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Impact of Jigsaw Cooperative Learning Strategy on Nursing Students' Academic Achievement and Opinions

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ABSTRACT

Introduction: Employing innovative teaching strategies is urgently needed for nursing education systems.

Objective: This study aimed to determine the effectiveness of the jigsaw cooperative learning strategy on nursing students' academic achievement and opinions.

Materials and Methods: This research is a randomized controlled trial. The study sample consisted of 160 nursing students randomly selected and assigned to the intervention (80 students in 8 groups of 10 students each) and the control group (80 students in another 8 groups of 10 students each). The study data were collected at two time points after the intervention. A self-administered questionnaire was used to collect data about students' academic achievement and opinions regarding the jigsaw cooperative learning strategy (only for the intervention group). The Chi-squared test and repeated measure analysis of variance (ANOVA) were used for data analysis.

Results: The mean age of the experimental group was 20.8±0.74 years, while that of the control groups was 20.7±0.81 years. There is a significant difference in mean scores of academic achievements between the control and intervention groups (P=0.001) over time based on repeated measure ANOVA, and a significant difference between the two groups over time group effect by using repeated measure ANOVA (P=0.001). The paired t-test showed a significant difference between students' academic performance in time I and time II (P<0.05). In the control group, the descriptive statistics show that students' academic achievement (time I) was slightly higher in the posttest (time I) and dropped slightly in time II. The paired t-test showed a nonsignificant difference between students' academic performance in time II and time I.

Conclusion: The results indicated the substantial need for using novel nursing education models in nursing education to enhance learning outcomes in training settings.

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Highlights

• The jigsaw cooperative learning strategy is effective in enhancing academic achievement among nursing students.

• Nursing students had positive opinions and perceptions towards using Jigsaw cooperative learning strategy.

• The sociodemographic and organization-related factors do not influence students' academic achievement after using the Jigsaw cooperative learning strategy.

Plain Language Summary

Teaching and training nursing students is a challenge that nurse educators have been confronted with in the past few decades. With advanced education technology, maternal nursing training should be updated and enhanced with more promising teaching methods. Many studies have focused on various forms of online and simulated training and education. However, maternal nursing training requires unique approaches to be used, especially in cultures that have some gender-related issues and concerns. This study tested Jigsaw cooperative learning strategy and its applicability and showed that this strategy positively influenced students' accumulated level of knowledge and drew their positive opinions. Nurse educators are recommended to use the jigsaw cooperative learning strategy and similar learning approaches to ensure high-quality maternal nursing education and training.

Introduction

Nursing education has turned out to be a challenge to nurse educators. Teaching and training nursing students in maternal and midwifery courses are particularly important for several factors regarding cultural and gender-based areas [1]. Using traditional educational methods to teach and train nursing students is unacceptable and noncompetitive, considering the advanced online and interactive teaching methods. This situation might require searching for more innovative teaching and training approaches to ensure the safety and effectiveness of training. Especially after the pandemic of COVID-19, educational bodies have been forced to think and use innovative and applicable approaches to teach and train nursing students in a risk-free environment using reflective and creative principles [2]. The pandemic of COVID-19 resulted in psychological and social dysfunction among nursing and university students causing additional burdens on students [3].

Nevertheless, maternal and midwifery courses must be addressed in an integrated format. They should promote analytical thinking and willingness to interpret, evaluate, and transfer new information to the clinical practice area using safer and risk-free models [2]. The literature has provided evidence that there is a need to improve nursing students' decision-making abilities and problem-solving skills and enhance the students' motivation for learning and achievement [4, 5]. Application of acquired knowledge from educational environments to maternal clinical settings requires that nursing students could evaluate gender-based issues and cultural and personal barriers to caring for women in these settings [6]. Using student-centered learning indicates that students should be able to use their learning skills and be more responsible, aware, and motivated toward learning [4, 7].

This ability has previously been emphasized and addressed in other areas; however, maternal and midwifery courses and training settings are different in Muslim and Arabic countries because of cultural and religious rules. The "no-mix" notion between males and females at certain nursing schools and lacking male nursing students at maternal and midwifery clinical training settings due to religious and cultural barriers may hinder abilities or assess the differences between students. Thus, more innovative teaching and training approaches should be used at nursing schools and maternal and midwifery clinical training settings. The jigsaw technique is a strategy of cooperative and collaborative learning proposed for effective and creative teaching. The jigsaw cooperative learning strategy (JLS) is an integrated learning strategy that enables students to interact, plan, and participate in maternity and midwifery course materials, lead and present materials, and encourage each other [8]. The jigsaw teaching method depends on the collection of topics developed by students. They should be prepared for discussion and cooperation to make a

complete idea. The jigsaw cooperative learning strategy allows students to become responsible for a topic presented in class and the training area. Students must research and develop their ideas and be responsible for teaching themselves [8-9]. Maternity nursing courses should prepare nursing students to work with mothers and their children. Such an environment requires high levels of flexibility and creativity that jigsaw strategy can provide, ensuring high quality and safe training and practice [9]. Using JLS enhances the long-term retention of acquired knowledge in learners, improves decision-making and problem-solving skills, and reinforces critical thinking skills [10]. This quality makes JLS an appropriate and crucial approach in the maternity field, particularly maternity nursing training. This strategy ensures safe practices and improved maternal healthcare outcomes among mothers and newborns [11].

Although calling for innovative approaches in nursing education is well established, traditional and online nursing education is needed to ensure adequate skills for applying principles of integrated learning [12]. The literature is scarce in testing the effectiveness of innovative nursing teaching methods such as jigsaw across cultures. In particular, maternal nursing and midwifery are special training topics among Arabian and Muslim academic institutions due to religious and cultural impediments. Such a topic in many nursing schools is not presented to male students, and for female nursing students, this might also be one culturally sensitive issue to be discussed [11, 13]. Thus, this study investigated the effectiveness of using the jigsaw technique to provide maternity nursing students with the best learning opportunities and develop their critical thinking, problem-solving, and decision-making skills, as well as retention of information. This pioneering study emphasizes topics in the era of online and distance education. This study aimed to evaluate the effectiveness of the jigsaw cooperative learning strategy on the opinions and academic achievement among maternity nursing students.

Materials and Methods

This study is a randomized controlled trial. The study population comprised students in maternal nursing courses. The study data were collected from the 5th level nursing students (the level where students can register for maternal nursing theoretical and practical courses) (Figure 1). To be eligible to participate in the study, the students must be at least 18 years old and enrolled (currently registering) in maternal nursing theoretical and practical courses. Other inclusion criteria reflected the demands of the study protocol: ability to read, write and speak Arabic, absence of significant hearing or a visual impairment, and ability to come to the research site two times throughout sessions. A cluster sampling technique was used to recruit the students. A cluster sample per class was used first, and then students per class were randomly assigned to JLS or the waiting-list control group. Initially, all courses designated for nursing students teaching maternal nursing were pooled and clustered into males and females and then were randomly assigned to the intervention (JLS group) and the waiting-list control group. The power calculation for this study was established on the assumption that the participants in the two groups were equally divided, considering the sample size and setting. Thus, 160 nursing students were recruited, 80 students per group.

The data were collected using the Arabic version of the self-administered questionnaires. The first tool is a demographic questionnaire developed by the researcher to collect data regarding students' characteristics such as age, marital status, and palace of residence.

The second tool is the Arabic version of the knowledge accumulation scale that measures academic achievement [6]. The scale comprises 20 multiple-choice questions that test the accumulation of knowledge regarding maternal nursing care, including definition, prevalence, risk factors, causes, signs, symptoms, and diagnosis. The students are asked to rate their responses on a 3-point Likert scale ranging from no (0) to yes (2). The score then is converted to "complete no" and "uncertain" as 0, reflecting the incorrect answers, while the yes answers are converted to 1. This will enable calculating the mean item scores. The Arabic version of the scale has good validity and reliability [6]. In our study, the tool also showed good reliability with a Cronbach alpha of 0.79.

The third one is the Arabic version of the Cooperative Jigsaw Opinion Scale (CJOS) that assesses the student's opinions related to the strategy of the JLS as a learning technique in the intervention group [6]. The scale is formed of 14 items where students are asked to make their dichotomous responses, either yes (1) or no (0), with a total score ranging from 0 to 14. Where the yes answers reflect the positive and the no reflects the negative opinions. Therefore, a higher score indicates a more positive opinion about JLS. This tool was used for the intervention group. The Arabic version of the scale is valid and reliable [6]. In our study, the tool also showed good reliability with a Cronbach alpha of 0.82.

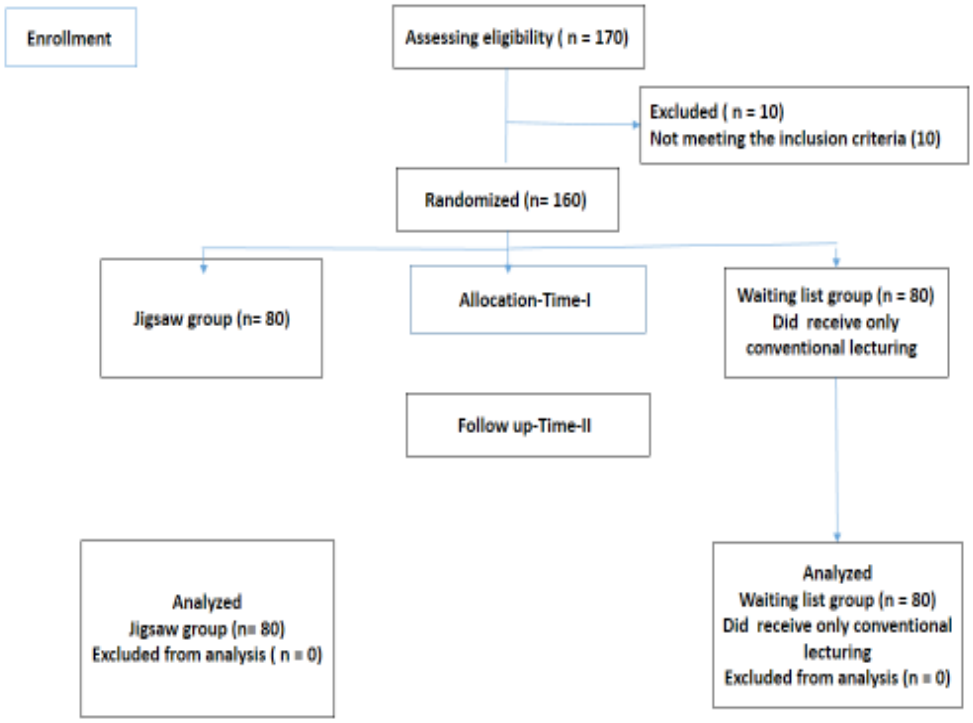

Figure 1. CONSORT flow diagram of the participants

The experimental group received the jigsaw learning strategy comprising five fundamental elements: positive autonomy, interaction promotion, individual responsibility, interpersonal and social skills teaching, and group processing quality (Table 1). The academic, social, affective, and psychological development of nursing students is established by working together in groups [9]. The study group was divided into eight heterogeneous subgroups, each group comprising 10 students. The study was conducted at a nursing school in Saudi Arabia during the maternity nursing course. The intervention was conducted over five sessions, from preparatory to evaluation sessions, with various timing per session ranging from 2-4 hours. For the waiting-list control group, four teaching sessions were conducted; each session took two hours.

JLS is a promising approach to training and learning in which students depend on puzzle-like scenarios to make pieces of pictures and related information together. It specifies topics and allows students to make a holistic and well-developed idea related to that suggested topic and share it with the other students or groups in the class. JLS is characterized by allowing students to reach a higher level of understanding, be active, explore the information in-depth, and formulate ideas based on the given topic. The researchers provided scientific content using the conventional format that students are used to at nursing school. The study data were collected at the pretest and posttest points. At the end of the intervention, one session for the waiting-list control group was held. The session was presented in an interactive format to ensure that all students received the same intervention materials. Regarding the control group, they were only exposed to the conventional model of maternity nursing teaching style during the intervention period for the experimental group. After the study completion, the control groups were presented to the jigsaw cooperative learning to ensure equity and fair treatment immediately after the data collection of time II.

First, students signed approval and informed consent. Then, students who met the eligibility criteria were invited to participate in the study and were given the time and date of the 1st meeting. Also, the student's contact information for future contact was obtained, and the researcher's contact information was shared with them. The process continued till reaching the required sample size (160 participants). Then, eligible students were randomly assigned to JLS and waiting-list control groups (80 participants per group). Each group, after randomization, was contacted and set for a meeting separately to minimize internal and external validity threats. The intervention group was informed about the time, date, and place of the sessions. Confirmation of participants' contact information was done in each meeting to en-

Table 1. Protocol of the Jigsaw learning strategy

Sessions	Contents
Positive autonomy	Teaching the students, the capacity for setting goals and purposes of learning success and the ability to decide on learning outcomes
Interaction promotion	Students work in small groups. In this technique, each group is assigned to become an "expert" on several aspects of the study topic. They work in groups, but everyone must master one of the subtopics.
Individual responsibility	The students are given a framework for managing their time on the various parts of the jigsaw task. This technique allows students to take full accountability for their actions, decisions, and thoughts regarding the learning process and outcomes.
Interpersonal and social skills teaching	Students are taught to communicate, interact, and work effectively with individuals and within a group. This session includes managing relationships, understanding the feelings of others, cooperating with others, showing respect, and active listening.
Group processing quality	Students practice team building, gathering information, encouraging listening, group engagement, and empathy.

hance commitment and minimize possible dropouts (control of attrition). The sessions were randomly audiotaped and videotaped to ensure the integrity of the sessions (validity, resemblances, consistency, and reliability of information provided). The group leaders provided progress reports after each session, and the expert tutor, an external evaluator, reviewed the content of one-third of the sessions to ensure internal validity.

The study data were collected in the first (Time I) and second semesters (Time II) of 2019-2020. The SPSS software version 24 was used to describe the opinions and achievements of students using the central tendency measures (Means±SD and medians). Repeated measure ANOVA was used to compare the mean differences of the study outcomes of the JLS impact on the academic achievement between the experimental and control group across the two times of measurement (immediately after the course and four weeks later) and under the effect of time and group. The Chi-square test was used to investigate the difference in academic achievement using the Time-I data concerning age group, marital status, and living area. Normality was tested on a skewness level of -1.0 to +1.0, and alpha values were set at a 0.05 level of significance.

Results

The analysis showed that the mean ages of the JLS and waiting-list control groups were 20.8±0.74 and 20.7±0.81 years. In the JLS group, 96.3% were single, compared to 91.7% in the control group. Those living in urban areas were 56.3% in the JLS group compared to 62.5% in the control group.

The Chi-square test was used to investigate the difference in academic achievement using the Time-I data (n=160) concerning age group, marital status, and living area (Table 2). Results showed no statistically significant difference in university students' academic achievement concerning age group, marital status, and area of living.

Repeated measures ANOVA was used to explore the changes in students' performance and the effect of JLS

Table 2. Descriptive and homogeneity of the groups at time I

Variables		No. (%)/Mean±SD				p
		Jigsaw		Control		
Marital status	Single	77	96.3	78	91.7	0.99
	Married	3	3.7	2	8.3	
Living area	Urban	45	56.3	50	62.5	0.30
	Rural	35	43.8	30	37.5	
Age (y)	-	20.8±0.74		20.7±0.81		0.30

Table 3. Repeated measures analysis of variance of academic achievement regarding time effect among two groups

Academic Achievement	Mean±SD	
	Time I	Time II
JLS*	16.9±2.5	15.8±2.4
Waiting-List control group	12.5±3.5	12.2±2.7

Time & Group Effect	Repeated Measures	
	F	P
Time	6.5	0 .001
Time & Group	5.8	0 .001

* Jigsaw learning strategy

intervention on students' academic achievement (Table 3). In the intervention group, results showed that the mean score of students' academic achievement in the posttest (the time I after the intervention) was higher immediately after the intervention compared to 4 weeks later, while it decreased a little (time II after the intervention). The paired t-test showed a significant difference in students' academic achievement in the JLS group between the time I and time II ($P<0.05$). In the control group, the descriptive statistics show that the mean score of students' academic achievement was slightly higher in the posttest (time I) and dropped a little in time II. The paired t-test showed a nonsignificant difference in the control group between students' academic performance in time I and time II. Using the repeated measure analysis to test for the main effect, the results showed a significant effect over time difference in mean scores of academic achievements between the control and intervention groups ($F=6.5$, $P=0.001$). The repeated measure ANO-

Table 4. The Opinions of students about Jigsaw learning strategy (JLS)

Students' opinions	No. (%)
JLS improved communication skillfulness & self-confidence.	75(93.0)
JLS improved teamwork.	78(97.5)
JLS helps in the understanding of the course content.	77(96.3)
JLS enriched the retention of knowledge.	76(95.0)
JLS improved problem-solving skills.	70(87.5)
JLS improved critical thinking & decision-making skills.	71(88.8)
JLS improved to advance information management skills.	73(91.3)
JLS simplifies applying information into clinical practice.	69(86.3)
JLS was an effective way of learning and comprehending.	74(92.5)
JLS It enhanced communication skills & self-confidence.	74(92.5)
JLS ensured the correction of our misinformation.	72(90.0)
JLS facilitated applying knowledge into clinical practice.	71(88.8)
JLS was an innovative teaching-learning technique.	70(87.5)
Overall, I am satisfied with JLS.	72(90.0)

VA showed a significant difference between the two groups regarding the time effect (F=5.8, P=0.001).

Regarding students' opinions of the Jigsaw Learning Strategy (JLS), the analysis showed that students, in general, are satisfied with the JLS, with a satisfaction level of 87.5% about "JLS improved problem-solving skill" and "JLS was innovative teaching-learning technique" to 97.5% about "JLS improved teamwork" (Table 4). The other top reported item was "JLS helps in the understanding of the course content" (96.3%) and "JLS enriched retention of knowledge" (95%). On the other hand, 88.75% recommended the application of jigsaw in further nursing courses as a teaching method.

Discussion

The ultimate goal of nursing education is to enhance and prepare nursing students' skills to ensure the high quality of nursing care practice after graduation [14, 15]. This objective would encourage nursing educators to use innovative education and training methods for nursing students and test their effectiveness. This study tested one innovative learning strategy, the jigsaw cooperative learning strategy, among maternal nursing students and assessed its effectiveness in improving students' knowledge accumulation compared to conventional nursing education methods. We found that JSL significantly improved academic achievement among maternity nursing students immediately after using the method, and this improvement was sustained after four weeks of the intervention. Such findings indicate that nursing students who were exposed to JSL could retain the information and skills learned over time and at higher levels than the students trained with traditional models of teaching, such as lecturing. The results also infer that the safe practice of nursing students has been enhanced depending on the notion that a higher level of knowledge would indicate better skills and self-efficacy in performing tasks and academic assignments. Previous studies found that internal motivation, academic achievement, and anxiety are linked with learning self-efficacy and using innovative methods of teaching [14-17].

One explanation for the results, although expected, is related to components of JLS that enhance integration, interaction, and reflective skills of learning among students. At the same time, traditional lecturing will indirectly force students toward one-way communication, which may lower their problem-solving skills and creativity [18]. The results regarding the effectiveness of JLS are inconsistent in the literature. Many studies [6, 19] reported that JSL was effective in improving nursing students' accumulation of knowledge and enhancing components related to reflective skills, creativity, and problem-solving. The difference was observed immediately after the intervention; however, the effectiveness decline after four weeks indicates the importance of a sustainable and consistent format of nursing education across courses and training scenarios to maintain the consistent mental preparedness of students. The novel use of any teaching and learning strategy would speculate a lack of sustainable outcomes unless fostered with and across other courses.

What would also indicate the benefits and improved accumulation of knowledge among students is how students perceive and evaluate the proposed novel methods of teaching: the JSL. In this study, nursing students enrolled in maternity nursing courses reported high to extreme levels of positive opinions regarding the benefits of JLS. About 90% of students indicated positive outcomes of JLS. This report will also explain the high accumulation of knowledge over time. The literature has emphasized the importance and role of a positive impression on students regarding the novel methods of learning on their academic achievement, and consequently, enhancing safe practice in clinical settings [11]. The results also support the idea that JLS can be applied to other settings and courses across the healthcare field. For example, Karimi and Bagheri [20] reported that JLS are applicable to other educational levels of nursing curricula, like mother disciplines such as medical education, dentistry, rehabilitation, and pharmacy. The belief in the long-term benefits of JSL relies on the components and secondary gains of using JSL. For example, JLS is fostering a deeper attitude to learning, improving interactive skills, teamwork, and leadership abilities, considering stress-free learning methods, and increasing self-confidence and satisfaction [21-23]. Nevertheless, few reports show a low level of satisfaction due to the belief that such a learning strategy is temporary and causes confusion regarding applicability to other training and learning environments.

One limitation of this study is related to specifying the outcomes in the theoretical part, while it would be more imperative if nursing students' skill's clinical part were added to the theoretical one.

Using innovative and novel learning methods for nursing students influences their academic achievement positively and has been perceived positively by students. JLS has a sustainable positive impact on academic achievement among maternity nursing students

enrolled in maternal nursing courses compared to the comparative lecture format of tutoring. The study has implications for nurse educators and students. Nurse educators must upgrade and tailor their electronic and novel teaching methods for nursing curricula to enhance training outcomes and safe practices in clinical areas. Moving toward a blended learning approach and depending largely on online education platforms should provoke attention to the suitability of such novel means of learning and teaching for nursing students. They were utilizing and among nursing students. Nursing students also need to improve their skills and utilize novel ways of teaching that enhance their problem-solving skills and creativity in theory and practice courses. Further studies should be conducted to assess the utility and feasibility of using various models of teaching that meet the learning needs of students and enable achieving nursing learning outcomes.

Ethical Considerations

Compliance with ethical guidelines

The study was approved by the Ethics Committee of the University of Hafr Al Batin (No.: 14/2019-2020).

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Authors' contributions

Study design and Manuscript writing: Majedsulaiman Alamry, Baderjamaan Alshaery, Ayman Hamdan Mansour; Data collection: Randamohammed Abobaker, Banderjamaan Alshaery; Data analysis: Ayman Hamdan Mansour, Randamohammed Abobaker; All authors approved the final manuscription.

Conflict of interest

The authors declared no conflict of interest.

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