



Shokrollah Heydari¹, Mehri Yavari^{1*}, Mina Yazdani¹
¹Department of Medical Education, School of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

*Mashhad University of Medical Sciences, Faculty of Medicine, Azadi square, Mashhad, 9177948564 Iran

Tel: +989155029884

Fax: +985138828560

Email: yavarim@mums.ac.ir

Comparison of common and Jigsaw educational methods on the learning of health care provider students in Qaen City Behvarzic Training Center

Background: Today, most universities around the world are looking for educational methods that promote healthcare providers. Due to the lack of study in this field and the importance of healthcare providers providing care services to patients, therefore, the purpose of this study was to compare the effect of the lecture and Jigsaw teaching technique on first-aid learning in healthcare provider students.

Method: In this semi-experimental study, 50 healthcare provider students were randomly divided into control (traditional method) and case (Jigsaw method) groups with health care training for four sessions of 90 minutes in the form of basic first aid lessoning. At the first and end of the study, pre and post-exams have been taken from both groups.

Results: In this research, the 50 students were studied in case and control groups. There were no significant differences in terms of age ($P=0.678$), sex ($P=0.474$), location ($P=0.77$), marital status ($P=0.774$), and total GPA ($P=0.68$) between the experimental and control groups. The results also showed that the difference between the mean and standard deviation of pre-and post-test results in the experimental group was significantly higher than in the control group ($p<0.001$). Thus, the effectiveness of the jigsaw educational method on the learning of the control group was confirmed.

Conclusion: The results showed that the Jigsaw training method can be very effective in the learning rate of healthcare provider students. Additional studies are recommended to achieve reliable results.

Keywords: Jigsaw Teaching Method, Lecture Teaching Method, Learning, Health Care Provider

مقایسه دو روش آموزشی سخنرانی و جیگساو بر یادگیری دانش آموزان بهورزی مرکز آموزش بهورزی شهرستان قاینات

زمینه و هدف: امروزه اکثر دانشگاه‌های دنیا در پی یافتن روش های آموزشی هستند که موجب ارتقاء ارائه دهندگان مراقبت های بهداشتی درمانی گردد. با توجه به کمبود مطالعه در این زمینه و اهمیت بهورزان جهت ارائه خدمات بهداشتی و مراقبتی در بیماران، هدف از این مطالعه بررسی مقایسه روش آموزشی جیگساو و سخنرانی بر یادگیری درس کمک های اولیه در دانش آموزان بهورزی می‌باشد.

روش: در مطالعه نیمه تجربی حاضر، ۵۰ دانش آموز بهورزی مرکز آموزش بهورزی شهرستان قاینات به صورت تصادفی در دو گروه شاهد (سخنرانی) و آزمون (روش جیگساو) تقسیم بندی شده و به مدت چهار جلسه ۹۰ دقیقه ای در قالب آموزش های درس کمک های اولیه ویژه بهورزان تحت آموزش قرار گرفتند. در ابتدا و انتهای برنامه آموزشی از هر دو گروه، آزمون گرفته شد.

یافته ها: در این مطالعه، ۵۰ دانش آموز بهورزی در دو گروه آزمون و شاهد مورد مطالعه قرار گرفتند. هیچ تفاوت معناداری از لحاظ سن ($P=0.678$)، جنسیت ($P=0.474$)، محل سکونت ($P=0.77$)، وضعیت تأهل ($P=0.774$) و معدل کل ($P=0.68$) بین دو گروه آزمون و شاهد مشاهده نشد. همچنین نتایج نشان دادند که اختلاف میانگین و انحراف معیار نتایج پیش و پس آزمون در گروه آزمون بطور معناداری بیشتر از گروه شاهد می‌باشد ($p<0.001$). بدین ترتیب اثربخشی روش آموزشی جیگساو بر یادگیری گروه آزمون به تأیید رسید.

نتیجه گیری: نتایج نشان داد که روش آموزشی جیگساو می تواند در میزان یادگیری دانش آموزان بهورزی بسیار مؤثر باشد. انجام مطالعات تکمیلی برای دستیابی به نتایج قابل اعتماد پیشنهاد می‌شود.

واژه های کلیدی: روش آموزشی جیگساو، روش آموزشی سخنرانی، یادگیری، رشته بهورزی

مقایسه بین الأسالیب التعليمية الشائعة وطرق Jigsaw حول تعلم طلاب مقدمي الرعاية الصحية في مركز تدريب بهفارزي مدينة كابين

الخلفية: اليوم، تبحث معظم الجامعات حول العالم عن طرق تعليمية تعزز مقدمي الرعاية الصحية. نظراً لقلّة الدراسة في هذا المجال وأهمية مقدمي الرعاية الصحية الذين يقدمون خدمات الرعاية للمرضى، لذلك كان الغرض من هذه الدراسة هو مقارنة تأثير المحاضرة وتقنية تعليم Jigsaw على تعلم الإسعافات الأولية في طلاب مقدمي الرعاية الصحية.

الطريقة: في هذه الدراسة شبه التجريبية، تم تقسيم 50 طالباً من مقدمي الرعاية الصحية بشكل عشوائي إلى مجموعات تحكم (الطريقة التقليدية) وحالة (طريقة Jigsaw) مع تدريب على الرعاية الصحية لمدة أربع جلسات لمدة 90 دقيقة في شكل دروس الإسعافات الأولية الأساسية. في بداية الدراسة ونهايتها، تم أخذ الاختبارات التمهيدية واللاحقة من كلا المجموعتين.

النتائج: في هذا البحث، تمت دراسة 50 طالباً في حالة ومجموعات ضابطة. لا توجد فروق ذات دلالة إحصائية من حيث العمر ($P=0.678$) والجنس ($P=0.474$) والموقع ($P=0.77$) والحالة الاجتماعية ($P=0.774$) وإجمالي المعدل التراكمي ($P=0.68$) بين التجريبية والضابطة. كما أظهرت النتائج أن الفرق بين المتوسط والانحراف المعياري لنتائج الاختبار القبلي والبعدي في المجموعة التجريبية كان أعلى معنوياً منه في المجموعة الضابطة ($p<0.001$). وبالتالي، تم تأكيد فعالية طريقة بانوراما التعليمية على تعلم مجموعة التحكم.

الخلاصة: أظهرت النتائج أن طريقة تدريب Jigsaw يمكن أن تكون فعالة جداً في معدل التعلم لطلاب مقدمي الرعاية الصحية. يوصى بدراسات إضافية لتحقيق نتائج موثوقة.

الكلمات المفتاحية: طريقة التدريس Jigsaw، طريقة تدريس المحاضرة، التعلم، مقدم الرعاية الصحية

قین سٹی بھورزی ٹریننگ سنٹر میں صحت کی دیکھ بھال فراہم کرنے والے طلباء کے سیکھنے کے بارے میں عام اور Jigsaw تعلیمی طریقوں کا موازنہ

پس منظر: آج دنیا بھر کی زیادہ تر یونیورسٹیاں ایسے تعلیمی طریقوں کی تلاش میں ہیں جو صحت کی دیکھ بھال فراہم کرنے والوں کو فروغ دیں۔ اس شعبے میں مطالعہ کی کمی اور مریضوں کو دیکھ بھال کی خدمات فراہم کرنے والے صحت کی دیکھ بھال فراہم کرنے والوں کی اہمیت کی وجہ سے، اس وجہ سے، اس مطالعہ کا مقصد ہیلتھ کیئر فراہم کرنے والے طلباء میں ابتدائی طبی امداد کی تعلیم پر لیکچر اور Jigsaw تدریسی تکنیک کے اثرات کا موازنہ کرنا تھا۔

طریقہ: اس نیم تجرباتی مطالعہ میں، صحت کی دیکھ بھال فراہم کرنے والے 50 طلباء کو تصادفی طور پر کنٹرول (روایتی طریقہ) اور کیس (جیگس میتھڈ) گروپس میں تقسیم کیا گیا جس میں بنیادی ابتدائی طبی امداد کے سبق کی شکل میں 90 منٹ کے چار سیشن کے لیے صحت کی دیکھ بھال کی تربیت دی گئی۔ مطالعہ کے پہلے اور اختتام پر، دونوں گروپس سے پری اور پوسٹ امتحانات لیے گئے ہیں۔

نتائج: اس تحقیق میں، 50 طلباء کا کیس اور کنٹرول گروپس میں مطالعہ کیا گیا۔ تجرباتی اور کنٹرول کے درمیان عمر ($P=0.678$)، جنس ($P=0.474$)، مقام ($P=0.77$)، ازدواجی حیثیت ($P=0.774$)، اور کل GPA ($P=0.68$) کے لحاظ سے کوئی خاص فرق نہیں تھا۔ گروپس نتائج نے یہ بھی ظاہر کیا کہ تجرباتی گروپ میں پری اور پوسٹ ٹیسٹ کے نتائج کے اوسط اور معیاری انحراف کے درمیان فرق کنٹرول گروپ ($p<0.001$) کے مقابلے میں نمایاں طور پر زیادہ تھا۔ اس طرح، کنٹرول گروپ کے سیکھنے پر Jigsaw تعلیمی طریقہ کار کی تاثیر کی تصدیق کی گئی تھی۔

نتیجہ: نتائج سے پتہ چلتا ہے کہ صحت کی دیکھ بھال فراہم کرنے والے طلباء کے سیکھنے کی شرح میں Jigsaw ٹریننگ کا طریقہ بہت مؤثر ہو سکتا ہے۔ قابل اعتماد نتائج حاصل کرنے کے لیے اضافی مطالعات کی سفارش کی جاتی ہے۔

کلیدی الفاظ: مطلوبہ الفاظ: Jigsaw تدریس کا طریقہ، لیکچر سکھانے کا طریقہ، سیکھنے، صحت کی دیکھ بھال فراہم کرنے والا

INTRODUCTION

Education is one of the most fundamental needs of human societies and one of the necessities of sustainable development. According to experts, effective and efficient education is the most important factor in the educational progress and learning of students (1). The traditional methods of teaching and learning in the educational environment and relying on the mere memorization of information do not meet the educational needs of the current and future generations. Therefore, it is necessary to use methods that stimulate students' thinking, creativity and activity (2). The purpose of teaching is to increase the ability to learn (3). Learning is a dynamic process throughout life by which people acquire new knowledge or skills and change their thoughts, feelings, attitudes, and actions (4). In general, teaching methods are divided into two categories: the first category is teacher-centered method, such as the lecture method, which mainly includes the oral presentation of materials by the professor to the students, and most colleges and universities use lectures as the central teaching method (1,5). A lecture consists of presenting the knowledge to a large group in a short time (6) where students receive information in a fragmented manner (7). This educational method is widely used in education due to reasons such as low cost and the possibility of directly teaching a large number of learners (8) and it is the most common educational method that puts all learners in the same conditions despite individual differences (9). The second category of teaching methods is student-centered method in which students are actively involved in learning (1). The active methods themselves are divided into different methods that cooperative learning methods and group discussion are among these methods (10,11). Bandura believed that personally reinforced behavior is better maintained than externally reinforced behavior (9). Collaborative learning is one of the new approaches to teaching and learning that some educational systems in the world have recognized as an alternative to end the rule of traditional methods (12) and it helps students to free themselves from the mentality that teachers are the only source of knowledge since information is to be released (13). Collaborative learning is a type of teaching method in which students with different ability levels work in small learning groups to achieve a common goal (14). Nowadays, the subject of active teaching methods, active learning and the active learner has found a special place in educational discussions (15,16). In this method, although students learn as a group, the evaluation of their learning is done individually so that in this way they are also considered for individual learning (17,18). Research has shown that about 72% of nursing instructors use passive methods in their teaching and it is estimated that about 80% of the training provided by this method is forgotten within 8 weeks (19). One of the methods of active education is the use of a collaborative learning model of the jigsaw type. In this model, the students of a class are grouped for training and the participation of each student is necessary like each piece of a puzzle to complete and fully understand the result and

the final result (6 and 8). This model was invented for the first time in 1970 by Elliot Aronson (20). In this method, learners are divided into small groups of three to five non-homogeneous people. Then, one person from each group is given a subject to study. In the same way, the materials are distributed among the people of each group. After the study time is over, the people of each group who had a common topic gather together and form a new group. Again, during a certain time, they share what they have on that topic. Finally, each person returns to his group and presents his material to other group members. In this way, each article is repeated and reviewed three times for the individuals (15,7). 15 to 18 percent of American schools use the jigsaw pattern in their classes, and the interest of teachers in using this pattern is increasing (20,21).

The training method in health care is very important because the main mission of training health care providers is to train capable and competent people who have the necessary knowledge, attitude, and skills to maintain and improve the health of society (4,9). Today, most universities in the world are looking for educational methods that can expand and improve clinical decision-making capacities and continuous and self-oriented learning, and as a result, self-efficacy in health care providers. Medical science education instructors have found that active learning methods promote a meaningful correlation between theory and clinical practice (7). Considering the lack of studies in this field and the importance of familiarizing people with the basics of growth and development to prepare them to provide care and wellness services for patients, as well as the importance of training and applying the basic principles of first aid, the purpose of this study is to investigate the effect of the technique of Educational jigsaw (puzzle) based on the learning rate of first aid lessons in health care students of a health education center in Qaenat city.

METHODS

This study was a semi-experimental intervention study. The studied population included 50 students studying at Behvarzi Education Center in Qaenat city during the years 2018 and 2019, who have chosen the first aid course. The entry criteria for the students included the selection of the theoretical unit of the first aid course and having the willingness and informed consent to participate in the study. The criteria for students to withdraw from the study were absence of more than two sessions of classes, absence of participation in one of the pre- and post-intervention tests, and lack of consent to participate in this study. During this study, at any time, any of the participants, who wanted to withdraw from the study, could freely make this decision. The tool of this research included a demographic questionnaire that included age, gender, place of residence, overall grade point average, and marital status. Then the samples were randomly divided into two control (25 participants using the lecture or traditional method) and test (25 participants using the jigsaw method) groups, and they were trained for 4 sessions of 90 minutes in the form of first aid lessons. First, a pre-test was taken from both groups in such a way that 20 questions were proposed as a test from

the desired chapters, which were confirmed in terms of validity by subject experts and professors of Mashhad University of Medical Sciences and reliability using Cronbach's alpha. In this pre-test, the amount of previous knowledge of the students of both groups was examined. The education of these students was done with two different educational methods, including lectures or traditional and jigsaw. The control group was trained by the traditional and usual method of the class, and the test groups was divided into 5 groups of 5 students and were trained by the puzzle method. Therefore, in the test group, the contents of the first aid course for the elderly were taught with the jigsaw method. Each discussion session was randomly divided into 5 parts and each part was randomly distributed among the groups. All the members of the groups read the article individually for 15 minutes, and then, within 5 minutes, one person from each group explained an article to the rest of the group members and exchange opinions; And after that, within 5-10 minutes, a representative from each group would explain his group's material in order of priority to all students in class, and in this way, each material was repeated and reviewed three times for each person (16,17). Also, in the control group, the contents of the 7th, 8th, 10th, 11th, and 13th chapters of the first aid course for the elderly were taught to the students in four 90-minute lectures, and at the end of the educational program, a post-test was taken from both groups.

Finally, after collecting the data, SPSS version 16 software was used to analyze the data, as well as to compare before and after the intervention in each group, as well as between the two groups, using inferential statistics methods including the Chi-Square test, T-Test and Mann-Whitney were used.

RESULTS

In this study, 50 first- and second-year health care students of Qaenat Health Education Center were studied in two experimental (25 people) and control (25 people) groups. The demographic characteristics of the participants in this study are shown in Table 1, separately for case and control groups.

The total GPA of all examined samples out of 20 was 16.99 ± 0.91 . The GPA of the total samples in the test group out of 20 was 16.93 ± 0.92 and in the control group it was

17.04 ± 0.92 . The statistical analysis of the data showed that there is no significant difference between the two test and control groups in terms of the total grade point average (Figure 1).

The findings of the pre-test and post-test results in the control group showed that the mean and standard deviation of the pre-test score was 7.64 ± 2.48 with a maximum score of 14 and a minimum score of 4, and the mean and standard deviation of the pre-test score was 14.20 ± 1.46 with a maximum score of 14. 19 and the minimum score was 11 (Figure 2). The statistical analysis of the data showed that the mean difference and standard deviation of the pre- and post-test results in the control group was 6.56 ± 2.82 . Also, the results showed that the average post-test score in the control group increased significantly compared to the pre-test ($p < 0.001$, $t = 11.59$, $SEM = 0.565$).

Also, the findings from the examination of the pre- and post-test results in the test group showed that the mean and standard deviation of the pre-test score was 6.72 ± 2.38 with a maximum score of 13 and a minimum score of 3, and the mean and standard deviation of the pre-test score was 16.80 ± 1.65 with a maximum The score was 20 and the minimum score was 15. The statistical analysis of the data showed that the difference between the mean and the standard deviation

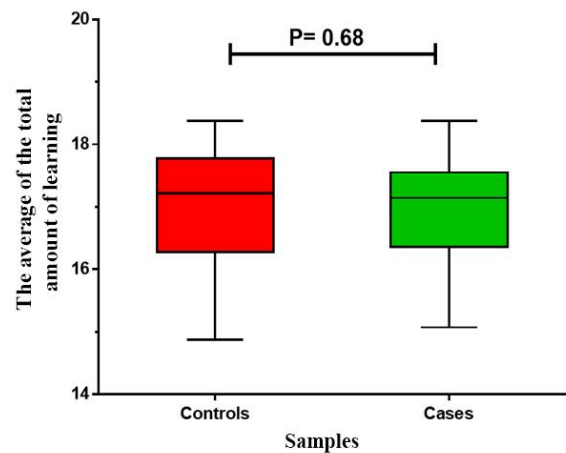


Figure 1. Average and standard deviation of the GPA of all samples by test and control group

Table 1. Demographic characteristics of participants by case and control groups			
Group	Test	The witness	P-value
Mean age ± Standard deviation (Year)	23.52 ± 1.41	23.32 ± 1.93	0.678
Man	13 (52%)	14 (56%)	0.474
Female	12 (48%)	11 (44%)	
Single	15 (60%)	14 (56%)	0.774
Married	10 (40%)	11 (44%)	
Native	11 (44%)	12 (48%)	0.77
Non-native	14 (56%)	13 (52%)	

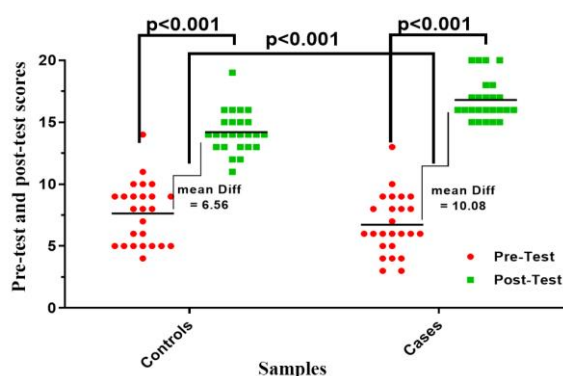


Figure 2. Frequency, mean difference and standard deviation of the pre- and post-test results in the two test and control groups

of the pre- and post-test results in the control group was 10.08 ± 3.26 . Also, the results showed that the average post-test score in the control group increased significantly compared to the pre-test ($p < 0.001$, $t = 15.43$, $SEM = 0.652$). Finally, the findings of the examination of the pre- and post-test results in the test and control groups showed that the mean difference and standard deviation of the pre- and post-test results in the test group were significantly greater than the mean difference and standard deviation of the pre- and post-test results in the control group ($p < 0.001$).

DISCUSSION

The present study was conducted with the overall aim of comparing two common educational methods on the learning of health care students in the health care center of Qaenat city. The results of this study showed that there is a significant difference between the pre-test and post-test scores of the test group. Therefore, the better effects of the jigsaw method on the learning of health care students of the health education center in Qaenat city were confirmed in the first aid course compared to the lecture or traditional methods.

In line with the results of this research, in the study of Azizi et al. in 2020 with the aim of comparing the effect of two jigsaw teaching methods and feedback on the level of satisfaction of nursing and intelligence students, the results showed that the dynamic and passive teaching method of jigsaw and involving students in the teaching-learning process, leads to more and more students' interest in discussing relevant topics, and using this teaching method, in addition to familiarizing students with new educational methods, can lead students to self-education (22). Also, in a study conducted by Mohammadi et al. in 2006 with the aim of measuring the effectiveness of teaching methods in increasing the awareness and changing the attitude of students towards family planning programs, the results showed that the effect of the public discussion method in changing the (positive) attitude of the subjects is more compared to the current (control) and speech methods (13). In a study conducted by Saif et al., entitled "Comparison of lecture teaching method with group discussion teaching method in biology education at Farhangian University of

Tehran, the results of the study showed that the average evaluation scores during three sessions in the group discussion teaching method (72.97 out of 100) was significantly more than the lecture teaching method (55.16 out of 100) ($p = 0.0001$) (14). The results of this study are in line with the findings of the present study. Based on the studies, the jigsaw teaching method is one of the best strategies in teaching. Our study also confirms these results.

Hanani et al.'s study with the aim of comparing education with two traditional methods and jigsaw on the amount of learning and understanding of the learning environment of undergraduate students in the operating room, determined that student-centered learning leads to improved learning. Also, there is a statistically significant difference in the understanding of the educational environment in the students of the two groups of jigsaw and traditional education. Therefore, teaching with the jigsaw method due to the active involvement of students in a favorable way increases the amount of learning and significantly improves the understanding of the learning environment of the operating room students (7). In Sepahrian's study, the findings showed that the jigsaw method has a positive effect on the need for autonomy, communication, and competence (15). Also, Zare et al.'s study showed that the puzzle or jigsaw method can be a very effective method in the learning of learners and this method can be a suitable alternative method for the lecture teaching method (16). Torabizadeh's study proved that the level of perception of the psycho-social atmosphere of classrooms in nursing students who were subjected to the intervention with the puzzle method was much higher than the samples subjected to the intervention with the planned lecture method. They also suggested that the puzzle method can be a useful method for teaching nursing students (17).

Among the weak points of this study, we can point out the low statistical population size in this study, which was out of reach due to the limited number of students of the Health Education Center of Qaenat city. Among the other limitations of the study, the existence of the corona disease epidemic was one of the limitations that made the study difficult. Therefore, it is suggested to repeat this study in other populations with a larger sample size in order to achieve reliable results and the ability to generalize the results. It is also suggested that this study be examined in other lessons. In addition, similar research can be done in other fields/degrees.

In this study, there was no significant difference between the average scores of the control group before the interventions. The results of the study showed that the jigsaw educational method can be very effective in the learning rate of fitness students. So that the mean difference and standard deviation of the pre- and post-test results in the test group (jigsaw educational method) were significantly higher than the mean difference and standard deviation of the pre- and post-test results in the control group (lecture educational method). Therefore, the results showed the better effects of the jigsaw method on the learning of the health care students of the health education

center of Qaenat city in the first aid course compared to the lecture method. One of the strengths of this study was the regular implementation of training classes in two test groups (jigsaw training method).

Ethical considerations

This research was approved by the Regional Organizational Ethics Committee of Mashhad University of Medical Sciences with the number IR.MUMS.MEDICAL.REC1399.792. At the beginning of the study, a separate initial familiarization meeting was held with the students regarding the research objectives, the necessary explanations were given to the samples, and their consent to participate in the study was obtained from them.

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Conflict of Interest: None

REFERENCES

1. Araghian, F. AMSaL J. Jigsaw training technique is a suitable approach in nursing education. *Developmental steps in medical education*. 2015; 13(1):96-7. Persian.
2. Gholami, M. Comparison of the effect of two methods of teaching lecture and combination in teaching the subject of diagnosis and treatment of dyslipidemia on motivation and academic achievement of medical trainees and interns. *BUMS Thesis*. 2019; 18:1-74. Persian.
3. Charania NA, Kausar F, Cassum S. Playing jigsaw: a cooperative learning experience. *J nurs educ*. 2001; 40(9):420-1.
4. Crofts L. Learning from experience: constructing critical case reviews for a leadership programmed. *Intensive crit care nurs*. 2006; 22(5):294-300.
5. Esmaili Ibrahim MF. Comparison of participatory teaching methods through e-learning environment with lecture method and their effect on creativity and academic achievement. *Educational studies*. 2014; 4(12): 97-109. Persian.
6. Golafrooz Shahri, H KM. Introduction to oral presentation teaching method. *Educat Strategy Med Sci*. 2010; 2(4):161-6. Persian.
7. Hannani S SN, Khacian A. Comparison of Traditional and Jigsaw Teaching Methods on Learning and Perception of Learning Environment of Operating Room Students of Iran University of Medical Sciences. *J Nurs Educ*. 2019; 8(5):39-46.
8. O'Keeffe L, O'Reilly A, and O'Brien G, Buckley R, Illback R. Description and outcome evaluation of Jigsaw: an emergent Irish mental health early intervention programmed for young people. *Ir J Psychol Med*. 2015; 32(1):71-7.
9. Sagsoz O, Karatas O, Turel V, Yildiz M, Kaya E. Effectiveness of Jigsaw learning compared to lecture-based learning in dental education. *Eur J Dent Educ* 2017; 21(1):28-32.
10. Sanaie N, Vasli P, Sedighi L, Sadeghi B. Comparing the effect of lecture and Jigsaw teaching strategies on the nursing students' self-regulated learning and academic motivation: A quasi-experimental study. *Nurs educ today*. 2019; 79:35-40.
11. Alrassi J, Mortensen M. Jigsaw Group-Based Learning in Difficult Airway Management: An Alternative Way to Teach Surgical Didactics. *J Surg Educ*. 2020; 77(4):723-5.
12. Hashemi Jalal JS, Haghani Fariba. Comparing the effects of "lecture" and "simulated patient" teaching methods on promoting the knowledge and performance of healthcare providers. *Iranian Journal of Medical Education*. 2007; 17(79):145-56. Persian.
13. Mohammadi MJ. The effect of two teaching methods (lectures and public discussion) on the knowledge and attitude of students in population and family planning. *Educational management innovations*. 2006; 5(2):97-106. Persian.
14. Seif Reza Mahmood RRM, Lotfipanah. Comparison of lecture and group discussion teaching method in biology education at Farhangian University of Tehran. *Research in biology education*. 2019; 1(2):27-34. Persian.
15. Farokhi, S. The Effect of Jigsaw Cooperative Learning Method on Students' basic Psychological needs. *Research in School and Virtual Learning*. 2016; 4(13):21-30. Persian.
16. Zare, AS. The Effect of Teaching Methods of Puzzle on Students Learning. *Research in School and Virtual Learning*. 2015; 2(6):7-16. Persian.
17. Torabzadeh K. Rahmani Azad E. Comparison of the effect of puzzles and planned lectures on nursing students' perceptions of the psychosocial atmosphere of the classrooms. *Education in medical sciences*. 2010; 9(4):290-301. Persian.
18. Kam-Wing C. Using Jigsaw II in teacher education programs. *Hong Kong Teachers' Centre Journal*. 2004; 3(1):91-7.
19. Leyva-Moral JM, Camps MR. Teaching research methods in nursing using Aronson's Jigsaw Technique. A cross-sectional survey of student satisfaction. *Nurs educ today*. 2016; 40:78-83.
20. Masukawa H. Theory and practice of the constructive jigsaw method in advancing domain knowledge and skills in parallel. *Yakugaku Zasshi*. 2016; 136(3):369-79.
21. Yu D, Cao S, Zhang S. The application of a jigsaw puzzle flap based on a freestyle perforator and an aesthetic unit for large facial defects. *J Craniofac Surg*. 2019; 30(5):1529-32.
22. Azizi S, Bagheri M, Karimi Moonaghi H, Mazloum S. Comparison of the Effect of Two Educational methods of Jigsaw and Feedback on the Level of Satisfaction of Nursing and Anesthesia Students of Mashhad School of Nursing and Midwifery. *Research in Medical Education*. 2020; 12(4):16-28. Persian.