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# Effect Of Jigsaw Method On Higher Order Thinking Skills (Hots) In The Subject Of Mathematics At Elementary Level

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## Abstract

In our everyday lives, mathematics is an essential subject. Teaching of mathematics subject used of several methods one of them were jigsaw cooperative learning method to improve the students higher ordered thinking skills. The research purpose was to investigate the "Effect of jigsaw method on higher order thinking skills (HOTs) in the subject of mathematics at elementary level"; the study's purpose was to find out the effect of jigsaw method on analysing, evaluating and creating. The hypothesis was tested that the mean score of the test group and the control group is not significantly different on analysing, evaluating and creating skills of students. The population of study was all students at elementary level in district Peshawar. Purposive sampling techniques were used. The sample size was 60 students and two groups of each were made. The method is used experimental and the design is pretest-posttest control group. The major finding were analysed by applying t-test and conclusion was drown. This study concluded that the jigsaw method is important for academic performance in District Peshawar elementary school since it is more efficient for mathematics learners. Comparing the effect of the jigsaw technique and the traditional method for academic results, the jigsaw method is more efficient than a traditional method since it has an influence on the student's learning process forever because the effect of learning in the motivate environment.On the basis of findings, it is suggested that the

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jigsaw method should be applied for teaching at elementary level. The curriculum maker/experts should include this strategy best for teaching of mathematics at elementary level. The jigsaw method policy should be included in the Ministry of Education for new students. Teachers involved in educational institutions suggest and emphasis on jigsaw methods as teaching approaches for learning, since it enhances students' academic achievements particularly in mathematics.

**Key words**: Effectiveness, Jigsaw Method, Higher Order Thinking Skill, Analysing, Evaluating, Creating, Student's Achievements, And Elementary Level.

**Introduction**

It is obvious that mathematics is a real or genuine tool for functional education. Students are concerned about lower achievement in all of their beneficial subjects as a result of this vision. Jacob, R (2008) says education achievement draws students' performance and is built on a standard measurement, i-e, analytical thinking test, performance test, skill test. This is not to explain educational achievement by gathering data on the consequences of understudies' participation in a learning system or movement. As a result, learning refers to a change in an individual's social performance rather than just a change in their behavior. Instruction accomplishment is a valid and genuine arranged connection that outlines the enormous demonstration of wanted work. (Rix, 2010).

**What is jigsaw method?**

The 'Jigsaw Method,' the way pupils work in groups and rely on each other, is the approach used. This teaching approach is efficient for the multipurpose and personal responsibility of students each member has something unique in this basic method to group work to contribute to the ultimate output of the group, much as every piece of a puzzle is combined to make a finished image. As no one else works on the same initiative at school, every kid has a more linked sense of ownership with his colleagues.

**History of jigsaw method**

In America in the late 1950s, public schools were decommissioned. Brown v. Decision 1954 of the Education Board of the US Supreme Court laid forth a statutory condition for the integration of public schools, which found separating schools fundamentally uniform. The merger actually lasted years and was hard and tough. Schools have become frequent for struggles, intolerance and hate crimes. New students were intimidated by white, nationalist and racialist white groups. This made pupils feel insecure and damaged their academic skills overall in their courses. Without incident, students will hardly stay in the same room, let alone work together. For

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teachers, students, parents, friends and the whole nation this created problems since omnipresent hostility and prejudice prevented the whole student generation from studying. During this time, counselors were invited to inform schools on how the problem may be handled. Dr Elliot Aronson was engaged in 1971 to provide advice on how to disarm the hostile teaching facilities and student distrust in an Austin, Texas School District.

He employed the therapeutic method for helping students deal with classroom difficulties, which was at the time Aronson was a lecturer at the Austin University in Texas. The student's degree of rivalry has always reached its peak. It immediately became clear that students were encouraged to harass and discriminate against other people who are different from them to progress their rank in a competitive setting in the classroom. To resolve this question, students were segregated into various groups so that they would be able to work together and the competitive atmosphere would be minimized. Students were unable to adjust to the ethnic disparity of the school. Aronson created an atmosphere that promoted stronger cooperation and minimized resistance to working together. Aronson invented activities that made every member of the group feel equally important. The pupils had to be very diligent and gather many data from the other class members. This enables every member of the group to offer a small part to the greater scene, making it all essential for the group. Since they want other students to do well and their score depends on other students, this allows students to rely on one other and reduces their abuse.

**Steps of jigsaw learning method**

Conferring to panitz (1996) shows that students may find new knowledge and use the concepts which they can acquire and relate their level of thought. It can boost fresh experience in learning. The pupils' active participation in the learning includes. Traditional methods of teaching include passive data recognition. Furthermore, Peniutz found that collaborative learning may be carried out in a way that segregates material into separate components. Every individual in the group becomes expert in another concept, trying to clarify it to other members of the group.

I..... The instructor separates participants into four or five ethnically and racially diverse groups or teams

II. A leader, who must be mature in the group, must be a student from each group.

III. The instructor is divided into four or five categories.

IV..... Appointment of expert groups in the provided material after mastery.

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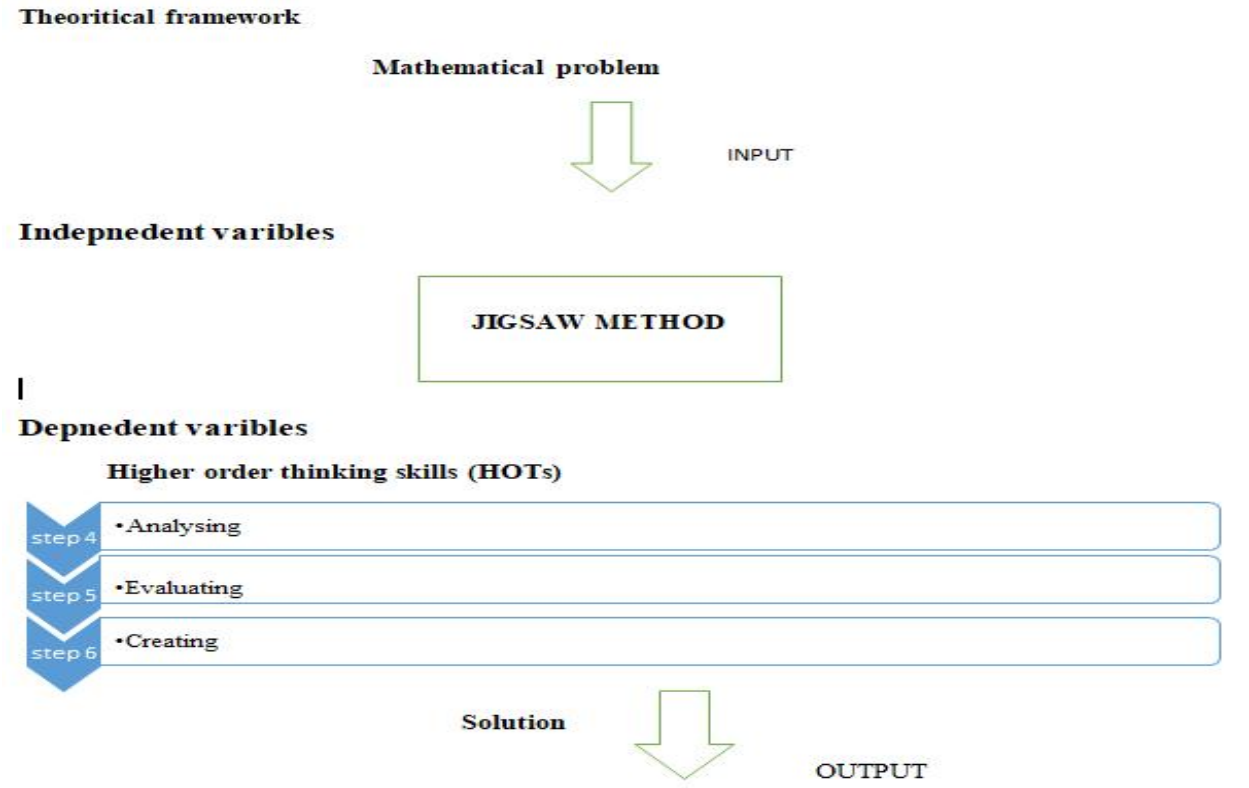
V..... The pupils float from group to group for mastery.
VI..... In the end, quiz is going to be taken.

## Conceptual Framework




## Statement of the Problem

The progressive of science and technology is based on mathematics. Students are used to of root memorization. In many researcher proof that this is more boring and dull subject. Results of many study conducted around the globe found that jigsaw method effect positively contribute towards academic achievement of learner. Traditional method that is incapable of developing higher order thinking skills (HOTs) at mathematics. This review was absorbed in order to discover how the Jigsaw method works in the field of mathematics to develop higher-order thinking skills (HOTs). The intend of the study was to find out the effect of jigsaw method on higher order thinking skills in the subject in mathematics.

## Research Objectives

1. To find out the effect of Jigsaw method on analyzing skills of students.
2. To investigate the effect of Jigsaw method on evaluating skills of students.
3. To check the effect of Jigsaw method on creating skills of students.

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**Research Hypothesis**

Ho1: There is no significant difference between the mean score of experimental group and control group on analyzing skills of students.

Ho2: There is no significant difference between the mean score of experimental group and control group on evaluating skills of students.

Ho3: There is no significant difference between the mean score of experimental group and control group on evaluating creating skills of students.

**Review of Literature**

**Higher Order Thinking**

Tutkun (2012) defines content that in blossom's scientific categorization noteworthy made to address the old sprout domain. Higher order thinking plays an essential part in the ability to grasp things. According to studies, when kids' higher level thinking is overloaded, teachers notice more growth in their pupils' reading scores.(Peterson & Taylor, 2012). Teachers encourage their pupils to use techniques to think better reading examinations. This implies that they perform better in reading tests. The following are examples of the higher orders of thinking: questioning, writing and connecting levels. First, there are three kinds of issues of higher order. Teachers might first query the subject of a tale for kids. This sort of higher level survey helps pupils comprehend the basic theme of the tale. The question about friendship is the following: "How do you know someone is your friend?" Character explanation is another example of higher order issues. This is the time when students consider the more profound characters. "How has the character changed through the whole tale, for example?" This causes students to think deeply about a character's motivations. When pupils connect, the last higher order question is (Peterson & Taylor, 2012).

The last kind of inquiry is when students create connections while reading about the next issue in higher order thinking. During reading, children can form three sorts of connections: text-to-text, text-to-self and text-to-world. If kids can connect, they use tactics of a higher order. Finally, writing is a higher-level thinking method. Integrating reading with writing improves understanding, because both processes are reciprocal. Writing involves kids, expands thoughts and improves comprehension (Knipper & Duggan, 2006). Therefore, if students write after reading, they should become more aware of the text. (Sulliv, Ginasilva. 2018).

The components extend a wide range of exercises and goals, but do not cover the new destinations of information and communication

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technology development and reconciliation into the hall and life of our undergraduate students.

**Revised Bloom Taxonomy Cognitive Process Dimension**

This taxonomy is divided into six categories that collect and clarify the "verbs". They are more likely to be knowledgeable, while understudies rely on possible teaching.(Anderson, 2000).

**1. Remembering**

The first aspect of the new RBT is the lowest level of cognitive skills. For this dimension, the learner recognizes and recalls more significant information and knowledge of the memorial's overall arrangement. The estimation consists of both basic substitute sessions, i.e. recognizing and recalling the ability to recall past information and recollection of that required (Anderson 2000).

**2. Understanding**

The revised bloom taxonomy (RBT) is the second dimension of the lowest order of thought abilities. The understanding of progression agreements by ability between understudies can describe as well as repeat concepts to give them their own understanding. They have more parts, such as interrelating, comparing, exemplifying and summarizing. (Anderson, 2000).

**3. Applying**

The third or last aspect of the revised bloom taxonomy (RBT) is the lower order of thinking skills. The aspect of arranging ability of utilizing learned knowledge related or innovative. That is, they demonstrate their learning outcomes by executing and implementing them in an especially innovative or ancient situation.

**4. Analyzing**

This is the first aspect of the (RBT) taxonomy in the higher order of thinking skills. The aspect of breaking down knowledge into different parts and studying all of them helps to comprehend the entire data. This ability dimension is distinguishing, organizing, and attributing.

**5. Evaluating**

The higher order of thinking skills is the second aspect of the (RBT) taxonomy. The ability to check and critique process agreements is an important aspect of them.

**6. Creating**

The third aspect of the revised bloom taxonomy (RBT). The previous taxonomy was not included. It has most astounding capacity as well as changed through the combination of past taxonomy. They include the placement of knowledge, the improvement of innovative knowledge, and

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the creation of something new. It incorporates creating, delivering and arranging. The learning outcomes of this capacity are dependent on combining bits of information to create new or unfamiliar thoughts and things. Plans have been made to prepare new things to assess how well the task needs to be complied with (Anderson, 2000).

**Methodology**

The study was defined the effect of jigsaw method on higher order thinking skills (hots) of mathematics at elementary level. For appraising academic achievement of elementary students pretest post-test design of experimental research was implemented of both groups experimental and control group. The research was quantitative. The approach was truly experimental, namely the independent variable for the pretest and post-test control group while achievement is dependent variable. The sample of study was preserved with experimental and control group techniques through jigsaw method.

**Population and Sampling**

The population is a group of individuals having few similarities, according to Gay (2000). Creswell (2012) defined population as a collection of people who have shared features or belong to a certain demographic. The study population is composed of elementary students who study at the University Public School (UPS) Peshawar. According to kpk Directorate of Educations Statistics Report (2014-15), there are two hundred ninety six Schools in in Peshawar with total student strength of 9958 male students. Purposive sampling technique used for this study and sample is taken from L.R GAY book at p, 125. The sample of study is taken from University Public School (UPS) Peshawar. There was a school chosen to study. The list of students was provided to allow a simple random sampling technique to retrieve the sample. The size of the sample was 60 students of class $8^{th}$.

**Internal Validity Threats**

(History, Maturation, Testing, Instrumentation, Statistical Regression, Selection, Experimental Mortality)

**External Validity Threats**

(Selection Bias, Reactive Effects of Experimental Testing, Multiple Treatment Interference, Validity and reliability)

**Research Instrument**

Two techniques for measuring the instruments used in this investigation. First, the right response paper was selected and the question was answered by both the research supervisor and specialists. Second, under the supervision of the supervisor, the subject of the mathematics was picked. The editor selected the right answer paper when minor

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modifications were made. After the review process, mathematics picked the right answer paper for the pre-test post processes. The student received the correct reply paper. The assessment tool for pupils has been developed using Khyber pukhtukhwa Text Book Board mathematics book. The gadgets were utilized as the test for fixed marks for assessing the experimental and control group. The test was 100 marks in the data gathering performance / performance test. The puzzle approach and therapy were utilized.

**Data Collection and Analysis**

For data collecting, the researchers utilize an experimental technique. Both groups were chosen from the institution for this investigation. The study was conducted in the field of mathematics using Jigsaw's Higher Order Mental Knowledge technique, such that two groups, experimental and control groups received a chapter. Data is statistically significant ANOVA and t-testing using SPSS analyzed one way. Lesson planning is use for the contents of the mathematics of Khyber pukhtunkhwa text book board. The sample test is prepared and tested upon the students accordingly.

**Results**

**Demographics Data of Experimental Group**

| Sr. No | Age group | Frequency |
|---|---|---|
| 1 | 12-13 | 18 |
| 2 | 14-15 | 10 |
| 3 | 16-17 | 2 |
| | | Total = 30 |

The experimental group was taught by jigsaw method, in which the majority of participating respondents are from the 12 to 13 age group. It is approximately 60% of all respondents. Age of 14-15years was 33.33% in respondents. There were 6.66 per cent of the 16-17 age groups

**Demographics Data of Control Group**

| Sr. No | Age group | Frequency |
|---|---|---|
| 1 | 12-13 | 18 |
| 2 | 14-15 | 19 |
| 3 | 16-17 | 1 |
| | | Total = 30 |

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The participant is 60% from the age of 12-13, and statistically the groups were grouped to determine how many learners are inside each age group. The second class intervals, i.e. 14–15, representing around 63, 33% of the total population, were associated with most of the responses. This control group was taught by traditional methods and 25% of learners are 16 to 17 years old. In 16-17 years, the lowest number of people examined.

**Validity and reliability**

The instrument content has been chosen from the textbook Khyber pukhtunkhwa. The supervisor and teacher of the Department of Education at Islamic International Institute Islamabad reviewed Pretest and Posttest's choice of the proper one. To guarantee consistency, cronbach alpha was calculated using the reliability test.

**Descriptive statistic pre-test and post-test mean comparison of jigsaw method**

| **Pre-test & post-test Means of jigsaw method of teaching** | | |
|---|---|---|
| **Particulars** | **Pretest** | **Posttest** |
| Multiple choice question | 36.5333 | 48.3000 |
| Question Answers | 4.0667 | 9.4667 |
| Total | 40.6 | 57.7667 |

The traditional post-test mean values reflect greater than pre-test values comparison of pre-test and post-test mean of jigsaw technique in part. The pre-test mean values for multi-choice are less than the mean value sections for post-test. It shows that pupils educated via questions in MCQs will not obtain higher results. The total number of questions asked via the jigsaw technique was 36,5333. The mean after test was 48, 3000, which meant improvement was on the jigsaw method, although the jigsaw procedure worked better on the academic performance of students. The response to the question is less than the mean value after the test. It shows that the pupils taught using jigsaw technique will not obtain superior results. The total answering method for the jigsaw was 4,0667. This means that the jigsaw technique progressed, but the jigsaw method was more successful in the academic performance of the student.

**Descriptive statistic pre-test and post-test mean comparison of traditional method**

| **Pre-test & post-test Means of traditional method of teaching** | | |
|---|---|---|
| **Particulars** | **Pretest** | **Posttest** |
| Multiple choice question | 28.1000 | 32.9667 |
| Question Answers | 3.4000 | 7.1000 |

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| | | |
|---|---|---|
| Total | 31.5 | 40.0667 |

The traditional method after testing means values are higher than the pre-testing values and comparisons between pretest and post-test mean of the traditional method in part. The pre-test mean values for multi-choice are less than the mean value sections for post-test. It shows that pupils educated via jigsaw method in MCQs will not obtain higher results. The mean of pre-test question in all was 28.1000 for the traditional method. The mean after test was 32.9667, meaning that post-testing is more official than multiple section pre-testing. The response to the question is less than the mean value after the test. it shows that the students taught with traditional methods would not achieve better results in this question. Altogether the traditional pre-test response method was 3, 4000. The mean after-test was 7,1 000, which means that the traditional post-test method is better than the pre-test answer.

**Finding**

1. All the learners were taken from 8th class. Most of the participants from experimental and control group were related to 12 to 13 year age group. The gender of all the participants was male and more than half of the participants belong to Middle class family.
2. The two Experiment Group and Control Group meetings were conducted by the researcher himself. The group was first watched and instructed using the jigsaw technique. The first day focused on innovative inspirational learning settings. It was found during the instruction of the experimental group that the newly introduced teaching approach enjoyed and satisfied them. They are engaged and interested in learning through a new motivated technique that gives them a pleasant atmosphere through natural events or surroundings that favorably affects their academic performance. The performance of the experimental group participants was good for multiple choice questions. As seen in figure 2, they had increased considerably from 36, 5333 to 48, 3000 pretest and posttest means across all MCQ parts. The shift of the scores using the jigsaw approach increases progress in all questions of multiple choices as it enhances the academic success of students.
3. The table number one of statically analysis reveals the average rating of 48.3000 jigsaw method participants and 32.5000 for all traditional method participants. The picture expressly shows that the new style of teaching served to inspire and motivate participants in academic performance 4.2. They were forced to talk about the issue by their nature. The jigsaw procedure increases its degree of cognitive, understanding,

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remembering, application and idea that improve the performance of the traditional method in comparison.

4. Some experimental participants felt hesitant to take a new approach to teaching. After a few of days, the students and their classmates were acquainted with the many ways of learning using jigsaw technology. The pupils studied and read carefully. In the 1st segment of multiple-choice JM issues, the median result of the participants is greater than the TM. Students Study successfully and learn to improve knowledge and cognitive abilities among individuals. The averages of the participants in first 40 multiple choice questions were lower in the multiple choice questions than in the experimental group, respectively 1.96 and 2.53. Discussion of phenomenon knowledge leads to autonomous, seamless communication. It removes participants' unintentional mistakes to convey a whole coherent statement to others and allows them to accurately select questions and correctly write the response to the type paper.
5. The mean of the participants to the jigsaw learning method was 7,1000 in Section Two of the question answer and was comparably better than in the traditional method as shown in Table 4.2. This demonstrates that the students answered the negative questions using a jigsaw method relatively better.
6. The second section was consists of multiple choice question & question answers. The multiple-choice question score was 28.1000 for participants. The median group was 32, 9667. The score for the solution was 3, 4000 for the participants. The mean group of motivators was 7, 1000. This mean distance suggests more encouraging and better than TM motivating technique. Students supplied essential descriptions and comprehension notes. They present essential remarks, questions and points about the topic. The talks of the student provide comprehensible solutions to the problems.
7. The mean values in the total participants of control group were 1.12. The mean score in the test total was 2.14. It shows that the participation is more successful than leaning through the traditional method in the jigsaw effect.
8. In the study of pre-test results, it has been shown that learners progress in post-test in comparison to pre-test results. In traditional method, the average pre-test results totaled 30 whereas in post-test, as shown in Figure 4, there was a slight increase. 3. The conventional teaching technique has beneficial impacts on the academic success of students, and also suggests that the students have progressed via the traditional

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style of teaching, whereas the students paid less attention in a tranquil atmosphere, especially in practically every lecture. The researchers themselves observed and gave the entire presentation. In the beginning, they took full interest in studying, and listened carefully to what has been taught and why they were good at the test.

9. By comparing both teaching approaches, the statistical results of pre-test and post-testing in relation to jigsaw methods stressed that the mean difference of the jigsaw method was larger and more progressive.
10. In all the parts of multiple-choice question, the statistical and interpretive analysis (t-test value) reveals that the traditional method was not as successful as the jigsaw method, as evidenced by results.

**Discussions**

The major purpose of the present study was to describe the impact of the jigsaw method on the topic of mathematics. The researchers picked the experimental study and the outcomes based on the data analysis from pre-test & post-test papers for this purpose. The primary objective of the study is to determine the efficacy of the jigsaw method on elementary school academic success of pupils. The researchers performed and created objective type papers in order to compare the effect of the jigsaw technique with traditional method.

Researcher personally arranged the meeting with each participant. It is observed that the experiment group of students was interested in new way of teaching. According to Saha (2020) devote Also explain in your study that the jigsaw technique has a good impact on the academic success of the student using traditional methods. This study finding Students were able to easily discuss the various subjects of the teacher's lessons and created appropriate comprehension notes and outlines. They discuss numerous key aspects and raise crucial issues for a class to address. Rosenthal, devoid of research, also offers comparable results which stimulate motivation and involvement via the management of the classroom.

The new administration of the classroom encouraged and motivates the inclination of the student to debate the topic freely. Some learners are reluctant to study and are aware of the many ways of education using jigsaw methods. The students were reading and learning with full attention and motivation. The students discussed well and from motivated groups they switch to master groups to improve learning, and focus on the jigsaw technique. The students were easily involved in the discussion. Each type of class rewards and promote different pattern of interaction among the

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students. Jigsaw method enhances the cognitive understanding of the Students (MartínezSanchis et al., 2020).

Students were contributing equally in the classroom during the lecture. In order to grasp and absorb the equal portion of the book content lesson, learners were separated from teaching material. The motivation helps you enhance your degree of cognition. The knowledge should also be remembered and understood for a lengthy duration. The learner and his colleagues are interested in pupils who were less careful in the course of teaching and learning. According to Kim, Kim, Koo, and in his research, additionally Cannon (2019) highlighted that this strategy leads to the low and high degree of ability that the jigsaw method requires to encourage and motivate.

During Less attention was paid to teaching in the traditional context, especially towards the end of each lecture, by the students. The researcher observed and transmitted the entire lecture. They were really keen to learn and listen carefully to what teachers taught during supplication, but after some time only few teachers began to lose focus. During the lecture several of the students made noise. In addition, in their research Gentrup and Rjosk (2018) stated that pupils can be lost in the traditional study method. After some period in traditional methods of learning, students lost their ears and don't pay attention to teaching throughout class.

The teacher could not answer the questions efficiently and fully at the end of the lesson. Eden (2018) emphasizes that traditional learning methods have less impact on students than jigsaw methods on problems.

Researchers studied how the jigsaw process increased the learning of learners, which positively affects their academic performance. The study reveals that the jigsaw technique in the field of, mathematics is more significant and successful.

**Conclusions**

1 For elementary students, the jigsaw method can be used. This policy should be included in the Ministry of Education for new students. Teachers involved in educational institutions suggest and emphasis on jigsaw methods as teaching approaches for learning, since it enhances students' academic achievements particularly in mathematics.
2 Eight classes took all the leaners. Most experimental and control group participants had 12-13 years of age. The gender was male, and over half of the participants belonged to the families of the middle classes.
3 The two Experiment Group and Control Group sessions were performed by the researchers themselves. The Experiment Group was first watched

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and the jigsaw approach was taught. The first day was guided to new learning environments. Participants.

4 It was found that they were enjoying and happy with the teaching method introduced recently during the teaching of the experimental group. They were engaged and interested in learning using a unique motivated method that offers pleasant environments through natural circumstances or settings. It has a favorable impact on academic performance of students.

5 Khyber Pashtun's current text board can contain guidance on delivering the information about the relevant subject to be taught using traditional jigsaw methods on the last page of the book. The policymaker and the educational planner might provide guidance on the material which should be taught in particular by a jigsaw method with a traditional method.

**Recommendation**

1. The jigsaw method may be applied for elementary school students to enhance their vision of learning. The Jigsaw method can be used in elementary school learning for school students.
2. The Education Ministry may include a policy to enhance the education process at elementary school level.
3. The policy makers, educational planners and teachers may use combination of both jigsaw method and traditional method at elementary school level to increase students" academic performance.
4. The school administration may need to develop and maintain the strategy plan for efficient use of jigsaw method with motivational guidelines that will produce significant outcomes in the student's academic achievement.
5. The school administration may need to develop and maintain the strategy plan in efficient use of jigsaw method with motivational guidelines for the students that will produce significant outcomes in the student's academic achievement.
6. School may arrange a motivational sessions for students" parents students and social people regarding the importance of jigsaw method.

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