

Impact of Activity based Approaches on Mathematics learning in Secondary Schools

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Abstract

Educational opportunities are widely regarded as the most important means of enabling individuals and nations alike to meet the ever-increasing challenges in the fields of economics, technology, social welfare, and personal development. In addition to ensuring that students are literate, education should also foster rationale thinking, knowledge, ability, and self-sufficiency in students. In any field, there is hope for progress when there is a willingness to adapt to new circumstances. The ability to develop creativity and innovate is beneficial to both students and teachers. Education must be centred on all-round development, and the best way to achieve this is through hands-on experience. Mathematics is the subject that is most closely related to our everyday lives. Its knowledge is precise, systematic, logical, and unambiguous. A process of intellectual development of mental faculties is entailed in the study of mathematics. It is not the case that mathematical knowledge is only required by engineers, doctors, or business professionals; rather, it is the opposite. Even the smallest members of society, such as labourers and factory workers, require a fundamental understanding of mathematics.

The purpose of this paper is to Study the Achievement level of experimental group & control group in Mathematics through activity based learning and traditional learning respectively and to find the effectiveness level of activity-based learning in secondary level Mathematics classroom. Activity based learning can be approaches in imparting knowledge to the students in secondary schools. The paper employs both quantitative and qualitative approach to find out the Impact of Mathematics learning through Activity based Approaches in Secondary Schools and also highlighted the activity-based learning modes. This paper deals with the Concept of activity-based learning in Mathematics, Learning by Activity Problems faced by the learners, Strategies and objectives of the study. To discuss the concept to be taught to the Learners by different field activities and through model/ chart. The paper also discusses that through activity-based learning in mathematics how to develop the skills & innovative ideas in learners through teaching Mathematics.

Key words: Activity based learning, Education, Mathematics, Learners.

Introduction:

Education plays a vital role of changing the mind of people. We can think that something has changed in our life after getting education. Change in respect to behavior, life

style, economic growth, good health, living in healthy environment, coordination with member of family etc. Education needs to focus on all-round development and it is best obtained through practical experience of life. Education is effective when it is transacted through by expert teacher who has depth and practical experience of life. Role of teacher is the most important to transect knowledge amongst the learner. The best teacher is the one who teaches less but inspires more and more. Teachers should teach based on their experience not only through books and abstraction. Calculus is the science of measuring, counting, and calculating magnitudes and quantities. It is the branch of science in which we primarily calculate the variables and constants. It is also referred to as the "science of calculation." Education in mathematics is primarily concerned with the development of children's mathematical abilities. Schools use mathematics to develop 'useful' capabilities, particularly in the areas of numeracy (numbers, number operations, measurements, decimals, and percentages), which is the narrow goal of school mathematics. The ultimate goal is to develop the child's ability to think and reason mathematically, to follow assumptions to their logical conclusion, and to deal with abstract concepts and situations. It encompasses a way of going about things, as well as the ability and attitude to formulate and solve problems as they arise.

Conceptual Framework:

It is the outline, the scheme, the paradigm of the operation of the all types of variables. The plan is the only scheme of the research. It includes an outline of everything like writing the objective, collection of data and their operational implications to the final analysis of the data. Based on above work Researcher will do investigation. The structure of the research should be more specific. Strategy is more specific than plan. It includes the methods to be used together and analyses the data.

The objectives of this study to examine the Impact of Mathematics learning through Activity based Approaches in Secondary Schools of east Sikkim. This study involves an exhaustive study of Activity based Approaches in the mind of the class IX students of Greendale senior secondary school and SaiGurukul Academy Gangtok, East Sikkim. The researcher focuses on the different dimensions of skills and activity-based learning through model showing and creative learning approach. On the basis of the dimensions of skills and activity-based learning, the researcher develops separate questionnaire for the class IX students of Greendale senior secondary school and SaiGurukul Academy Gangtok, East Sikkim to know their learning skills and activity-based learning. This impact of Mathematics learning and Methodology will be ideal for other secondary level school of East Sikkim. New methodology and strategy will be betterment for the students.

Learning by Activity:

- To benefit from the experience, the learner must be willing to participate fully in all aspects of it; the learner must be able to reflect on it;
- The learner must possess and use analytical skills in order to conceptualize it;

- The learner must possess decision making and problem-solving skills in order to put the new ideas gained from the experience to use.
- The learners show keen interest in the activities and events happening in the surroundings
- The learner should enhance their knowledge
- The learner should aware that to one child in a family is equivalent to the full family and its neighborhood.

Mathematics is based on learner-centered teaching model, In the process of acquiring their own mathematical knowledge; learners take an active role in the process. Based on the pragmatic principle of "hands on," the model is very similar to the process of learning a trade, in which an apprentice shoemaker learns by working in a shoemaker's workshop rather than in a classroom. Consequently, students are similar to mathematician apprentices who learn by applying their previous knowledge in a sort of mathematics workshop environment. Learners develop their skills in a collaborative and harmonious social environment, and the teacher serves as a guide who directs the process, designs the teaching activities, and monitors the entire process. **“The progress and improvement of mathematics are linked to the prosperity of the state” (Napoleon).** Despite the fact that mathematics plays an important role in our cultural development as well as our personal development, it is not the subject of choice for many high school students. Mathematics is taught as if it were a mechanical subject, with little emphasis on creativity or the use of useful techniques and models. Students receive little instruction in the development of mathematical calculation skills. We are not encouraged to develop our mathematical reasoning abilities or problem-solving approaches. When the All-India Survey of Mathematics Achievement was conducted in 1970, it was discovered that children's mathematics achievement at the elementary level was below the level that was expected. If the answer books from the Secondary School Examination were examined, it would be discovered that a large number of students failed the mathematics portion of the examination. The students, parents, or teachers should all be held accountable, but who should bear the brunt of the blame? Is mathematics phobia an inherited tendency or something that develops over time? The answer is a little hazy. In our society, there is a widespread belief that the greater a person's intelligence, the greater his or her aptitude in mathematics. However, even if two people have a similar I.Q., their perception, judgement, reasoning, word fluency, vocabulary, spatial orientation, and other abilities may differ. Intelligence, on the other hand, is concerned with general mental ability, whereas aptitude, on the other hand, is concerned with specific sensory-motor-mechanical-artistic-professional abilities, such as artistic ability or mechanical ability. Knowing the individual's intellectual level, which can be determined through an Intelligence Test or School Progress, allows us to predict the likelihood of the branch of occupation that is more suitable for the individual.

Some important problems faced by learners:

- Fear and Failure
- Learners are learning the formula rather understanding the concept

- Lack of Activity based learning in the teaching methodology.
- Teaching in classroom using chalk and talk is “one-way flow” of information.
- Lack of quality of Mathematics Teacher.

Oribhabor, C. B. (2020) "Evaluating the effect of activity-based mathematics teaching methods on Nigerian secondary school students' achievement in mathematics" was the subject of a study conducted by the author. When the pre-test results were controlled for, the results revealed that there was a statistically significant difference in mathematics performance between the post-test mean scores of the students who were exposed to activity-based teaching methods (experimental) and those who were taught with lecture methods (control) groups. This was true even after controlling for the effect of the pre-test on Mathematics scores. Students who were taught using the activity method outperformed those who were taught using the lecture method, according to the findings of the study.

Khan. K (2019) “A Study on Learning Difficulties Faced by High School Students in Mathematics” the study was observed that most of the High School students are facing difficulties in learning mathematics especially in content areas Geometry, Mensuration and Arithmetic. It is due to lack of basic knowledge in mathematics like measuring angles, interoperating the relationship between mathematical concepts, formulas, figures and construction.

R.Level&Majid.K.R (2019) A comparison of activity-based teaching and the traditional method of teaching mathematics at the elementary level was conducted. The research was experimental in nature, with a control group design that included a pre-test and a post-test. A pre-test was administered to them in order to ensure that the groups were equal. According to the results of the pre-test, students were randomly divided into two groups (experimental and control). It was discovered that students who were taught through activity-based instruction performed significantly better on the post-test.

Bhuvaneshwari (2018)“Effect of Cooperative Learning and Metacognitive Strategies on Mathematics Achievement of Class VIII students” The results of this study indicate that there is a statistically significant difference in achievement of groups being taught by Jigsaw cum discussion approach of Cooperative Learning strategy and metacognitive strategies as compared to those taught by conventional method, meaning thereby that the two strategies are more effective compared to the conventional teaching. Similar results were obtained in case of students belonging to higher intelligence group.

Celik. H.C(2018)Study on “The Effects of Activity Based Learning on Sixth Grade Students’ Achievement and Attitudes towards Mathematics Activities” The study used an experimental research design with a control group that was tested before and after the study. The participants were divided into two groups: one received traditional learning and the other received activity-based learning. Following a review of the studies, it was discovered that both groups' academic achievement had improved. On the other hand, while attitudes toward

activities among students in the experiment group decreased significantly, attitudes toward activities among students in the control group increased significantly.

Kaur. H &Sankhian.A(2017) Effect of Activity Based Method on Achievement Motivation and Academic Achievement in Mathematics at the secondary school level was investigated. When comparing the results of the study to the control group, it was discovered that students who are taught mathematics through an activity-based method demonstrate significantly higher levels of achievement motivation and academic achievement (Traditional Teaching method).

Thosar. M (2017)Study on “Effectiveness of a program based on Self-Regulated Learning Model for Primary level Mathematics”. A significant difference between the mathematical thinking of students in the experimental and control groups was discovered by this study, according to its findings. In light of the fact that the mean post-test score of the experimental groups is significantly higher than that of the control group, it can be concluded that students' mathematical thinking skills have significantly improved after being exposed to self-regulated learning strategies.

Nandakumar. S.N (2015) Study on “Impact of New Trends of Teaching Learning Process in Mathematics towards the Competitiveness of Female Students at Higher Secondary Schools in Mumbai” It was found that it is concluded that new trends of teaching learning processes available today has great influence on the present generation of female students. They believe that this new trend of teaching learning mathematics subject brings a liking towards that subject and remove fear.

Yadav.P(2015) An investigation into the impact of using activity-based teaching methods on students' achievement in mathematics at the primary level. The purpose of the study was to determine the effectiveness of activity-based mathematics instruction in improving the mathematics achievement of primary level students. It was discovered that engaging students in an activity that aids in their learning and provides them with a strong foundation is beneficial.

Yuksel. Ismail (2014) on the 'examine the impact of activity-based mathematics instruction on mathematics performance'. The study's goal was to examine the relationship between prior knowledge, self-regulation, prior attitude, and reading ability and students' mathematics performance. Participants were divided into four groups. The preliminary findings indicated that activity-based mathematics instruction made a significant contribution to students' mathematics performance as well as their mathematics attitude in mathematics classes. Students with strong prior knowledge as well as strong self-regulation skills showed greater improvements in mathematics performance than other students. Prior knowledge was found to be associated with a more positive attitude toward mathematics among students with high prior knowledge. Students with little prior knowledge and poor reading skills, on the other hand, perform poorly on a retention test. Study on "Teaching of Mathematics through an Integrated Approach at Secondary Level for Value Inculcation" by Panicker, V.M. (2014). According to the findings of the study, the integrated approach to teaching mathematics was found to be effective in terms of students' conceptual knowledge and students' perception, in

all of the values considered for the current study's findings. The integrated approach was found to be effective in terms of standard VIII students' achievement in mathematics, as evidenced by the fact that the mean gain scores of achievements in mathematics of the experimental group were found to be significantly higher than those of the comparison group. Students in the experimental group performed significantly better in mathematics than students in the control group.

A. Benard (2013) A study on "activity-based learning strategies in mathematics classrooms" was conducted by A. Benard in 2013. It is the purpose of this paper to discuss strategies for implementing activity-based learning in the mathematics classroom. Cooperative learning or small group learning, as well as discussion in class, are some of the strategies that can be used. The paper comes to the conclusion that mathematics teachers should move away from traditional methods and toward activity-based learning strategies instead.

Fallon Walsh and Prendergast (2013): An activity-based approach to the learning and teaching of research methods: Measuring student engagement and learning is the subject of a study conducted by Fallon Walsh and Prendergast. It was discovered that student engagement was low and that learning opportunities were limited. This Module's development team believed that successful completion of the project would provide students with a well-honed set of research skills that they could apply to their future academic and professional endeavours. The completion of a series of activities based on various research methods enabled students to demonstrate their understanding of the material.

Gooden (2003): The findings of a study conducted by Gooden on "Action research falls under the broad umbrella of professional development" revealed that the activity allows teachers to choose from a variety of options and design a programme that is best suited to their specific needs.

Anderson, S. (2003): Study on "the effect of cooperative learning on the mathematical achievement of fifth grade students" was carried out by Anderson. When comparing cooperative learning strategies to traditional mathematics instruction, the findings of this study revealed that there was a statistically significant difference in the mathematical achievement of fifth grade students when using cooperative learning strategies. Additionally, according to the findings of this study, fifth-grade students who learned mathematics through cooperative learning showed greater interest in mathematics than fifth-grade students who learned mathematics through traditional instructional methods.

Objectives of the Study:

- To Study the Achievement level of Experimental group & Control group in Mathematics through Activity based learning and traditional learning respectively.
- To Study the effectiveness level of Activity based learning in secondary level Mathematics classroom.
- To know the opinion of mathematics teacher in respect to Activity based learning and traditional learning.

Strategies:

- To Develop the new Concept Activity based learning in teaching Mathematics
- To create Techniques in teaching Mathematics
- To develop the new Models and Charts to teach Mathematics
- To Apply Activity in teaching Mathematics

Concept to be taught to the Learners: Learners should understand the concept rather learning the formula. They may learn through practical based and through experiential learning. Teachers should guide them. Problems of Mathematics may solve by different activity-based methods. So, interest can be developed in children. They may develop new idea activity-based learning.

Methodology of the Study: The researcher used both quantitative and qualitative methodologies to find out the Impact of Mathematics learning through Activity based approaches in Secondary Schools. This study is delimited to East Sikkim. This Study conducted in Greendale senior secondary school and SaiGurukul Academy Gangtok, East Sikkim through online mode.

Population Sample: The sample has taken 42 students (21 boys and 21 girls) from class IX out of 62 students of Greendale senior secondary school and SaiGurukul Academy Gangtok, East Sikkim.

Procedure of data collection:

The Investigators for Qualitative Analysis developed the self-made tool has been designed; Items have been selected based on the topic surface area and volume of 3-dimensional shape: Cube and cuboid through online mode to know the knowledge of students. The investigator followed the norms & condition laid down in the tools for the proper administration of the test. The investigator had to take personal care in giving direction to the students and teachers for answering questions keeping track of time. The investigator took the sample of 21 students from Experimental group of Greendale senior secondary school and 21 students from Control group of SaiGurukul Academy Gangtok, East Sikkim. A semi-structured interview schedule was prepared to get the opinion and detailed information from teachers and students about the activity-based learning. Their experiences, perceptions and reflections regarding the activity-based learning process were consolidated for qualitative analysis. In the first phase of data collection, the Investigators got permission from the principal of, Greendale senior secondary school and SaiGurukul Academy Gangtok, East Sikkim. The second phase involved the semi-structured interviews of teachers' and students' perception about activity-based methods in mathematics through google form. All the sample respondents extended their full co-operation by responding to the questionnaire. Valuable feedback and suggestions were gathered while interviewing through online mode. Data obtained from the various sources were analyzed by using the Qualitative Analysis was used as needed for the study. Percentage Analysis was done according to variables.

Table 1: Performance of Experimental Group: Greendale Senior Secondary School:

%of marks	90%	80%	70%	60%	50%	40%	30%	20%
No. of students	3	3	6	2	4	1	2	0

Figure:1 Performance of Experimental Group:Greendale Senior SecondarySchool:

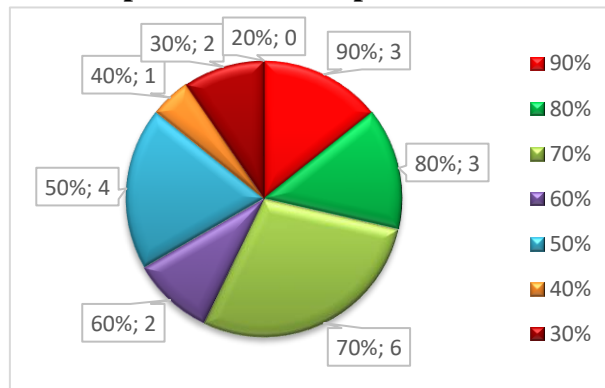
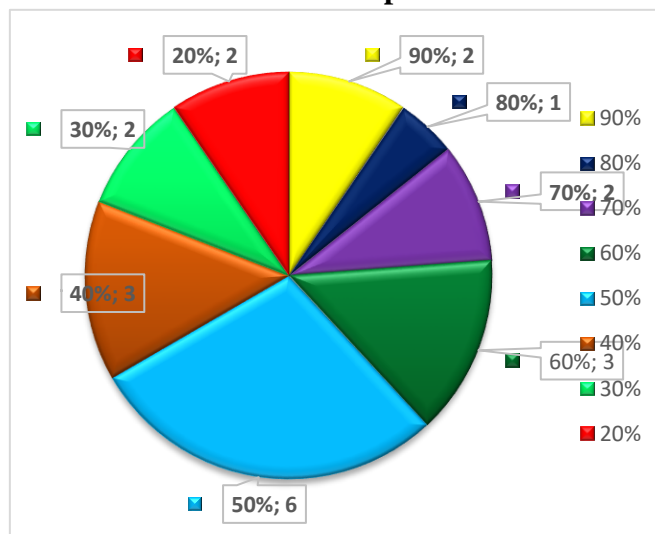


Table 2 : Performance of Control Group : Sai Gurukul Secondary School Class:

% of marks	90%	80%	70%	60%	50%	40%	30%	20%
No. of students	2	1	2	3	6	3	2	2

Figure 2: Performance of Control Group:Sai Gurukul SecondarySchool:



Findings of Study:

This section presents objective wise findings derived after percentage analysis and content analysis.

Related to objective one:

Findings related to objective one to get the findings of objective one, Investigator conducted an online class and test in which percentage analyses have been done to know the performance of Experimental group and Control group students. 3 students secured 90% marks in Experimental group whereas only 2 students secured 90% marks in Control group. No one secured less than 30% marks in Experimental group whereas 2 students secured less than 30% marks in Control group. Thus, the study showed that the performance of Experimental group students is much better than Control group students.

Related to objective two: To get the findings of objective two, i.e., the Study the effectiveness level of activity-based learning in secondary level Mathematics classroom.

the content analysis of the questionnaire on the perception of students about activity-based learning has been done through online mode by google form. Investigator also collected detailed information about experiences of activity-based learning class in written mode.

Perception and experiences of Students:

- It was found that 100% students responded that they like Activities based learning. None of the students responded that activity-based learning is not suit for them.
- It was found that 100% students responded that they enjoy through Activities based learning. None of the students are disagreeing with above statement.
- It was found that 90% students responded that they did not face any difficulties to get knowledge through Activities based learning .10% students found many difficulties to get knowledge through Activities based learning.
- It was found that 90% students responded that they may improve marks in Mathematics through Activities based learning. 10% students are disagreeing with above statement.
- It was found that 90% students responded that Activities based learning is relevant to their needs. 10% students are disagreeing with above statement.
- It was found that 55% students responded that they learned some topic through Activities based learning but 45% students found that experiential learning is new for them.
- It was found that 95% students responded that they liked very much when teachers teach chart/ Models. 5% students are feeling difficulties to learn through chart/ model.
- It was found that 85% students responded that they may apply Activities based learning concepts in real-life situations. 15% students are not agreed with above statement.
- It was found that 90% students responded that they may develop self-confidence in doing Mathematics 10% students are disagreed.
- It was found that 95% students responded that they may develop interest in doing Mathematics but 5% students are not getting interest.
- It's kind a fun with friends to learn or understand the concept properly.
- Mathematics is important in our daily life because we need to calculate the things that we buy in shop so, mathematics is a part of our life
- Mathematical knowledge plays a crucial role in understanding the contents of other school subjects such as science, social studies, and even music and art.

- Mathematics makes our life orderly and it make us creative, spatial thinking and critical also, problem solving ability etc.
- Mathematics makes us ability to learn various methods which is unknown and it make us creative by helping us solve problem
- Mathematics is very important in our daily life because without mathematics we cannot be able to learn computer too.

The study showed that effectiveness level of Activity based learning is very high in respect to understanding the concept, enjoyment, improving marks, Capability, creativity of learners in secondary level Mathematics classroom and it is also showed that effectiveness level of activity-based is high in respect to developing self-confidence and applying the knowledge in real life situation. Some of students are facing some difficulties when using new experiment in beginning. Most of students responded that feeling good, enjoy a lot, very nice experience. They observed that Activity based is very fun activity. They responded that new technique will be helpful for understanding the concept and improving marks in upcoming exams.

Related to objective third: To get the findings of third objective i.e. To know the opinion of mathematics teacher in respect to Activity based learning and traditional learning. The content analysis of the questionnaire on the perception of teachers about activity-based learning has been done through online mode by google form. Investigator also collected detailed information about experiences of activity-based teaching class in written mode.

Opinion & experiences of Teachers:

- All teachers responded that learning should through activity-based methods.
- All teachers responded that they did not face any difficulties to teach to students through Activity based learning
- Most of teachers responded that they may improve teaching proficiency in school through experiential learning to a great extent and someone of them to some extent.
- Most of teachers responded that the Activity based learning relevant to their needs to some extent.
- All teacher responded that he attended Activity based programme previously.
- All teachers like to teach to students through chart/ Models.
- All teachers believe that Students' may develop understanding of Mathematics knowledge by Activity based learning. All teachers responded that Students' may develop their Capacity to solve problem of Mathematics by Activity based learning.
- All teachers agreed that Students' may develop ability to apply or generalize skills and concepts to other areas of Mathematics, other disciplines & real-life situations.
- All teachers responded that Students' may develop self-confidence in doing Mathematics through by Activity based learning.
- All teachers believe that Students' may develop interest in doing Mathematics through by Activity based learning.
- Teaching should be done in such a way that it relates with day-to-day activities. More focus should be given on the concepts than the formula.
- Introducing mathematics should be done by games and puzzles.

- 2D and 3D shapes and finding the area, volume etc. should be done through Models and activity.
- Teaching should be done by learning with experience.
- Teaching should be done by both activities based cum Audi- visual methods

The study showed that the opinion of mathematics teacher in respect to Activity based learning is more positive than traditional learning. Most of teacher revealed that best teaching should be done in such a way that it relates with day-to-day activities. Activity based learning is very effective to understand the concept of topic.

Conclusion:Activity based learning is very effective methodology in teaching learning process. Teachers play vital role to develop interest in learners. They may update the knowledge of learners by different activities. Some of the important recommendations are given below.

- There is an urgent need to provide facilities to school in respect to Infrastructure, Activity Lab, resources to teach in practical manners.
- Students should aware about new methodology and techniques. So, they may get interest in study.
- Teachers should update their knowledge and trained themselves. So that qualitative improvement can be brought in the institutions.
- The teachers at the secondary level need to be trained more and oriented about the conceptual framework and use of mastery learning strategies.
- Provision should be made by the Government to ensure that whatever secondary teachers are learning in the trainings must be practical in the class room situations. The trainings must emphasis on practical demonstrations.
- Teachers and School management should get target to bring change in Community.

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