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INVESTIGATING THE EFFECT OF ORI-GEOMETRY FOR IMPROVING THE VISUALIZATION ABILITY IN MATHEMATICS

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ABSTRACT

The study was aiming at observing the effect of ori-geometry on visualization ability in mathematics. The major objective of the study was;to investigate the effect of ori-geometry for improving the visualization ability in Mathematics. To achieve the above objective, null hypotheses were tested. A sample of 40 students from class three was used in the study. An experimental equivalent group pretest post-test research design was used in the study. For data collection pretest, post-test and retention test were developed. To measure the performance of the students, statistical techniques such as mean, standard deviation and t-test were applied to analyze the collected data. The results of study indicated that there was significant effect of ori-geometry on the performance of students. The results revealed that the students of experimental group performed better than the students of control group. It is therefore recommended that this study is equally significant for all elementary level students, teachers, researchers and curriculum developers. For the improvement of visual spatial skills of students ori-geometry methods should be used while teaching mathematics of elementary level.

Keywords: Ori-geometry, visualization, Mathematics

INTRODUCTION

Nature cannot be assumed without mathematics because mathematics is the language of nature. A vibrant role in human life is played by mathematics. From earlychildhood to secondary education all over the world learning mathematics is an important quantity of the curriculum (Khan, 2011).

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secondary education all over the world learning mathematics is an important quantity of the curriculum (Khan, 2011).

In everyday tasks visual spatial relationships are also important. .Spatial ability is "the capacity to create and manipulate mental representations in the mind". It was described as the skill in demonstrating, altering, creating, and eliciting symbolic, non-linguistic information. The term "spatial aptitude" was regularly used to refer to skills involving space around. The intellectual handling of things and their components in 2D and 3D space, according to his general definition of spatial ability. In other words, although the same term has been defined in many literary works, we may say that the perception of spatial ability is one of picture manipulation in the mind (Cakmak, 2009).

Objective of the Study

Major objective of the study was as under; to investigate the effect of ori-geometry for improving the visualization ability in Mathematics

Hypotheses of the Study

The following null hypotheses were tested to achieve the objective of the study;

H01: There is no significant difference between the mean score of control and experimental groups for improving visualization ability in Mathematics in pretest.

H02: There is no significant difference between the mean score of control and experimental groups for improving visualization ability in Mathematics in post- test.

H03:There is no significant difference between mean score of control and experimental group for improving visualization ability in Mathematics in retention-test.

H04: There is no significant difference between mean score of experimental group for improving visualization ability in Mathematics in pretest and post-test of experimental group.

H05: There is no significant difference between the mean score of the control group for improving visualization ability in Mathematics in pretest and post-test.

Significance of the Study

Origami is a novel idea for Pakistani students especially for Mathematics teachers. They mostly used a traditional method of teaching to teach Geometry to students. Students, especially in rural schools mostly used to learn Geometry through pen, pencil, and by drawing shapes. They did not have much deep conceptual knowledge due to reason; they learn geometry with traditional methods only. So, to build their concepts, and to improve their skills in the Mathematics field required to change the traditional method to the modern method of teaching geometry, that is Origami (a paper folding method used by Japanese and Chinese teachers in their classroom). This study tried to explain the importance of ori-geometry for the improvement of visualization among students in their daily life.

Literature Review

The outcome of education and its systems is directly related to societal change. There is need to change the teaching of mathematics according to National Curriculum for Mathematics (2006) from transmission of knowledge to understanding of Mathematical concepts with the focus on active involvement of learners as every new era has different needs and demands from the former ones. The education system required rearrangement and greater emphasis on subjects like mathematics after Pakistan's independence. Pakistani teachers of mathematics usually used deductive method of teaching with a single teacher for teaching mathematics. Memorization of Mathematics formulae to solve Mathematical problems with reflexive involvement of students is practiced in such kind of teaching. While teaching mathematics students are supposed to note down the answers on their note books by coping from the blackboard. The subject of mathematics is divided into arithmetic, which studies numbers; algebra, which studies structures; calculus; and geometry, which studies space. Due to its characteristics, for example, language, symbols, and abstraction in its conceptions, the subject of mathematics is dissimilar from other subjects. Many students faced trouble learning mathematics. In general, a single mathematics teacher cannot address all of a student's flaws in the learning of mathematical theories (Iqbal, 2016).

According to Utomo (2017), visualization plays a crucial part in the development of the cognitive process, in understanding mathematics, and in the transition from concrete to abstract cognition while tackling a problem. There has been some research on the advantages of visualization in relation to arithmetic problem solving. Additionally, the new Bruns wick Mathematics Grade 8 Curriculum Guide (2011) noted that one of the crucial elements that established the mathematics education objective was visualization. In33 general, the topic of visualization and its relationship have been covered in some research. In defining "visualization", there were a number of terms that were frequently used and could be altered by literature, including "visualization" "visual literacy" and "image".

Mathematical visualization" was a mental skill or mental activity where a person enhanced the link between an internal construct and something accessed by the senses. The ability to see, generalize, explain, prove, and imagine visual information was a key component of mathematical visualization and was crucial for comprehending pictures and other visuals. Visualization was a method of creating an image through an action where a person created a strong connection between their thoughts and something they could access through their senses. In addition to construction and thought, visualization was one of three free cognitive styles that served a distinct is technological role in mathematics. It was defined as an act in which a person creates a solid link between an internal construct and something to which they have sensory access. Such a link can be established in either of two directions. Any mental construction of things or procedures that a person associates with things or events they believe to be external might be considered a visualization act. An alternative to visualization is the formation of images that one associates with actual objects or processes in their mind on a surface other than their mind, such

as paper, a white board, or a computer screen. There were some parts of the visualizing process that were useful in addressing mathematical problems, such as:

- Knowledge generation: To gather information on problematic goods.
- Inspection: Inspection, the selection of a specific mathematical concept to solve a problem;
- Transformation: Transformation is the modification or manipulation of the representations of a mathematical notion to address a problem.
- Use: Use this to create representative forms for problem-solving.

The term "visualization" refers to a technique that makes the invisible visible. It can also refer to the concretization of abstract ideas, their illustration, or the arrangement of abstract ideas using visual elements (such as images, graphics, etc.) in such a way that they are easily understood by the sense of sight. Mathematical visualization's most significant advantage is its ability to reduce the degree of abstraction by making concepts more concrete. This is crucial for pupils who find it difficult to comprehend complex mathematical ideas (Delice, Taşova & Ali, 2011).

Visualization is a skill, a process, and a result of creating, interpreting, using, and reflecting on pictures, images, and diagrams in our minds, on paper, or with technological tools with the aim of illustrating and communicating information, thinking about and developing previously unrealized ideas, and improving understandings. The emphasis in this description is on the fact that visualization is a potent tool for exploring mathematical issues and for providing context for mathematical ideas and their connections. In situations where there is a lot of information to process, visualization helps to simplify things (Rösken, Rolka, 2006).

Origami has become a popular instructional method in the mathematics classroom. Numerous books and practitioner articles cite origami as a useful way to teach mathematics concepts, especially as it relates to geometry and spatial concepts. In addition, the National Council of Teachers of Mathematics (NCTM), in its Principles and Standards of School Mathematics, supports the use of such methods, suggesting that students engage in active exploration that allows students to study the construction and deconstruction of two- and three-dimensional figures. An examination of literature regarding origami as an instructional tool, however, reveals a lack of studies focusing on the impact of origami instruction within the mathematics classroom (Boaks, 2009).

Risma (2013) conducted a study on developing students' spatial visualization abilities. Risma explores the building blocks and abilities of the students through learning activities. The objectives were to study students' visualization and interpretation of the building blocks and how their visualization ability was enhanced. The result of the study showed that experiences in spatial visualization related to students practical abilities in three dimensions significantly improved.

Research Methodology

Sample of the study

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By using convenient sampling method, Government Boys High School Shakardara, Attock was chosen as the sample school. Forty students (Boys) from grade-3 were chosen as subjects of the study.

Research Instrument

A teacher made pretest and posttest was used as research tool. In order to split the class 3 pupils into the experimental and control groups, a pretest was given to them. While the control group received standard instruction, the experimental group received the therapy (Paper-pencil technique). The experimental group received therapy for six weeks, and both the experimental and control group's subjects underwent a post-test. This study sought to determine how ori-geometry affected students' visualization ability. The tests that came next were carried out to collect the data.

Data Analysis

H01: There is no significant difference between the mean score of control and experimental groups for improving visualization ability in Mathematics in pretest.

Table: Significance of difference between the mean score of control and experimental groups for improving visualization ability in Mathematics in pretest.

Group	N	Mean	SD	df	t-value	p-value	Effect
Control	20	3.38	2.09	38	0.26	0.000	Insignificant
Experimental	20	3.95	1.51				

table value of *t* at 0.05=2.093 *insignificant

Table shows that the t-value was 0.26 which was less than the table t-value at 0.05 level of significance. Hence there is a weak evidence against the null hypothesis. So we fail to reject the null hypothesis. It means that there was no significant difference between the mean scores of experimental and control groups for improving visualization ability in mathematics in pretest which states that both the groups were identical for improving visualization ability.

H02: There is no significant difference between the mean score of control and experimental groups for improving visualization ability in Mathematics in post- test.

Table : Significance of difference between the mean score of control and experimental group for improving visualization ability in Mathematics in post-test.

Group	N	Mean	SD	df	t-value	p-value	Effect
Control	20	7.35	1.93	38	10.56	0.0001	Significant
Experimental	20	14.35	2.24				

table value of *t* at 0.05= 2.093 *significant

Table indicates that t-value was 10.56 which was greater than table t-value at 0.05 level of significance. Hence the null hypothesis was rejected. Hence, null hypothesis was rejected which indicates that there was a significant difference for improving visualization ability in Mathematics between the mean score of control group and experimental group in post-test.

H03:There is no significant difference between mean score of control and experimental group for improving visualization ability in Mathematics in retention-test.

Table: Significance of difference between control and experimental group for improving visualization ability in Mathematics in retention-test.

Group	N	Mean	SD	df	t-value	p-value	Effect
Control	20	5.95	1.39	38	21.72	0.000	significant
Experimental	20	15.80	1.47				

table value of *t* at 0.05= 2.093 * significant

Table shows that in retention test the mean value regarding visual ability of the students in the subject of mathematics was (15.80) that was much greater than the mean values of the scores (5.95) of control group. The calculated value (21.72) was also much greater than the table value. It shows that there was a significance difference between the experimental and control group in retention test. Hence, there is sufficient evidence to reject the null hypothesis.

H04: There is no significant difference between mean score of experimental group for improving visualization ability in Mathematics in pretest and post-test of experimental group.

Table: Significance of difference between the experimental group in improving visualization ability in Mathematics in pretest and post-test.

Group	N	Mean	SD	df	t-value	p-value	Effect
Control	20	3.95	1.51	19	17.16	0.000	significant
Experimental	20	14.35	2.26				

table value of *t* at 0.05=2.093 * significant

Table shows that the t-value was 17.16 which was greater than the table value (2.093) at 0.05 level of significance. Hence there is sufficient evidence to reject the null hypothesis. It indicates that there is significant difference in the mean scores for improving visualization ability in mathematics between the pretest and the post-test of experimental group.

H05: There is no significant difference between the mean score of the control group for improving visualization ability in Mathematics in pretest and post-test.

Table: Significance of difference between the mean score of control group for improving visualization ability in Mathematics in pretest and post- test.

Group	N	Mean	SD	df	t-value	p-value	Effect
Control	20	3.38	2.09	19	5.58	0.000	significant
Experimental	20	7.35	1.93				

table value of *t* at 0.05=2.093 * significant

Table indicates that the calculated t-value was 5.58, which was greater than the table value (2.093) at 0.05 level of significance. Hence, there is enough evidence to reject the null hypothesis which shows that there is significant difference between mean scores of pretest and post-test in improving visualization ability in mathematics of the control group.

Conclusions

The result of the study revealed that there was a significant difference between the performance of experimental group students from pretest to post-test and retention test regarding improving visualization ability. Comparatively the performance of the students taught through ori-geometry method of teaching was much better than the control group regarding improving visual spatial ability. In post-test and retention test of both experimental and control group, an increasing trend had been observed regarding mean values of visualization ability.

Recommendations

The present study was conducted to investigate the effect of ori-geometry for improving visualization ability in Mathematics at elementary level. Following recommendations have been made on the basis of conclusions;

- Results revealed that students' visualization ability enhanced through ori-geometry teaching method. So it is recommended that for enhancement of visualization ability of elementary students ori-geometry method should be used in mathematics teaching.
- The study showed that the students taught through ori-geometry method showed comparatively better results as compared to the students who were taught through the traditional method of teaching. It is recommended that the curriculum of mathematics should be revised to incorporate teaching through ori-geometry method. Moreover, different activities in the textbooks at the elementary level be added so that teacher may use ori-geometry method.
- The study showed that students' performance increased due to visualization ability , so it is recommended to to use ori-geometry method for mathematics teaching.

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