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Improving Grade I Students' Conceptual Understanding in Science and Technology Subject Through Experiential Learning: A Study at Rinchen Kuenphen Primary School

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Abstract

This action research examined the effectiveness of experiential learning in improving Grade I students' conceptual understanding in Science and Technology at Rinchen Kuenphen Primary School. The research was undertaken to improve students' poor conceptual understanding, lack of participation in the classroom, and inability to apply concepts using traditional teaching approaches.

A mixed-method approach was used. The quantitative data were obtained from pre-test and post-test involving 32 Grade I B students, and the qualitative data from classroom observations of 16 randomly chosen students. The pre-test results revealed students' limited understanding, participation, and skill application. To improve these situational skills, experiential learning techniques, including hands-on tasks, observation tasks, group discussions, videos, and worksheets, were applied for four weeks. The mean score in the pre-test (6.34) improved to 8.59 in the post-test, suggesting improvements in conceptual understanding. Teacher observations also confirmed the increased engagement, participation, curiosity, and learning behaviour.

It was found that experiential learning improved students' conceptual understanding and interest in Science and Technology. The study suggests implementing experiential learning strategies in lower primary education.

Keywords: Grade I, Experiential learning, conceptual understanding, Science and Technology

Chapter I

1.1 Introduction

The introduction of Science and Technology as a subject in the lower primary curriculum in Bhutan marks a significant reform in the education system. This new subject, introduced in 2026, aims to foster curiosity, critical thinking, and problem-solving skills among students while aligning with international standards and 21st-century competencies. Unlike the previous Information and Communication Technology (ICT) curriculum, which focused primarily on digital skills, the Science and Technology subject emphasizes scientific concepts, everyday technologies, and exploration of the natural world.

However, the transition to this new subject has posed challenges for teachers and learners alike. Grade I students, in particular, have limited prior exposure to structured science education and often rely on their personal experiences and observations to make sense of the world. Traditional teacher-centered

approaches, such as lectures and rote memorization, have proven insufficient for fostering deep conceptual understanding among these young learners. Consequently, there is an urgent need to adopt innovative, learner-centered pedagogies that actively engage students and support the construction of knowledge through experience.

Experiential learning, rooted in constructivist theory, offers a promising solution. This approach emphasizes "learning by doing," enabling students to interact with their environment and reflect on their experiences to develop meaningful understanding. By engaging in hands-on activities, observations, and inquiry, students are better equipped to relate theoretical concepts to real-life phenomena. Research in Bhutan and beyond has consistently demonstrated the effectiveness of experiential learning in enhancing engagement, critical thinking, and academic performance in science education.

This action research aims to explore the potential of experiential learning strategies to improve Grade I students' conceptual understanding and engagement in the Science and Technology subject at Rinchen Kuenphen Primary School. By applying experiential learning approaches in the classroom, the study is expected to address the challenges of traditional teaching methods and provide evidence-based insights to improve teaching and learning practices.

1.2 Significance of the Study

This action research is important as it relates to the challenges of implementing the new Science and Technology Curriculum in lower primary classes in Bhutan. Children in Grade I have little experience in science learning; therefore, it is important to understand how best to teach them to achieve strong conceptual understanding. The results of this research may offer insights into how experiential learning opportunities may improve conceptual learning in young students through engagement and experiences.

The study will benefit students through the provision of meaningful learning opportunities that help them understand science concepts, find science learning fun and relevant to their everyday lives. Experiential activities may help students be more active, curious, and independent in their learning.

To teachers, the study may provide a guide to implement a learner-centered approach that goes beyond the traditional teacher-centered method of teaching. This may enable teachers to recognise the benefits of experiential learning to enhance engagement and learning in the classroom, and to build concepts for young students.

The results may also help school administrators and policy makers to understand the effective teaching and learning strategies that can be adopted to help in the successful implementation of the new Science and Technology curriculum in Bhutan. The research might inspire schools to facilitate activity-based learning environments and equip classrooms with resources for activity-based learning.

1.3 Situational Analysis

This action research will be conducted in a Grade I classroom at Rinchen Kuenphen Primary School in Thimphu Thromde. The class consists of 32 students with diverse learning abilities and varying degrees of prior exposure to scientific concepts. Since Science and Technology is a newly introduced subject, students lack foundational knowledge and rely heavily on daily experiences to understand their environment.

Initial classroom observations indicate that students show greater interest and engagement during hands-on activities, demonstrations, and visual materials compared to traditional textbook-based lessons. Many students struggle to grasp abstract concepts through teacher explanations alone, leading to surface-level learning and reliance on memorization.

The students come from varied cultural and socioeconomic backgrounds, which influence their access to educational resources and parental support. While some students receive significant home support, others face challenges that affect their learning pace and overall academic performance.

1.4. Research Aims and Objectives

This action research seeks to contribute to the growing body of evidence on the effectiveness of experiential learning in early primary science education. By exploring its impact on Grade I students' conceptual understanding and engagement, the study aims to inform teaching practices and support the successful implementation of Bhutan's new Science and Technology curriculum.

The action research objectives are to:

1. Investigate the effects of experiential learning on students' conceptual knowledge of Science and Technology.
2. Assess students' engagement and participation during experiential learning activities.
3. Compare students' understanding of the concept before and after the implementation of experiential learning activities.

1.5 Action Research Question

Aligned to the research objectives, this research will seek to answer the following questions:

1. How does experiential learning impact the conceptual understanding of Grade I students in the Science and Technology subject?
2. How does experiential learning influence the engagement and participation of Grade I students during Science and Technology lessons?
3. What are the differences in students' conceptual understanding of Science and Technology before and after the use of experiential learning strategies?

Chapter II

Literature Review

The primary level of Science and Technology education is important in making students curious, critical, and learn about the natural world. Exposing children to scientific concepts early in life helps them develop a foundation of basic knowledge and form positive perspectives on the subject. Nonetheless, a significant number of young students experience challenges in grasping scientific concepts when using pedagogic approaches that are primarily based on theoretical explanations and memorization. The conventional teacher-centered learning concept tends to deprive students of their abilities to explore, discover, and engage in the learning process. Consequently, students can acquire a shallow knowledge of scientific concepts and will not be motivated to learn science and technology. To address these problems, there has been a growing focus by educators on the significance of student-centered methods of instruction, like experiential learning, to facilitate conceptual knowledge acquisition in science education.

Experiential learning is the process of learning, where students acquire knowledge and skills through first-hand experiences and by engaging themselves. Learners, rather than sitting back and passively receiving information, are involved in practical activities, experiments, observations, and reflections. In this way, they will be able to build their own definition of scientific concepts. Experiential learning facilitates the learner to engage with the environment and relate real-life experiences to the theoretical knowledge. Experience has demonstrated that experiential learning can be very helpful in enhancing the comprehension and academic achievement of students in science. In a study, which was done among Bhutanese Grade 6 students, it was revealed that the approach of experiential learning was a very effective

way of improving the learning achievement of students in science. Experiential learning activities showed better academic results and increased participation among students as opposed to those who were taught in a conventional way (Dorji & Sakulwongs, 2025). The researchers came to the conclusion that experiential learning helps students to gain a deeper understanding of scientific concepts due to the ability to observe, experiment with, and reflect, which positively impacts the overall learning outcomes.

Another Bhutanese research carried out also demonstrates the effectiveness of experiential learning on science education. Thinley (2025) conducted a study to explore the efficacy of Hands-on Learning as a teaching tool used to teach primary science to Grade VI students in Wangdue Primary School. His results indicated that students who were exposed to practical learning showed greater improvement in academic performance as compared to those taught through the traditional approach. The researcher, therefore, determined that practical activities and close contact with materials contributed to their learning scientific concepts. Dorji (2024) investigated the impact of Inquiry-Based Learning on the performance of Grade VI students. Students noted that the approach assisted them to learn concepts better, enhanced engagement, and skills to solve problems.

A different research examining the strategies of experiential learning in the elementary school came up with significant student improvement in their performance in science. The researchers supported their study by finding out that students who used experiential learning exercises like group experiments, group discussions, and hands-on investigations had strong conceptual knowledge and a higher passing rate than students who used traditional teaching techniques (Dorji & Sakulwongs, 2025). This development indicates the success of experiential learning in enhancing active learning and better performance in science. Along with enhancing academic performance, experiential learning can also lead to student independence and involvement in the classroom.

Hossain and Manzoor (2023) highlight that experiential learning motivates students to be accountable for their own learning through engaging in activities, discussions, and group activities. Students who are allowed to explore and discover by themselves have more comprehensive insight into the subject matter and are more motivated. These learner-centered methods are especially useful among young learners since they bring a conducive and interesting learning atmosphere. Within the Bhutanese education system, science education has been receiving more focus in terms of enhancing it by implementing new and student-centered methods of teaching. The educational research conducted in Bhutan indicates that the use of interactive and practical methods in teaching can help to increase students' knowledge on scientific topics and even learning outcomes (Thinley, 2021). Experience-based learning, whose orientation is based on practical activities and interactions, is in line with these education objectives and will help in enhancing the quality of science education in the Bhutanese schools.

Moreover, experiential science classroom learning can also be enhanced through the use of modern educational tools and technologies. Online technologies and interactive materials can be used by teachers to design interactive learning spaces that will allow learners to study the principles of science with the help of simulations, multimedia texts, and group assignments. Studies on technology in teaching science show that the application of technology can be effective in facilitating student involvement and facilitating the process of active learning of science subjects (Yunus & Suliman, 2014).

According to the analyzed literature, experiential learning tends to become one of the promising methods of instructional approach used to enhance conceptual learning, engagement, and academic achievement in science subjects. The results of the past research show that experiential learning has the ability to facilitate in-depth learning, critical thinking, and active engagement among learners. Nevertheless, more studies are

required to understand the potential of employing experiential learning strategies in the primary learning classroom at the earlier stages. This paper will, therefore, seek to explore how experiential learning can help improve the conceptual understanding of Grade I students in the Science and Technology subject at Rinchen Kuenphen Primary School.

Despite the above findings, there is limited research on the application of experiential learning in lower primary classrooms. This gap underscores the need for studies focused on early primary learners, who require developmentally appropriate and interactive teaching methods. This action research aims to address this gap by exploring the impact of experiential learning strategies on Grade I students in the context of Bhutan's newly introduced Science and Technology curriculum.

Chapter III: Methodology

3.1 Research Design

A mixed-method approach was employed to evaluate the impact of experiential learning on Grade I students' conceptual understanding and engagement. This approach was chosen as it enables the researcher to collect both numerical and descriptive data to obtain a comprehensive evaluation of the effectiveness of the intervention strategies implemented. The pre-and post-test quantitative data enabled the assessment of the changes in students' conceptual understanding before and after the intervention. The pre- and post-classroom observation qualitative data provided information about students' interactions, participation, and learning during experiential learning activities. Using both approaches enhances the validity and reliability of the results by allowing to triangulate data and providing a more comprehensive view of the study results.

3.2 Sampling/Participants

There are six sections of Grade I at Rinchen Kuenphen Primary School, and I have chosen Class I B students as participants of this study. For quantitative data, all 32 students of Class I B were involved, and the sampling technique adopted was convenience sampling, as the researcher teaches the subject in this section and had direct access to the participants. These students participated in pre-test and post-test to assess changes in the conceptual understanding of Science and Technology.

For qualitative data collection, 16 students from the same class were selected through simple random sampling for classroom observations. Random sampling was used to ensure fair representation of students with varying learning abilities and engagement levels during the experiential learning activities. The selected students were observed during both baseline and post-intervention stages to understand changes in their conceptual understanding, participation, and learning behaviours.

This sampling approach was appropriate for the study as it allowed the researcher to conveniently implement the intervention within the researcher's own classroom while also obtaining detailed observational data from a manageable number of participants.

3.3 Data Collection Tools

This study used two primary tools to collect both quantitative and qualitative data: a pre-test and post-test, and a structured classroom observation checklist.

Pre-test

A set of test questions was used to assess students' conceptual understanding of the topic "Classifying Materials (Natural and Human-made)" in Science and Technology. The test consisted of age-appropriate questions aligned with the learning objectives of the lesson. It measured students' ability to identify natural

materials, identify human-made materials, and classify them correctly. The pre-test was administered before the intervention to determine students' baseline understanding of the concept.

Classroom Observation

A structured observation checklist was used to collect qualitative data on students' engagement, participation, learning behaviour, and conceptual understanding during classroom activities. Descriptive notes were recorded based on students' actions, responses, interactions, and challenges during lessons.

3.4 Data Collection Process

Before the collection of the data, informed consents were obtained from students and their parents/guardians, emphasizing voluntary participation and confidentiality of responses (attached as Appendix A). In the baseline data collection, all 32 students in Class I B took the pre-test to determine their initial knowledge of material classification. Observations were also made of 16 randomly chosen students, using the observation checklist during the normal classroom lessons.

After collecting baseline data, the experiential learning strategies were implemented during Science and Technology lessons for four weeks. The strategies involved classifying exercises, observation, manipulation of real objects from their environment, discussion, worksheets, and videos. Following the intervention, the same 32 students took the same post-test to assess their conceptual understanding. The same 16 randomly selected students were observed again using the observation checklist to assess engagement, participation, learning, and conceptual understanding.

3.5 Data Analysis

Quantitative data from pre- and post-test scores were analyzed using descriptive statistics through Jamovi (Version 2.6). Mean scores, median, and standard deviation were calculated to compare students' conceptual understanding before and after the intervention.

Qualitative data for observation were analyzed using thematic analysis. The researcher reviewed observation notes from 16 selected students and identified recurring patterns and behaviours. The data were grouped into four themes.

3.5.1 Baseline Data Analysis

Pre-test Analysis

A pre-test was administered to 32 Grade I B students to determine their initial conceptual understanding of the topic "Classifying materials". The data from the test were analyzed with descriptive statistics in Jamovi (Version 2.6).

Descriptives

	N	Missing	Mean	Median	SD
Pre-Test	32	0	6.34	6.00	2.25

The Descriptive statistics show that the students achieved a mean score of 6.34, a median score of 6.00, and a standard deviation of 2.25. The mean score suggested that students had a low understanding of the concept before the intervention, showing that many students struggled to identify and categorize natural and man-made materials. The standard deviation (2.25) showed that there was some diversity in students' performance. This revealed that while some students showed a higher level of conceptual understanding, others performed poorly on the topic. Therefore, the baseline assessment revealed the students' lack of

prior knowledge about the concept and the need to apply experiential teaching-learning approaches to improve their conceptual understanding in the Science and Technology
subject.

Pre-observation Analysis

Baseline classroom observations were made for 16 randomly selected students in Grade I B before the implementation of experiential learning strategies. Observations were made to assess their initial understanding of the concept, skills application, engagement, participation, and learning behaviour in Science and Technology lessons. Themes were derived from the observation data.

Theme 1: Weak Conceptual Understanding

Baseline observation showed that students had limited knowledge of natural and man-made materials. Some students could name some natural materials like rocks, leaves, and water, but they could not classify all materials. For example, students classified paper as a natural material because it's made from trees, and were unclear about plastic. A large number of students were highly dependent on teacher support when it came to identifying and categorising materials, and struggled to justify their answer when explaining why an object belonged to a certain category. This suggested they had a poor understanding of the topic.

Theme 2: Limited Use of Skills

There was poor application of knowledge in the classroom. When looking at materials, some students only used surface characteristics such as colour instead of considering properties such as texture, use, or source. Few students were able to relate the lesson to their environment. This implied that students didn't have the chance to use scientific ideas in reality.

Theme 3: Limited Engagement

The data revealed that students were interested in visuals and objects in the classroom. But engagement was low. There were only a handful of students who answered questions posed by the teacher; others remained silent unless called. This showed that while students were motivated to learn from activities, they were less confident and engaged in the lesson.

Theme 4: Poor Learning Behaviour and Curiosity

The observation also highlighted issues with students' learning behaviour. A few students struggled to pay attention to instructions for classroom activities, as well as being easily distracted. Some students needed constant reminding to focus on the task. Few students asked questions or expressed interest by investigating classroom resources.

This may have been a result of traditional classroom teaching not facilitating exploration and inquiry.

The overall baseline observation revealed that students had poor conceptual knowledge, application skills, engagement, and curiosity before the intervention. This suggested that experiential learning approaches could be useful to offer students hands-on experiences to enhance their learning and participation in Science and Technology classes.

3.5.2 Intervention

Following the baseline test and classroom observations, experiential learning strategies were introduced as an intervention to enhance Grade I students' conceptual learning in Science and Technology. The intervention lasted for two months and was conducted during the classroom lessons on the topic “Classifying Materials (Natural and Human-made).”

The intervention incorporated active and student-centered learning strategies to enable students to learn from their experiences. Students were involved in various activities, including observing real-life objects, categorising materials as natural or human-made, engaging in discussion, watching videos, working on

classification worksheets, and exploring the materials around them. Students were given opportunities to explore, observe, compare, and classify materials based on their characteristics and source.

The teacher played the role of a facilitator during the intervention by asking questions and facilitating discussions in each activity. These hands-on activities were incorporated into the lessons to enhance learning experiences and improve conceptual understanding, engagement, and participation of students.

3.5.3 Post-data Analysis

Post-test Analysis

The same group (32 Grade I B students) was given a post-test after the experiential learning strategies were implemented to investigate their conceptual understanding of the topic "Classifying Materials (Natural and Human-made)." Descriptive statistics in Jamovi (Version 3.4) were used to investigate the post-test data.

Descriptives

	N	Missing	Mean	Median	SD
Post-Test	32	0	8.59	9.00	1.53

The descriptive statistics showed that students scored an average (mean) of 8.59, a median of 9.00, and a standard deviation of 1.53. The mean score of 8.59 on the post-test shows an increase of 2.25 points from the baseline mean score of 6.34, which indicates that experiential learning approaches helped students develop a better understanding of the concepts of natural and human-made materials.

The median score of 9.00 also suggests that most students scored well in the post-test, indicating that most students were able to identify and classify materials correctly after engaging in experiential learning activities. The reduced standard deviation of 1.53 (compared to 2.25 at the baseline) also indicates that there was less variability in student performance after the intervention. This shows that the number of students who found the concept difficult was reduced as a result of the experiential learning activities.

Post-observation Analysis

Post-classroom observations were conducted with the same 16 randomly selected Grade I B students after the implementation of experiential learning strategies.

Theme 1: Improved Conceptual Knowledge

The post-observation findings revealed an improvement in students' identification and classification of natural and human-made materials. The majority of students were able to accurately name natural and human-made materials. Students were able to provide more reasoning for their classification of materials. For instance, some students explained that bottles were human-made because they are produced in a factory, and leaves are natural because they are found on trees. Students were more independent and confident with classifying materials.

Theme 2: Improved Skill Use

Students were able to improve their application skills during classroom lessons. Students observed the properties of materials (texture, shape, colour, and source) to sort them. Some students could apply concepts learned in the classroom to experiences outside the classroom by referring to familiar objects from their home and neighbourhood. This suggested that the learning-by-doing approach assisted in the successful application of science concepts.

Theme 3: More Engagement and Participation

The findings showed an increased engagement of students in classroom activities. Students were enthusi-

astic about interacting with real objects and engaged in grouping and sorting activities. Students often answered questions posed by the teachers and shared opinions in group discussions. The incorporation of manipulatives, videos, and tasks appeared to engage students in learning.

Theme 4: Good Learning Behaviour and Interest

There were improved learning behaviours in post-observation. A majority of students were more independent in following instructions and focused on the tasks. Some students demonstrated curiosity by making comments such as why particular materials belonged in particular groups. Some students investigated other objects in the classroom and tried to categorise these objects.

3.6 Ethical Considerations

The researcher adhered to ethical guidelines by securing permission from the parents of all students before their involvement in the study. All participants were wholly voluntary. All the data collected was anonymized and securely stored purely for keeping confidentiality. A design of the intervention and data collection process was put in place to prevent any disturbance to normal teaching and learning activities. Participating in the research didn't lead any of the participants to fall at any disadvantage. All through its duration, the study was implemented with transparency, respect, and integrity.

Baseline Data Analysis

Chapter V: Findings and Discussions

This chapter discusses the key findings of the study, based on the quantitative and qualitative data analysis. The purpose of this study was to explore the impact of experiential learning on the conceptual understandings of Grade I students in Science and Technology.

4.1 Experiential learning improved students' conceptual understanding

The quantitative results from the pre-test and post-test indicated that there was an increase in students' conceptual understanding. The pre-test scores had a mean score of 6.34, showing that students in general had a poor understanding of classifying natural and man-made materials before the intervention. The mean score for the post-test increased to 8.59, an improvement of 2.25 points after the intervention using experiential learning strategies. The reduced standard deviation from 2.25 to 1.53 also suggested that students' performance improved without much variance. This result indicates that the experiential learning strategies improved students' learning outcomes.

4.2 Students showed improved skills

In pre-intervention observations, many students had difficulties applying their knowledge in classification activities and needed support from teachers. But post-observation observations showed that students were able to observe materials, acknowledge their characteristics, and classify materials on their own. Students also related their experiences with classroom lessons. This suggests that experiential learning enhanced students' skills in applying knowledge.

4.3 Student participation and engagement were improved

Before the intervention, observations indicated that a few students were quiet and shy to answer questions. Following the intervention, students engaged in classroom tasks and discussions and completed practical activities. They were more engaged and enthusiastic in lessons. This suggests that experiential learning engages students in learning.

4.4 Students adopted positive learning behaviours

At the start of the study, students lacked curiosity, had trouble following instructions, and were easily distracted. Observations after the activity revealed that students were more focused, able to follow

instructions, and independently explore the materials. A large proportion of students showed curiosity through questioning. This shows that experiential learning encouraged positive behaviours.

4.5 Conclusion

The study showed that experiential learning improved Grade I students' conceptual learning in Science and Technology at Rinchen Kuenphen Primary School. This study revealed that experiential learning enhanced students' understanding of the concept of natural and human-made materials.

The study also improved students' engagement, participation, skills application, and interest in learning. This experiential learning approach ensured students had the chance to learn through practical experiences with the materials and everyday experiences. This was more successful than more traditional teacher-centered approaches to learning in supporting very young students in developing concepts.

4.6 Recommendations:

Based on the findings, some recommendations on how teaching and learning of Science and technology can be improved. The experiential learning activities can be regularly incorporated into the lessons in the form of hands-on activities, simple experiments, and observation tasks to enable students to build a deeper conceptual knowledge. Teachers can also promote active engagement and inquiry-based discussions to ensure that students provide their ideas, observations, and explanations to any learning activity. Other researchers may replicate the study with a bigger sample or other primary grade levels.

Studies indicate that practical and inquiry-based learning in science enhances curiosity, motivation, and involvement of students. Therefore, schools can facilitate this strategy by providing proper learning resources and experiences of applied learning activities that enable the young learners to gain scientific curiosity and problem-solving skills.

4.7 Limitations

The research could be limited to:

1. The study took place within a constrained period of time, and this might limit the extent of observation and intervention of the conceptual development of the students.
2. As only one section of Grade I is involved, this could pose a problem in generalizing the result to other situations.
3. As Science and Technology is a new subject in Grade I, learners might not have a lot of prior knowledge of scientific concepts, and this might influence the initial performance in activities.

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