

Research Paper

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

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ABSTRACT

21st century education is undergoing a revolutionary change that gives birth to positive psychology in the process of education, That Flourished the classroom engagement and result in remarkable role in academic field. Policy makers and many educators worldwide have noticed the burgeoning field of experiential learning in the 21st century. Learning in real life situations, hone creativity, communication and collaboration skills among students, which leads to better understanding of concepts. In particularly mathematics subject learning theory and practice together, is more beneficial. In India NPE 2020 emphasized on “how to learn” or we can say skills-based learning and gave importance to “learning by doing”. Experiential learning in arithmetic and geometry at 5th grade was studied to see if experiential learning could positively help students’ participation to increase their maths learning outcomes. A series of pedagogical experiments with 20 fifth-grade students on topics related to arithmetic and geometry was conducted to confirm research goals. Students were required to develop attitude to solve problems respective criteria of 5th grade. Only group method was subjected to a pre-test and a post- test design. Teacher made achievement test was used as a tool for data collection. The results were found that experiential learning activities positively influence the students motivation and students achievement of the class.

Keywords: *Experiential learning, Arithmetic, Geometry, Mathematics achievement, Students motivation, Students attitude*

“For the things we have to learn before we do them, we learn by doing them” -Aristotle

Past decades emphasized on the information gathering and to imbibe students mind with Facts, information and text book Content which will promote them to next grade. But 21st century focus on skills which will help children succeed in the rapidly changing world. Now children learn diversities of surrounding and want to learn about differences respect to those.

“Experiential learning is a philosophy and methodology in which educators purposefully engaged with students in direct experience and focused reflection in order to increase

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Received: January 26, 2024; Revision Received: February 02, 2024; Accepted: February 06, 2024

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

knowledge, develop skills, and Clarify values". (Association for experiential education, Para 2).

2st century education focuses on student centre experience and technology-based learning, which promote skills and understanding of students, which will cope their future needs.

Experiential learning is experience based learning, it includes corporation, collaboration, action, participation, adventure, incidental learning, practical, problem solving, critical thinking, project based learning, role play simulation, team learning i.e. experiential learning is broad umbrella term to cover wide variety of approaches to learning by doing.

In the field of experiential learning, there are many theorists as John Dewey living Jean Piaget and David Kolb. David Kolb's model of 4 stage is a fundamental presentation of experiential approach. Kolb states that John Dewey, Kurt Lewin and Jean Piaget are founders of this approach. Kolb has used Kurt Lewin trend of action research and John Dewey's work to substantiate his model, Kolb's model is eclectic model of experiential learning.

Experiential learning is research based approach which requires content areas on real life situation according to Kolb (1984) experiential learning has 4 different stages to occur:

1. concrete experience
2. Concrete experience reflective observation
3. Reflective observation abstract conceptual
4. Abstract conceptualization active experimentation

On the basis of above stages student must act, reflect, think and apply Experiential, learning process occurs along with all 4 stages.

Experiential learning is an effective model, which contribute to liberal learning model requires careful supervision of students' classroom experiences. Studies on cooperative education and school programme, Often mismatch with the stated goal of programmes and the actual experiences of students that's why the concept to combine formal teaching in the classroom with direct learning experiences in selected environments was proposed experiential learning in the digital world is blended form of audio, videos field trips experiments with the experiences in the real world.

Experiential learning promotes critical thinking, collaboration, Elaboration and creativity, which engage cognitive, emotional and physical aspect of experiences.

Elements of experiential learning

- It is based on naturalistic approach, which includes the possibility to learn, by natural consequences and studies learning by their mistakes and successes.
- It engages students intellectually, emotionally, socially, creatively and physically.
- It reflects critical thinking and synthesis, analysis and creativity.
- It gives students liberal environment to take initiatives, decisions and be responsible for their results.

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

Experiential learning approach is holistic approach, which is combination of pragmatic common naturalist and extends philosophical approach by using the approach students learn better than conventional classroom learning.

This approach is designed to attain better understanding of content, as it is community learning approach it gives broader view of the world and an appreciation of community it faces on insightful learning students take interest according to their interest, fashion and values. Students get opportunity to collaborate with diverse communities and people by using technology it is based on positive psychology which gratify the students which with self-confidence leadership skills and motivation. Experiential learning approach engages students to own experiences and reflections and to help to learn in real world situation in classroom.

Advantage of experiential learning

In the field of mathematics education has been known that there are more positive effects of experiential learning in the educational outcome and motivation (Venkataraman et. al., 2019).

Researches showed that experiential learning positively affect students mathematics creativity.

The experiential learning is more effective than traditional teaching and learning methods, students engage in experiential learning express better and their critical skills are also more developed.

Experiential learning helps students to improve their problem-solving skills full it gives opportunity to resolve real life problems also it has been found that students enjoy learning activity which improve their knowledge and understanding of maths that reduces the burden of their curriculum.

The uses of experiential learning strategies engage teachers students and school which create positive learning environment and has numerous advantages for educators.

Drawbacks of experiential learning

The major drawback of experiential learning is time duration, it needs much time which is main constraints for complete syllabus.

Second factor is that students and teachers come from different background, so sometimes it becomes difficult to express as lack of compatibility hinders it.

It is more useful in lower grades and difficult to apply in higher education at lower level sometimes students become used to of their activities but all the activities are not compatible for every subject.

RELATED LITERATURE

Austin, M. J and Rust, Z. Diana (2015), Developed 3 year time period and was fully implemented in 5 year and found that experiential learning engages students in hands on learning so the institution implemented 10 year experiential learning program.

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

Venkatraman et.al (2019), Stated, an experiential learning framework can be successful if each student is directly involved in the experience by carrying out the tasks.

Yongtau, Kong (2021), Studied the role of experiential learning on students motivation and classroom engagement and find that experiential learning effect positively on students learning and plays very important role on students motivation and classroom engagement.

Mamatha, S. M (2021), Studies experiential learning in higher education aims to highlight the concept of experiential learning, its importance, advantages challenges and to point out the opportunities to implement experiential learning in Indian higher education system based on the review of the available literature in the field of study and stated that when experiential learning is very useful when the content being taught is context that will be used in a real-world situation.

Uyen, P. Bui, Tong, Hui and Lien, B. N (2022), Studied the effectiveness of experiential learning in teaching arithmetic and geometry in 6th grade commerce showed the result that experiential learning activities positively influenced math learning attitudes and students achievement progress in the classroom.

Objectives of the study

- To determine the effectiveness of experiential learning on mathematics achievement in 5th grade students.
- To assess the effects of experiential learning on their attitude towards mathematics.

Hypothesis of the study

- The Experiential learning has no effect on mathematical achievement of 5th grade students.
- The experiential learning effect on the attitudes towards mathematics of 5th grade students.

METHODS AND MATERIALS

The research observes the 5th grade students of Primary school of Toraigoan region at Barabanki district (U.P), India. The experiment is conducted on the whole 5th grade rather than grouping random samples so, it used Quasi experimental approach.

In this study the class of 20 students of grade 5 is the sample. Others school teachers and parents are allowed to express their concerns. The teacher uses to assess students an attitude scale based on 5 criteria. (table1).

In this study teacher use experiential model to teach the class of 20 students according to tradition the other teacher use conventional model to instruct the same sample of 20 students of class. Parents of the student already told to notice their children's participation in the experiment and also allowed to express their views. After the traditional teaching the pre test was taken the teacher has given the treatment of experiential teaching and finally post test data is collected in the form of the achievement. The study used paired t test to determine the effect of experiential learning.

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

Table 1: Criteria for teachers to evaluate student's attitude towards mathematics

S.No.	Criteria	Levels				
		1	2	3	4	5
1.	Active and Enthusiastic					
2.	Cooperation in group					
3.	Task performing efficacy					
4.	Logical presentation of problem					
5.	Consulting with teacher					

Conceptual framework

The teaching process of experiential mathematics is proposed in 5 step conceptual design. Planning, Organising, Preparation, Implementation, Assessment and evaluation.

- Stage1. Choosing the realistic goal.
The planning is according to students' age and grade level that is adequate for the young minds to digest and absorb new information of mathematics.
- Stage 2. Deciding the topics.
Aim to decide the topic and organise the experiences. By the learning topics and classroom conditions. There should be clear connection between content and activities.
- Stage 3. Knowing the needs and talents of the students.
The teacher will get important information about need and talents of student and use it to prepare hands on learning to the students.
- Stage 4. Using the teaching approaches and methods.
Experiential activities will be used to clarify and comprehend the new knowledge about the content
- Stage 5. Assessment and evaluation.
Teacher can use various assessment methods at this stage to know the successful completion of lessons.

Table 2: Interventions and activities

S.no.	Topics	Objectives	Activities	Duration
1.	Fractions [Multiplications]	To conceptualize fractions and apply it in real life. Perform different types of operations on fractions. Comprehend and solve word stories related to real life situations.	Group activity of cutting sheet in equal parts. Collage activity Fractions of realistic objects. Worksheets Multiplication of fractions.	5 days

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

S.no.	Topics	Objectives	Activities	Duration
2.	Percentage	To conceptualize, operationalize, comprehend percentage and apply it in daily life.	Showing pictures about percentage in daily life. Showing price of cycle with discount percentage. Craft activity on percentage. Worksheets on percentage.	5 days
3.	Shapes and Angles	To introduce the students the concept of angles as rotation and naming the angles. To help students to learn various types of angles and their measurement.	Activity like 'head, shoulder, knees, toe, ears, mouth and nose. With the help of clock 's hands rotation angles of different types are shown. Activity on chart paper and worksheets.	5 days
4.	Area	To develop the concept of area. To determine the area of rectangle and square. To help the students to apply the concept of area in daily life.	Measuring the length and breadth of books. Counting of blocks in rectangle and square. Counting the tiles of classroom. Pasting of stamps to certain area. Practice on worksheets.	5 days

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

Data collection and analysis

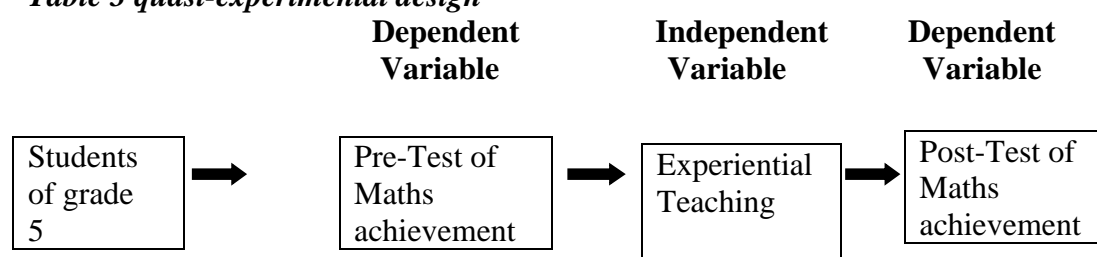
The studies based on grade 5 of the school rather than Randomization it uses all 20 students of the class listed in S01 to S20, so a quasi experimental approach is used.

The data was collected by the same sample using only group pre test post test design before and after treatment.

Pre-test of the students taken to evaluate the results using Conventional teaching approach followed by textbook method after giving the treatment of experimental teaching the post test was conducted together data for both pre and post test were evaluated by teacher main achievement test based on the topics which has been taught i.e., Fractions percentage shapes and angles area. The data collection process is shown in Table 2.

The data was analysed quantitatively with SPSS and qualitatively on the basis of observation and worksheet, activities and students participation, which evaluated student ability and their change attitude towards mathematics subject.

Table 3 quasi-experimental design



Experimental design

According to learning outcomes of experimental and traditional teaching, the researcher collaborated to develop experimental lesson plans that covered arithmetic and geometric topics and its applications. Two periods are proposed for the experimental lesson plan, each are as follows the new lesson plan other is the activity and practice. Every topic is followed by the test after the completion of the plan. It took 5 days for every topic to complete. Finally, the post -test data collected to evaluate the effectiveness of the experiential teaching approach.

Data analysis

Table 4: Paired Samples Statistics

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	PRE-TEST SCORE	34.40	20	7.11	1.59
	POST TEST SCORE	59.80	20	7.98	1.78

Table 5: Paired Samples Correlations

		N	Correlation	Sig.
Pair 1	PRE-TEST SCORE & POST TEST SCORE	20	.75	.00

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

Table 4 resulted in the value of $0.00 < 0.05$. The evidence rejected the null hypothesis because the value applied fell within the rejection domain. Pre and post scores were significantly different for the experimental class. The findings indicate the students learning efficacy increased in the experimental class compared to pre experiment. After the successful intervention of experiential learning students perform better academically. Table 5 shows the pre and post experiment, the correlation shows significant level 2 tailed < 0.05 , the Pearson correlation coefficient of 0.75, indicates a significant correlation.

Table 6 : Paired Samples Test

	Paired Differences			t	df	Sig. (2-tailed)		
	Mean	Std. Deviation	Std. Error Mean				95% Confidence Interval of the Difference	
							Lower	Upper
PRE TEST-POST TEST	25.40	5.37	1.20	27.91	22.88	21.13 19 .00		

Table 6 shows, since the P value is smaller than alpha, null hypothesis is rejected, the post test score mean is considered to be not equal to pre test score mean, In other words the sample difference between the means of pre and post test is large which is enough to be statistically significant. The table shows that P value 0.957 is smaller than alpha. It means that the chance of type 2 error is small, the smaller p- value, the more it supports research hypothesis.

The test statistics, t value equals to 21.33, which is not in the 95% region of acceptance (2.093, -2.093). The difference of pre and post test (25.40), Is not in the 95% region of acceptance.

Hence the result of paired t test indicated that there is significant large difference between pre(M=21.33,, SD=7.11) And post (M=59.80, SD=7.98), $t(19) = 21.33$, $p < .001$.Rejects the null hypothesis, shows the intervention is effective in learning mathematics.

Experiment revealed that students in the experimental class were more engaged and enthusiastic about the real world problems. The variety of mathematical activities and applications found in diverse fields of study has led to the result that there is a correlation between the real world issues and mathematical interests.

Results of observation and students opinion

It was observed that students learn very actively and enthusiastically, they took interest in real experience based learning they participated in every activity which has been given they give most cost effective ideas to solve problems in real life situations. As a result, students better understood how mathematics is useful in daily life and how maths can be applied in real life situations.

The students are questioned regarding their experiences after the lesson taught through experiential approach 75% student answer “I enjoyed maths lessons more than before”.62%

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

of students he told that doing maths problems is a fun, 56% accepted maths is an important subject, 38.5% of students wanted to learn similar experiential lessons.

To understand students' attitude better a question is asked to know students' attitude towards experiential lesson, just after completing the lesson taught through activities followed by worksheets. Researcher asked "Do you have any opinion about the class?". The answers of students are as follows:

- Student S01: She told I really had fun learning and understood lessons very easily. She wishes to have classes like this.
- Student S02, S03, S17, told that how maths become very easy subject for them, they enjoyed learning as the activities were very interesting and the worksheets were also very easy, they want more worksheets like this.
- Student S11, S13 and S16 told that they had fun in class, they wish to have these like classes and they will come regularly at school.

Of course, the last answer amused the researcher most as it is the big obstacle in teaching learning process in primary schools of India.

In regards to the assessment of attitude based on the criteria established by the researcher; it was concluded that there is positive changes in students' attitude towards mathematics as a result of study students learning outcome increased after the experiential lessons.

As a result of the project "My House" given to students. Figure1, the researchers found a great understanding of students regarding to all 4 topics of arithmetic and geometric experiential learning. It was well demonstration of knowledge through experiential activities. Their corporation, interest and application in the real world situations.

Figure1: Students project "My House"



DISCUSSION

In this study, researchers were able to obtain the objectives, which have been established. Following the study researchers used only 4-maths topic related to arithmetic and geometry because of short of time and partially hypothesized as students were not familiar with the approach of experiential lessons. Although the effect is very large, this is promising indication of positive effect of experiential learning on students' achievement in mathematics.

Analysing students activities worksheets works, projects and test revealed that their mathematical problem solving abilities have improved their learning abilities for applying their knowledge to the real world situations. Students attitude towards mathematics also has been positively improved, their motivation towards learning mathematics increased due to

The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

the activities performed in experiential class. The study shows the increased learning outcome of students after experiential class. Students gave their valuable feedback, which shows their interest in using this method in future lessons.

CONCLUSION

The study has revealed through observation and analysis of experimental classes and assessment results that learning through experiential lessons is very effective and feasible. After being exposed to experiential class activities associated with 2 arithmetic and 2 geometric topics has been explored that after experiential class the students test scores are higher as comparatively before experiment. In addition, students learning outcome improved due to their active participation in activities.

In this study teacher better understands the difficulties and problems which students face. This approach assisted students in developing mathematical qualities and competencies.

In addition to many fruitful findings the study has some limitations the sample size was small the time spent in experiment was also short activities had to be planned to fit in short learning plan which became constraint in this research. As students were not familiar to the approach so there were initial confusion on their part, along to this study several other studies have also faced this problem (Cranton, 2011; Kolb and Kolb, 2017).

The study suggests that future research on experiential learning in mathematics can include other topics of algebra, calculus, and statistics in other grades also. Future studies should consider to be long term planning and also can be used for interdisciplinary approach.

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The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study

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Acknowledgment

Thanks to all students and parents who took part in investigation as well as the teachers who assisted with it.

Author contributions

Both the authors listed have made substantial, intellectual and direct contribution to the study and approved it for publication.

Conflict of Interest

The author(s) declared no conflict of interest.

How to cite this article: Bajpai, N. & Pandey, J. (2024). The Effectiveness of Experiential Learning on Mathematics Achievement among Fifth Grade School Students: A Quasi Experimental Study. *International Journal of Indian Psychology*, 12(1), 525-535. DIP: 18.01.048.20241201, DOI:10.25215/1201.048