

Activity-Based Teaching versus Traditional Method of Teaching in Mathematics at Elementary Level

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Abstract

The aim of this research was to study the effect of activity-based teaching and traditional method of teaching on students' achievement in the subject of Mathematics at elementary stage. The research was experimental based on pre-test, post-test control group design. Two units of geometry were selected from seventh grade Mathematics for this research. Population of the study was the 120 students of seventh grade from GGHS Bhedian Pattoki, District Kasur, Punjab (Pakistan). Sixty students of class seventh were taken randomly from Govt. Girls High School Bhedian Pattoki, District Kasur. A pre-test was administered on them for equalizing the groups. Students were randomly divided into two groups (experimental and control) according to the results of pre-test. Both tests were developed from the seventh class Mathematics book for the compilation of data. Tests were administered keeping cognitive domain in view. Selected unit 10 (exercise 10.1 to 10.4 and revision exercise) and unit 12 (12.1 to 12.6 and revision exercise) from seventh class Mathematics book prescribed by Punjab Text Book Board were taught to both groups (experimental and control) for a period of eight weeks. Activities were used for experimental group only and other group was taught traditionally. Time for the teaching Mathematics was 40 minutes daily to each group. Independent sample *t*-test was applied on the pre-test and post-test scores to check whether there is a difference in the performances of two groups. It was also concluded that students taught through activity based teaching performed better in post-test. It is recommended that in future Mathematics may be taught with activities at elementary level. Mathematics kit containing material for activities may be provided to Mathematics teachers.

Keywords: Mathematics, geometry, traditional method of teaching, activity based teaching/learning

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Introduction

Mathematics is a key subject of study. Mathematics might be described as the essential science. It is that branch of science that utilizes numbers and signs. Numbers and signs are organized utilizing orderly numerical principles. It might be comprehensively defined as the science of space, time, capacity, amounts, shapes, numbers and their association with each other.

It is considered that Math is hard to learn whereas it has unique ideas and is called the study of logical thinking. It assists a person to provide precise clarification to his thoughts and decisions. Mathematics is the establishment for achievement in child's instructive practice. The nation needs such persons who would be capable to handle difficult issues and have competency to take care of various issues. They ought to have the capacity to pass on their ideas to others affectively. Education of Math furnishes the learners by such abilities and manners that are vital for the effective lifespan in a civilization. Knowledge of Mathematics creates inventiveness and unlocks the minds of the pupils. Geometry is one of the most widely used areas of knowledge. It is the key to Mathematical thinking. Geometry is a part of everyday life and different geometric shapes are part of our normal environment. Students take interest in their daily used items. Geometrical items are easily available in students' daily life. So, researcher selected this branch of Mathematics for research study.

Rationale of the study

The greater part of educating in classrooms is completed by traditional method generally. The kids sit silently in rows in the classrooms, the educator does all the speaking and the pupils inactively listen to the instructor. They talk just when approached and do just as they are told. In a conventional classroom, the learning abilities of majority of the learners are restricted only to duplicate what is written on the board and they are not capable of effectively handling the data through thoughts, evaluation and investigation. Because of this constrained intellectual capability, learners lose interest in learning. Activity based teaching is a strategy focused on the idea that learners ought to be included through activities. Activity based teaching is a method adopted by a teacher to emphasize his or her technique of teaching through action in which the learners take interest comprehensively and realize effective learning practices. It is the procedure in which the child is effectively included in taking interest rationally and physically. Activity-based learning is interpreted as meaningful school learning settings in which the learner creates Mathematical ideas through dynamic contribution. This procedure may include the control of physical materials, the usage of games, or participating in experimentations with physical items.

Fundamentals of Mathematics are taught at basic level. Therefore, an instructor ought to instruct the essential equations and ideas with full commitment and constant work. Instructors ought to satisfy the pupils at this level and ought to respond to every one of their questions. Traditional method of teaching Mathematics is still utilized as a part of a large portion of the educational establishments in Pakistan. In this strategy, instructors do not use activity and AV aids in instructing except of white board. Pupils don't appreciate this technique. Utilization of activities can make the education of Mathematics further successful. Keeping this perspective in view the investigator has attempted to work on "finding effects of activity based teaching and traditional technique of teaching Mathematics at students of elementary classes".

Review of the Literature

Mathematics: Mathematics is language of nature and plays dynamic role in human life. Its learning is a compulsory part of curriculum from early childhood to secondary education in the entire world. According to Babar, (2011, p. 23) "Mathematics originates from nature. Mathematics started with simple counting and these numbers adopted new forms with the passage of time. New branches of mathematics came into being. Abstract ideas in mathematics helped in discovery of new formulae which made abstract ideas clear to man." Saleem (2006, p. 28) described, "Mathematics is deductive study of numbers, geometry and different dynamic constructs or structures. It is comprehensively divided into foundations, algebra, investigations and geometry which include hypothetical computer science." Mathematics is simply an extension of reality. Pound (2011, p. 1) described, "Mathematics is the unique key which turns the lock of the physical universe." Nisar (2005, p.1) described, "Mathematics is the science that uses easy words for hard ideas." He quoted the famous saying of Muslim scholar Ibn-Khaldun, "Mathematics cleans the filth of mind as soap cleans the dirty clothes." No other subject can be alternate for Mathematics. Saleem (2006, p. 29) described, "Mathematics is considered as exercise for the brain. It develops cognitive functioning, which enhances ability to think quickly, rationally, practically and abstractly. It also improves general problem solving ability for use in all facets of life." Significance of Mathematics is confirmed mostly by its efficiency, in economics, science, and engineering and in public decision-making. Mathematics is an interesting subject and is helpful in problem solving. Anything we learn from Mathematics helps us in arts, sciences, finance and health. It is true that Mathematics helps us in each and every sphere of life. According to Singh (2004, pp.46-47) "In our daily life it is mixed as the oxygen in the air. Every day of our life begins and ends with the Mathematical thinking. We use Mathematics in our daily household problems, food, clothing, idea of quality and quantity, daily account of income and expenditure, allocation of funds etc."

Mathematics is the queen of all sciences and this imperative subject needs effective strategies for teaching. It is viewed as that Mathematics is uninteresting subject and has theoretical ideas. According to Amirali (2010, p.27), "Mathematics is at the sentiment of numerous effective vocations and effective lives for improvement, especially in extraordinary and quickening change circumstances. However, as a general, a great many people and pupils specially hate Math. The survey of school-based instructive research has found that the larger part of pupils discovers Math as the most tough, unique, theoretical, tiresome, destructive and tedious subject."

Geometry: The concepts of Geometry affect every person from birth to death. Pictures that child draws with points, lines and planes are simply representations of abstract ideas. It provides knowledge and enables students to do things logically. Geometry has central position in the modern Mathematical applications and it plays a vital role in finance, weather forecasting or in other fields. Some Geometrical principles (e.g. equality, proportion, similarity) are implanted in the nature of things. It is useful in many other branches of study e.g., engineering, architecture, interior decoration, construction etc. According to Ahmad (2005, pp. 69-70), "Geometry is the science of space and extent. It develops the ability to draw accurate plans and is important in a person's cultural development. In ancient time, the flood of River Neel erased the sign of measurement of agricultural area. It was for this reason that the area for agriculture had to measure again for dividing among farmers. The area was measured again and again because in those days agriculture near the rivers and flood of river erased its measurement. It became the base of Geometry. Geo means land and metry means measurement. Rafiq and Ansari (2012, p. 125) described about Geometry, "Geometry has a long and wonderful history. It helped us to make art, construct buildings, development of structures and to find different universe. In this way, the learning of geometry remained the center of ancient Mathematicians."

Geometry is the branch of Mathematics stressed with the properties of points, lines, surfaces and solids. Most manufactured items follow ordinary geometric structures: book is rectangular; a wheel is round, a sandwich is triangular etc. Geometry is in this way a unique thought that helps us to examine measure and make objects. It is greatly important, because it permits us to simplify the great complication of nature. Geometry is one of mankind's most powerful thinking instruments. In the words of Kausar and Zaheer (2008, p.19) "Geometry signifies "land estimation." Geometric thoughts were produced by early man when he watched and looked at changed shapes in his surroundings environment and when he was met with the issue of measuring land." The place of Geometry in the school educational programs is very significant. Geometry has central position in the advanced Mathematical applications and it plays a dynamic role in finance, weather forecasting or in other fields.

Traditional Method of teaching: In Traditional Method of teaching the instructor is viewed as the pivot in the classroom, responsible for all actions and guaranteeing that all class room message goes through him or the deductive strategy for instructing. Conventional technique is content focus. In this, instructor remains more dynamic, more subjective and less affective (Singh (2004). Conventional techniques are concerned with the review of true information and mainly disregard higher levels of rational outcomes (Rao, 2001). Traditional teaching strategy works against the normal working of human mind (Weber, 2006). Students are involved in repetitive learning. Instructor forces the students to repeat the material that has been told to them. Corporal punishment, hatred of the teachers and frightening role of commanding teacher is noticeable generally in our classrooms. During the long conventional teaching periods, interests and consideration of learners can't be looked after (Cangelosi, 2003).

Conventional strategy is an instructor focused technique. In the conventional technique, a lot of tension is laid on the educating of course book by utilizing the technique, which is alike, an adjustment of the Grammar-interpretation strategy. Traditional teaching strategies are defined as being teacher-arranged, in a speech style and are firm. Lessons are typically educated by the teacher presenting skills utilizing a blackboard joined by a verbal clarification or lecture. According to reformers, traditional instructor-centered techniques concentrated on repetition learning. Traditional teaching strategies tend greatly toward class address book knowledge through repetition and retention of actualities, equivalences and formulas. Recitation as a general rule comprises repeating without tending what the book or teacher has communicated. "The teachers are ignorant of the current investigations in the field of dialect educating. The part of instructor inside the class is dictator with the minimum contribution of the learners." (Behlol, 2009, pp.2-3).

The traditional teaching technique comprises primarily conveying addresses by the instructors and pupils are mentally dynamic, however, physically sit without moving. Learners might be involved in note taking (Haghighi, Vakil, & Weitba, 2005). In classroom teaching learning sessions, the main physical task done by the students is either note-taking or remaining on the seat to answer any inquiry of the teacher. There is no way for learners to present somewhat in the class to talk in the class and thus pupils get to be inactive learners. It makes the entire procedure of the showing learning dull and dry. It provides no room in any movement to the educator and to the learners. The learners think about the dialect yet they are not in situation to talk easily. A disadvantage of this technique is that students who have learning problems can't adjust how the lessons are conveyed.

Activity-based Teaching/Learning: Learning by doing is very important in successful knowledge because it is proved that more the senses are inspired, more a person learns and longer he/she retains. Activities bring activeness and smartness among the learners. Because we know that education means all round improvement of the child, therefore we have to organize numerous activities to build up the learner's personalities in several ways. Activity-based instruction technique acts as a dynamic problem solver for the learners. It improves innovative part of experience and gives reality for learning. It gives various experiences to the learners to encourage the acquisition of information, experience, abilities and qualities. It builds the students self-confidence and creates understanding through works. It creates cheerful relationship and enthusiasm for them. If child is given the chance to investigate by his own and gave an ideal learning environment, then the learning gets to be cheerful and durable. It inspires the learners to apply their innovative ideas, information and minds in solving problems. Under Activity-based learning instruction key focus is on child or we can state that it is one of child focused approach. It creates self-learning ability among the students and allows a student to learn according to his or her ability. As noted in Johnson, Johnson & Smith (1998) (referred in Ahlfeldt, Mehta, & Sellnow, 2005, p.52), "It is the old pattern to give all the resources to the inactive learner by the teacher. The innovative pattern is to dynamically connect learners with the resources and each other."

According to Hussain, Anwar and Majoka (2011), Activity-based learning integrated with peer instruction creates an ideal situation for teaching science subjects and specially physics. In an activity-based learning class, students are actively involved in hands-on experiences and get chance to relate abstract ideas and theories with concrete observations. This helps them to make deep understanding of scientific concepts. Çelik (2018) describes, It was seen that activity based learning activities improve students' academic achievements and attitudes towards activities. According to Shah and Rahat (2014), Activity-based learning teaching method generates an ideal situation for science teaching especially at Elementary level. In activity-based teaching methods, learners are involved actively in hands-on minds on experiences and acquire an opportunity to relate intangible concepts and theories with actual observations. Activity based teaching method helps learners to understand the scientific concepts. Students' actively involved in teaching learning process and activities help them in application of scientific knowledge in various real life situations. "Activity based mathematics instruction is based on activity by involving learners in reading, discussion, practical activities, engagement in solving problems, analysis, synthesis and evaluation (Festus, 2013)." Innovative teaching methods that provide positive mathematical learning experiences could help to enhance students' achievement in mathematics (Riley et al., 2017). If the learner is provided with the opportunity to explore their environment and provided an optimum learning

environment then the learning becomes joyful and long lasting. This learning strategy means reversing the traditional teacher-centered understanding of the learning process and putting students at the center of the learning process (Golji & Dangepe, 2016).

As per Fallows and Ahmet (1999), “education is best when learners’ association, contribution and collaboration are maximized.” McGrath and MacEwan (2011) clarified, “In activity-based instruction, the learner participates in the educational procedure during demonstration of ‘doing’ than in conventional technique.” According to Prince (2004), “Activity-based learning is a learning technique where learners are busy in the educating process.” Activities related to actual life practice help out students to exchange information into their individual information which they can relate in diverse conditions. (Edward, 2001).

Kenly (2007, p.57) stated, “activity-based learning technique is diverse from conventional technique of instructing. Learners take active part in it. Activity-based learning is such education in which learner is dynamically involved in doing or in considering something prepared. As Churchill (2003) said, “such learning helps learners to make intellectual models that take into consideration 'higher-order' presentation, for example, applied critical thinking and exchange of data a skill”. According to Hake (1998) “learners’ inspiration by interfacing with learners in instinctive activities is a feasible and useful technique for instructing difficult ideas. He described the significance of various activities correlated to the thoughts being displayed.” Learners’ inspiration is high if these activities are face-to-face to the learners (Hug, Krajcik & Marx 2005). In lab strategy learning by doing may be possible as in activity based teaching/learning.

Objectives of the Study

Following were objectives:

1. To analyze the students’ achievement taught through activity based teaching and the traditional method of teaching Mathematics.
2. To check the retention power of students taught through activity based teaching.

Research Hypothesis

Following were hypotheses:

1. There is no important differentiation in mean achievement scores of students instructed by activity-based teaching and the conventional technique of teaching in Mathematics at elementary school students.
2. There is no important differentiation in mean score on retention power of Mathematics learners instructed through activity based teaching at elementary level.

Delimitations of the Study: Govt. Girls High School Bhedian (Pattoki) District Kasur was selected for research study. Only students of seventh class were included. Academic Session for research study was 2016-17. (Fundamentals of Geometry 10.1 to 10.4 and revision exercise) and (Circumference, Area and Volume 12.1 to 12.6 and revision exercise) were selected from the subject of Mathematics for research study.

Research Methodology

Population of the Study: All (120) student of class seventh from Govt. Girls High School Bhedian Pattoki District Kasur constituted the population.

Sample of the Study: For selection of sample 60 students of class seventh were taken randomly from Govt. Girls High School Bhedian Pattoki District Kasur. A pre-test was administered for assigning the pupils to two groups (experimental and control) on the basis of outcome comparing equal marks.

Content of the Study: (Fundamentals of Geometry 10.1 to 10.4 and revision exercise) and (Circumference, Area and Volume 12.1 to 12.6 and revision exercise) were selected to teach to both groups.

Research Design: The research was experimental based on pre-test, post-test control group design.

Procedure of Data Collection

Pre-test and post-test were made from (Fundamentals of Geometry 10.1 to 10.4 and revision exercise) and (Circumference, Area and Volume 12.1 to 12.6 and revision exercise) of seventh grade Mathematics. Out of 50 questions, ten (10) of knowledge, ten (10) of comprehension, ten (10) of application, ten (10) of analysis, and ten (10) questions of synthesis were made. The circulation of the questions keeps on same for every domain in the pre-test and post-test. 25 MCQs items were included in pre-test and 25 MCQs items were included in post-test. Different items were used for pre-test and post-test which were selected from same content so that effectiveness of activity-based teaching would be checked in better way. All items were selected keeping in view cognitive domains. Proportion of items according to cognitive domains was same in pre-test and post-test. Items of all levels (knowledge to synthesis) were included in tests because students learn more effectively if easy to difficult and concrete to abstract way would be used.

On the result of the pre-test two equal groups were formed experimental group and control group. Result list was prepared in descending order. First student was in Group A, second in Group B, third in Group A, fourth in Group B and so on. Mean of both the groups were same in the start. Pre-test was administered to the seventh class before the start of the experiment. (Fundamentals of Geometry, Circumference, Area and Volume) were taught to both groups (experimental and control) for the time of two months. Experimental group was taught with activities and other group was taught without it. Different activities were selected according to the units selected from seventh class Mathematics to teach experimental group while the control group was taught without using these activities.

Activities as for example students pointed out line segment, lines, parallel lines, rays & angles, acute, right and obtuse, complementary and supplementary angles, adjacent and vertical angles, triangles, congruent and similar figures, circle, radius, diameter and chord, arcs, semicircle and segments of circle, from their classroom, from different books, papers, work sheets, pictures, from cards and other things (candle, match-box stick, torch and bulb) put in basket. Student drew these shapes on white board, note books, charts, graph paper and gave different names to different things etc. Students made all these shapes by scissor, glue stick, different small boxes and formic sheet, thermopile sheet, pins thumb pins. Students gave examples of these shapes with straw, ice-cream sticks, with their arms, book, note-book, geometry-box, charts, calendar, shawl, candle, match-box stick, torch, bulb, scales, scissor, clocks, color shawls, currency note, glass, torch, window, door, wall, board, the Sun, the full Moon, wheels of cars, clocks and watches, dinner plates, (pizza, wheel, plate, mirror, football, biscuit, and bottle, lid of bottle, sharpener, bangle, fan, button, and plastic pins) working fan, dry milk box for cylinder etc. Students made different geometrical shapes physically as angles with their arms, fingers and elbow etc. It was guessed about different shapes who am i? Students competed with others in making different geometrical shapes, writing different angles on board and in note-books. Students measured different geometrical objects with protractor, scale and so on.

Selected content of Mathematics was taught to each group daily for 40 minutes. On completion of teaching of the specified units with activities and without activities a post-test was prepared in which items were selected from all levels in order to determine the effectiveness of treatment.

Analysis and Interpretation of the data

Mean score and *t*-test were used to evaluate and analyze the test marks of two groups. Independent sample *t*-tests at .05 level of significant were applied on both the tests scores to check whether there is really important distinction between the performance of two groups previously, and afterward the treatment. Mean value, standard deviation, *t*-value and p-value were calculated for the purpose of data analysis.

Comparison of the performance of pre-test of both groups

Groups	N	M	SD	t-value	df	Significance/P-value
Experimental Group	30	18.47	4.125	.000	58	1.000
Control Group	30	18.47	4.091			

Table value of “*t*” at 0.05 = 2.00

It shows that the *mean* score of pre-test of experimental group is 18.47 with *SD* 4.125, and the *mean* score of pre-test of control group is 18.47 with *SD* of 4.091. The tabulated-value for df 58 is 0.000 whereas table value is 2.00. As calculation of *t* is less than table value. Therefore, it may be concluded that results of both groups were the similar before the treatment.

Comparison of the performance of post-test of both groups

Groups	N	M	SD	t-value	df	Sig/P-value
Experimental Group	30	48.80	2.140	33.876	58	P < .001
Control Group	30	20.00	4.136			

The mean score of post-test of experimental group is 48.80 with *SD* of 2.140 and the mean score of post-test of control group is 20.00 with *SD* of 4.136. The computed *t*-value for df 58 is 33.876 whereas table value 2.00 which is not as much as table value. As computed *t*-value is greater than table value so H_0 (There is no important differentiation in students’ mean achievement marks instructed by activity based teaching and the traditional teaching method in Mathematics at elementary school level) is rejected and alternative hypothesis, H_1 (There is important differentiation in mean achievement marks of learners instructed by activity based teaching and the traditional teaching method in Mathematics at elementary school level) is accepted. Therefore, it may be concluded that results of both groups were the different in post-test.

Achievement scores of experimental group in pre and post-test

Groups	N	M	SD	t-value	df	Sig/P-value
Post-test Experimental Group	30	48.80	2.140	37.786	29	P < .001
Pre-test Experimental Group	30	18.47	4.125			

The mean score of post-test of experimental group is 48.80 with *SD* 2.140, and the mean score of pre-test of experimental group is 18.47 with *SD* of 4.125. The computed *t*-value for *df* 29 is 37.768 whereas the table value is 2.05 which is less than *t*-value. As calculated *t*-value is not as much as table value so H_0 (There is no important differentiation in mean score on retention power of Mathematics students instructed through activity based teaching at elementary level) is rejected and consequently alternative hypothesis H_1 (There is important differentiation in mean score on retention power of Mathematics students instructed through activity based teaching at elementary level) is accepted hence it can be concluded that students taught through activity based teaching has strong power of retention.

Comparison of the performance of control group in pre and post test

Groups	N	M	SD	t-value	df	Sig/P-value
Post-test control Group	30	20.00	4.136	1.916	29	.065
Pre- test control Group	30	18.47	4.091			

The mean score of post-test of control group is 20.00 with *SD* 4.136, and the mean score of pre-test of control group is 18.47 with *SD* of 4.091. The computed *t*-value for *df* 29 is 1.916 whereas the table value is 2.05 which is not as much as *t*-value at 0.05 level of significance. As computed *t*-value is not greater than table value so H_0 (There is no important differentiation in mean score on retention power of Mathematics students instructed through traditional method of teaching at elementary level) is accepted and alternative hypothesis H_1 (There is significant difference in mean score on retention power of Mathematics students instructed through traditional technique of teaching at elementary level) is not accepted, hence it can be concluded that students taught through traditional method of teaching have almost same power of retention in pre-test and post-test.

Discussion

The results of this study are supported by the findings as noted by Hussain, Anwar and Majoka (2011) Activity-based learning integrated with peer instruction creates an ideal situation for teaching science subjects and specially physics. In an activity-based learning class, students are actively involved in hands-on experiences and get chance to relate abstract ideas and theories with concrete observations. This helps them to make deep understanding of scientific concepts. Çelik (2018) describes, It was seen that activity based learning activities improve students' academic achievements and attitudes towards activities. According to Shah and Rahat (2014), Activity-based learning teaching method generates an ideal situation for science teaching especially at Elementary level. In activity-based teaching methods, learners are involved actively in hands-on minds experiences and acquire an opportunity to relate intangible concepts and theories with

actual observations. Activity based teaching method helps learners to understand the scientific concepts. Students' actively involved in teaching learning process and activities help them in application of scientific knowledge in various real life situations. "In activity-based instruction, the learner participates in the educational procedure during demonstration of 'doing' than in conventional technique (McGrath & MacEwan 2011)." "Activity-based learning is a learning technique where learners are busy in the educating process (Prince, 2004)." Activities related to actual life practice help out students to exchange information into their individual information which they can relate in diverse conditions (Edward, 2001). Kenly (2007, p.57) said, "activity-based learning technique is diverse from conventional technique of instructing. Learners take active part in it. Activity-based learning is such education in which learner is dynamically involved in doing or in considering something prepared. "Such learning helps learners to make intellectual models that take into consideration 'higher-order' presentation, for example, applied critical thinking and exchange of data a skill (Churchill, 2003)."

Conclusions

The results of this study did not support the hypothesis that there is no significant difference between student's achievement when taught with activity-based teaching and traditional method of teaching. It was concluded that there was no statistically difference between the mean scores of experimental and control groups in pre-test (before the treatment). The main aim of study was to compare the effects of activity based teaching and traditional Method teaching in Mathematics at elementary level.

There was significant difference between the mean achievement score of experimental and control group in post-test. Students of experimental group got higher marks in the area of (knowledge, comprehension, application, analysis and synthesis) than the students of control group. Results of those students remained same in pre-test and post-test those were taught through traditional method of teaching. It was also concluded that students taught through activity based teaching have strong power of retention. / Learning through activity based teaching retains for a longer period of time.

The performance of experimental group was more effective after the experiment. Use of activities in Mathematics has a positive impact on the performance of the learners. Students take more interest in the lesson if activities are used in Mathematics. Information provided through activities is concise and quick. Complex ideas can be understood with ease with the help of activity-based teaching. Activity-based teaching stimulates a high degree of interest in the learners and makes the message clear. Activity-based teaching found to be appropriate for improving the performance of the learners. Use of activities supplements the study material. Use of activities helps the teachers to explain the subject

matter easily. Activities make Mathematics joyful, interesting and fruitful. It was concluded that there was a positive impact of activity-based teaching in developing cognitive skills in the students of Mathematics at elementary level. Activity-based teaching is also more effective for the development of higher order thinking skills in the students.

Recommendations

It is recommended that Mathematics kit containing material for activities may be provided to Mathematics teachers to teach math with activities. A separate room for Mathematics may be allocated in every school and may be equipped with material for activities. Textbooks may be illustrated with graphs, pictures, maps, diagrams, guidelines for activities and updated knowledge /information/ data.

It is also recommended that teachers may be trained for conducting activities in different subjects. Appropriate activities may be used at appropriate time. Activities according to content may be planned by the teachers at the start of academic session. Refresher courses and workshops may be arranged on regular basis for Mathematics teachers to update their knowledge. It would not only be helpful for teachers to refresh their knowledge but also helpful for new teachers.

It is recommended for further researchers that studies may be carried out separately for each subject to know the effectiveness of activity based teaching and experiment may be applied on other classes also/Studies may be conducted for class I _VI and VIII.

References

- Ahlfeldt, S., Mehta, S., & Sellnow, T. (2005). Measurement and analysis of student engagement in university classes where varying levels of PBL methods of instruction are in use. *Higher Education Research and Development*, 24(1) 5-20.
- Ahmed, E. (2005). *Identification of the problems of the low achievers in the subject of Mathematics at secondary level*. (Un-published Thesis) IER, Lahore: University of the Punjab.
- Amirali, M. (2010). Students, concepts of the nature of mathematics and attitude towards mathematics learning. *Journal of Research and Reflection in Education*. 4(1), 27.
- Babar, S. (2011). *Relationship between methods of mathematics teaching at B.ed teacher training programme and its applications in the actual classrooms* (Un-Published Thesis). Islamabad: AIOU

- Behlol, G. (2009). *Development and validation of module in English at secondary level in Pakistan*. (Unpublished Ph. D thesis). Islamabad: International Islamic University
- Cangelosi, (2003). Quoted by National Science Foundation, *Vol. 1, No. 1* (2006) pp. 62–82, *Applications and Applied Mathematics (AAM): An International Journal*
- Çelik, H. C. (2018). *The Effects of activity based learning on sixth grade students' achievement and attitudes towards mathematics activities*. Eurasia Journal of Mathematics, Science and Technology Education, 14(5), 1963-1977.
- Churchill. D. (2003). *Effective design principles for activity-based learning: the crucial role of 'learning objects' in Science and engineering education*. Retrieved from <http://www.learnerstogether.net/PDF/Effective-Design-Principles.pdf> on 10 Oct, 2011.
- Edward, N. S. (2001). Evaluation of a constructivist approach to student induction in relation to students' learning style. *European Journal of Engineering Education*. 26(4) 429-440.
- Fallows, S., & Ahmet, K. (Eds.) (1999). *Inspiring students: Case studies in motivating the learner*. London: Kogan Page/Staff and Education Development Association.
- Festus, A. B. (2013). *Activity-based learning strategies in the Mathematics classroom*. Journal of Education and Practice, 8-14. 4(13),
- Golji, G. G., & Dangpe, A. K. D. (2016). Activity-based learning strategies (ABLS) as best practice for secondary mathematics teaching and learning. *International Advanced Journal of Teaching and Learning*, 2(9), 106-116
- Haghighi, A. M., Vakil, R. & Weitba, J. K. (2005). *Reverse-traditional/hands-on: An alternative method of teaching statistics. Application and applied mathematics (AAM.)*. 1, (2006).
- Hake, R. R. (1998). *Interactive-engagement versus traditional methods: A six- thousand-student survey of mechanics test data for introductory physics courses*. *American Journal of Physics*, 66(1), 64-74.
- Hug, B., Krajcik, J. S. & Marx, R. W. (2005). *Using innovative learning technologies to promote learning and engagement in an urban science classroom*. *Urban Education*, 40(4), 446-472.
- Hussain, S., Anwar, S., & Majoka, M. I. (2011). *Effect of peer group activity-based learning on students' academic achievement in physics at secondary level*. *International Journal of Academic Research*, 3, 940-944.
- Johnson, D. W., Johnson R., & Smith K., (1998). *Active Learning: Co-operation in the college classroom*. Edina, MB: Interaction Book Co.

- Kausar, R., & Zaheer, S. (2008). *Analysis of grade 4 students' performance in Mathematics*. (Un-published thesis) IER, Lahore: University of the Punjab.
- Kenley, R. (2007). *Activity-based teaching for Unitec New Zealand construction students*. *Emirates Journal for Engineering Research*, 12(1), 57-63
- McGrath, J. R., & MacEwan, G. (2011). *Linking pedagogical practices of activity-based teaching*. *The International Journal of Interdisciplinary Social Sciences*, 6(3), 261-274.
- Nisar, N. (2005). *Performance analysis of students in the subject of Mathematics at O-Level (GCE) and Secondary level*, (Un-published Thesis). Provincial Institute of Teacher Education (PITE) Punjab. Lahore: University of Education.
- Pound, L. (2011). *Teaching mathematics creatively*. London and New York: Routledge Taylor & Francis Group
- Prince, M. (2004). *Does active learning work? A review of the Research*. Retrieved from http://ctl.jhsph.edu/resources/views/content/files/150/Does_Active_Learning_Work.pdf on 03 Jan, 2012.
- Rafiq, M. T., & Ansari, Z. (2012). *Mathematics-7*. Lahore: Punjab Text Book board.
- Rao, D. (2001). *Science education in developing countries*. New Delhi; Discovery Publishing House (124-126)
- Riley, N., Luban, D., Holmes, K., Gore, J., & Morgan, P. (2017). *Movement-based mathematics: Enjoyment and engagement without compromising learning through the easy minds program*. *EURASIA Journal of Mathematics Science and Technology Education*, 13(6):1653-1673.
- Saleem, B. (2006). *A study to evaluate the effect of play based learning activities on Mathematics achievement of early graders* (Un-Published Thesis). IER, Lahore
- Schmidt, H. G., & Van der Molen, H. T. (2001). *Self-reported competency ratings of graduates of a problem-based medical curriculum*. *Acad. Med*, 76(5), 466-468. University of the Punjab.
- Shah, I., & Rahat, T. (2014). Effect of activity based teaching method in science. *International Journal of Humanities and Management Sciences (IJHMS)*, 2(1), 39-41.
- Singh, M. (2004). *Modern teaching of Mathematics*. New Delhi: Anmol publications PVT. LTD.
- Weber E. (2006). *Brain based business*. Retrieved from <http://brainbasedbusiness.com>. on December 23, 2007.