Journal of Elementary Education
Volume 34, No. 2, pp.69-79
December, 2024

Effect of Jigsaw Method on 8th-grade math's Student's Academic Achievement in Algebra

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Abstract

The researcher investigated the Effect of the Jigsaw Method on 8th-graders' Academic Achievement in Mathematics in comparison with the Traditional Method in this study. This study aimed to examine the effect of the Jigsaw method on 8th-grades students' learning algebra using a quasi-experimental research design consisting of pre-test and post-test with a control group and an experimental group. The researcher randomly picked out of 423 schools of District Islamabad, two Government schools, one being IMCB Nilore Islamabad where the researcher personally took a hands-on approach teaching 41 students in the experimental group and the other being a government institution with 41 students as control group. Second was IMSB Sihala Islamabad where 42 students were kept as control group who were taught with traditional methods by a voluntary teacher. An MCQ-based exam was used to gauge pupils' mathematics proficiency. There were 30 algebra problems on the test. The duration of the experiment was eight weeks. Experts ensured the content validity of the test by using an independent t-test was used to analyse the test scores. The Shapiro-Wilk test of normality and Q-Q plot were used to determine the normalcy of data and it was found that the data were normal at the outset. The results indicated that the use of Jigsaw method significantly improved all dimensions of the academic achievement of the students. However, a significant difference was found in the Jigsaw method compared to the traditional method in all aspects.

Keywords: Algebra, 8th grade, jigsaw method, Traditional method

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Introduction

As mathematics is one of the subjects taught in schools. The challenges pupils faced when learning mathematics were mostly caused by the way the subject was taught (Russell, 2006). Teachers in Pakistan primarily employed the deductive method of instruction, which entails imparting knowledge in the classroom without developing any concepts. In order to answer the questions, students had to commit formulas to memory, which were usually taught at the start of lectures (Mirza & Iqbal, 2014). Failure results from inadequate math instruction for both teachers and students. The majority of pupils say that mathematics is hard, boring, and challenging, which makes them feel more doubtful, confused, and inadequate (Qayyum, Malik, & Rafique, 2019). A nationwide study by teachers at Aga Khan University's Institute for Educational Development found that more than 90% of Pakistani primary and presecondary school students have inadequate or basic skills in science and mathematics. According to Express Tribune headlines headed "Pakistani students below par in mathmatics and science," Punjab had the highest average math score (532) among students in Class VIII on the 2014 National Education Assessment System (NEAS) Tests. Islamabad Capital Territory (ICT) (466), AJK (445), Gilgit-Baltistan (438), Khyber Pakhtunkhawa (423), Balochistan (422), Sindh (416), and FATA (416) were the areas that lagged a little.
With a focus on student participation, the National Curriculum for Mathematics (2006) highlighted the change in emphasis from information transfer to comprehension and then application of mathematical concepts. Scientific instructors, especially maths teachers, used a range of teaching techniques and tactics to get pupils involved in the teaching-learning process and accomplish the academic session's objective. Teachers must use a variety of strategies in the classroom, such as the Jigsaw teaching technique, to guarantee that pupils have opportunity to progress to further studies in the future. It implied that modern methods of teaching mathematics could be a helpful tool for concept formation in Pakistan's multicultural setting.

Literature review

Cooperative learning is one of the fundamental solutions in education. It can be characterized as an instructional approach that makes use of motivating methods to make learning more engaging and meaningful (Cornelius-Ukpepi et al., 2016).

There is no one instructional method that can produce all the desired results, but research has shown that cooperative learning has been quite effective in raising student accomplishment. With great success, teachers have employed the cooperative Jigsaw method. Jigsaw was used by Gocer (2010) to teach literary genres. Demonstrated that pupils who are taught utilizing the Jigsaw method outperform those who are taught using the traditional method. Jigsaw puzzles were utilized by Kermal (2008) to teach written expression. According to the findings, Jigsaw method students do noticeably better than

instructor-centered approach pupils. Tahar and Acar (2012) found that teaching chemistry using jigsaw was more effective than using traditional approaches. There is a wealth of literature on the effects of the Jigsaw method.

Theoretical Background

On the academic performance of eighth-grade math students in algebra. According to Gillies (2003), cooperative learning encompasses more than merely having students work independently while seated next to each other at a desk. Johnson and Johnson (1998) state that "putting people in the same room, sitting them together, declaring that they are a cooperative group, and telling them to "cooperate" does not make them a cooperative group" (p. 15). If groups are organised so that members collaborate with one another in their activities to support one another's learning, a cooperative learning environment will develop (Ballantine & Larres, 2007).

The Jigsaw teaching method is one kind of cooperative learning (formal cooperative learning group). Piaget (1926) and Vygotsky (1978) expressed concerns about the cognitive development approach. They believe, along with others, that early discussions about suitable academic projects help youngsters develop their critical thinking skills and conceptual knowledge (Slavin, 2011). Learning can be aided by Vygotsky's Zone of Proximal Development (ZPD) theory. In the ZPD, learning takes place through interpersonal involvement. According to Vygotsky (1978), the ZPD is the difference between the possible level of development when the problem is solved with the assistance of a teacher or a more experienced peer and the actual level of development, which is decided by the problem independently. Elliot Aronson and his students at the universities of Texas and California created and developed it in the early 1970s (Aydin & Biyikni, 2017). In formal cooperative learning groups, students collaborate to finish the assignment or learning activity and achieve shared objectives. The duration of these groups can vary from one class hour to many weeks.

Objectives of study

This research study's goals were to: Objectives Determine how the Jigsaw technique affects eighth-grade math students' academic performance in algebra. 1) Determine how the Jigsaw technique affects eighth-grade students' academic performance in factorisation, simultaneous equations, and polynomials.

Hypothesis

H01: There is no significant difference between experimental and control group student's academic achievement of 8th grade Algebra.

H02: There is no significant difference between experimental and control group student's academic achievement in Polynomials.

H03: The achievement of students in experimental and control group as far as factorization ability is concerned is not significantly different at 0.05 level.

H04: There is no significant difference between experimental and control group student's academic achievement in simultaneous equations.

Research methodology

This study looked at how eighth-grade students' academic performance in algebra, which includes the subjects of polynomials, factorisation, and simultaneous equations, was affected by the Jigsaw technique as opposed to the conventional approach. With intact groups, a quasi-experimental pre-test-post-test methodology was used. Two schools, each located in a separate part of Islamabad's rural area, were chosen by the researcher as intact groups. The pre-test and post-test were successful in gathering the required data. Previously, the pre-test and post-test were identical. The fact that the pre-test and post-test were identical was not disclosed to the pupils. In order to lower the risk of internal validity and compare the performance of two groups—the experimental and control groups—the researcher gathered the data, statistically analysed it, and applied the findings to the sample population.

Population

The Ministry of Federal Education and Professional Training oversees 423 schools that enroll over 220,000 students from pre-kindergarten through post-graduate levels. It employs 9663 teaching staff and 4423 supportive staff or non-teaching staff. The total number of schools, including primary, middle, and high, was 391 (urban 116 and rural 275). 58978 students are enrolled in elementary level (comprising VI to VIII classes) in the entire Islamabad. Furthermore, 275 institutions work in the federal area of Islamabad. The enrolment in VIII classes was 21,362 students in 2023, which was considered a study population.

Sample

Two schools in the Islamabad federal domain were conveniently chosen for this research study, i.e., IMCB Nilore, which was considered an experimental group (researcher also teaching in this institution) with 41 students, and IMSB Sihala with 42 students each. Intact classes in 8^{th} grade were taken for control and experimental groups. Group B is known as the experimental group, whereas Group A is known as the control group. The researcher chose the entire class as a sample without distinction between low and high achievers and no need for high and low achievement to be segregated. The researcher investigated the effect of Jigsaw method Vs traditional method on 8th-grade mathematics student's academic achievement in Algebra considering the topic of polynomials, factorization, and simultaneous equations.

Instrumentation

The researcher developed a pre-test to assess the existing level of understanding of mathematics students. Initially, the purpose of the test was determined, and then the content was selected. It was based on two units (Algebra and Sequences and Linear

Equations and Inequalities) from the mathematics of 8th grade (Federal textbook Board, Islamabad). Thirty suitable items were finalized through item analysis. Out of 30 learning outcomes, 08 were from polynomials, 12 were from factorization, and 10 were from simultaneous equations; therefore, the portion of Polynomials was 25%, factorization was 40%, and the simultaneous equation was 35% (as per the national curriculum 2006). For each item, there were four possible choices provided as the correct response. The accomplishment test had a total score of 30. The exam lasted for forty minutes. A correct response was once given 1 mark, and an incorrect response was once given 0 marks.

Data Analysis

Shapiro-Wilk statistics was used to verify the data's normality before analysis and after the post-test, the comparison was made on the area of polynomials, factorization, and simultaneous equations.

Table 01

Shapiro-Wilk test of normality

Scale	Statistics	df	Sig
MCT	.967	83	.032

According to Table 01, the.032 value was significant. This indicates that the data was normal, an alternative hypothesis on the data was accepted, and the null hypothesis was rejected.

Table 02

Comparison of means, standard deviation, and t test on students' pretest score

Groups	N	M	SD	df	t	Sig
Control group	42	10.4524	2.61	81	-1.597	0.114
Experimental group	41	9.5366	2.60			

The results of the individual t-test samples indicated that there was no significant difference in the mean mathematic achievement rankings between the experimental and control groups for each student at p>.05, suggesting that there was no significant difference in mathematics achievement between the experimental and control corporations for each school. Table 02 displayed the mean and well-known variance of the mathematical performance marks in the pre-test. It indicates that the experimental and control groups were cognitively at the same level.

Table 03

Comparison of means scores, standard deviation, and t test on students' post test scores

Groups	N	M	SD	df	t	Sig
Control group	42	12.75	3.1	81	8.03	.045
Experimental group	41	19.02	4.2			

The consequence and common variance of the arithmetic success ratings in the post-test Showed that mathematics success ranking of the experimental group was higher than that of the control group (P<0.05).

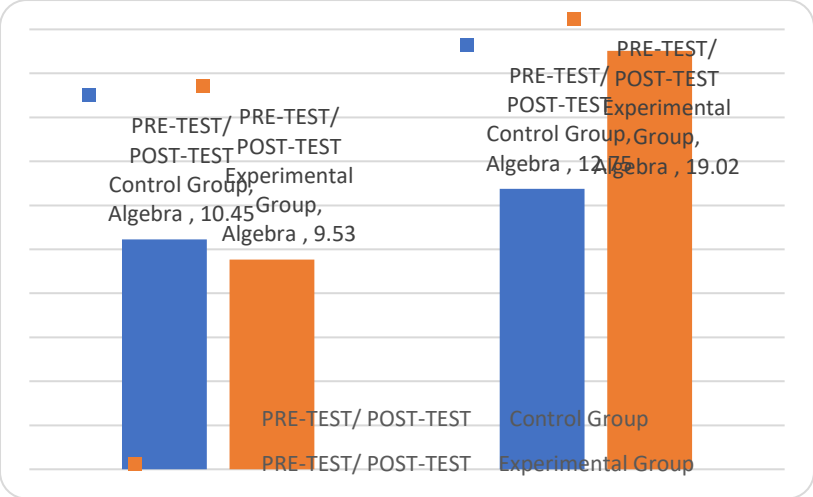


Table 04

Comparison of means, standard deviation, and t-test on students' post-test scores in polynomial

Groups	N	M	SD	df	t	Sig
Control	42	4.30	1.5	81	1.58	.117
Experimental	41	4.85	1.5			

Table 04 the consequences of the independent-samples t-test display that there was no significant difference in the mean achievement scores between the experimental and control groups for both institutions in the content of polynomial, as p > .05 indicated that the experimental group did not perform better in the knowledge of polynomial than the control group.

Table 05

Comparison of means, standard deviation, and t test on students' posttest score in factorization

Groups	N	M	SD	df	t	Sig
Control	42	4.1	2.0	81	6.52	.000
Experimental	41	6.9	1.9			

The results of the independent-samples t test were shown in Table 05, which showed that there was a significant difference in the mean achievement score of the experimental and control groups for both institutes in the factorisation content material. The results showed that there was a significant difference in mathematics success between the experimental and control groups of the eighth standard, indicating that the experimental crew achieved significantly higher than the control team in the factorisation content.

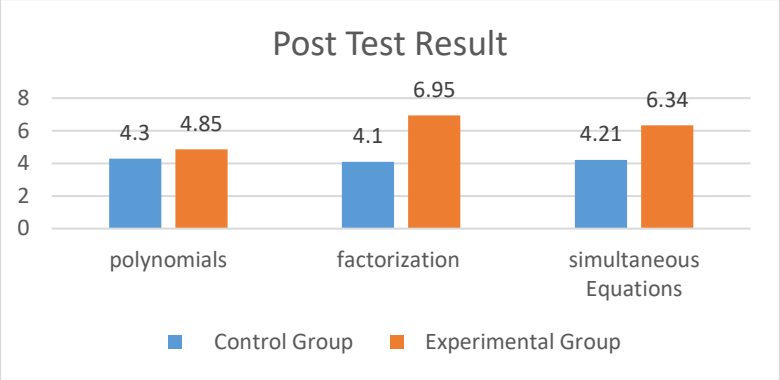
Table 06

Comparison of means scores, standard deviation, and t-test on students' post-test scores in simultaneous equation

Groups	N	M	SD	df	t	Sig
Control	42	4.21	1.3	81	5.6	.000
Experimental	41	6.34	1.9			

Table 06 showed the result of the independent sample assessments and showed that the mean arithmetic accomplishment rate was very different for the experimental and control group for both institutes in content of simultaneous equation as $p<.05$ indicating there was sizable difference in mathematics accomplishment between the experimental and control companies in simultaneous equation of 8th standard and thus the experimental group had much higher than the control group in the content of simultaneous equation.

Comparison of student's scores in Polynomials, Factorization, and Simultaneous Equations.



Conclusion

During this investigation, the Jigsaw-equipped interventions produced greater results for the experimental crew than the non-Jigsaw-equipped ones. The post-test rankings revealed that there was a significant difference in the two groups' typical achievement of mathematical principles in the algebraic domains, with the exception of the polynomial portion. Jigsaw did increase pupils' understanding of maths, as seen by their superior success levels. Curriculum supervisors, teacher educators, professional development staff, classroom teachers, and those who were first hired as teachers were all encouraged by this study to incorporate the Jigsaw method into mathematics instruction.

Discussion

The purpose of this study was to determine how the Jigsaw approach affected the eighth-grade students' academic performance in algebra. The results of this investigation aligned with those of Khan's (2015) study. It was found that the Jigsaw method works well for teaching chemistry to secondary school pupils in District Peshawar. Students' performance in chemistry has improved as a result. The study's findings demonstrated that the Jigsaw method outperforms the conventional teaching approach. The findings of this investigation supported the research conducted by Doymus and associates (2010), which indicates that the Jigsaw technique outperforms the control group. According to Doymus (2007), the Jigsaw approach has a greater impact on students' academic performance than individual instruction.

This study validates a number of research studies that examined the impact of the Jigsaw approach on mathematics learning (Sabbah, 2016; Darnon et al., 2012; Iqbal & Rashid, 2020). The findings of those studies showed that the Jigsaw technique improved elementary and secondary students' mathematics performance.

The study "The Effect of Jigsaw model of Cooperative Learning on improving student learning in Science learning at Elementary school" was carried out by Iqbal and Rashid in 2020. The study used an experimental design with a control group, an experimental group, and a pre-test and post-test. Students in the eighth grade at Musa Kalan Government High School in the M.B. Din district made up the population. The findings showed that the experimental groups outperformed the control group, suggesting that the Jigsaw technique is superior to the conventional teaching approach.

The results of this study supported every previous study listed above that found the Jigsaw approach had a beneficial effect on eighth-grade students' academic performance in algebra. This covered subjects like as factorisation of polynomials and simultaneous equations.

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