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Jigsaw Classroom: A Process of Cooperative Learning and Discussion

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ABSTRACT

The jigsaw classroom is a non-traditional classroom teaching style. Rather than forming a large group of students around a teacher, students are taught to work in smaller, interdependent groups; each student is assigned a part of a topic to study, and when finished, the students fit their pieces of the subject area together to produce a whole "jigsaw" picture. A thorough understanding of theoretical topics in geology, such as those in The Study of Rocks, is essential for exam reasoning, problem solving, and technical skill enhancement. Nevertheless, learners and teachers both commonly perceive this subject as being arid, unpredictable, and challenging to comprehend. The causes could include the breadth of the subject, the effectiveness of student learning, the length of the study period (greater than one hour), the physical environment within the classrooms (one-way teaching by the instructor), and so on. These factors contribute to a lack of student attentiveness and boredom in the classroom. The purpose of this study was to determine the efficacy of implementing jigsaw classroom approaches in theoretical courses. A quantitative approach was used to collect empirical data by sending the questionnaire survey amongst 125 civil engineering students at UiTM Pahang,Cawangan Jengka. The collected data was analysed using a descriptive version of the Statistical Package for Social Sciences for Windows Version (SPSS) software, such as mean score, percentage, and frequency. The study found that the majority of respondents agreed that Jigsaw Classroom Learning (JCL) could improve their communication skills. Besides that, JCL is an effective and faster way to learn theoretical subjects, especially in geology topics. JCL can also help students build self-confidence, especially among shy and hesitant students in the class. Using a jigsaw classroom as a cooperative learning technique can improve teaching and learning efficiency for students while also enhancing their academic performance.

1. Introduction

Education is an essential aspect of human development. It differs from schooling. Schooling is merely one method of providing education; education is concerned with the entire process of human learning in which knowledge is transmitted, faculties are exercised, and various abilities are cultivated. Bamisaiye [1] defined education as "a cumulative process of the development of

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intellectual abilities, skills, and attitudes, all of which form our various outlooks and dispositions to action in life generally." According to Kamath *et al.,* [2], education attempts to develop students' critical thinking, knowledge, and self-reliance in addition to reading. Throughout the past century, lecturing has been the most common technique of instruction and an efficient way to convey knowledge to students [3]. While lecturing can effectively impart knowledge that is not easily accessible through other means, it is not the only way to engage students in the material being presented [4]. For many years, theory-based subjects have been taught using the traditional teacher-oriented technique. Most students struggle to absorb concepts, facts, and history. [5] To improve the traditional teacher-oriented teaching approach, students should be encouraged to be active learners and make the most of their time while pursuing a bachelor's degree in civil engineering.

Cooperative learning is characterised as an active learning technique in which a diverse collection of students collaborates in small groups to achieve a common goal, as referred to in Mutlu's [6] previous research. According to research by Rao [7], the jigsaw classroom is one such strategy that teaches cooperation over competitiveness. At the University of Texas and the University of California, Aronson *et al.,* [8] introduced the Jigsaw Classroom Learning (JCL) method. Like a jigsaw puzzle, each student's contribution is crucial for a complete understanding of the final outcome, as stated in the previous study [9]. According to Sagsoz O *et al.,* [10], this method of learning can improve students interpersonal and social skills when students work together, trust each other, and resolve problems constructively in order to achieve the objectives. This teaching-learning (TL) method enhances comprehension, knowledge, critical thinking, problem-solving, clinical skills, self-confidence, and communication, especially listening, as defined in a previous study by Philips J *et al.* and Elmi *et al.* [11,12]. Extensive research on the Jigsaw method of learning has been conducted at various educational levels, ranging from elementary school to higher education, as indicated in a study by Souvignier *et al*., [13]. Previous studies [14] have indicated that the strategy is beneficial for teaching, although students' opinions have varied. Bykerk-Kauffman [15] defined the "Jigsaw" method as a strategy that involves dividing a complex topic into smaller parts. Each small team focuses on mastering their assigned portion and then shares their expertise with other teams. Krych *et al.,* [16] defined the jigsaw classroom as promoting the growth of communication skills, teamwork, leadership, confidence, respect for peers, and a thorough comprehension of course content essential for cultivating professionalism in their civil engineering field. According to Lalit *et al.,* [17], Active Learning Methodology (ALM) by jigsaw technique motivated and encouraged active student participation and discussions. Furthermore, it is necessary to assess whether the teaching tool can enhance the learning and comprehension of theory-based subjects such as The Study of Rocks. Students must comprehend the basic principles and processes of the geological rock cycle, recognise the categories of rocks (igneous, sedimentary, and metamorphic), and understand the formation processes of rocks, including their classification and engineering applications. Singh. *et al.,* [18] emphasised that the rock cycle is a crucial idea that serves as a foundation for significant geological discussions in beginning geology courses at colleges and high schools. This study aims to assess the learning experiences and perceptions of Active Learning Methodology (ALM), specifically the jigsaw technique, as a motivational tool to enhance students' ability to analyse, synthesise, and evaluate material through discussions with their peers.

2. Methodology

2.1 Questionnaire Survey

According to Miles *et al.,* [19], when conducting a study, various elements must be taken into consideration when selecting a respondent, such as the time constraints and the authorization to

enter the study location. This study's methodology involves distributing a survey questionnaire via the Google Form platform, with the questionnaire link shared over messaging programmes like WhatsApp and Telegram. The study included 125 students from semester 2 at the UiTM School of Civil Engineering, Jengka Branch, Pahang, as participants. The survey utilized a quantitative approach, gathering data through a questionnaire that employed a Likert scale with five response possibilities ranging from 1 to 5 (very agree–very disagree). The acquired data was analysed using the descriptive features of the Statistical Package for Social Sciences for Windows Version (SPSS) software, including mean score, percentage, and standard deviation.

2.2 Method of Jigsaw Technique taken from Previous Study

This instructional learning strategy focused on the study of rocks. This chapter's subtopic was the rock cycle, which includes three types of rocks: igneous, sedimentary, and metamorphic. Previously, one of the lecturers presented the contents in a didactic lecture class. The Jigsaw Classroom Learning tool was used to strengthen the topics covered in the lecture class. During a geology class attended by one batch (125 students), they must follow the following requirements:

Step 1: After introducing the TL technique, the 20 students were divided into four home groups, labelled I to IV, with four students in each group based on their role numbers. Each set of students was assigned numbers 1 to 4, as illustrated in Figure 1.

Step 2: The students were then re-grouped into expert new groups labelled A to D based on the common numbers from the home group, as shown in Figure 1. This new group was assigned one subtopic to prepare from multiple resources (class notes, textbooks, online resources, etc.) and discuss and argue for 30 minutes.

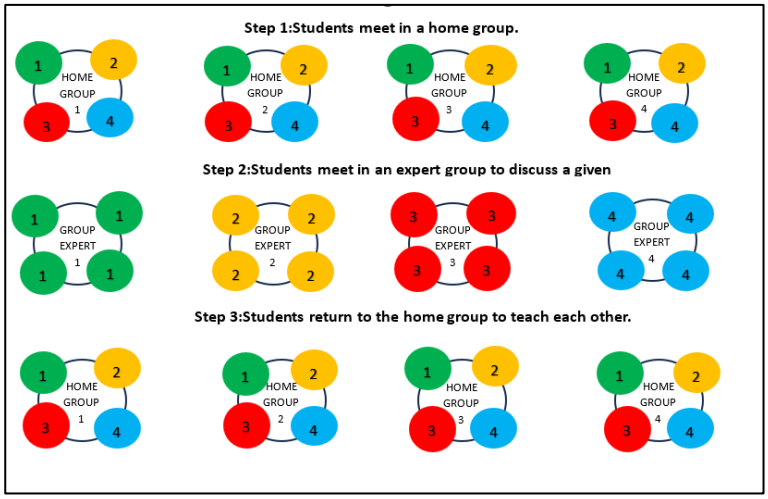

Fig. 1. An overview of the jigsaw technique, showing the establishment of home and expert groups

The subtopic distribution was as follows:
Expert Group 1: Rock Cycle
Expert Group 2: Igneous Rocks
Expert Group 3: Sedimentary Rocks
Expert Group 4: Metamorphic Rocks

Step 3: After 30 minutes, each student returned to their original group. Each student in the home group specialized in a specific subtopic. The students lectured and discussed the issue, ensuring that everyone in the group had a thorough understanding. The time allocated was 60 minutes.
Step 4 involved randomly assigning students from each home group to present one subtopic for five minutes, then other home groups and the facilitator engaged in two minutes of discussion and questioning. All groups spent 25–30 minutes completing this exercise.
Step 5: Finally, the students were invited to complete a feedback questionnaire with both closed-ended and open-ended questions. The questionnaire assessed students' perceptions of the jigsaw technique using a five-point Likert scale, ranging from 1 for strongly disagreeing to 5 for strongly agreeing. In the second part of the questionnaire, students were asked open-ended questions about the benefits, drawbacks (optional), and preference for using the jigsaw methodology for teaching. The final assessment will analyze the effectiveness of the Jigsaw Classroom Learning (JCL) method.

3.Result and Discussion

3.1 Respondent's Profile

The demographic profile of the respondents who participated in this study is shown in Figure 2. A total of 125 respondents were involved in this study. They consisted of 42% of female respondents and the remaining 58% of male respondents.

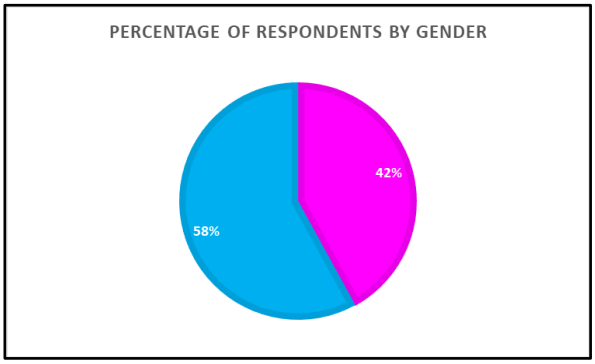

Fig. 2. Percentage of Gender Respondent

3.2 Students Feedback

The findings are interpreted using Jainabee and Jamil's mean score table [20] from Table 1 for descriptive data analysis.

Table 1
Interpretation of Score Mean

Mean Score	Interpretation
1-1.8	Very Low
1.81-2.6	Low
2.61-3.40	Medium
3.41-4.20	High
4.21-5.00	Very High

3.2.1 Analysis of student perceptions in the Jigsaw Classroom Learning Method

Respondents were asked to rate their level of agreement with the benefits of Jigsaw Classroom activities for their courses. The Jigsaw Classroom has been applied across various educational settings and subject areas, demonstrating positive effects on students' academic achievement, social skills, and attitudes towards others. Respondents rated potential JCL benefits, with the findings organised in Table 2 by mean scores. The primary benefit identified is that effective students acquire skills in effective communication and conflict resolution. According to Dhage *et al.'s* [21] study, the proposed jigsaw activity effectively achieves the primary learning goal while also developing other soft skills. Teamwork (second-ranked, mean score of 4.2), followed by positive interdependence (mean score of 4.04) and enhancing students' confidence level (mean score of 3.92). Additionally, JCL was improving analytical thinking. Improving cognitive skills by allowing students to produce information and lead their studies (fourth-ranked, mean score 3.89) and this technique is capable of providing both awareness as well as a platform to build skills, and also the bonding between the students is found to be increased, as mentioned by Dhage *et al.,* [21].Besides that, the jigsaw classroom also covers several topics in a short period of time (fifth-ranked, mean score 3.75); the activity enabled thorough subject exploration (sixth-ranked, mean score 3.67) and reduced prejudice and stereotyping (seventh-ranked, mean score 3.4).

Table 2
Benefits of Jigsaw Classroom Learning

No	Item	Mean Score	Rank
I1	Students acquire skills in effective communication, conflict resolution, and teamwork.	4.2	1
I2	The jigsaw classroom promotes positive interdependence by enhancing cooperation, collaboration, and creating a more positive learning atmosphere.	4.04	2
I3	The jigsaw classroom activity could increase students' confidence, especially in coming up with their own ideas.	3.92	3
I4	Jigsaw classrooms improve analytical thinking. Improving cognitive skills by allowing students to produce information and lead their studies.	3.89	4
I5	The activity encompasses numerous subjects within a short or restricted timeframe.	3.75	5
I6	The activity facilitated a thorough exploration of the subject.	3.67	6
I7	Jigsaw classrooms reduce student prejudice and stereotyping. Students who work with diverse peers are more likely to question prejudices and acquire favourable attitudes towards others.	3.4	8

3.2.2 Preferring teaching and learning based on student feedback

The present study also showed that 55% of students preferred JCL, which is consistent with a study by Varma SR [22], who found that 90% of participants were comfortable with this method However, 10% of students preferred the old technique, while 35% enjoyed both methods of learning, as seen in Fig. 3. According to research by Persky AM and Pollack GM [14], 55.4% of participants thought they learned less using this strategy. According to Slavin [23], a recent assessment of research indicated that active learning enhances the development of critical thinking skills and encourages social interdependence among students. A prior study by Faust JL *et al.,* [24] showed that using collaborative learning approaches enhances student attitudes, relationships, and retention compared to traditional competitive or individualistic methods.

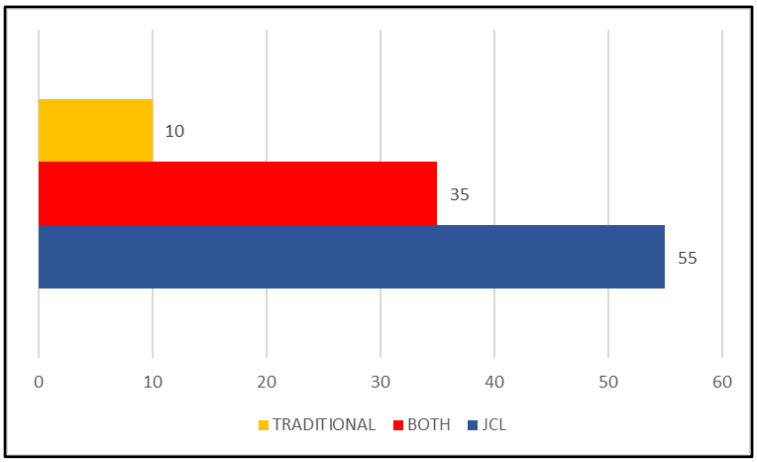

Fig. 3. Percentage of preferring teaching and learning methods

3.2.3 Students feedback on open-ended questions

Interviews confirm the advantages and disadvantages of JCL. Most people believed that all complex subjects should be taught with this approach. They found the method to be very beneficial, engaging, and inspiring. However, students also pointed out the challenges of implementing an active learning approach, noting that JCL necessitates active participation from all participants. If one person is not completely contributing, the entire group is affected, leading to some students having a grasp of the topic but struggling to articulate their thoughts effectively. The jigsaw classroom technique works well when everyone participates with enthusiasm and dedication, as demonstrated in a study by Omelicheva *et al.,* [25]. On the other hand, Nurbianta N. *et al.,* [26] discuss this in their research. Jigsaw is a cooperative learning approach used to enhance student motivation and encourage active participation in learning the material. A study emphasised that an active and engaging learning technique can effectively be employed as a learning tool in geology courses. Students prepared general education Earth Science presentations by utilising their creativity, curiosity, and intelligence, as stated by McConnell. *et al*., [27]. The jigsaw approach utilised in this study demonstrated active engagement from both educators and students. The jigsaw strategy encouraged students to experiment with different learning methods, resulting in perceived benefits from the change. Students supported the idea of expanding the range of topics taught by active learning methods. The jigsaw technique involves small groups of students working together to enhance their own and each other's learning, as well as to develop communication skills that are transferable to their future professions as professionals. Time management was a significant constraint in this case. The topic that is typically covered in a 1-hour lecture ended up taking around 3 hours to complete. This resulted from the students independently reading the material using the jigsaw technique, talking with the faculty about their concerns, instructing their home groups, and receiving faculty evaluations. Another significant constraint was that several students were unable to articulate themselves completely to their peers. Upon assessment by the faculty, it was clear that they possessed knowledge of the content. However, due to their inadequate communication abilities, the home group also struggled to properly comprehend the topic.

4. Conclusion

This research assessed the application of jigsaw classroom learning (JCL) in civil engineering studies. The survey indicated that 55% of respondents prefer JCL as an active learning method for

their lessons, especially for the theory-based subject. A notable finding is that the jigsaw strategy encouraged students to attempt new learning methods, and they reported feeling benefited as a result. Students thought this method was an exciting way to study and that significant chapters should be taught using the jigsaw classroom activity. Faculty members must be sensitised and trained in order to effectively implement this technique. To address the time-consuming aspect of the approach, themes might be conveyed to students ahead of time for expert group preparation, as demonstrated in certain studies.

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