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Using the Jigsaw (Puzzle) Method in Academic Environments: Benefits and Challenges

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Abstract

Background: Over the past few decades, collaborative teaching methods have attracted the attention of university professors. Numerous researches in this field emphasize the need for a systematic review. The present study aimed to review the studies on the effectiveness of the Jigsaw educational method on university students and expresses the advantages and disadvantages of this educational method.

Materials and Methods: In this systematic review, a systemic search of online databases (Medline, EMBASE, Scopus, Web of Science, Cochrane Library, Magiran, CIVILICA, SID, and Google Scholar search engine) was conducted for related national studies with no time limit up to December 2021. Qualitative, experimental, and quasi-experimental studies were included. Two reviewers evaluated the quality of eligible studies and carried out the selection procedure.

Results: Finally, ten studies (n= 535 students) were selected. The national literature review indicated that the Jigsaw method is effective in improving students' knowledge and skills. This method increases motivation to learn and improves deep learning, creates enjoyable learning, increases academic success, self-confidence, and self-esteem, updates information, and promotes interpersonal communication. This cooperative method can be used in different fields of study (educational sciences, English, nursing, anesthesiology, and operating room). Nevertheless, the Jigsaw teaching approach can pose challenges for both the teacher and the learner. The ineffective involvement of learners, crowded classrooms, piece learning, and a lack of final ending are among the most significant of these issues.

Conclusion: Each educational method has its strengths and weaknesses. By eliminating the weaknesses of the Jigsaw method, this educational method in Iran's educational system can have positive effects on learners' knowledge and academic performance.

Key Words: Academic Environments, Challenges, Learning, Jigsaw, Puzzle, University Students.

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1- INTRODUCTION

It is generally believed that learners learn better when they work together than alone (1-4). One of the most important and widely used methods of active teaching is collaborative learning and group discussion, where learning is done in groups. Collaborative learning and cooperation are critical concepts in group learning (5). Group learning methods are based on the theory of constructivism (6), which emphasizes the cooperation of learners with each other to achieve knowledge and understanding (7). The Jigsaw teaching method (Puzzle) is one of the models of participatory teaching that is suitable for educational environments. This method was first used in 1978 by Elliot Aronson. In this method, learners acquire perfect skills in some required subjects and then teach what they have learned to other members of their group. The advantage of the Jigsaw model is that although the results of each learner's effort differ among learners, it offers all learners with different abilities the same responsibility (8-10).

This model is exactly like a puzzle; the participation of each learner, like any puzzle piece, is necessary to complete the puzzle and fully understand the product and the final result (11). Numerous quantitative studies have been conducted to evaluate the effectiveness of this educational method on school students (10, 12-16). Despite the advantages of this teaching method, limited research in Iran exists on its effect on the academic achievement of learners, especially university students. On the other hand, teachers have not been instructed on the effectiveness of group teaching methods (especially the Jigsaw method) on different learners and their use in appropriate situations. Moreover, there are ambiguities about the advantages and disadvantages of this educational method. Therefore, the present study aimed to review the studies on the effectiveness of the Jigsaw educational method on university students and to express the advantages and disadvantages of this educational method.

2- MATERIALS AND METHODS

The Preferred Reporting Items for Systematic review and Meta-Analysis (PRISMA) checklist was used as the template for this review (17).

2-1. Eligibility criteria

Participants, interventions, comparators, and outcome (PICO) was used to formulate the review objective and inclusion criteria.

2-1-1. Participants: Iranian university students.

2-1-2. Interventions*:* The included research are non- interventional studies, so we did not have comparison group.

2-1-3. Comparators: We did not have a comparison group and intervention.

2-1-4. Outcomes: Effectiveness of the Jigsaw educational method.

2-2. Included studies: Quantitative (e.g., controlled studies, before and after studies, post-course studies, longitudinal studies); and qualitative (e.g., action research, case studies), were included. Studies were published in English or Persian up to December 2021.

2-3. Exclusion criteria: The exclusion criteria were abstracts not linked to the full article, articles not written in English or Persian, pilot, preliminary, reviews or meta-analyses, letters to the editor, editorials, short reports, case reports, and briefs.

2-4. Information sources

A systemic search of electronic databases Medline (via PubMed), EMBASE, Scopus, Web of Science, Cochrane Library, CIVILICA, Magiran, SID, and Google Scholar search engine was conducted for

related studies in the Iranian context. The search was done independently and in duplication by two reviewers, and any disagreement between the reviews was dissolved by the supervisor.

2-5. Search

Search words were a combination of (Jigsaw OR Puzzle) AND (Satisfaction OR Attitude OR Perspective) AND (Students OR University Students OR Academic Students).

2-6. Study selection

Database search was done for possible studies, study abstracts were screened for eligible studies, full-text articles were obtained and assessed, and a final list of included studies was made. This process was done independently and in duplication by two reviewers, and any disagreement was resolved by the third reviewer. References were organized and managed using EndNote software (version X8).

2-7. Data collection process

A researcher form was developed and followed for each study. Two reviewers collected the data independently. The collected data were combined and compared for accuracy, and a third reviewer solved any discrepancies.

2-8. Risk of bias in individual studies

The risk of bias assessment was done using the Newcastle–Ottawa scale (NOS). NOS is a valuable tool to evaluate the quality of non-randomized studies included in a systematic review and meta-analysis. The NOS had three categorical criteria with a maximum score of 9 points. The quality of each study was rated using the following scoring algorithms: ≥7 points was considered "good", 2 to 6 points was considered "fair", and ≤1 point was considered "poor" quality (18). The assessment was done by two reviewers independently and in duplication, and any discrepancies were resolved by the third reviewer. All selected articles had a score of 7.0.

3- RESULTS

In this review article, ten articles with a sample size of 535 students from educational sciences, English language, operating room, nursing, and anesthesia were selected (**Figure.1**). The main characteristics of the selected studies are summarized below:

1. A quasi-experimental study on 60 undergraduate students of educational sciences investigated the effectiveness of the participatory teaching-learning method (Jigsaw) on the academic performance of students of Shahid Motahari Campus of the Farhangian University of Zahedan. The results of the analysis of covariance and multivariate analysis of covariance (MANCOVA) showed that academic performance, total academic performance, and components of self-efficacy, planning, and motivation were significantly different between the control and experimental groups. It means that due to the activity of students in the active teaching method, they learned the course material better, and as a result, they performed better in the post-test. Students participating in the traditional teaching method showed lower performance due to reliance on memory and not engaging with the content (19).

2. In a quasi-experimental study on 28 undergraduate operating room students at Iran University of Medical Sciences, the effect of the Jigsaw teaching method on the learning and understanding of students was investigated compared with the traditional teaching method. The results showed that teaching by the Jigsaw method improved learning and understanding and the learning environment of undergraduate operating room students (20).

3. A quasi-experimental study on 65 undergraduate nursing and anesthesia

students of Mashhad University of Medical Sciences, School of Nursing and Midwifery, compared the effect of two educational methods of Jigsaw and Feedback on the level of satisfaction of students. The results showed the satisfaction of the students with the Jigsaw method in all three studied criteria of time, skills development, and interest in motivation, significantly more than the Feedback method (p=0.002) (21).

4. In a quasi-experimental study on 48 anesthesia students, the effect of peer and non-peer educational methods was investigated on the clinical learning of students at Sabzevar University of Medical Sciences. The analysis of covariance showed that learning from peers had a significant positive effect on students' clinical performance ($p < 0.05$) (22).

5. In a quasi-experimental study on 72 undergraduate nursing students of Iran and Tehran Universities of Medical Sciences, the effect of peer education by the Jigsaw method on the knowledge and practice of nursing students in adult cardiopulmonary resuscitation was investigated. The results showed that compared to the control group, knowledge and performance scores increased immediately and three months after training in the intervention group. The effect of the intervention was higher for both variables at both times. Thus, peer education by the Jigsaw method was effective in increasing the knowledge and performance of nursing students (23).

6. In a quasi-experimental study on 50 second-year nursing students, perception of the psycho-social atmosphere of classrooms and the effect of two active educational methods, i.e., scheduled lectures and puzzles, on improving their perceptions were examined. The results showed no significant difference between these two active educational methods in terms of the nursing students' perceptions of the psycho-social atmosphere of the classrooms (24).

7. A pretest/post-test study on two identical groups of 24 ESP (English for Specific Purposes) intermediate psychology students at Kerman University of Applied Science and Technology in Kerman, Iran (n=48), examined the effects of the Jigsaw (cooperative learning) method and listen-and-do tasks on English reading comprehension and translation for Specific Purposes students. The results showed a significant difference in the effect of the Jigsaw task and listen-and-do task on learners' reading comprehension and translation. The results of two post-tests demonstrated that the experimental group who received jigsaw tasks outperformed the experimental group exposed to the listen-and-do tasks (25).

8. In a quasi-experimental study with pretest and post-test design on 70 nursing students of Urmia University of Medical Sciences, the effect of the Jigsaw cooperative learning method on the clinical competency of students was examined. The results showed that the Jigsaw cooperative learning method was effective in improving students' knowledge and skills (26).

9. In a quasi-experimental study on 60 anesthesiology students of the Islamic Azad University of Mashhad, the effect of the lecture and puzzle methods on the learning of emergency medicine for anesthesia students and their views on these teaching methods were examined. The results showed that the mean scores of the lecture and puzzle groups after teaching were 7±1.47 and 8.5±1.1, respectively, which were statistically significant. A survey of students about teaching methods showed a positive view of students on the puzzle teaching method on their participation in the class, creating interest and motivation, establishing effective communication with classmates, and deep learning. Students also expressed

higher satisfaction with this teaching method (27).

10. A three-year study between 2016 and 2019 on 34 third-year undergraduate nursing students used a qualitative methodology to evaluate the implementation of the puzzle teaching method in the home nursing care course of the nursing program. The results showed that using the puzzle teaching approach can be challenging for both the teacher and the learners. The ineffective involvement of learners, crowded classrooms, piece learning, and a lack of final ending were among the most significant of these issues (28).

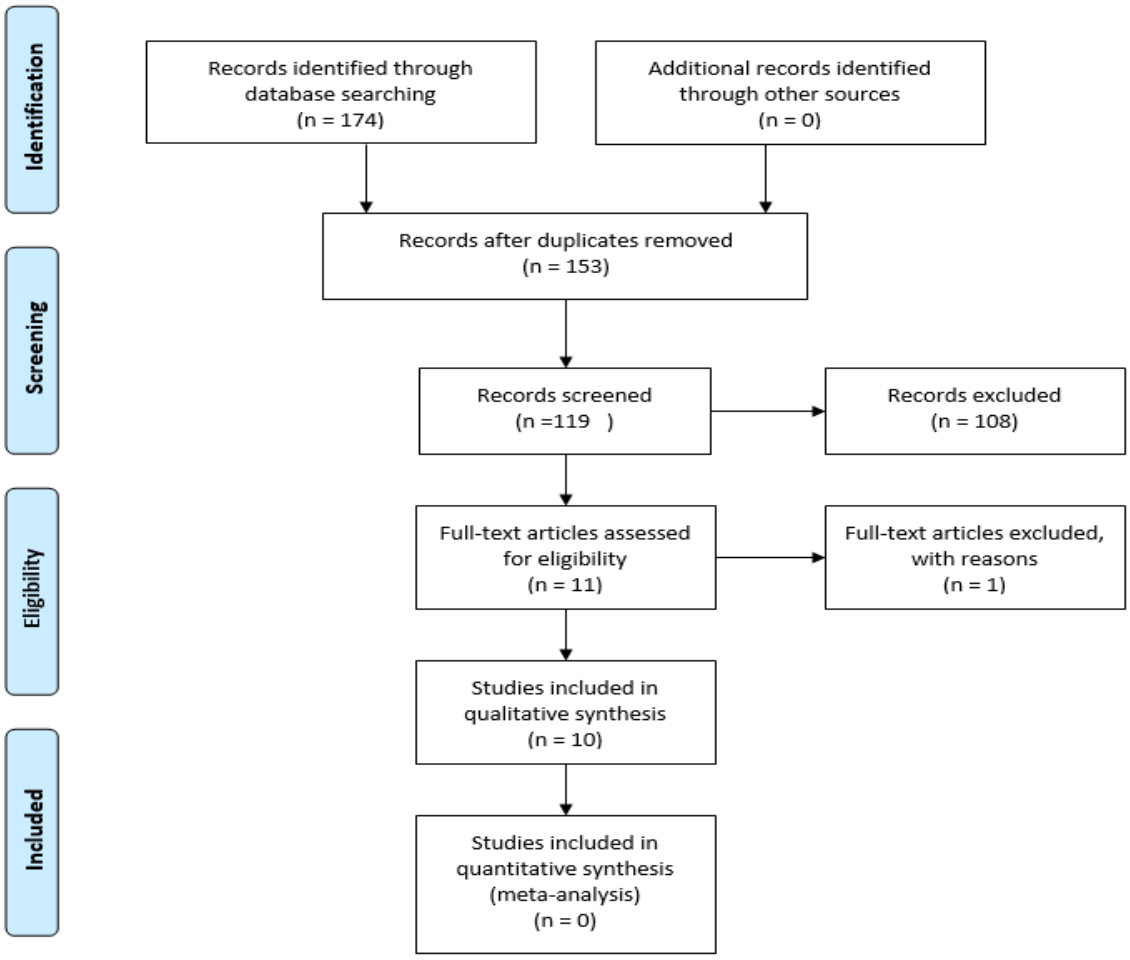

Fig.1: PRISMA Flowchart.

4- DISCUSSION

The present study aimed to review the studies on the effectiveness of the Jigsaw educational method on university students and to express its advantages and disadvantages. The results showed the following advantages and limitations: the jigsaw method is effective in improving students' knowledge and skills. This method increases motivation to learn, improves deep learning, creates enjoyable learning, increases academic success, self-confidence, and self-esteem, updates information, and promotes interpersonal communication. However, the Jigsaw teaching approach can be challenging for both the teacher and the learner. The ineffective involvement of learners, crowded classrooms, piece learning, and a

lack of final ending are among the most significant of these issues. The jigsaw technique is a method of organizing classroom activities that makes students dependent on each other to succeed. It divides classes into groups that each assemble a piece of an assignment and synthesize their work when finished. It was designed by social psychologist Elliot Aronson to help alleviate racial cliques in forcibly integrated schools (1, 2, 8). Studies show that students prefer active learning methods to traditional ones (29-32). Student-centered learning, which is based on cognitive-social theory and constructivism, directly involves students in the learning process. Its essential characteristics are active, creative, and social learning (33). The Jigsaw teaching method has an interactive approach that involves learners with a learning strategy in small groups to achieve a common goal, i.e., learning for themselves and other members of the group (34-39).

The benefits of this method include reducing pervasive fatigue, increasing self-confidence and motivation, participation in learning, and creating lasting learning (8, 11, 29-35). Torabizadeh believes that active educational methods such as puzzles in education increase the interest in the curriculum, and these active teaching methods can bring students out of passivity and increase their satisfaction and motivation for studying (35). The results of a review article (n= 46 articles) from 2004 to 2017 showed that the Jigsaw method increases motivation to learn lessons, makes learning enjoyable, increases academic success, self-confidence, and self-esteem, updates information, increases interest, and promotes interpersonal communication. This participatory method can be used at different levels of education (elementary, high school, and university) and in different fields. This teaching method is recommended to teachers in different subjects to promote critical thinking, problem-solving abilities, academic success, self-confidence, self-esteem, and students' interest in learning (40). A meta-analysis study (n=10), also showed that the Jigsaw method is not sufficiently used in medical education (9). On the other hand, several studies have reported few advantages for the Jigsaw method. They cite disadvantages such as ineffective involvement, inadequate teacher supervision, unnecessary content, lack of final summarization by faculty members, crowded classrooms, the need for evaluation, and piece learning (24, 28, 41). However, most studies have shown the positive effects of the Jigsaw method and high satisfaction with it. Collaborative teaching improves students' communication and social, emotional, and psychological skills (29-39). Nevertheless, active educational methods, along with positive points and advantages, have limitations and weaknesses. By combining educational methods, their strengths are multiplied and weaknesses reduced.

5- CONCLUSION

The Jigsaw teaching method has an interactive approach where learners with learning strategies in small groups try to achieve a common goal, i.e., learning for themselves and other group members. The present review showed that most of the studies reported the positive effects of the Jigsaw and the high satisfaction of learners. Teaching through the Jigsaw method improves learning, enhances knowledge, and leads to better students' performance. A survey about teaching methods showed a positive view of students on the puzzle teaching methods on their participation in the class, creating interest and motivation in study topics, establishing effective communication with classmates, and deep learning. Jigsaw teaching, due to the active involvement of students in a desirable way, significantly enhances learning and understanding and

the students' learning environment. Some studies have also reported limitations for the Jigsaw method, including ineffective involvement, inadequate teacher supervision, unnecessary content, lack of final summarization by the faculty member, crowded classrooms, the need for evaluation, and piece learning. This study recommends combining this teaching approach with other methods such as interactive lectures, group discussions, questions and answers, summarization, and evaluation at the end of teaching sessions.

6- AUTHORS' CONTRIBUTIONS

Study conception or design: AM and ZD; Data analyzing and draft manuscript preparation: RK and FV; Critical revision of the paper: RK and ZD; Supervision of the research: AM and ZD; Final approval of the version to be published: AM, RK, FV, and ZD.

7- CONFLICT OF INTEREST: None.

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