic performance including self-efficacy, emotional influences, planning, and lack of outcome control was more than 5% ($P < 0.05$), which indicates the variance of self-efficacy and motivation in academic performance of architecture students between the control and experimental groups, was no significant difference in the design of therapeutic spaces at the 5% level. Table 10 (group row) shows the Eta coefficients of different dimensions of academic performance of architectural students in the design of therapeutic spaces, respectively: 0.099, 0.057, 0.028, 0.0 and 0.164, which means that approximately 9% of the differences observed in self-efficacy, 5% of differences in emotional effects, 2% of differences in planning, and 16% of differences in motivation of architecture students in designing therapeutic spaces were related to the training of mental simulation strategies. On the other hand, since the p-value of the test in motivational dimension of academic performance is less than 5% ($P < 0.05$), therefore, training of mental simulation strategies at 5% level has significant effect on the motivation of students' academic performance in designing therapeutic spaces.

4th Special Hypothesis: Teaching mental simulation strategies influences the creativity aspects of architecture students in designing therapeutic spaces.

Table 11: Results of analysis of covariance test in the dimensions of creativity of architecture students in the design of medical spaces

Eta coefficient	P-value	Test statistics	average of squares	Degrees of freedom	Total square	Source of dispersion	Dimensions
0.05	0.23	1.45	4.37	1	4.37	Pre-test	beliefs
0.08	0.12	2.49	7.50	1	7.50	Group	
			3.00	27	81.09	Error	
				30	1045.00	Total	
0.004	0.73	0.11	0.12	1	0.12	Pre-test	Imagination
0.14	0.04	4.41	4.75	1	4.75	Group	
			1.07	27	29.07	Error	
				30	1114.00	Total	
0.23	0.008	8.16	7.80	1	7.80	Pre-test	freedom of thought expression
0.06	0.17	1.94	1.85	1	1.85	Group	
			0.95	27	25.80	Error	
				30	270.00	Total	
0.27	0.004	10.15	8.56	1	8.56	Pre-test	aesthetic orientation
0.03	0.30	1.09	0.92	1	0.92	Group	
			0.84	27	22.77	Error	
				30	280.00	Total	
0.05	0.23	1.49	0.90	1	0.90	Pre-test	tendency to innovation
0.10	0.09	3.06	1.86	1	1.86	Group	
			0.60	27	16.42	Error	
				30	90.00	Total	

P-value of Levin test in aspects of confidence of beliefs, freedom of thought expression, theoretical and aesthetic orientation, and tendency to innovate were more than 5% ($P < 0.05$). Therefore, the variance of these dimensions of architectural students' creativity in designing therapeutic spaces was not significantly different between control and experimental groups at 5% level. As can be seen in Table 11 (group row), the Eta coefficient in different dimensions of the creativity of the architectural students in the design of therapeutic spaces are 0.086, 0.040, 0.07, 0.039 and 0.02, respectively. It means that, about

8.5% of the differences in confidence of beliefs, 14% of differences in sense of imagination, 6.7% of differences in freedom of expression in thoughts, 3.9% of differences in theoretical and aesthetic orientation, and 10.2% of differences in desire to innovate observed in architectural students to design therapeutic spaces, were related to the training mental simulation strategies. On the other hand, since the p-value is less than 5% ($P < 0.05$) in sub-factor of sense of imagination, therefore, training of mental simulation strategies has a significant effect at the 5% level on sense of imagination in architecture students in designing therapeutic spaces.

Discussion And Conclusion

The purpose of this study was to investigate the effect of mental simulation strategies on academic performance and creativity of architecture students in designing therapeutic spaces. Few studies have investigated the effect of mental simulation on learning, academic achievement, academic performance, etc. Since there are also sub-factors in creativity and academic performance that simulation have a direct impact on them, the on the architecture student community in the design of therapeutic spaces was unclear. The circumstance and extent of this impact on the two groups in the experimental and control groups was examined by the researcher and the main results are discussed.

In discussing the first hypothesis of the study (teaching simulation strategies influence the academic performance and creativity of architecture students in the design of therapeutic spaces), the results of tables 4 and 9 indicate that there is a significant difference in academic performance between the experimental and control groups. It was also observed that the level of students' academic performance that were trained with simulation strategies was higher than that of students that were not trained with this field, thus it confirms the researcher's hypothesis. Also, according to tables 6 and 11, the results showed that the average creativity of the experimental group was higher than the control group but did not show a significant level. The results of this study showed that mental simulation improves students' academic performance, which was in line with the findings of Pham and Taylor, 1999; Rivkin & Taylor, 1999 (quoted in Derataj, 2004); Taylor, Pham, Rivkin & Amor, (1998); Nematollahzadeh Mahani et al., (2000); Derataj (2004); Siavashi (2006) and Singer et al. (2001, cited by Wilson, 2005), in which showed that mental simulation improves academic performance.

In the discussion of the third research hypothesis (teaching mental simulation strategies affects the academic performance dimensions of architectural students in the design of therapeutic spaces), according to table 12, it can be concluded that among the dimensions of academic performance, There was a significant difference between the motivation of the experimental and control groups and the scores of the academic performance dimensions of students whom were trained with simulation strategies were higher than those of students whom were not trained with simulation strategies. There was no significant difference in planning dimension; that was in line with the findings of Dartaj (2004). According to the findings of the Dartaj study, mental simulation has no effect on students' planning and, ultimately, Process Mental Simulation is a process that affects students' motivation. This finding is in line with the findings of Taylor & Pham, Rivkin & Amor, 1998; Martin & Hall, 1995; Singer et al., 2001 (cited by

Wilson, 2005); Kitsantas et al., 2004; Dertaj, 2004, and Siavash, 2006 which has been shown that the effects of Process Mental Simulation are better than those of Outcome Mental Simulation, that increase the internal motivation.

About the fourth hypothesis of the study (teaching simulation Strategies affect on the creativity dimensions of architecture students in designing therapeutic spaces), it can be concluded from table 14 that from the extent of creativity dimensions, there is a significant difference between the experimental and control group in sense of imagination and the creativity score of students whom are trained with simulation strategies is higher than that of students whom are not trained with simulation strategies. No research has been found to measure the impact of training mental simulation strategies on the dimensions of creativity. Because the creativity variable is a wide variable with many factors involved and maybe one of these factors is mental simulation, so mental simulation has little effect on the creativity of architecture students in the design of therapeutic spaces. The influence of other factors is likely to overcome this factor. In order to reveal the effect of mental simulation, it seems to be better to use intra-group statistical methods.

About these findings, it can be said that training mental simulation strategies has the potential act to acquire behaviors in the fields like real practice. The use of mental simulation is a tool by which the expectations of failing to perform and negative skills and expectation of negative consequences that reduce self-confidence and causes anxiety are eliminated. Mental simulation makes events seem real (Dartaj, 2004). With this feature, architecture students can visualize the situations such as being in different hospital spaces and designing therapeutic spaces in their minds, before designing therapeutic spaces. Because mental simulation focuses on causal relationships between phenomena, so individuals are able to make their own changes to these causal relationships in their minds. Remove a group, add some, and replace some, and act in the real world on the basis of newly established relationships (Dartaj, 2004).

The limitations of this study are the difficult cooperation of some students in completing the questionnaires, the impossibility of examining the effect of gender on mental simulation (due to the lower number of male students), and the limited sample of research to architecture students of Mohaghegh Ardebili University of Ardabil Province.

According to the findings of the study, based on the effect of motivational mental simulation, it is suggested to provide educational goals for students by holding architectural workshops on designing therapeutic spaces. For example, in the context of motivation to enhance learning motivation and academic achievement, designing mental simulation-based training classes can facilitate the achievement of educational goals and achieve development goals in different dimensions of society.

Given that one of the most important reasons for using mental simulation is to emphasize students' responsibility, this approach seems to be appropriate for those students who suffer from inattention or lack of attention in the design classes, because when the individuals find themselves responsible for their own learning, it increases their accuracy and attention and reduces their distraction; so teachers,

counselors, and psychologists can encourage students to engage in complex and challenging activities by teaching these techniques to students. Also, conducting similar research in larger sample volumes and in other architectural training courses can provide more information.

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Declarations

Competing interests: The authors declare no competing interests.