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Enhancing Scientific Skills among Students Through Engaging in Active Learning Activities

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***Abstract*—** This study investigates the enhancement of scientific skills among students through engaging active learning activities in educational settings. Active learning, characterized by hands-on experiments, interactive discussions, and problem-solving tasks, offers a dynamic approach to science education. The rationale for this research lies in the recognition of the importance of scientific literacy and critical thinking skills among students to prepare them for success in a technologically-driven world. The study encompasses diverse active learning strategies employed by science teachers in private schools in Bulan, Sorsogon, emphasizing engagement, collaboration, and practical application of scientific concepts. Methodological aspects include surveys, discussions, and analysis of responses from science teachers to identify prevalent active learning activities, challenges faced, and effective teaching strategies. Findings reveal a range of active learning methods, such as hands-on experiments and group discussions, which enhance students' understanding and retention of scientific principles. Interpretations emphasize the importance of addressing these challenges through comprehensive training programs and systemic changes in curriculum design. The study underscores the significance of integrating active learning modules into the curriculum to create engaging learning environments that promote scientific skills development.

***Keywords*—** active learning, scientific skills, science education, student engagement, curriculum design

I.INTRODUCTION

In the contemporary educational landscape, amidst the rapid globalization and technological advancements of the digital era, there's an urgent need to adapt teaching methods. This necessity arises from the demand to empower students with scientific skills that are essential for navigating the complexities of today's world. One effective strategy for achieving this goal is through active learning activities. Active learning engages students directly in the learning process, encouraging them to inquire, think critically, and develop skills for lifelong learning (Brown, 2022).

In today's rapidly evolving landscape, characterized by technological advancements and dynamic socio-economic trends, the imperative to cultivate robust scientific literacy among students has never been more pressing. Recognizing this urgency, UNESCO advocates for the enhancement of science education worldwide, emphasizing the pivotal role of academic achievement and laboratory competence in preparing learners for the challenges of the 21st century.

Within the Philippine context, the Department of Education (DepEd) faces significant challenges in improving educational standards, especially in science teaching. Many schools struggle with low academic performance and inadequate laboratory skills among students, highlighting the need for innovative teaching methods. In this context, active learning activities stand out as a promising approach to enhance scientific skills among students (DepEd, 2018). These activities involve hands-on experiences and interactive tasks that encourage students to engage directly with scientific concepts, fostering deeper understanding and proficiency.

Despite the promising potential of incorporating active learning activities into Philippine classrooms, their widespread implementation is still in its early stages, leaving much untapped potential. Therefore, it is crucial to conduct empirical research to understand how these activities impact students' academic achievement and laboratory skills. This study aims to address this gap by exploring how active learning activities, aligned with the promotion of scientific skills, influence student performance in general science education. Specifically, the research will examine the relationship between active learning methods and academic outcomes, as well as laboratory competencies. Through this investigation, valuable insights can be gained to guide evidence-based teaching practices and shape the direction of science education towards excellence (Smith & Johnson, 2019).

Enhancing scientific skills among students through engaging active learning activities embodies a

significant departure from conventional educational practices, prioritizing student involvement and independence in the learning process. Unlike traditional teaching methods centered on passive reception of knowledge, this approach empowers students to take charge of their learning with guidance from instructors. The effectiveness of this approach, showing that students engaged in active learning activities exhibited notably enhanced academic performance and proficiency in laboratory skills across various scientific disciplines (Santos and colleagues, 2019).

The research aims to explore how active learning activities can enhance students' scientific skills. By examining the effectiveness of active learning methods in promoting a better grasp of scientific concepts, this study seeks to uncover their specific advantages. Through thorough analysis and practical investigation, it delves into the various ways in which active learning contributes to a deeper understanding of science among students. This research sheds light on the potential of active learning strategies to revolutionize science education in the Philippines (Garcia et al., 2019).

In pursuit of enhancing scientific skills among students through engaging in active learning activities, this study sets sail on a journey driven by evidence-based practice. It navigates unexplored territories to uncover insights that could revolutionize science education in the Philippines. By exploring the relationship between teaching methods and student outcomes, it aims to gain a deeper comprehension of the intricate dynamics that contribute to successful teaching and learning experiences (Smith & Jones, 2018).

At its core, this study embodies the essence of scientific inquiry, inviting researchers to explore new horizons in pursuit of knowledge and insight. With its thorough approach and insightful examination, it aims to uncover the fundamental aspects of successful teaching and learning, providing valuable perspectives that can guide policies and practices in science education (Smith, 2018). Within the realm of inquiry, this study embraces scholarly rigor and intellectual exploration, encouraging researchers to delve into unexplored territories of educational research in their quest for truth and comprehension. Through its meticulous analysis and rigorous methodology, it seeks to unravel the complexities surrounding student learning, shedding light on the transformative power of active learning activities within the educational context of the Philippines. By conducting empirical investigations and upholding scholarly standards, this study endeavors to demystify the process of student learning, revealing the potential of active learning approaches to revolutionize science education in the Philippines. Navigating through the intricate pathways of educational discourse, it remains steadfast in its mission to elucidate the underlying principles of effective teaching and learning, offering insights that can shape policies and practices in the science education domain.

In the realm of education, this study serves as a crucial guidepost for ushering in positive changes, paving the way for improved teaching methods and enhanced learning outcomes. By delving deeply into the dynamics of student learning, it aims to shed light on effective strategies that foster academic success and mastery of scientific skills.

The study at hand serves as a testament to the enduring curiosity that drives academic exploration, inspiring researchers to uncover the secrets nestled between theory and practice. Employing a rigorous methodology and thorough analysis, it aims to break free from conventional teaching methods, paving the way for innovative approaches to learning. Amidst the myriad of voices and perspectives, this study shines as a symbol of intellectual rigor and academic curiosity, urging educators and policymakers to embrace its call for change. By offering sharp analysis and nuanced observations, it seeks to initiate conversations that bridge disciplinary gaps, promoting cooperation and joint efforts in revitalizing education (Wang et al., 2019).

In pursuit of knowledge and understanding, this study embodies the essence of academic investigation. By gathering evidence and presenting reasoned arguments, it seeks to illuminate pathways toward enlightenment. Within the realm of education, it remains dedicated to unraveling the complexities of student learning, shedding light on how active learning activities can enhance scientific skills among students. This research, conducted within the educational context of the Philippines, serves as a catalyst for intellectual growth. Through a rigorous examination of various teaching methods and careful analysis, it aims to surpass conventional thinking, paving the way for innovative teaching practices and improved educational outcomes (Johnson, 2016).

In advancing the enhancing scientific skills among students through engaging in active learning activities, this study is deeply rooted in gathering solid evidence from empirical sources, avoiding mere guesswork, and prioritizing thoroughness and accuracy. As it delves into the realm of education, dedication lies in uncovering the secrets that surround student learning, paving the way for both academic success and mastery of laboratory techniques.

In the pursuit of enhancing scientific skills among students through engaging in active learning activities, this study embodies the relentless curiosity driving academic exploration. It invites researchers to delve into new realms of understanding, aiming to uncover insights that illuminate the learning process. By employing thorough analysis and robust methodology, this research seeks to demystify the intricacies of student learning within the Philippine educational context, highlighting the transformative power of engaging learning experiences.

II.OBJECTIVES

This study was conducted to enhance scientific skills among students through engaging in active learning activities. Specifically, it aims to identify the different activities employed by science teachers that engage in active learning and examine the specific scientific skills that are cultivated through these activities. To analyze the various strategies used by teachers to implement active learning effectively, as well as to investigate the factors that hinder teachers from employing these methods.

Furthermore, the study aims to propose a comprehensive teaching-learning package that incorporates active learning techniques to improve the scientific skills of learners, addressing the identified challenges and enhancing the overall educational experience in science classrooms.

III.METHODOLOGY

This study employed a mixed-method research design to evaluate the impact of active learning activities on student engagement and scientific skills development. The explanatory sequential method was used to comprehensively examine the effectiveness of active learning strategies. Quantitative data were collected through surveys administered to science teachers, while qualitative data were gathered via classroom observations and focused group discussions. This approach facilitated a thorough understanding of the implementation and outcomes of active learning activities in science education.

The participants were science teachers from private schools in Bulan, Sorsogon. A total of 15 teachers from St. Louise de Marillac School of Bulan, Inc. (11 teachers) and Solis Institute of Technology, Inc. (4 teachers) were selected using a simple random sampling method. This approach ensured a representative sample, mitigating bias and enhancing the validity of the findings. Participants were informed about the study's objectives and procedures, and informed consent was obtained to adhere to ethical standards. Confidentiality and anonymity were maintained throughout the research.

Various research instruments were employed to evaluate the effectiveness of active learning in science education. These included survey questionnaires administered to science teachers to gather data on their perceptions and experiences with active learning activities. Focus-group discussions were conducted to gain qualitative insights into students' development of practical scientific skills through these activities. Classroom observations documented interactions, participation levels, and engagement during active learning sessions, providing qualitative insights into instructional dynamics. Additionally, semi-structured interviews with teachers delved deeper into their perspectives on the effectiveness and challenges of active learning activities.

Data gathering procedures involved several steps. Permissions and approvals were obtained from school administrations and relevant authorities to conduct the study within the schools. Informants were selected based on teaching experience, subject expertise, and willingness to participate, ensuring a comprehensive sample. Active learning activities were implemented in selected science classes, with teachers receiving training and guidance to ensure consistent and effective implementation. Surveys were administered, and focus-group discussions were held to collect qualitative feedback.

Data were treated through both quantitative and qualitative analyses. Survey responses were subjected to frequency counts to identify prevalent themes and perspectives among the informants. Qualitative data from focus-group discussions and interviews were

analyzed using thematic analysis, involving coding and identifying patterns within the data. This dual approach provided deeper insights into teachers' experiences and perceptions.

By integrating quantitative and qualitative data, the study provided a robust understanding of the effectiveness of active learning activities in enhancing scientific skills among students in private schools in Bulan, Sorsogon. The combined analysis allowed for meaningful conclusions and recommendations based on the comprehensive perceptions and experiences of the participating science teachers.

IV.RESULTS AND DISCUSSION

The following results were gathered, analyzed, and interpreted by the researcher based on the objectives of the study. Frequency count and thematic analysis were also used.

1. Activities Employed by Science Teachers that Promote Active Learning

The study delves into how science teachers actively engage their students in the learning process. It seeks to understand the various methods and activities utilized by teachers to promote active learning in science classrooms. Active learning involves techniques where students are actively involved in the learning process rather than passively receiving information. By investigating these activities, the research aims to uncover the diverse approaches teachers employ to make science education more interactive and engaging for students. From hands-on experiments to group discussions and interactive demonstrations, the study explores the spectrum of strategies teachers use to foster a dynamic learning environment where students are actively involved in their own education.

Table 1.0 *Activities Employed by Science Teachers that Promote Engaging Active Learning*

Activities	Frequency	Rank
Interactive/Group Discussion	15	1.5
Problem-solving Activities	15	1.5
Hands-on Experiments	14	3
Online Quizzes and Games	12	4
Concept Mapping	11	5
Simulations and Virtual Labs	9	6
Jigsaw Activities	7	7.5
Science Debates	7	7.5
Role-playing	5	9
Field Trips	0	10

Table 1.0 provides insights into the frequency and ranking of various activities that promote engaging active learning in science, as perceived by the informants. Interactive/Group Discussion and Problem-solving Activities emerged as the most frequently cited activities, with both obtained a high frequency of 15 and sharing the top rank of 1.5. This suggests that informant highly value interactive discussions and problem-solving tasks as effective means to engage students actively in science learning. These activities likely encourage critical thinking, collaboration, and application of scientific concepts. Hands-on Experiments also garnered a significant frequency of 14 and obtained the rank of 3. This indicates that hands-on experiments are widely recognized as valuable active learning tools in science education. They provide students with tangible experiences, allowing them to explore scientific phenomena firsthand and develop practical skills. Online Quizzes and Games obtained a frequency of 12 and ranked of 4. This suggests that informant perceive the integration of technology-mediated activities as beneficial for promoting active learning in science. Online quizzes and games can enhance student engagement and motivation while providing opportunities for self-assessment and reinforcement of scientific concepts.

Furthermore, Concept Mapping obtained a frequency of 11 and obtained the rank of 5. Concept mapping is valued for its ability to visually represent relationships between scientific concepts, aiding in comprehension and retention. Its inclusion in the list indicates recognition of its effectiveness in promoting active learning. Simulations and Virtual Labs were mentioned by 9 informants and rank of 6. While slightly less frequent than other activities, simulations and virtual

labs offer valuable opportunities for students to explore complex scientific phenomena in a controlled virtual environment, fostering inquiry and experimentation. Jigsaw Activities and Science Debates were cited by 7 respondents each, sharing the rank of 7.5. These activities promote cooperative learning and critical thinking, allowing students to analyze and synthesize information from different perspectives. Role-playing activities cited by 5 respondents and obtained the rank of 9. While less frequently mentioned, role-playing can be an engaging way to contextualize scientific concepts and promote empathy and perspective-taking. And Field Trips obtained 0 frequency from the informants and placed the rank of 10, indicating that it is not commonly perceived as a primary activity for promoting active learning in science among the informants.

The data highlight the diversity of activities that educators perceive as effective in promoting active learning in science. Interactive discussions, problem-solving tasks, hands-on experiments, and technology-mediated activities are particularly valued, while others like field trips may be less commonly implemented or considered. These findings underscore the importance of incorporating a variety of active learning strategies to cater to diverse learning styles and foster meaningful engagement in science education.

2. Scientific Skills Developed in Using Active Learning Activities

The responses from science teachers highlighted the effectiveness of active learning activities in fostering the development of scientific skills among students. Theme 1&2 Hands-on Learning and Conceptual Understanding are promoted through active learning activities like hands-on experiments and group discussions. These methods enable students to construct their understanding of scientific concepts, resulting in deeper comprehension and retention. Additionally, Theme 3 Contextualized Learning integrates these activities into real-life contexts, ensuring students develop fundamental scientific skills in a meaningful and engaging manner. By teaching scientific concepts within relevant contexts, educators create opportunities for students to apply their knowledge in practical scenarios, fostering a deeper understanding of scientific principles. Theme 4 Collaboration and Engagement are also emphasized, as active learning encourages students to share ideas, discuss concepts, and work together towards common goals. Through collaborative learning experiences, students not only enhance their understanding of scientific concepts but also develop essential interpersonal skills such as communication and teamwork.

Theme 5&6 Problem-solving and Critical Thinking skills are honed through activities like problem-solving tasks and simulations. These methods engaged students in analyzing data, evaluating hypotheses, and drawing informed conclusions, preparing them to tackle complex scientific challenges. Theme 7 Real-world Application of Knowledge is facilitated by active learning activities that enable students to apply their scientific knowledge and skills to practical scenarios. By bridging the gap between theoretical learning and practical application, students developed the complex scientific skills necessary for success in academic and professional environments. Theme 8 Immersive Experiences, such as simulations and virtual labs, provide students with opportunities to interact with complicated scientific phenomena. Through these experiences, students develop critical thinking and problem-solving skills essential for scientific inquiry and discovery.

3. Teaching Strategies Employed by Science Teachers in Active Learning

Science teachers employed a diverse range of teaching strategies to foster active learning in their classrooms. Among these, Theme 1 Discussion and Expression of Ideas stand out as pivotal components of science education. These practices created collaborative learning environments where students can share, debate, and refine their understanding of scientific concepts. Through facilitated discussions and prompts for expression, teachers encourage critical thinking and engagement, fostering the construction of knowledge through dialogue and interaction.

Theme 2 Discovery Learning Approach represents a fundamental shift in the educational paradigm, empowering students to actively explore and discover new knowledge through hands-on experiences and problem-solving activities. By assuming the role of facilitators rather than lecturers, teachers guide students in inquiry, investigation, and independent discovery. Through this approach, students develop critical thinking and problem-solving skills while taking ownership of their learning journey.

Theme 3 Differentiated Instruction serves as a cornerstone in science education, allowing teachers to address the diverse learning needs, interests, and

abilities of students within the classroom. By tailoring instruction to individual needs, educators ensure that all students have opportunities to engage effectively with the curriculum. Through the use of differentiated instructional materials and activities, students are empowered to leverage their strengths and contribute meaningfully to the learning community.

Theme 4 Gamification and Game-Based Teaching represent innovative approaches to science education, integrating game elements into the instructional process to enhance engagement and motivation. Techniques such as points, badges, and challenges are utilized to create interactive and experiential learning environments. Through gamification, teachers promote active learning, critical thinking, and collaboration among students, making science education more engaging and effective.

4. Factors that Hinder Teacher's Employment of Active Learning

Science teachers encounter several challenges when it comes to effectively implementing active learning methods in the classroom. These hurdles are multifaceted, encompassing factors like Theme 1 Lack of Resources, Theme 2 Time Constraints, Theme 3 Classroom Management and Student Engagement, and Theme 4 Curriculum Constraints Training.

One significant challenge is the lack of resources, which includes limitations in time, materials, technology, and support personnel. Time constraints within the curriculum often restrict teachers from integrating hands-on activities, experiments, and group projects into their lesson plans, impacting the practical application of scientific concepts. Additionally, inadequate access to laboratory equipment, science kits, and other essential materials further impedes the implementation of active learning strategies.

Moreover, challenges related to classroom management present significant obstacles to creating an environment conducive to active learning. Maintaining discipline and managing student behavior are vital aspects of facilitating effective learning experiences. Furthermore, the lack of access to materials and insufficient training in implementing active learning activities pose significant hurdles for educators. Without proper training and support, teachers may struggle to incorporate innovative teaching methods effectively, ultimately impacting the promotion of scientific skills among students. Addressing these challenges requires comprehensive solutions that prioritize resource allocation, professional development opportunities, and strategies for enhancing classroom management practices.

5. Proposed Teaching-Learning Package on Active Learning to Improve Scientific Skills of the Learners

The proposed teaching-learning package on active learning aims to enhance students' scientific skills by integrating innovative instructional methods into the curriculum. It recognizes the importance of active learning methodologies in promoting deeper understanding, critical thinking, and problem-solving among learners. Through hands-on exploration, inquiry-based learning, and collaborative activities, the package seeks to create an engaging learning environment where students can develop essential scientific skills such as critical thinking, problem-solving, and communication.

Comprising active learning modules, tailored assessment tools, and teacher support materials, the package is designed to provide comprehensive resources for both students and educators. The active learning modules will offer interactive lessons and activities that encourage student engagement and exploration of scientific concepts. Assessment tools will be specifically designed to measure students' progress in developing scientific skills, while teacher support materials will equip educators with the necessary resources and guidance to effectively implement active learning strategies in the classroom. Together, these components aim to promote a student-centered approach to learning and foster the development of scientific skills among students in Private Schools in Bulan, Sorsogon.

V.CONCLUSIONS AND RECOMMENDATIONS

Based on the preceding findings, the researcher concludes that the inquiry-based approach is the most common activity in engaging students and enhancing scientific skills employed by science teachers. Both the basic and the complex scientific skills are developed through active learning activities.

In implementing active learning, the strategies used by science teachers include, allowing learners to involve themselves in discussions and expression of ideas, exposing them to discovery learning, employing differentiated instruction, and adopting gamification techniques. The factors that hinder teachers from employing active learning activities include limited

resources, time constraints, poor classroom management, and limited learning and development. The proposed teaching-learning package on active learning offers a comprehensive approach to enhancing students' scientific skills by integrating innovative instructional methods into the curriculum. Such as active learning modules, tailored assessment tools, and teacher support materials, the package aims to promote a student-centered approach to learning and foster the development of scientific skills among students in Private Schools in Bulan, Sorsogon.

Finally, the researcher offers the following recommendations based on the findings and conclusions made: (1) Promoting active learning be continuously employed by science teachers through a variety of relevant science activities. (2) The level of development of both the basic and complex scientific skills be assessed by the science teachers. (3) Science teachers be kept abreast with the time-tested and emerging strategies that promote active learning in their learning and development. (4) Science teachers in the locale be organized as a professional learning community to facilitate the resolution of issues and gaps that concern science education. (5) Fostering collaboration among science teachers within Private Schools in Bulan, Sorsogon be made to share best practices, resources, and innovative ideas for promoting active learning. (6) The establishment of learning communities be given preferential attention by the education sector where educators can collaborate, exchange experiences, and support each other in implementing active learning approaches. (7) The proposed teaching-learning package be further enhanced for the effectiveness of active learning strategies in promoting scientific skills among students.

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