SJIF Impact Factor (2023): 8.574| ISI I.F. Value: 1.241| Journal DOI: 10.36713/epra2016 ISSN: 2455-7838(Online)
EPRA International Journal of Research and Development (IJRD)
Volume: 9 | Issue: 1 | January 2024 - Peer Reviewed Journal

ADDRESSING LEAST MASTERED SKILLS ON EARTH AND LIFE SCIENCE OF SBUR SHS STUDENTS THROUGH SCAFFOLDED TECHNOLOGY-ASSISTED ASYNCHRONOUS ACTIVITIES

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ABSTRACT
Strategies about addressing Least Mastered Skills of the students are necessary because of the effect of Covid 19 Pandemic. Many schools are subscribing to different platforms to maximize the time they must implement the curriculum and address the least mastered skills brought by pandemic and other classes interruptions. The study sought to assess the effect of Scaffolded Technology – assisted Asynchronous Activities to address the Least Mastered Skills of SBUR SHS students in Earth and Life Science. Based on the results of the 1st quarter exams in Earth and Life Science, most of the students of SBUR got very low scores in the topic Minerals and Rocks wherein majority of the students got the wrong answers consisting of 11 items. These items were considered by the researchers as Least Mastered Skills. An intervention called Scaffolded Technology – assisted Asynchronous Activities was developed following the Scaffolding Framework by (Hattie, 2019) consisting of modeling, guided practice, and independent practice. The intervention was developed by the researcher and the science teachers of San Beda University Rizal (SBUR). After the validation process, it was given to the students who are taking Earth and Life Science subject and were given two weeks to complete the activities. After two weeks, students were given a Post Test parallel to the test they encountered during the 1st quarter examination. Students who have not completed the intervention activities are not considered as participants of the study. The mean percentage of 11 items of the Least Mastered Skills is 0.33 while the mean percentage of these items during the Post Test is 0.54. When paired – sample T Test is used, the computed value is 0.003 which is lower than the critical value of α=0.05, which means there is a significant difference between the scores in the 1st quarter exams and the Post Test results of the participants. This implies that the Scaffolded Technology – assisted Asynchronous Activities are effective in addressing the Least Mastered Skills of SBUR SHS students in Earth and Life Science.

KEYWORDS: *least mastered skills, scaffolded technology – assisted asynchronous activities, mean percentage, paired T-test, earth and life science, minerals and rocks*

INTRODUCTION

Educational research continually strives to address the diverse needs of learners, striving for equitable academic achievement. An essential aspect of this endeavor is the identification and amelioration of "least mastered skills" among students. These skills represent the specific competencies, concepts, or knowledge areas in which students exhibit pronounced deficits or struggle to achieve proficiency. Understanding and addressing these least mastered skills are vital for improving learning outcomes and fostering academic success.

Based on the current practice of San Beda University Senior High School, least mastered skills are identified based on the collaboration of teachers, results of diagnostic assessments necessary before the start of the new lessons. However, least mastered skills after major assessments like quarterly examinations are not given priorities because the focus of the school is the students who failed in the quarter which usually given remedial program. The least mastered skills of the students as a batch or as a group are not directly addressed.

The focus of this study is to provide interventions to the least mastered skills identified after the results of the 1st quarter examinations. However, since at the end of the 1st quarter examinations, the school proceed immediately to the skills and lessons assigned for the 2nd quarter to meet the requirements of the Department of Education, the intervention will be implemented asynchronously so the second quarter time frame will not be affected.

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As education endeavors to be more inclusive and responsive to the unique requirements of students, recognizing the existence of least mastered skills and their impact on overall performance is paramount. This study delves into the identification and remediation of these skills, seeking to shed light on the challenges that students face and the potential strategies to overcome them. By conducting a comprehensive analysis, this research contributes to the ongoing dialogue surrounding the improvement of educational practices and policies, ensuring that all students can reach their fullest academic potential.

BACKGROUND OF THE STUDY

Identifying the least mastered skills among students is a critical aspect of educational research, as it helps educators target specific areas for improvement and design targeted interventions. Numerous studies have focused on assessing the least mastered skills across various subjects and grade levels to inform instructional strategies and curriculum development.

Based on the study conducted by the National Assessment of Educational Progress (NAEP) in the United States regularly identifies the least mastered skills in subjects such as mathematics and reading. The NAEP assessments provide a comprehensive overview of students' proficiency levels and highlight specific areas where students struggle the most (National Center for Education Statistics, 2021). By pinpointing these least mastered skills, educators and policymakers gain insights into where educational resources and support are most needed.

Additionally, research by Darling-Hammond and Ifill-Lynch (2006) emphasizes the importance of formative assessment and ongoing diagnostic evaluation to identify specific learning gaps and least mastered skills. This approach allows for a more dynamic and responsive educational system, where teachers can adapt their instruction based on real-time data about students' understanding and performance. The study underscores the value of continuous assessment practices in addressing least mastered skills and fostering student success.

Understanding the background and context of studies on least mastered skills is crucial for developing evidence-based strategies to enhance educational outcomes. Educators can tailor their instructional approaches to meet the diverse needs of students, ultimately fostering a more equitable and effective learning environment if they can be able to identify and address these specific challenges.
To address the least mastered skills among the learners, educators are exploring different ways to solve this problem. One of these is the use of scaffolding activities in teaching and the utilization of technology-based activities.

The term ‘scaffolding’ was used to describe the type of assistance offered by a teacher or peer to support learning. Wherein the teacher helps the student master a task or concept that the student is initially unable to grasp independently. The teacher helps with only those skills that are beyond the student’s capability. The scaffolding framework allows the student to complete as much of the task as possible, unassisted…Student errors are expected, but, with teacher feedback and prompting, the student can achieve the task or goal (Hattie, 2009).

In mathematics education scaffolding activities are essential for helping students develop problem-solving skills and a deeper understanding of mathematical concepts. This refers to the instructional support and guidance provided to students as they engage with increasingly complex tasks. Research by Wood, Bruner, and Ross (1976) highlighted the importance of scaffolding in the Zone of Proximal Development (ZPD), where students can accomplish tasks with assistance that they would not be able to complete independently. Effective scaffolding activities in math involve providing just enough support to allow students to make progress while challenging them to think critically.

A study by Yackel and Cobb (1996) explored scaffolding in the context of mathematical discussions. They found that teacher scaffolding could help students articulate their mathematical reasoning, engage in meaningful dialogue, and collectively build a deeper understanding of mathematical concepts. This research underscores the role of teacher facilitation in scaffolding activities, emphasizing the importance of a supportive and collaborative learning environment in mathematics classrooms.

Scaffolding activities can take various forms, such as providing prompts, asking probing questions, or offering concrete examples. In a study by Sfard (1991), it was shown that the choice of scaffolding strategies can significantly impact students' ability to internalize mathematical concepts and move toward more independent problem-solving. This research underscores the importance of tailoring scaffolding approaches to match the specific needs of students and the mathematical content being taught. Overall, scaffolding activities in math are a powerful tool for guiding students toward a deeper understanding of mathematical concepts and promoting mathematical thinking and problem-solving skills.

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Scaffolding activities in science education are critical for facilitating students' development of scientific inquiry skills and a comprehensive understanding of complex scientific concepts. Scaffolding involves providing instructional support that helps students address the gap between their existing knowledge and the intended learning outcomes. Vygotsky's Zone of Proximal Development (ZPD) theory highlights the use of scaffolding to challenge students while providing necessary guidance. In a study by Reiser and Tabak (2014), scaffolding in science was found to be effective in promoting students' science learning, particularly in the context of collaborative learning environments.

One important aspect of scaffolding activities in science education is the use of conceptual frameworks, visual representations, and inquiry-based learning. A research study by Minstrell (2003) focused on the use of scaffolded inquiry activities to support students' understanding of scientific concepts. The findings suggested that carefully designed scaffolded inquiry tasks could help students make meaningful connections between their prior knowledge and new scientific information. This research underscores the value of structured scaffolding to guide students through the inquiry process and enhance their scientific reasoning and problem-solving abilities.

Furthermore, the implementation of formative assessment strategies as part of scaffolding activities in science has been explored in research. Black and Wiliam (1998) highlighted in their study the significance of formative assessment in providing ongoing feedback to both teachers and learners. Formative assessments can be a valuable tool within the scaffolding process, enabling teachers to adjust their support based on students' progress and needs, ultimately leading to improved scientific understanding and achievement. In essence, scaffolding activities in science education play a pivotal role in helping students engage in scientific practices, develop critical thinking skills, and deepen their understanding of scientific concepts.

The use of technology in teaching has become a fundamental aspect of modern education, providing educators with tools to enhance pedagogy and engage students effectively. Research has shown that technology can significantly improve teaching and learning. The integration of technology in the classroom had a positive effect on student achievement, with an average effect size of 0.41 (Frey and Hattie, 2017). This research underlines the use of technology to facilitate more effective teaching strategies and improve academic performance.

The combination of traditional in-person teaching with online components is considered blended learning which is another area of extensive research. In a meta-analysis of research conducted by U.S. Department of Education found that students in blended learning environments outperformed those in traditional face-to-face classes, with an effect size of 0.35 (Means et al., 2013). This research highlights the idea that technology can be used to personalize instruction and provide students with more control over their learning, leading to improved outcomes.

Furthermore, technology can play a crucial role in addressing educational inequalities. Warschauer and Matuchniak (2010) emphasized in their study the importance of technology in reducing the digital divide and providing access to educational resources for all students. With these teachers can create inclusive learning environments that cater to diverse student needs. In summary, research consistently demonstrates the positive effect of technology on teaching, learning, and educational equity, making it a valuable tool in modern education.

This study will focus on addressing the least mastered skills based on the results of the 1st quarter exams of the Senior High School Students using technology - based activities following the scaffolding framework of modelling, guided practice, and independent practice which will be given to students asynchronously.

Research Objectives

1. Design scaffolded activities to address the least mastered skills in Earth and Life Science.
2. Test the impact of Scaffolded Technology-assisted Asynchronous Activities on the academic performance of SBU SHS students particularly in Earth and Life Science.

Conceptual Model and Operational Framework

This study will make use of the Input – Process – Output (IPO) conceptual model. It is a structured approach that identifies the impact of strategy to enhance students' academic achievement (Smith & Johnson, 2019).

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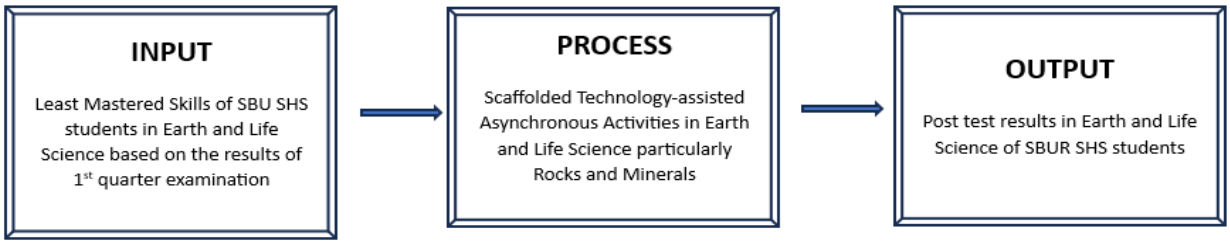
In this study the inputs include least mastered skills of the students in Earth and Life Science subject based on the results of the 1st quarter examinations. The processes involve the implementation of asynchronous technology – based activities following the scaffolding framework. The outputs are measured through post-test given to students after doing the intervention.

Figure 1



Input

There are many ways to determine the least mastered skills of the students. Some educators conduct formative assessments, analyze student performance data, collect feedback, or collaborate with peers.

Use formative assessments, quizzes, tests, or standardized assessments to gauge students' understanding of different skills. According to (Black & Wiliam, 1998), formative assessment is a process used by teachers and students during instruction that provides feedback to adjust ongoing teaching and learning to improve students' achievement of intended instructional outcomes.

Utilize data analysis tools to identify patterns and trends in students' performance. Consider using statistical methods or educational data mining techniques to uncover insights from the assessment results (Romero, et al., 2008).

Understand the typical progression of skills within a subject or course to identify areas where students might be struggling. Learning progressions help educators understand the sequence of skills that students should master at different stages of their education (Pellegrino, et al., 2001).

Solicit feedback from students through surveys or interviews to understand their perceptions of challenging areas. Feedback from students can provide valuable insights into their learning experiences (Hattie & Timperley, 2007).

Review existing educational research and literature to identify common challenges and least mastered skills in specific subjects or courses. Identify key studies or meta-analyses relevant to your subject area to gain insights into areas where students commonly struggle (Bryk & Schneider, 2002).

Engage in collaborative discussions with other educators to share insights and experiences regarding students' challenges. Collaborative efforts can provide a broader perspective on common areas of difficulty (Bryk & Schneider, 2002).

For this study, the researchers will utilize the results of the 1st quarter examinations in Earth and Life Science subject of San Beda University - Rizal Senior High School students.

PROCESS

Educators have different ways to improve the least mastered skills, some are utilizing differentiated instruction, formative assessments and feedback, peer – assisted learning, individualized learning plans, technology – enhanced learning, active learning strategies, or explicit instruction. However, most of these strategies require contact time with the students which is considered as major factor in choosing the strategies.

Teachers may implement differentiated instruction to meet the diverse learning needs of students. Tailor teaching methods, materials, and assessments to address individual strengths and weaknesses (Tomlinson & Allan, 2000).

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Use formative assessments regularly to check on student progress. Provide timely and immediate feedback to guide students in understanding and correcting their mistakes (Hattie & Timperley, 2007).
Incorporate peer-assisted learning strategies where students work together to reinforce and explain concepts. Peer tutoring and collaborative activities can enhance understanding (Topping, 2005).
Develop individualized learning plans for students, identifying specific learning goals and strategies tailored to their needs (Guskey & Bailey, 2001).
Integrate technology into the curriculum to provide interactive and engaging learning experiences. Educational apps, online resources, and interactive simulations can support skill development (Spires, et al., 2012).
Apply active learning strategies including problem-solving activities, case studies, and hands-on experiments, to enhance student engagement and deepen understanding (Prince, 2004).
Use explicit instruction methods that provide clear explanations, modeling, and guided practice to ensure students understand and master specific skills (Archer & Hughes, 2011).
Since the least mastered skills belong to the 1st quarter and 2nd quarter has different sets of lessons to discuss, the researchers will be utilizing the technology – based intervention activities following the scaffolding framework which will be implemented asynchronously so that the allotted time for the second quarter will not be affected.

Output
Once the students have accomplished the activities, a post test will be given which is parallel to the items in the 1st quarter exams which are the least mastered skills. The results of the post test will determine whether the intervention is effective or not.
Specifically, this study sought to answer the following questions:
1. What are the least mastered skills of the SBUR SHS students in Earth and Life Science?
2. How did the Scaffolded Technology-assisted Asynchronous Activities on Earth and Life Science develop?

3. What is the effect of the Scaffolded Technology-assisted Asynchronous Activities in the performance of SBUR SHS students in Earth and Life Science?

METHODOLOGY

Research Design
This study used quantitative research design. According to (Creswell, 2014), quantitative research design is appropriate when researchers aim to gather numerical data that can be analyzed statistically to draw conclusions and generalize about a population. Use quantitative research when the goal is to measure and quantify variables objectively. This approach is suitable for situations where numerical data provide a clear and precise representation of the phenomena under study.

Participants
A total of 397 male and female grade 11 senior high school students currently enrolled in San Beda University Rizal Campus. These students are currently taking Earth and Life Science subject. All students were considered participants of the study.

Procedures
Ethical approval was secured from the university's Research Ethics Board before the conduct of the study. The researchers requested permission from the Principal of the Integrated Basic Education Department of San Beda University Rizal campus as regards the conduct of the study and the materials and documents that will be utilized. Participants were informed about the conduct of the study.

Measures
Baseline Data. The results of the 1st quarter examinations of the Grade 11 SBU SHS students was used as a basis for identifying the least mastered skills. The quarterly examinations undergone a process of validation. These are standardized tests since every implementation item analysis was conducted and good items go to item bank. Item analysis of the 1st quarter exam was used to determine the least mastered skills.

Scaffolded Technology-assisted asynchronous activities. Using the least mastered skills, the teacher assigned for Earth and Life Science and the researchers developed a Scaffolded Technology-assisted Asynchronous Activities. Teachers are trained in doing these activities since this was part of their In-service training. The created activities undergone validation process to ensure that they meet its purpose. It was given to experts for validation purposes. After the validation process, the activities were given to students and asked them to do the activities within two weeks. The assigned teacher monitored the submission and provided feedback when necessary.

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Post Test. A posttest was constructed which questions are parallel to the least mastered skills. The items for the posttest were taken from the item bank of the teachers. For validity and reliability tests, it was given first to a small group of Grade 12 students and item analysis was conducted. Items were revised and improved. When the students have completed the intervention activities, posttest was administered.

Data Analysis

To determine the least mastered skills of the participants, the researchers utilized the results of the item analysis of the 1st quarter examination on Earth and Life Science, items where most of the students got the wrong answers are least mastered skills.

To develop the Scaffolded Technology-assisted Asynchronous Activities, the researchers utilized the results of the 1st quarter examination in Earth and Life Science. There were five (5) lessons in this subject, the researchers selected 1 lesson with the greatest number of items which are least mastered skills.

To determine the effect of Scaffolded Technology-assisted Asynchronous Activities on the performance of SBU SHS students in Earth and Life Science the researchers utilized the mean comparison test and paired sample t – test.

RESULTS AND DISCUSSION

The study intended to determine the least mastered skills of the SBUR SHS students in Earth and Life Science based on the results of the 1st Quarter Examination. Develop a Scaffolded Technology-assisted Asynchronous Activities to address the least mastered skills to minimize the possible learning gaps in Earth and Life Science subject.

Based on the results of the 1st Quarter Examination on Earth and Life Science subject, the researchers found out that the least mastered skills focused on the lessons on Minerals and Rocks where most of the students failed to answer the items correctly. With these results, the researchers developed the Scaffolded Technology-assisted Asynchronous Activities on Earth and Life Science focusing on Rocks and Minerals. After giving the intervention, it turned out that the mean of the percentages of scores has improved from 0.33 to 0.54. This also means that before the intervention only 33% of the students got the items on Rocks and Minerals correctly but after the intervention 54% of the students got the items correctly. When the Paired Samples T Test was applied it has a computed value of 0.003 which is less than the critical value of 0.05, so there is a significant difference between the results of the Quarterly Exams (Least Mastered Skills) and the Post Test Result. This means that the intervention given to the students has significantly increased the performance of the students.

CONCLUSION

The findings of the study revealed that the least mastered skills in Earth and Life Science of SBUR SHS students focused more on Rocks and Minerals. The Scaffolded Technology-assisted Asynchronous Activities focused more on these topics. The activities are varied consisting of modelled, guided, and independent activities (Frey and Hattie, 2017). After allowing the students to work on the intervention activities for 2 weeks they took the Post Test. The result of the Post Test turned out that the mean average of the Post Test is higher than the results of the items in the Quarterly Exams. When the paired sample T test is applied, the Quarterly Exams and the Post Test results have significant difference which implies that the intervention used to address the least mastered skills of SBUR SHS students in Earth and Life Science is effective.

Recommendations

It is highly recommended to dig deeper by conducting FGD to the students who took the intervention to determine what can be improved and sustained for other subjects. Future researchers may also conduct similar studies using different subjects and populations.

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