



EFFECTIVENESS OF EXPERIENTIAL LEARNING IN TEACHING MATHEMATICS TO PRIMARY SCHOOL STUDENTS

Dr Madhu Sahni

Associate Professor, Vaish Collage of Education, Rohtak-124001 (Haryana, India)

Abstract: In regards to NEP 2020, experiential learning is gaining popularity in India. Students who participate in experiential learning gain knowledge by becoming fully involved in an experience and by reflecting on it. They acquire new knowledge, attitudes, and abilities in this way. The aim of the current study was to compare the efficacy of the experiential learning approach with the traditional method for teaching mathematics to primary school students. Instructional treatment was carried out for three days in both experimental as well as control group. The sample consisted of 40 sixth-grade students of govt. senior secondary school of district Gurugram (Haryana, India). A pretest-posttest control group design was employed in the investigation. The sample for the research replied to the achievement test and experiential learning program on three topics of geometry constructed by investigator. The two-way ANOVA (2x2 factorial design) and t-test were used for data analysis. The findings showed that (a) students who were exposed to experiential learning programs learned more than those who were taught using traditional method, and (b) low achievers were more likely to benefit from experiential learning approach than high achievers.

Keywords: Experiential Learning, Primary school students

1 INTRODUCTION

The conventional methods of learning, such as the lecture technique, recitation, rote learning, etc., were once thought to be used in schools. But in the current modern scientific and technological era, the traditional instructional approaches are insufficient to grab students' attention and do not satisfy their demands on an intellectual, psychological, or emotional level. The demand for pedagogical changes at all educational levels that would shift away from the current rote-learning culture and toward actual comprehension and learning how to learn was highlighted in a number of policy documents (NCF 2005, NFG 2006, and NEP 2020). As a result, NEP 2020 emphasized the adoption of experiential learning as a standard pedagogy for every topic at all levels. In words of Habib et al., 2021, "The educational trend of the twenty-first century is student-centered, experiential, technology based, and question-based learning and empathic and understanding."

Due to its relevance, experiential learning is becoming more prevalent in educational settings worldwide. Students of the modern age are lacking in concentration. They get distracted easily. To quote McCoy (2016), "Studies show that the majority of students have used their digital devices for non-classroom activities." It is now important to involve the students in more "hands-on" learning activities, such as experiential learning. Silberman (2007) has defined experiential learning as "the process of involving students in real-world experiences that allow them to apply what they have learned and provides them with the chance to reflect on those experiences." There are many benefits of using experiential learning in the classroom. As stated by Pittaway and Cope (2007), educators are being encouraged to forgo the conventional methodology in order to foster hands-on learning. Participating in experiential learning helps educators develop successful educational programs, offer students with a supportive educational and cultural environment, and provide a conducive learning environment (Tong et al., 2020). Additionally, examining experiential learning via the lens of liminality offers a fresh perspective on how these activities affect people, institutions, and society (Amigó and Lloyd, 2021).

2 STUDY RATIONALE

Mathematics makes students more logical and skilled at reasoning. The results and grades of students from various boards demonstrate that the majority of pupils have no interest in the mathematics and view it as a boring, dry, and challenging subject. The council of boards of school education in India has already given the subject a great deal of consideration, especially in light of its curriculum transaction.

Being teacher educator of mathematics, the investigator believed that traditional teaching methods were insufficient to inspire, develop interest in, and seize the attention of students of mathematics. An alternate teaching method was to be used in order to raise student comprehension levels, foster their interests, and boost motivation. One way to get over this was through experiential learning. Consequently, students were to be encouraged to develop an interest in mathematics through having fun while learning and comprehending mathematical ideas through activities and experiments.

Related research in literature also revealed that teaching mathematics through experiential learning approach improved students' creativity (Chesimet et al., 2016) and problem solving abilities (Mwei, 2017 and Manfreda and Hodnik, 2021) in mathematics. Furthermore, the benefits of experiential learning on learning outcomes of mathematics have also been recognized (Avelino et al., 2017; Mutmainah et al., 2019). But there is a scarce of such studies in Indian context especially in the field of mathematics education.

The researcher thought it was appropriate to look into the impact of the experiential learning approach in teaching mathematics in light of the facts mentioned above. The undertaken study has got special significance in view of the fact that it was conducted on primary school students as development of children is important in formative years. Children are very active from nature. They like to play with things. If at this stage they are taught mathematical concepts by engaging them in activities, then their interest in mathematics will increase and their learning will become stable. Consequently, they will be more inclined towards mathematics. Here primary school students refers to the sixth class students studying in govt. senior secondary school of district Gurugram.

3 RESEARCH QUESTIONS

The present study investigated the following research queries:

1. Do primary school students who got instruction through experiential learning approach and those who received traditional instruction vary in their post-test results?
2. Do primary school students with high and low level of achievement vary in their post-test results?
3. Do the variables instructional treatments and levels of achievement interact with each other on post test results?

4 OBJECTIVES OF THE STUDY

The study had following objectives:

1. To compare the post-test results of the primary school students who received instruction using the traditional method and the experiential learning approach.
2. To investigate the efficacy of two teaching approaches for primary school students with high and low achievement.

5 METHODOLOGY OF THE STUDY

5.1 Experimental Design

The pretest-posttest control group design was used in this study and is shown as below in figure 1:

Randomly Picked Experimental Group (R E)	Pre-test (O ₁)	Special Instructional Treatment (T ₁ -Experiential learning Approach)	Post-test (O ₂)
Randomly Picked Control Group (R C)	Pre-test (O ₃)	No Special Instructional Treatment (T ₂ -Conventional Method)	Post-test (O ₄)

Figure 1: Pre-test- Posttest Control Group Design

5.2 Study Sample

The sixth graders at govt. senior secondary school, Molahera, Gurugram were the subjects of the study. All the sixth-graders present on the day of data collection constituted the sample of the study. Twenty of the forty students were chosen at random to make up the experimental group, which received instruction through experiential learning approach. A second group of twenty students was chosen to serve as the control group, and they received instruction through conventional method.

5.3 Tools Used

1. An achievement test on three topics of geometry, i.e., 'standard units of measurement', 'perimeter', and 'fraction' was prepared by the investigator. After carefully reviewing the test construction processes, the test was created. Twenty multiple-choice questions made up the test. These test items were based on the four objectives of the cognitive domain, i.e., knowledge, understanding, application, and skill.
2. Experiential learning program on the concepts of 'standard units of measurement', 'perimeter', and 'fraction' was developed by the investigator to execute the instructional treatment to teach the experimental group.

5.4 Statistical Procedures Employed

1. Using the t-test, it was determined if the difference between the mean scores of experimental and control groups on the pre- and post-test score variable was statistically significant.
2. Using a two-way Analysis of Variance (ANOVA) with a 2x2 factorial design, the main effects and interactional effects of independent variables (treatments) on dependent variables (achievement), was examined. t-test was further used to augment ANOVA. Figure 2 represents factorial design:

	Experimental Group	Control Group
High Achievers	Cell 1 (n=10)	Cell 2 (n=10)
Low Achievers	Cell 3 (n=10)	Cell 4 (n=10)

Figure 2: 2x2 Factorial Design

6 ANALYSIS AND INTERPRETATION OF DATA

Following a statistical analysis of the gathered data, the findings were interpreted in accordance with the following subheadings:

Table 1: Significance of pre-test mean score differences between experimental and control groups

Group	N	Mean	S.D.	t-value	Level of Significance
Experimental	20	17.65	2.5	1.21	Not significant even at .05 level
Control	20	16,55	3.2		

Table 1 indicates that even at the .05 level of significance, the t-value is insignificant. It shows that the mean pre-test scores of the students in the experimental group do not substantially vary from those of the control group.

Table 2: Significance of difference between mean scores of high achievers of experimental and control groups on pre-test

Group	N	Mean	S.D.	t-value	Level of Significance
High Achievers of Experimental Group	10	17.1	2.5	1.16	Not significant even at .05 level
High Achievers of Control Group	10	15.9	2.1		

Table 2 makes it clear that there is no statistically significant difference in the mean pre-test scores of high achievers in the experimental and control groups.

Table 3: Significance of difference between mean scores of low achievers of experimental and control groups on pre-test

Group	N	Mean	S.D	t-value	Level of Significance
Low Achievers of Experimental Group	10	16.5	2.2	1.75	Not significant even at .05 level
Low Achievers of Control Group	10	14.9	1.87		

According to table 3, there was not a significant difference between the pre-test mean scores of experimental and control group low achievers.

Table 4: Summary of 2x2 factorial design ANOVA for post test scores

Source of Variation	df	Sum of Squares	Mean Square	F	Level of Significance
Treatment	1	78.4	78.4	112.896	.05
Ach Level	1	96.1	96.1	138.384	.05
Interaction	1	12.1	12.1	17.424	.05
With in Cell	36	211.6	5.4256		

4.1 Main Effects

Treatment

The F-value for the difference in post-test scores between the two treatment groups is significant at 0.05 with a $df=1/36$, as can be shown in table 4. It demonstrates that two alternative instructional approaches produced different post-test mean scores. The t-test was used to interpret this. Table 5 presents the findings for the same.

Table 5: Significance of difference between mean scores of experimental and control groups on post test

Group	N	Mean	SD	t-value	Level of Significance
Experimental	20	19.05	2.3	2.02	.05
Control	20	17.7	1.9		

The t-value is significant at the .05 level, as shown in Table 5. It demonstrates a significant difference between students taught using an experiential approach and those taught using the conventional method of instruction in their mean post-test results. Additionally, the mean post-test scores of students taught using the experiential learning technique are 19.05, which is considerably higher than the mean post-test scores of students taught using the conventional method, which are 17.7. Therefore, it can be claimed that students who were taught experientially as opposed to those who were taught conventionally got their post-test scores to be significantly higher.

Level of Achievement

The F-value (vide Table 4) with $df=1/36$, indicates the substantial difference in their mean post-test scores of the two performance groups, i.e. the high achievers and low achievers. This means that two levels of achievement produced different post-test mean scores. This was interpreted using the t-test. Table 6 contains the findings for the same.

Table 6: Significance of difference between mean scores of high achievers and low achievers on post test

Group	N	Mean	SD	t-value	Level of Significance
High Achievers	20	19.62	2.3	0.94	Not significant even at .05 level
Low Achievers	20	18.99	1.9		

Table 6 makes clear that even at the .05 level of significance, the t-value is not significant. It reveals that the mean post-test results of high achievers and poor achievers do not differ statistically significantly.

4.2 Interaction Effect

Treatment and Level of Achievement

It may be concluded (vide table 4) that two variables viz. treatment and level of achievement interact with each other. The t- ratios were calculated to do further investigation. Table 7 contains the findings for the same.

Table 7: Significance of difference of mean post test scores among different combination groups for treatment (T) x achievement level (A)

Group	T ₁ A ₁ Mean=19.83	T ₁ A ₂ Mean=18.75	T ₂ A ₁ Mean=18.95	T ₂ A ₂ Mean=16.98
T ₁ A ₁ Mean=19.83	-	1.83 (NS)	2.01 **	5.56*
T ₁ A ₂ Mean=18.75	-	-	0.38 (NS)	3.23*
T ₂ A ₁ Mean=18.95	-	-	-	4.39*
T ₂ A ₂ Mean=16.98	-	-	-	-

*.01 level of significance, **.05 level of significance, NS-not significant even at .05 level T₁- Experiential Learning Approach, T₂- Conventional Method, A₁-High Achievers, A₂-Low Achievers

Table 7 shows that

- The mean post test scores for both high achievers (M=19.83) and low achievers (M=18.75) who were taught experientially were comparable.
- High achievers who were taught using an experiential learning approach performed better (M=19.83) than high achievers who were taught using a conventional method of instruction (M=18.95).
- High achievers taught using the experiential learning approach (M=19.83) performed better on post test as compared to low achievers taught using the traditional teaching approach (M=16.98).
- Mean post test scores of high achievers taught through conventional teaching method (M=18.95) and low achievers taught through experiential learning approach (M=18.75) were comparable.
- Low achievers who were taught using an experiential learning approach did better than low achievers who were taught using a traditional teaching method (M=18.75 Vs M=16.98)
- High achievers who were taught using the conventional method (M=18.95) performed better than low achievers who were taught using the conventional method (M=16.98).

Table 7 further demonstrates that students who received instruction through experiential approach had the highest post-test scores (M=19.83), whereas those who were taught through conventional method had the lowest post-test scores (M=16.98).

7 DISCUSSION OF THE RESULTS

The pretest scores of the experimental and control groups were compared statistically, and the findings revealed no significant differences between the two groups (see table 1), and both groups performed almost identically on the achievement test.

Additionally, the mean pretest scores of high achievers in the experimental and control groups did not differ significantly (see table 2) from one another. This shows that the achievement test results at the beginning of the experiment showed almost identical performance for high achievers in the experimental and control groups.

In the same way, there was no difference between the mean pretest scores of experimental group's low achievers and those of the control group (see table 3). This shows that the low achievers of experimental group and that of control group performed nearly equally on the achievement test.

The results of the study show that the experimental group fared better on the post-test than the control group (table 5). This indicates that students who were taught using an experiential learning approach outperformed scored better than those who were taught using the conventional approach. The outcomes of the investigation are in consistent with the the findings of Kılıç, 2002; Gosen & Washbush, 2004; McCarthy & McCarthy, 2006; Ernst, 2013; Konak, Manav & Eceoglu, 2014). Studies demonstrate that experiential learning has a favorable impact on academic performance, meaningful learning, and learning outcomes.

When high achievers and low achievers were compared, the experimental group's performance was significantly better to that of the control group. Moreover, a comparison of the post test scores of the experimental and control groups showed that those who were trained on the basis of the experiential approach perform significantly better compared to those who were trained by the conventional method.

Likewise, a comparison of the poor achievers' mean scores between the experimental and control groups revealed a substantial difference (table 7). For low achievers, the experiential learning approach thus appears to be more successful for low achievers.

As far as interaction between the variables viz. treatment and level of achievement is concerned, it can be concluded that joint effect of the variables might be statistically significant due to the reason that each variable is varying in distinct ways viz. experiential learning approach and conventional method; high achievement level and low achievement level.

Overall, it can be claimed that the experimental group outperformed the group taught using the conventional method of instruction.

8 EDUCATIONAL IMPLICATIONS OF THE STUDY

1. The research revealed that the experiential approach is successful in enhancing students' performance. To examine its efficacy, more units/topics of mathematics from different branches of mathematics may be taken.
2. The experiential learning approach encourages conventional educators to achieve their goals using novel methods in order to benefit greatly from it. Therefore, it is advised that educators use it to improve the effectiveness of teaching and learning in the classroom.
3. The results of the current study are especially valuable in the context of low achievers, as the experiential learning approach is important in promoting learning.
4. It is advised that this approach be widely publicized so that many additional experiential programs may be created for students in class sixth on various sub units of mathematics, particularly those that are challenging to learn.
5. The mathematics educators need to have enough orientation and training on how to create experiential learning programs.
6. Mathematics books should also incorporate activities along with each and every topic the students should be engaged in for comprehending the mathematical concepts.
7. The investigation focused on sixth class students. A sample of high school students can also be used to study the impact of experiential learning.
8. Research on the benefits of experiential learning can also be done in other academic fields.
9. It is also possible to determine how experiential learning affects other variables such as achievement motivation, creativity, etc.

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