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Research Paper

Exploring The Experiences of The BSED Major in Science Students in The Use of Laboratory Facilities and Equipment

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Abstract

Laboratory facilities and equipment are essential in science education, providing students with hands-on experience that enhances their scientific inquiry and critical thinking. However, many students face challenges due to outdated equipment, insufficient resources, and inadequate technical support, all of which hinder effective experimentation and learning. These limitations negatively impact students' academic performance and preparedness for future scientific endeavors. This qualitative study investigates the challenges BSED science majors encounter in laboratory-based learning at a private higher education institution in Pagadian City during the 2023-2024 academic year. Using Sharan B. Merriam's case study model, the research explores how limited laboratory access and resource constraints affect students' learning experiences. Data was collected through interviews and observations, with purposive sampling ensuring that participants met specific criteria. Thematic analysis and triangulation identified key themes, including laboratory accessibility, resource utilization, challenges in conducting experiments, and student coping strategies. Findings reveal that students struggle with inadequate laboratory spaces, malfunctioning or outdated equipment, and a lack of technical guidance, all of which impede their academic development. These issues underscore the crucial need for enhanced laboratory facilities and instructor training to facilitate effective science instruction. The study recommends enhancing laboratory infrastructure, ensuring regular equipment maintenance, and providing students and educators with adequate training in laboratory operations. Strengthening faculty expertise in handling laboratory tools is also essential. Addressing these concerns will contribute to a more effective science education framework, promoting better learning outcomes and higher standards of scientific experimentation.

Keywords: *Laboratory, Experiment, Laboratory Resources, Experiences of the BSED major in science students*

INTRODUCTION

The role of science education in equipping students to navigate the complexities of the modern world is crucial. A solid background in science nurtures essential skills such as critical thinking, problem-solving, and innovation, abilities necessary to keep up with the rapidly changing landscape of science and technology (Forawi, 2016) Laboratory experiences significantly contribute to this learning process by helping students connect theoretical concepts with real-world applications (Holstermann et al., 2010) For students pursuing a Bachelor of Secondary Education (BSED) degree in science, access to well-equipped laboratories is vital in developing the competencies required for effective teaching (Carmel et al., 2019) However, many institutions still face challenges in providing sufficient laboratory resources.

Despite the emphasis on practical learning, numerous schools continue to struggle with laboratory-related limitations. According to the UNESCO (2018) report, over 60% of secondary schools in low- and middle-income countries lack adequate laboratory facilities, restricting hands-on learning experiences. Similarly, the Philippine Department of Education (DepEd) has acknowledged that many schools contend with outdated equipment, limited laboratory space, and

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a shortage of necessary resources, all of which hinder the effective teaching of science (DepEd, 2021) These challenges are particularly concerning for BSED science majors, as their ability to conduct experiments and develop laboratory skills directly impacts their future teaching effectiveness.

While existing studies have widely examined the integration of technology and various teaching strategies in science education (Dökme & Ünlü, 2020), fewer have explored the first-hand experiences of BSED science majors in utilizing laboratory facilities. Most research has primarily focused on resource availability, yet there is limited insight into how these constraints influence students' learning experiences, problem-solving approaches, and preparedness for the teaching profession. Furthermore, there is a lack of in-depth exploration regarding the impact of laboratory limitations on pre-service teachers, who will ultimately shape the next generation of scientists (Pareek, 2019; Dekorver, 2016).

This study seeks to fill this gap by examining the experiences of BSED science majors in using laboratory facilities and equipment. It aims to identify the challenges they encounter, the strategies they adopt to overcome these obstacles, and the overall impact on their academic and professional development. The research findings will offer evidence-based recommendations to improve laboratory access, optimize resource distribution, and refine instructional methods, ultimately enhancing the quality of science education.

THEORETICAL FRAMEWORK

This study is anchored in David Kolb's Experiential Learning Theory (1984), which emphasizes the role of direct experiences in constructing knowledge. Kolb's model underscores that learning is most effective when students engage actively in hands-on activities, reflect on their experiences, and apply their understanding to new situations. In the context of this study, the theory helps explain how BSED science majors interact with laboratory equipment, overcome limitations, and refine their scientific competencies. Furthermore, applying Experiential Learning Theory allows for an in-depth analysis of factors influencing laboratory utilization, such as resource availability, instructional quality, and institutional support.

By employing this framework, the study seeks to uncover how students' prior knowledge shapes their engagement with laboratory tasks and how hands-on experiences contribute to their conceptual understanding. The insights gained will inform strategies for improving laboratory instruction and optimizing the use of available resources in teacher education programs.

RESEARCH QUESTIONS

This study aims to answer the central research question: "What are the experiences of BSED science majors in utilizing laboratory facilities and equipment for their laboratory activities, and how do they navigate the challenges encountered during these activities?" To address this overarching inquiry, the study specifically seeks to answer the following questions:

1. What types of laboratory activities do BSED science majors engage in?
2. What laboratory facilities and equipment are most frequently used in science experiments?
3. How do BSED science majors describe the condition and accessibility of laboratory facilities and equipment in their school?
4. What challenges do BSED science majors encounter when conducting laboratory activities?
5. What strategies do BSED science majors employ to overcome these challenges?

By answering these questions, this study aims to provide valuable insights into the current state of laboratory access in teacher education programs and offer actionable recommendations for improving science instruction.

LITERATURE REVIEW

The importance of laboratory facilities and equipment in science education is widely acknowledged, as they play a crucial role in enriching students' learning experiences. Practical laboratory activities offer hands-on engagement that strengthens scientific reasoning, critical thinking, and problem-solving, key competencies necessary for success in science-related fields (Kapici et al., 2020) Research suggests that laboratory-based learning not only enhances students' perception of science but also reinforces their conceptual understanding by linking theory to practical applications (Simon, 2015) Despite these benefits, challenges such as outdated equipment, inadequate resources, and limited funding continue to hinder effective laboratory instruction, negatively impacting students' academic performance and readiness for future careers in science education (Dahar et al., 2011).

One of the most pressing concerns in science education is the lack of access to well-equipped laboratories, particularly in developing countries where financial constraints limit investment in educational resources. According to the UNESCO (2018) report, more than 60% of secondary schools in low- and middle-income nations face severe shortages of laboratory facilities, restricting students' opportunities to develop essential scientific skills through hands-on experimentation. In the Philippines, the Department of Education (DepEd) has identified limited laboratory spaces and outdated equipment as major barriers to quality science education, particularly in public schools (DepEd, 2021).

To address these limitations, Doa (2023) highlights the significance of laboratory manuals as instructional tools that help maximize learning outcomes even in resource-limited environments. Although Doa's research focused on senior high school Life Science, its findings are relevant to BSED science majors, who also struggle with restricted access to laboratory resources. The insufficient availability of well-equipped laboratories in teacher education programs remains a major concern, as it may impact the training of future educators.

In addition to accessibility challenges, financial limitations further impede the maintenance and modernization of laboratory equipment, reducing students' ability to conduct experiments effectively (Halima & Ngozi, 2015) Poorly maintained laboratories pose safety hazards, disrupt learning activities, and diminish the effectiveness of practical science instruction (Ugochukwu & Ugwuoti, 2017) Caballes et al. (2024) highlight issues such as malfunctioning equipment, inadequate laboratory spaces, and a lack of essential materials, reinforcing the necessity for ongoing evaluation and investment in science education infrastructure. Moreover, Pasubillo and Asio (2023) emphasize that effective resource allocation and stakeholder involvement in school-based management are crucial in ensuring equitable distribution of laboratory resources, ultimately enhancing the quality of science instruction.

Beyond resource availability, student engagement and collaboration are also vital factors influencing the success of laboratory instruction. Studies indicate that cooperative learning in laboratory settings enhances students' ability to analyze scientific concepts, refine experimental skills, and develop teamwork abilities essential for scientific inquiry (Hofstein & Lunetta, 2004). However, cultural and pedagogical factors can shape how students collaborate in laboratory environments. Endro and Meilasari (2024) examined the impact of traditional collectivist values, such as gotong royong (mutual assistance) in Indonesia, on laboratory teamwork and contrasted it with individualistic tendencies. Similar challenges exist in the Philippine educational system, where

varying levels of student engagement influence collaborative learning in science laboratories. Recognizing these factors is crucial in designing instructional approaches that promote cooperation and inquiry-based learning.

While extensive research has explored laboratory access and resource constraints, notable gaps remain in the literature. Most studies have focused on the general effectiveness of laboratory instruction but have not examined the specific experiences of BSED science majors, who play a crucial role in shaping future generations of learners (Seery et al., 2018) Furthermore, existing research has primarily investigated broad technological integration and resource limitations while overlooking more specific aspects, such as the effectiveness of laboratory equipment in enhancing conceptual understanding. Although hands-on learning is widely regarded as beneficial, there is a need to determine which laboratory tools and activities contribute most effectively to student learning. Additionally, the impact of laboratory design on student learning remains underexplored, with few studies examining how the layout, structure, and organization of laboratory spaces influence students' ability to conduct experiments efficiently. Another critical concern is the sustainability and affordability of laboratory resources, as limited research has investigated cost-effective strategies for maintaining and upgrading laboratory facilities, particularly in private institutions facing financial constraints. Moreover, little research has examined how BSED science majors navigate laboratory-related challenges given their dual role as students and future educators. Understanding their experiences is essential for shaping policies, improving curricula, and guiding institutional investments to enhance laboratory resources and support science education effectively.

Furthermore, this research extends previous studies by linking laboratory experiences to professional readiness in teacher education. While prior research has largely focused on laboratory access and student performance, fewer studies have examined how these experiences shape the instructional confidence and teaching approaches of future educators. By addressing these gaps, this study aims to provide practical recommendations for improving science education, optimizing laboratory resource allocation, and strengthening teacher training programs.

Laboratory facilities are a fundamental component of science education, enabling students to apply theoretical concepts through experimentation and inquiry-based learning. However, persistent issues such as outdated equipment, limited funding, and varying levels of student engagement continue to challenge the effectiveness of laboratory instruction. While previous research has explored these challenges, studies specifically focusing on the experiences of BSED science majors remain scarce. Given that these students require access to well-equipped laboratories to develop the necessary competencies for their future teaching careers, this study aims to bridge the gap by investigating their lived experiences, identifying the difficulties they encounter, and analyzing how laboratory resources impact their academic and professional development.

RESEARCH OBJECTIVES

This study explores the experiences of BSED science majors in utilizing laboratory facilities and aims to:

1. Identify laboratory activities performed by students.
2. Determine the most commonly used facilities and equipment.
3. Assess students' perceptions of laboratory resources.
4. Identify challenges in laboratory use.
5. Explore how students address these challenges.

RESEARCH METHOD

This study employed a qualitative research approach using a case study methodology to explore the challenges faced by BSED Science majors in private higher education institutions. A case study design allows for an in-depth examination of real-life experiences within a specific context, providing a holistic understanding of students' struggles with laboratory facilities and equipment. By using this approach, the researchers were able to analyze patterns and themes that offer broader insights into the issue.

Merriam (1988) describes a case study as an intensive and detailed analysis of a particular instance, phenomenon, or social unit. This method was chosen because it enables an exploration of participants' attitudes, perceptions, and experiences in laboratory-based learning. Data was collected through various qualitative methods to gain a comprehensive understanding of the topic.

RESEARCH PARTICIPANTS

The study focused on BSED Science majors enrolled in a private higher education institution in Pagadian City. Participants were selected using purposive sampling, a technique that ensures the inclusion of individuals who meet specific criteria relevant to the study. The selection criteria were as follows: 1. Enrolled in the BSED Science program; 2. Currently in their second or third year of study, and 3. Had prior experience in laboratory-based courses.

These criteria ensured that the participants had sufficient exposure to laboratory activities, allowing them to provide meaningful insights into the challenges associated with science instruction.

DATA COLLECTION PROCEDURE

A formal request was submitted to the department dean for approval to conduct the study. Once permission was granted, participants were informed about the study's purpose, and their consent was obtained to ensure voluntary participation. They were assured of confidentiality, and permission was secured for audio recordings of the interviews. Data collection involved three key methods: semi-structured interviews, which provided participants the opportunity to share their experiences while allowing flexibility for follow-up questions; observations, where researchers documented students' engagement with laboratory facilities and identified any limitations affecting their learning; and document analysis, which involved reviewing laboratory-related policies and institutional reports to supplement findings from interviews and observations.

DATA ANALYSIS

Following Merriam's (1998) framework, data collection and analysis were conducted simultaneously to identify emerging patterns. The researchers utilized thematic analysis to categorize responses into recurring themes, followed by comparative analysis, where data from interviews, observations, and documents were cross-examined to identify similarities and differences. Triangulation was employed to validate findings by using multiple data sources, ensuring reliability and minimizing bias. Additionally, reflexivity measures were implemented, with researchers maintaining awareness of personal biases through reflective journals and peer debriefing to ensure objective interpretations. By applying these rigorous methods, the study aimed to generate credible and well-supported findings that contribute to understanding the challenges faced by BSED Science majors in laboratory-based learning.

FINDINGS AND DISCUSSION

This chapter presents the findings from interviews and data analysis, discussing the perspectives, challenges, and experiences of students regarding the use of laboratory facilities and equipment in their science education. The study involved 13 selected BSED-Science students and one cooperating teacher. To ensure confidentiality, participants were assigned codes: P1 to P13 for students and CT1 for the teacher.

Previous studies have highlighted the importance of laboratory facilities in effective science education. According to Holstermann et al. (2010), well-equipped laboratories help in motivating students as well as in better understanding the scientific principles. In a similar context, Carmel et al. (2019) noted that restricted access to laboratory instruments adversely affected students' hands-on abilities and scientific investigation. The results of this study support these conclusions, as participants were unanimous in their claim that they find that limited resources make it more difficult for them to learn. Yet, in contrast to Pareek (2019) and Dekorver (2016), who found that students made up for lab lack through digital simulations, our participants reported that they struggled to find such alternatives to replicate addressing issues.

Description of Laboratory Facilities and Equipment

The gathered data showed four sub-categories describing laboratory facilities and equipment: *Not Conducive for Learning, Limited Access to Laboratory Facilities for College Students, Inadequate Laboratory Equipment, and Obsolete Equipment.*

Not Conducive for Learning

Students cannot benefit from science as much if they do not participate in laboratory experiences in the classroom. One of the reasons why a laboratory facility should be conducive to learning is that it. The research participants conveyed:

> *"The laboratory facilities are open, noisy, and drafty," P6.*

> *"The laboratory facilities and equipment are not conducive to learning; still, the structure is fine." P10*

> *"I would not say I like it, to be honest. Aside from the fact that we cannot use it frequently, it is unpleasant to experiment with. For example, it is very noisy and hot, and it is not good to experiment there." P11*

The cooperating teacher was also asked to describe the laboratory facilities and equipment. Below is the response:

> *"Not conducive because it depends on the laboratory's usage time. It is okay when we use it at night because it does not get hot, but if we use it during the day, for example, from 11 AM to 1 PM or 1 PM to 3 PM, it gets very hot. CT1*

The challenges reported by participants regarding the laboratory environment resonate with findings from educational research (Roper & Juneja, 2008), which emphasized that distractions such as noise can significantly hinder students' focus and engagement during laboratory experiments. Similarly, Williams et al. (2008) highlighted the impact of inadequate ventilation on student comfort and performance in laboratory settings, noting that temperature

regulation and proper airflow are crucial for creating an optimal learning environment. Research on open-plan study environments has also shown that background noise can negatively impact students' performance on complex tasks, particularly those requiring logical reasoning (Braat-Eggen et al., 2021). This suggests that noise in the laboratory environment can pose a significant obstacle to effective learning, especially for tasks that require higher cognitive processing.

Limited Access to Laboratory Facilities for College Students

Students don't have enough opportunity to use laboratory facilities and equipment for their studies. The research participants conveyed:

> *"We cannot say that the laboratory facilities are ours because we borrowed them. The availability of the laboratory seems infinite to science students, not just during our class time; sometimes, we are asked, Why? Is it your class now? P8*

> *"The only thing I can say in the science laboratory is that the college does not have a laboratory." P10*

> *"We can't really call the laboratory room our own during our laboratory activities, because the senior high students also use it for their classes, and we are not allowed to use the room when they are there." P7*

> *"There is no dedicated laboratory for us, the science majors, so we can't easily use the laboratory, especially when the senior high school students are having their classes there." P13*

> *"For me, the laboratory is okay, but there are differences in the other school laboratories; for example, the other laboratories are accessible." P3*

> *"It is not easily accessible to students because it is located on the fourth (4th) floor of the building, and the spaces are not wide." P7*

> *"First and foremost, I don't like that room because it's too high; if you need to buy something downstairs, you have to go all the way down first, which is tiring. So, it's better if the room is downstairs so that when there's a need or an emergency, you can exit the classroom directly. Another experience I had was when there was a sudden power outage, and it was very difficult to feel your way up the stairs. What if we had an accident there?" P13*

The cooperating teachers' statement also corroborated the students' responses about the limited access to laboratory facilities for college students. The cooperating teacher said:

> *"The facility is hard to access. Just like that time when someone slipped on the stairs." CT1*

A study by Linn (1997) emphasizes the importance of dedicated and easily accessible laboratory spaces in educational institutions to support students' learning needs efficiently. This finding highlights the need for dedicated laboratory spaces for BSED science majors, as shared facilities can hinder their access and learning opportunities. This is particularly relevant to our findings, as the BSED science majors in our study expressed frustration with shared facilities and

limited access to laboratory resources. Furthermore, this study, which surveyed grade 9 science students in South Africa, found that students with access to laboratories exhibit a greater level of enjoyment towards science (NDELU, 2024) This suggests that the lack of dedicated laboratory space for BSED science majors not only hinders their learning opportunities but also potentially diminishes their enjoyment of science, which is crucial for their future careers as educators.

Inadequate Laboratory Equipment

Most of the research participants mentioned that the laboratory facilities have inadequate laboratory equipment. The research participants conveyed:

> *The laboratory facilities in our school lack equipment. Yes, there is equipment, but not all will function." P1*
>
> *"The laboratory equipment is not enough." P2*
>
> *"The school's laboratory lacks sufficient equipment; there is a shortage. Most outdated equipment needs replacement, as some are no longer functional." P3*
>
> *"There is a lack of equipment, and what is available is old." P4*
>
> *"The laboratory facilities and equipment are poorly maintained, with limited apparatus, limited opportunities for hands-on." P7*
>
> *"The laboratory lacks equipment, most of which is broken." P9*
>
> *"The laboratory equipment is inadequate."P13*

The cooperating teacher was also asked to describe the laboratory facilities and equipment. Below is the response:

> *"It's a yes, the laboratory in our department lacks the materials and other equipment necessary for the science activities inside the laboratory." CT1*

A study by Abas & Marasigan (2020) underscores the impact of outdated and insufficient laboratory equipment on students' practical learning experiences and academic performance. The study discusses how inadequate resources can hinder students' engagement in hands-on experiments, leading to decreased learning outcomes and reduced interest in scientific pursuits. This finding aligns with the experiences of our BSED science majors, who reported a lack of sufficient and functional equipment in the laboratory. Our findings, which highlight the lack of sufficient and functional equipment in the laboratory, are consistent with a broader study conducted in India (Pareek, 2019) that found that many schools in India face challenges with inadequate equipment and materials, even in schools with dedicated science laboratories. These findings underscore the urgent need for governments and educational institutions to prioritize investment in laboratory resources, particularly for BSED science majors, to support effective science education and ensure that future educators are adequately prepared.

OBSOLETE EQUIPMENT

The research participants mentioned that the laboratory equipment is already old. The following are the participants' responses:

"The laboratory equipment is old." P3

"Some of the laboratory equipment is old, and most of the microscopes have dust."P5

"It is indeed a science laboratory, but it is not advanced; the equipment is not advanced." P12

"The laboratory equipment is not up to date as some of them are very old, and the cleanliness was not maintained; you can see some equipment that is still dirty, so it needs to be washed." P13

The cooperating teacher was also asked to describe the laboratory facilities and equipment. Below is the response:

"Rusts, molds, stains. The laboratory equipment has them." CT1

The challenges related to obsolete equipment identified in our study are consistent with the findings of Mohzana et al. (2023). This study found that limited tools and materials frequently hinder the implementation of science practicum activities in high schools. Furthermore, [Mabini, 2022] highlights poor laboratory management as a contributing factor, which directly relates to the issues of poor maintenance and lack of equipment replacement identified in our study.

Challenges of the Science Major Students when doing Laboratory Activities

The BSED science students shared their challenges when performing their laboratory activities. The categories derived from their responses were a *lack of laboratory, and Laboratory equipment is Poor Performance.*

Lack of Laboratory

Some of the research participants mentioned that they lacked laboratory equipment. The following are the participants' responses:

"The lack of laboratory equipment is really challenging for us because there are instances when we cannot conduct our experimental activities." P2

"It's very difficult for us to perform the experiments when the needed materials are not available in the laboratory, which is why the teacher just skips those activities." P3

"The laboratory lacks a lot of equipment, and some of the available equipment is not updated. Because of this, we often encounter inaccurate results in our experiments." P11

"There are indeed instances where we fail to obtain the outcomes of our experiments because some of the apparatus in the laboratory is not updated." P10

"There is a lack of equipment in the laboratory, so we can't conduct all the experiments.

That's why our teachers just skip those activities." P4.

"Aside from the lack of equipment in the laboratory, we also encounter non-functioning equipment when conducting experiments." P9.

The cooperating teacher was also asked about the lack of laboratory equipment. Below is the response:

"There's indeed a lack of laboratory equipment, and some of it isn't working properly." CT1

A study by Geleta (2018) underscores the impact of inadequate laboratory equipment on students' practical learning experiences and academic performance. The study discusses how the unavailability of necessary tools can hinder students' ability to engage in hands-on experiments, leading to decreased learning outcomes and reduced interest in scientific pursuits. This finding further emphasizes the importance of addressing the lack of equipment to ensure that students have the necessary resources to conduct experiments and develop their practical skills.

Laboratory Equipment is performing poorly

Most of the research participants stated that it's very challenging for them to experiment, especially when the laboratory equipment isn't working properly. The research participants conveyed:

"One time during our evening experiment session, which is when our class schedule allows, we took a long time to complete our experiment simply because we were searching for a functional microscope. This is one of the challenges we face when conducting experiments." P9

"There are indeed shortages in laboratory equipment. It is tough to see the results when we use microscopes because microscopes do not function properly, and some are very old." P2

"Due to the delayed results of the experiments caused by malfunctioning equipment, the results may differ, and immediate performance of the activity becomes impossible. Consequently, the activity will not be perfect because we cannot achieve accurate results for the experiment." P5.

"Because the equipment is lacking maintenance and outdated, it's very challenging for us to perform the activities and experiments." P4

"I encountered limitations during our biology experiments that required using a microscope. The microscope was old, so we could not get accurate results from the experiment." P10

"During our experiment on microbiology, I had a hard time observing the microorganisms under the microscope because it was outdated. As a result, I felt that my learning experience was limited. Instead of being excited to see the shapes of the microorganisms under the microscope, my excitement faded because we could not get it to work properly." P11

The cooperating teacher was also asked to describe the poor performance of the laboratory equipment. Below is the response:

"It is true somehow because some are already old." CT1

The research participants' experiences highlight the challenges they face due to malfunctioning laboratory equipment. Their comments, such as "we took a long time to complete our experiment simply because we were searching for a functional microscope (P9) and "microscopes do not function properly, and some are very old (P2), demonstrate the direct impact of outdated and poorly maintained equipment on their ability to conduct experiments effectively. These findings align with a study by Aliyu et al. (2022), which underscores the significant negative impact of inadequate laboratory facilities and malfunctioning equipment on students' practical learning experiences and academic achievement in science subjects. This finding emphasizes the critical need for regular maintenance and repair of laboratory equipment to ensure its functionality and effectiveness in supporting student learning.

How do Students Deal with Challenges Encountered in doing the Laboratory Activities for Science Major Students?

The BSED science students shared how they deal with the challenges of laboratory activities and using laboratory facilities and equipment. The categories derived from their responses were *providing their own Laboratory equipment and testing the equipment first before borrowing it.*

Providing their own Laboratory Equipment

Science is often associated with the laboratory and its equipment; thus, students can still make scientific discoveries and gain comprehension of their subjects by using the equipment and apparatus they have provided. (Pilkington, 2017) The research participants conveyed:

"There are instances when the lab equipment needed for our experiments is unavailable, so we must improvise to conduct those experiments." P13

Before conducting an experiment, our teacher informs us in advance so we can prepare all the necessary apparatus. If some of the equipment is unavailable in the laboratory, we must provide it ourselves." P10

"Usually, when we conduct experiments, we often have to provide the apparatus unavailable in the laboratory to conduct those specific experiments." P4

"Whenever we have experiments to do, our teacher immediately announces what apparatus we need to bring so we can share the equipment and make sure everything is available." P1

"If we have experiments to do, we must improvise the equipment ourselves. Sometimes, our teacher announces in the group chat that we need to bring the apparatus in groups." P2

The cooperating teacher was also asked to describe the poor performance of the laboratory equipment. Below is the response:

"Yes. Me & my students and I usually improvise if it is unavailable in the laboratory" CT1.

By improvising and providing their own equipment, the students demonstrate their resourcefulness and determination to overcome obstacles in the laboratory. This proactive

According to Etkina et al. (2004) student initiative and resourcefulness in laboratory settings are critical for effective science education. Their study emphasizes that when students take an active role in overcoming equipment shortages, it fosters a deeper engagement with the material and enhances their problem-solving skills, which are essential for scientific inquiry. The students' proactive approach in providing their own equipment not only allows them to conduct experiments but also contributes to the development of essential skills such as physical skills (use of tools), social skills (interaction with others), concept development, process skills (practical activities), and attitude development (interest, persistence to solve problems, perseverance), as outlined in the study on improvisation in science teaching and learning (Nnorom & Obianuju, 2021) The teacher's role in facilitating this process is also crucial, as evidenced by the practice of informing students in advance about the necessary apparatus and encouraging collaborative sharing of equipment.

Testing the Equipment first before borrowing

It is emphasized that modern scientific equipment and proper laboratory design are essential. Students now need laboratory facilities and equipment that are being researched and tested by the learning institutions to succeed in their science subjects. (Wang, 2018) The research participants conveyed:

> *"When we conducted experiments that required using microscopes, it took us a long time to finish because we had to test multiple microscopes to find one that was functional so that we could see the results of our experiment." P9*

> *"When we conducted our experiment on cheek cells and onion cells, the first microscope we were given did not show clear results, so we had it replaced and then checked if the new one was functional. This causes significant delays if the apparatus is not functional." P7*

> *"There is indeed laboratory equipment that does not function. When we conduct experiments, we get delayed because we must search for the functional ones so we can see the outcomes of our work." P9*

The cooperating teacher was also asked to describe the poor performance of the laboratory equipment. Below is the response:

> *"My students test the equipment first before using it," CT1.*

This finding is further supported by research emphasizing the critical role of reliable laboratory infrastructure in fostering effective science education. For example, (Uboh et al., 2021) found that inadequate equipment availability and poor maintenance practices significantly hinder students' practical learning experiences and academic performance in biology, particularly in Akwa Ibom State. Asmarany et al. (2024) highlight the importance of effective laboratory management, which includes careful planning, procurement, and maintenance of adequate laboratory equipment, as well as the development of teacher and technician competency. These studies underscore the need for institutions to prioritize investment in and maintenance of laboratory equipment to ensure that students can focus on learning rather than troubleshooting malfunctioning tools.

CONCLUSIONS

The study reveals the challenges faced by BSED Science majors most in using laboratory facilities and equipment. It was seen that inadequacy in laboratory resources hampers students' hands-on learning experiences and, thus, their capacity to develop practical scientific skills. While some students developed an adaptation to these shortcomings, others had difficulties, mainly because of the absence of some essential equipment. The cooperating teacher confirmed several observations and recognized extra efforts to compensate via alternative teaching strategies, but there is still a need for better resources.

The study also emphasizes that there are greater implications with respect to investing in laboratory facilities. Laboratories that are adequately equipped facilitate further understanding by students of scientific principles and procedures while engendering the critical thinking necessary and creating an attraction for the subject. Future science educators with further laboratory experience of good quality will feel adequately prepared to educate and inspire their students in this area, to the benefit of a scientifically literate society.

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