

Problem – Based Learning Strategy Integration: Increasing Students' Motivation in Doing Scientific Research

208

Milton L. Benilan,^a MAEd, Wenefredo E. Cagape^b, EdD, PhD, Rosilyn P. Cajese^c, MAEd,
Cathleen Mae R. Pineda,^d PhD, Anfanna Krizza G. Quibod,^e MAEd

^amilton.benilan@hcdc.edu.ph/^bwenefredo.cagape001@deped.gov.ph/^crosilyn.cajese@hcdc.edu.ph/
^dcathleenmae.pineda@hcdc.edu.ph / ^eanfannakrizza.quibod@hcdc.edu.ph

a Currently Teaching at Mabini National High School, Master Teacher I, Department of Education, Davao de Oro, 8807, Philippines

b OIC, College President at City College of Davao, Professor III, Davao City, 8000, Philippines

c Currently Teaching at Montevista National High School, Master Teacher I, Department of Education, Davao De Oro, 8801, Philippines

d Former Dean for Basic Education Davao Doctors College, Inc., Basic Education, Davao Doctors College, 8000, Philippines

e Currently Teaching at Caraga National High School, Teacher III, Department of Education, Davao Oriental, 8203, Philippines

Abstract

This research study aimed to solicit and explore the impact of the intervention program on the student's experiences in the current setting on the development of scientific research. The study utilized a qualitative-phenomenological approach to understand the experiences of students towards PBL integration in doing scientific research. The participants of the study were fourteen (14) students of Special Science Class and STEM curriculum. The findings of the study revealed that the students perceived that a Problem - based learning strategy as an effective program that helped them improve their knowledge, skills and attitudes in conducting scientific research. Moreover, the students became more motivated and engaged in conducting research papers. It provides students with opportunities to deepen their learning and at the same time having fun while learning and be able to apply scientific concepts and skills in real life. The study contributes to the existing literature on PBL and provides insights for educators and policymakers on the potential benefits of integrating PBL strategy in teaching and learning.

Keywords: Problem-Based learning ; Science ; STEM

1. Introduction

Problem-based learning (PBL) is an approach to education that has recently gained increasing attention and popularity. The researchers are interested in exploring the impact of the intervention program on the student's experiences in the current setting on the development of scientific research. PBL is a method that emphasizes how students apply their knowledge to real-world issues. Students must work cooperatively to create solutions to open-ended problems or scenarios used in this method.

PBL was determined to be an effective teaching and learning strategy for enhancing students' critical thinking in the study done by Khoiriyah & Suardiman (2019). The study includes 22 studies from different nations, including the United States, Saudi Arabia, Indonesia, and Malaysia. Science research directs a new paradigm of the 21st century to embrace the advancement and address the Fourth Industrial Revolution difficulties creating innovative landscapes needed in the different facets of society, such as education, economy, business, and environment. Hence, Republic Act No. 10533, 2013 exemplifies that the curriculum in the science classroom shall be anchored on the principles of relevance, responsiveness, and research. Given these and other issues, it is imperative to understand, acknowledge, and build upon the abilities of adolescent learners while at the same time tailoring instruction to address the unique challenges faced by this age group.

Problem-based learning (PBL) is a compelling way for inquiry-based learning in which students use an exact problem as the context for an in-depth investigation of what they need and what to know. Problem-based learning differs from didactic teaching in those students, faced with a description of a new situation or event, must define their learning needs and questions to understand the situation or circumstance. PBL is a successful teaching strategy for science education because it encourages scientific inquiry (Chan & So, 2018).

Further, the science research goals of the country are also pitched down to the basic education level. The national research goals are embedded in the basic education research agenda formulated by the Department of Education (DO No. 39, s. 2016), particularly in the teaching and learning (T&L) agenda. Accordingly, in T&L, science studies may be integrated into instructional materials development, community contextualization, and performance-based assessments. In basic education, the latter two make science research possible to be conducted by elementary and high school students – through science investigatory projects (SIPs). These projects are instruments for students to make real-world connections and solve problems in their community.

In Davao de Oro Division, science teachers embed the teaching of the SIP content in the STEM and Special Science classes. Upon the results of focus group discussions during LAC sessions, teachers got bothered by some common reasons and hesitations, which are factors that could hinder their interest in fulfilling and completing their scientific investigation. These are some reasons behind their deteriorating performances in crafting the project. To sustain students' interest and ultimately develop the project, much to the desire to help, a simplified strategy for the students to continuously put the spirit into scientific research. The Problem – based learning strategy integration in the lesson delivery is an intervention that will be introduced particularly to students conducting scientific research. As part of the program, research teachers were encouraged to integrate Problem-based examples and situations in their lesson plans to further dig deeper into real-life problems to enhance the students' scientific skills. Thus, this will take action in addressing challenges in the conduct of scientific research and be able to develop desired scientific skills among students.

Thus, this research sought to solicit and explore the results of the program's influence on student's experiences in the current setting on the development of scientific research. This considered how the strategy could be improved the significance of work in education and create opportunities to learn science, learn science about science, and do science. Hence, the study was conducted.

1.1. Review of Related Literature

This section presents the related literature, studies, and related articles that could also support the investigation of this study.

Doing Scientific Research

Science educators in the first years of the 21st century face a wide range of challenges. European and Asian students continue to outperform their American counterparts in science. Textbook and resource accessibility, as well as teacher education and development, are just two examples of the many complexities inherent in science education. Political and religious opposition to cutting-edge science instruction must meet standards and prepare students for standardized examinations and the dramatically increasing utilization of the World Wide Web or Internet to acquire knowledge. Given these and other issues, it is extremely important to understand, acknowledge, and build upon the abilities of adolescent learners while at the same time tailoring instruction to address the unique challenges faced by this age group (NEDA, 2017).

Science investigatory projects (SIPs) provide students with the practical experiences of a scientist who follows the scientific method in conducting investigations and explorations within an area of inquiry. Doing SIPs is a good training ground to contribute to the body of knowledge, generate a beneficial impact on the community, and create new inventions – all for the gains and advantages of humankind (Lebednik, 2016).

Problem-Based Learning Strategy

PBL, or problem-based learning, is an active teaching method that empowers the pupil to take charge of and assume ownership of the learning process. Additionally, it enables students to collaborate with one another and

grow in their capacity to study independently as well as solve problems through an investigative process, analyze facts, and offer solutions throughout their lives (Lee & Hwang, 2018).

Experiences in Integrating Problem-Based Learning Strategy

Difficulty in Managing Time

Akyurek & Afacan (2018), the lack of mentorship provided by skilled professionals is considered one of the significant challenges encountered when doing scientific research. The participants said that they could not perform well the necessary procedures due to a lack of training given by the consultants and supervisors. The potential mentor needs to be more relaxed with their work and has constrained time for consultation.

Mentoring can enhance students' research abilities, self-assurance, and interest in the field. Successful research output can be encouraged by developing a relationship between the mentor and mentee (Latham & Ahn, 2018).

Struggling with Learning Without Facilitation

The most effective approach to move forward is to get some perspective and develop a strategy that engages teachers, students, parents, school administrators, and technology-based businesses Based on a shared vision. This collaborative approach is an innovative solution to this new problem (Joaquin et al., 2020).

Further, Waguey (2017) described that learners would benefit because they become independent and responsible, attending to their tasks with minimal supervision. As teachers raise their level of trust in their students, the value of independence among the students will manifest in their lives. Their proficiency and competency will grow.

Giving Motivation Upon Sharing the Knowledge and Skills

Kram's mentor role theory (1985) in collaborative learning it includes approaches involving joint intellectual and active effort, where social and intellectual engagement and mutual responsibility are emphasized between student and teacher. Mentors can provide two broad categories of mentor functions: career/cognitive development functions – which enhance the cognitive skills of the mentee, and psychosocial functions – which enhance the mentee's sense of competence, self-efficacy, engagement, and personal development. (Turkish et al., 2016).

Moreover, academic scientific research has its own culture made up of distinct aspects that help identify it and distinguish it from other academic fields, such as history. Comprehensive literature analysis and validation by subject matter experts were used to the core cultural aspects related to the work performed by scientists to produce scientific knowledge were identified and summarized in the Culture of Scientific Research (CSR) Framework (Toquero, 2020).

Being an Inspiration to Uplift Potentials

As stressed by Bates (2016) emphasized, seminars have been used as a teaching method since Socrates for their value in engaging students in the teaching and learning process. Socrates did not teach explicitly but created situations and raised questions that required students to think and analyze using their higher-level thinking skills to understand the underlying meaning of Socrates' words. Socrates' classes have promoted intellectual curiosity and independent learning and involved students as a valuable source of knowledge-sharing using their background knowledge to find 'the truth.'

Science investigatory projects (SIPs) provide students with the practical experiences of a scientist who follows the scientific method in conducting investigations and explorations within an area of inquiry. Doing SIPs is a good training ground to contribute to the body of knowledge, generate a beneficial impact on the community, and create new inventions – all for the gains and advantages of humankind (Lebednik, 2016).

Coping Mechanisms in Integrating Problem–Based Learning Strategy

Time Management

In particular, Moore (2016) observed that Science teachers become more creative, resourceful, and innovative. The method of assessment allowed the instructor to see a student's higher-order thinking, and the authors concluded that it appeared to be a viable additional tool for grading student performance. The ability to work on real research problems significantly increased student interest in the assignment.

Seek Help from Others

The findings of Silva (2016) propose a system of learning through action for management education in Brazil and suggest five dimensions that should be considered in teaching and developing leadership: the learning environment, the experience of the teacher and students, learning styles, reflective practice, and active teaching strategies. In addition, PBL is one of the active teaching strategies proposed by Silva (2016) to make management students' learning more meaningful, as it helps students reflect on their own needs and enhances their ability to develop independence as learners. Students work in groups to ask and address research questions for which the outcomes are unknown and of interest to the broader field (Brownell & Kloser, 2015; Dolan, 2016; Goodwin et al., 2021).

Use Other Supplementary Materials

According to Toquero (2020), the practical use of their scientific research abilities increased their research competency. They had issues, nevertheless, with the literature review and the research conceptualization as they were creating their action research.

Furthermore, problem-based learning offers a potent substitute for the passive lecture tradition in beginning scientific biology, physics, and chemistry courses by using real-world situations to convey concepts and drive learning in an active and cooperative learning environment (Allen et al., 2020).

Insights into Integrating Problem–Based Learning Strategy

Demand more Real-life Problems through Sample Videos.

In support, Zulirfan, Subahan, and Zanaton (2015), not all levels of scientific inquiry must be learned in the classroom or science laboratory setting, as some parts of the experiment or investigation can be performed by the students at home, especially those which are not complicated and dangerous to do. There are many reasons why science teachers refuse to apply the experimental method. Previous studies showed that teachers faced some difficulties, such as no science laboratory available, and if the school does have one, it is shared by many classes. In addition, many science laboratories need more apparatus and materials to do experiments as it is time-consuming.

Furthermore, Skamp (2017) expressed that constructivist approaches have intrinsic characteristics associated with high student satisfaction, including acknowledging students' voices, student–centered learning, a focus on scientific thinking, and first–hand investigation catalyzed by curiosity and a desire to understand, and use of multimodal approaches to representing ideas. Of course, science topics, concepts, and activities will intrinsically interest some students more than others. The teacher, however, can use other strategies to arouse and sustain interest and curiosity.

Embracing Innovations with Courage

The idea of Content et al. (2018) revealed that Science education is about teaching and learning that involves students in inquiry-based investigations in which they interact with their teachers and peers; develop linkages between the scientists' existing scientific knowledge and the scientific understandings; apply science concepts to new questions; engage in problem-solving, planning, reasoning from evidence, and group discussions; and experience an active approach to learning science.

In addition, Cardino and Dela Cruz's (2020) study revealed that students' scientific literacy in terms of writing was seen as good when they were presented with real-life problems while presenting scientific research was characterized as fair. The study also showed that the factors affecting teachers, the learning environment, and school administration assistance impact how well children improve their scientific literacy skills.

Strengthening Program Implementation

The findings revealed that to increase learning, Gooblar (2019) suggested the need for programs to design activities that would —improve student and teacher content knowledge and pedagogical skill. Activities such as conducting science projects are encouraged to use innovative strategies in and out of the classroom, including small group settings and hands-on activities and experiments to promote inquiry and curiosity. Finally, it recommended connecting learning to the real world by emphasizing —the application of science and technology to everyday life, employment, and the surrounding environment. By making students review their peers' work, the process teaches them valuable lessons about scientific work more generally and the variety of approaches that can lead to good and bad outcomes.

1.2. Research Objectives

Specifically, this research sought to answer the question:

- a. Describe the experiences of students in integrating problem-based learning strategy in conducting Scientific Research;
- b. Describe how the students cope with the challenges in integrating problem-based learning strategy in conducting Scientific Research; and
- c. Propose improvement and suggestions towards the integration of problem-based learning strategy implementation in conducting Scientific Research.

1.3. Scope and Delimitations

Participants in this study were chosen from Special Science Class and STEM students, Davao De Oro Division, for the school year 2022-2023. This was based on the following inclusion criteria: Students who have observed many lapses in submitting the desired tasks. These students were observed as not interested in participating most of the time and sometimes needed more support from family, which could hinder their interest in full participation. Also, these students got low performances, as observed from previous quarters.

2. Methodology

2.1. Research Design

This study utilized a qualitative-phenomenological approach to understand the experiences of students towards PBL integration in doing scientific research. As mentioned by Creswell (2018), qualitative research design is generally defined as a method which delves on participants' observations, experiences, thoughts and feelings. This was used to gain the understanding of underlying reasons, opinions, and motivations. This was used to uncover trends in thought and opinions, and digs deeper into the problem (Defranza, 2015). In addition, it was stated that

qualitative research is a method in exploring and understanding the group of people or individual who experienced the situation or phenomenon (Creswell, 2018). It's so ubiquitous that it's the standard method used in gathering data through interview which may be structured, semi-structured, unstructured (Freeman, 2016).

2.2. Participants of the Study

Participants in this research are fourteen (14) and had been selected from the following populations: Special Science Class and STEM students from the Davao De Oro Division, for the school year 2022-2023. This was based on the following inclusion criteria: Students who have observed many lapses in submitting the desired tasks. These students were observed as not interested in participating most of the time and sometimes needed more support from family, which could hinder their interest in full participation. Also, these students got low performances, as observed from previous quarters.

2.3. Data Gathering

This study selected participants from Special Science Class and STEM students of Davao De Oro Division, for the school year 2022-2023. This will be based on the following inclusion criteria: Students who have observed many lapses in submitting the desired tasks. These students were observed not interested in participating most of the time and sometimes lacked support from family, which could hinder their interest in full participation. Also, these students got low performances, as observed from previous quarters.

The researchers sought first-hand information about the participants' experiences through in-depth interviews and focus group discussions which were done virtually. Researchers asked permission from proper authorities that needed prior to data gathering. The researchers also secured the approval of the office of the School Principals before conducting the study. The letters were given personally and sent through personal e-mail.

Moreover, the researchers ensured that the identified participants had significant knowledge of the problem and were willing to participate and cooperate in completing the study. The researchers also provided informed consent to every qualified participant stating all the vital information about the study. However, they have the right to withdraw from participating in the study. The selection of participants was made voluntarily and without coercion. With this, the researchers ensured that the participants and their parents had affixed their signatures, whether electronically, scanned, or in any alternative means, as proof of verification of their voluntary participation.

Further, the researchers planned the proper protocol for conducting the interview. The in-depth interview and focus group discussion was at most 1 hour. It also occurred after the participants had signed the consent letter. They were informed about the overview of the study. Moreover, the interview guide questions were validated by the experts. Also, an audio recorder was utilized to ensure the accuracy and reliability of the interview. During the interview through google meet, the researcher and participants in IDI and FGD used headphones to ensure that nobody could hear the conversation except the interviewer and the interviewee. The researcher and the participants were alone, ensuring no one heard the conversation.

Then, recorded interviews were kept safely in my e-mail and another drive on my laptop to secure all the data taken throughout the study. The participants' answers were carefully transcribed verbatim to guarantee validity and precision during the data analysis. On the other hand, all the data were permanently destroyed by reformatting the external hard drive. At the same time, the paper records will be shredded three (3) years after the research study's conclusion. These actions ensured the confidentiality, privacy, and security of the participants and all the data.

The researchers utilized thematic analysis in analyzing the answers of the participants. The researchers also consulted experts to check and analyze the results to ensure the analyses were correct and valid.

2.4. Theoretical Lens

This study was viewed from the lens of Smith (1999), which described that problem-based learning (PBL) provides authentic experiences that promote active learning, support knowledge construction, and naturally integrate school learning and real life, as well as integrating disciplines. Students have engaged problem solvers, identifying the crux of the matter and the prerequisites for an effective resolution, pursuing meaning and understanding, and becoming self-directed learners. Teachers use real-world problems and role-playing to coach learning through probing, questioning, and challenging student thinking. Teachers are problem-solving colleagues who model interest and enthusiasm for learning and are also cognitive coaches who foster an environment that supports open inquiry. As teachers coach students toward these goals, they anticipate embedding essential instruction and assessment at critical points during problem investigation.

2.5. Data Analysis Plan

In line with this, data gathered from the interviews were transcribed correctly and translated. Reading and rereading the materials were the first step in analyzing the data. Reviewing and listening to the recorded audio were employed to get accurate data.

After rereading and understanding the transcripts, the researchers systematically organized them by generating codes. The researchers determined core ideas as well as major themes which were based on the topic of the study. The core ideas and major themes were grouped according to their similarities with other themes developed from the students' experiences and insights towards the intervention program.

The researchers also applied thematic Analysis to find patterns or themes. A procedure that is open to interpretation, thematic Analysis is used to recognize themes and essential in addressing the research problem (Braun & Clarke, 2006). Moreover, it aims to interpret and analyze the data thoroughly. The data gathered after data coding was carefully analyzed using thematic Analysis. The essential points were chunked according to their themes. This method was substantial in getting truthful and meaningful results. After defining and reviewing the themes, the researchers made conclusions and verification as my last step in analyzing the data. It was a critical stage to properly check and validate the Analysis of the study to obtain helpful information for the results and discussions.

2.6. Ethical Consideration

Belmont Report in 1979, as cited by Anabo et al. (2018), stressed that the ethical principles served as a crucial reference in evaluating the ethical sensitivity of research studies involving humans as participants in a qualitative study. This investigation is conducted correctly, according to moral criteria. Before the researchers begin the data collection process, they make it a point to obtain signed consent from the participants' parents and informed assent from them. When obtaining informed consent and assent from the parents and participants, the researchers ensure no face-to-face interaction between any parties involved. The informed consent from the parents and the informed assent from the participants will be sent through online messaging platforms like email and Messenger, which will also be used to obtain the informed consent from the parents. If it turns out that the parents do not have access to Messenger or email, the researcher will find other ways to provide them with the informed consent form and ensure that they sign it. For example, the researcher may deliver the form in person, following the appropriate health regulations. In addition, all research participants decide to participate with no force or pressure from the researchers. Anyone taking part in the study is not obligated to stay involved and can quit anytime. Participants are not required to explain why they are leaving out the research they are participating in.

3. Findings and Discussions

This chapter presents the findings to explore and understand the students' experiences with the Problem-based learning strategy to increase students' motivation in conducting scientific research. In order to answer this

research question, in-depth interviews and focus group discussions were conducted. Emerging themes were generated from the responses of the participants. The following are the accounts of responses.

3.1. Experiences of the Participants in integrating Problem – Based learning Strategy

The first research question asked the participants about their experiences in learning integrating Problem – based learning strategy. Four (4) major themes and core ideas emerged from the data collected. The participants' statements during the in-depth interview and focus group discussion support and justify these themes. The following are the accounts of responses: difficulty in managing time, struggling without facilitation, and giving the motivation to share knowledge and skills.

Difficulty in Managing Time

Students revealed that as they kept adjusting and addressing the necessary tasks upon implementing the problem-based learning strategy, they had difficulty managing their time efficiently. Participants had difficulty prioritizing the enhancement and editing of the paper presentations. These were the issues and concerns raised as to how they process the things to be done of what they learned throughout the implementation of the intervention.

As IDI 02 said that "I have difficulty having enough time to balance in fulfilling the needed tasks. I mean, contact only through the internet is not sufficient for the guidance we need in resolving the issues provided to us based on related studies".

Another idea presented by FGD 01 participant emphasized, "Unfortunately, we are unable to complete the required readings has made things challenging for us."

The above-generated ideas were factors to consider that throughout the benefit of implementing the intervention program, students struggle to accomplish the tasks within the given time.

This can be implied by the idea of Akyurek & Afacan (2018) the need for more mentorship provided by skilled professionals is considered one of the significant challenges encountered when doing scientific research. The participants said that they could not perform well the necessary procedures due to a lack of training given by the consultants and supervisors. The potential mentors need to be more relaxed with their work and have constrained time for consultation.

Direct mentorship opportunities are also limited; consequently, not all undergraduate students can participate. Therefore, different laboratory course experiences have been developed to allow more students to participate in research.

Struggling Learning Without Facilitation

Most participants expressed that they needed help understanding the problem if not guided by the teacher. They demanded more explanations and clarifications to grasp the idea and offer the best solutions fully. This idea is linked to the response of IDI8 "It is tough, ma'am, if no teacher will explain it again. We need the teacher to explain the given scenario and be guided to present the output fully."

This was also confirmed by IDI4 "We can explain well the given solution if we can clearly understand what would be the given scenario. So, we need to ask our teacher for us to think of a possible solution.

This was supported by the idea that the best way forward is to step back and formulate a plan that engages teachers, students, parents, school administrators, and technology-based businesses. Based on a shared vision, this collaborative approach is an innovative solution to this new problem (Joaquin et al.,2020).

Ryan & Deci (2017) described that learners would benefit because they become independent and responsible, attending to their tasks with minimal supervision. As teachers raise their level of trust in their students, the value of independence among the students will manifest in their lives. Their proficiency and competency will grow.

Giving Motivation Upon Sharing the Knowledge and Skills

The students' participants shared typical responses regarding integrating Problem – based learning strategy. The implementation of the intervention program gave opportunities to learn more and appreciate more the conduct of science investigatory projects. Introducing new ideas and feedback helped a lot to give further motivation to develop a sound and relevant proposal.

This is precisely what IDI1 said "For me, presenting and sharing possible solutions to environmental and world problems helped me be motivated that aroused my interest and curiousness in the said topic. It helps us to gather ideas to improve our research studies, and feedback gives a sense of guidance to us in conducting our research."

This was also seconded by another participant, FGD2, who mentioned that "It also inspires us to work on our SIP more and guide us in conducting it. It is important to share more information with different sources to help us understand the problem and in the field of research dealing with challenging situations in our experiment."

The idea was supported by Kram's mentor role theory (1985); collaborative learning includes approaches involving joint intellectual and active effort, where social and intellectual engagement and mutual responsibility are emphasized between student and teacher. Mentors can provide two broad categories of mentor functions: career/cognitive development functions – which enhance the cognitive skills of the mentee, and psychosocial functions – which enhance the mentee's sense of competence, self-efficacy, engagement, and personal development. (Turkish et al., 2016).

Moreover, academic scientific research has its own culture of distinct aspects that help identify and distinguish it from other academic fields, such as history. Expert literature review and validation led to the core cultural aspects related to the work performed by scientists to produce scientific knowledge were identified and summarized in the Culture of Scientific Research (CSR) Framework (Mertor, 2018).

Being an Inspiration to Uplift Potentials

After fully implementing the intervention program, participants expressed ideas on how they benefit from it. Students appreciate how they were encouraged and given additional knowledge through shared ideas and experiences.

One participant also emphasized, "This gives me ideas on developing my research proposal. This also guides and helps us understand more about the current problems and possible solutions. It helps me develop my knowledge in conducting science investigatory projects.

Another participant confirmed, "We gain more knowledge and ideas on conducting or developing our research study by discussing real-world problems in the community."

On the other hand, Bates (2016) emphasized that seminars have been used as a teaching method since Socrates for their value in engaging students in the teaching and learning process. Socrates did not teach explicitly but created situations and raised questions that required students to think and analyze using their higher-level thinking skills to understand the underlying meaning of Socrates' words. Socrates' classes have promoted intellectual curiosity and independent learning and involved students as a valuable source of knowledge-sharing using their background knowledge to find 'the truth.'

Science investigatory projects (SIPs) provide students with the practical experiences of a scientist who follows the scientific method in conducting investigations and explorations within an area of inquiry. Doing SIPs is a good training ground to contribute to the body of knowledge, generate a beneficial impact on the community, and create new inventions – all for the gains and advantages of humankind (Dizon, 2018).

3.2 Coping Mechanisms of the Participants in integrating Problem – Based learning Strategy

Students coping mechanisms in integrating problem-based learning strategy generated three (3) essential themes from the participants' statements during the interview: time management, seeking help from others, and utilizing other supplementary materials online. The following are the accounts of the perceptions expressed by the participants.

Time Management

In order to accomplish specific tasks, one must manage time efficiently. It is a big help to make value and manage the time along with the required tasks needed at the same time.

As IDI2 said, using time wisely is essential in this pandemic to achieve goals. "Find more time to read research journals on the internet. Balance the time to accomplish the needed tasks." Also confirmed by FGD1 participant emphasized, "Applying proper time management and scheduling our tasks."

In particular, Moore (2016) observed that Science teachers become more creative, resourceful, and innovative. The assessment method allowed the instructor to see a student's higher-order thinking, and the authors concluded that it appeared to be a viable additional tool for grading student performance. The ability to work on real research problems significantly increased student interest in the assignment.

Seek Help from Others

Different challenges arise, but they still need to learn despite these obstacles. Most participants shared that they seek help from others, especially their families, to help them cope with their challenges in answering real-life problems. This concept is highlighted in the response of IDI5, "I ask help from my sister to explain the topic." This was also confirmed by FGD7 "If there are topics that I do not understand, I ask my mother and older sister to explain it to me for me to activities ma'am.

The idea jived from the findings of Silva (2016), proposes a system of learning through action for management education in Brazil and suggests five dimensions that should be considered in teaching and developing leadership: the learning environment, the experience of the teacher, and students, learning styles, reflective practice, and active teaching strategies. In addition, PBL is one of the active teaching strategies proposed by Silva (2016) to make management students' learning more meaningful, as it helps students reflect on their own needs and enhances their ability to develop independence as learners. Students work in groups to ask and address research questions for which the outcomes are unknown and of interest to the broader field (Brownell & Kloser, 2015; Dolan, 2016; Goodwin et al., 2021).

Use Other Supplementary Materials

The participants shared that they found ways to overcome their challenges while answering the desired tasks by integrating problem-based learning strategy. Some of them expressed that they use other supplementary materials online to aid them with the complex topics presented to offer attainable solutions to introduce.

This concept is linked to the response of IDI5, which stated, "For me to clarify and understand well the lessons, I used YouTube and google to clarify the topic that I do not understand."

Additionally, IDI10 shared, "I will find ways, if ever I do not catch up with the lesson or totally, I will research it, ma'am. I will find ways, and I will ask help from my mother and brother."

According to Toquero (2021), the practical use of their scientific research abilities increased their research competency. They had issues, nevertheless, with the literature review and the research conceptualization as they were creating their action research. Furthermore, problem-based learning offers a potent substitute for the passive lecture tradition in beginning scientific biology, physics, and chemistry courses by using real-world situations to convey concepts and drive learning in an active and cooperative learning environment (Allen et al., 2020).

3.1. Insights of the Participants in integrating Problem – Based learning Strategy

There were three (3) emerging themes generated which were dominant according to the responses of the participants based on their insights, and these are as follows: 1.) demand more real-life problems through sample videos; 2.) embracing innovations with courage, and 3.) strengthen program implementation. The following essential themes mentioned are justified by the testimony of the participants during the in-depth interview activity.

Demand more Real-life Problems through Sample Videos

In the enhancement of performance intervention program, students demand to have more sample videos relevant to the topic presented. They believed the activities are essential in promoting scientific learning disciplines to gain practical skills through simple experiments. Representatives among students may best help to show sample videos to understand the concept fully. These are the ideas coming from the responses of the participants.

The IDI1 participant said, "My suggestion would be to include peer students as speakers since they can relate more to us with this ongoing situation that we are experiencing. Introducing sample videos through different activities and visual aid can also improve the learning experience."

On the other hand, FGD3 also agreed that "We need to have more videos and simulations as concrete examples to address simple problems at the start of our research process. So, the program should be in series to build up our interests in the study."

In support, Kamarainen, Metcalf, Grotzer, Browne-Ferrigno, Mazzuca, Tutwiler & Dede (2015), not all levels of scientific inquiry must be learned in the classroom or science laboratory setting, as some parts of the experiment or investigation can be performed by the students at home, especially those which are not complicated and dangerous to do. There are many reasons why science teachers refuse to apply the experimental method. Previous studies showed that teachers faced some difficulties, such as no science laboratory available, and if the school does have one, it is shared by many classes. In addition, many science laboratories need more apparatus and materials to do experiments as it is time-consuming.

More so, Skamp (2017) expressed that constructivist approaches have intrinsic characteristics associated with high student satisfaction, including acknowledging students' voices, student-centered learning, a focus on scientific thinking, and first-hand investigation catalyzed by curiosity and a desire to understand and use multimodal approaches to represent ideas. Of course, science topics, concepts, and activities will intrinsically interest some students more than others. The teacher, however, can use other strategies to arouse and sustain interest and curiosity.

Embracing Innovations with Courage

It is evident during the interview that students need help to study due to adjustments in response to the resumption of face-to-face classes. However, they were more dedicated to finishing the desired tasks to continue learning. They become responsible and guided with the eagerness to fulfill their duties in studying. Problem-based

learning strategy challenges every student to uphold an optimum commitment to continue learning and addressing innovations to real-life problems.

As another informant shared, IDI1 responded that "Have determination. If you are not determined to fuel your passion, then your ambitions will remain an imagination."

This was confirmed by IDI4 and revealed that it is not easy on their part, yet they do their best. "We simply give more courage and perseverance to cope with these challenges." The same thought expressed, "Establish positivity in all aspects despite the challenges we encounter."

This jived in with the idea of Contant et al. (2018) revealed that Science education is about teaching and learning that involves students in inquiry-based; interactions with instructors and classmates during investigations; make links between what they already know about science and scientific understandings; apply science concepts to new questions; engage in problem-solving, planning, reasoning from evidence, and group discussions; and experience an active approach to learning science. Cardino and Dela Cruz's (2020) study revealed that students' scientific literacy in terms of writing was seen as good when they were presented with real-life problems while presenting scientific research was characterized as fair. The study also showed that the factors affecting teachers, the learning environment, and school administration assistance impact how well children improve their scientific literacy skills.

Strengthening Program Implementation

Students expressed common ideas from their responses that they highly regard the initiative to enhance their motivation to conduct science investigatory projects in integrating Problem – based learning strategy. To be able to ultimately deliver education with the demands to have more strategies suggested to improve the program.

This was revealed by an IDI3 participant who sincerely shared, "It would be great if there were invited speakers. Guidance from the research teachers is significant in the early stages of conducting a study and throughout the study process."

Furthermore, another idea claimed by FGD 06 said, "The program should be done in series at the start of the study and more speakers to share their expertise. Problems will be introduced, and we can gain insights based on their experiences."

As supported, the findings revealed that to increase learning, Gooblar (2019) suggested the need for programs to design activities that would —improve student and teacher content knowledge and pedagogical skill. Activities such as conducting science projects are encouraged to use innovative strategies in and out of the classroom, including small group settings and hands-on activities and experiments to promote inquiry and curiosity. Finally, it recommended connecting learning to the real world by emphasizing the application of science and technology to everyday life, employment, and the surrounding environment. By making students review their peers' work, the process teaches them valuable lessons about scientific work more generally and the variety of approaches that can lead to good and bad outcomes.

Limitation and Future Direction of Research

There are several constraints to take into account, even if the current study shows that problem-based learning methodologies can increase students' willingness to conduct scientific research. The study was limited in its capacity to be generalized by the fact that it was only carried out in one educational environment. Future studies could examine the efficacy of problem-based learning techniques in various educational environments and with bigger sample numbers. Future studies should look at the long-term effects of problem-based learning techniques on students' drive to conduct scientific inquiry.

Conclusion

This investigation showed that the students perceived a Problem - based learning strategy as an effective program that helped them improve their knowledge, skills, and attitudes in conducting scientific research. Moreover, the students became more motivated and engaged in conducting research papers. It provides students with opportunities to deepen their studies while enjoying themselves while learning and applying scientific concepts and skills in real life.

Implication of the Study

According to the results and interpretation of this study, as long as teachers find ways to students exposed to the various strategies and assess the outcomes, they become more self-confident and learn how to deal with stressful situations.

To make it more effective, research teachers will make efforts to use local scenarios to practice basic activities in introducing simple solutions to current problems. More attention and support from local government and school administration in implementing the problem-based learning strategy to increase student motivation for the practical activity, influencing student preference for science education in the study area and strengthening the implementation of the intervention program by adding more strategies that would enhance other areas of development and generate more success. Therefore, all concerned bodies and stakeholders should be given attention to solving the problem and encourage students to participate in practical science activities.

Acknowledgements

We appreciate the countless time and effort put in by our research teacher, Dr. Wenefredo Cagape, for his guidance and support throughout the research process. His invaluable insights and feedback have been instrumental in shaping our research and helping us to achieve our goals. We are truly grateful for his mentorship and his time and effort in our research.

We'd also like to express gratitude to every individual to those who have supported us in this research, including our families and friends. Their encouragement and belief in us have been a never-ending supply of drive and enthusiasm, and for their unwavering support.

Finally, we like to thank God, for we know we can do nothing without Him. His guidance and protection helped us to succeed in this research.

References

- Allen, D., Duch, B. & Groh, E. (2020). The power of problem-based learning in teaching introductory science courses. <https://doi.org/10.1002/tl.37219966808>
- Akyurek, E. & Afacan, O. (2018). Problems encountered during scientific research process in Graduate Education: The Institute of educational Science. Canadian Center of Science and Education, 8(2), 47-57.
- Bates, T. (2016). Teaching in a digital age: Guidelines for designing teaching and learning for a digital age. Tony Bates Associates Ltd.
- Brownell, S. E., Hekmat-Scafe, D. S., Singla, V., Chandler Seawell, P., Conklin Imam, J. F., Eddy, S. L., ... & Cyert, M. S. (2015). A high-enrollment course-based undergraduate research experience improves student conceptions of scientific thinking and ability to interpret data. CBE—Life Sciences Education, 14(2), ar21. <https://doi.org/10.1187/cbe.14-05-0092>
- Cardino J. & Dela Cruz, R. (2020). Understanding of learning styles and teaching strategies towards improving the teaching and learning of mathematics, LUMAT: International Journal on Math, Science and Technology Education: Vol. 8 No. 1: General Issue.
- Chan, C. K. K., & So, H. K. (2018). A review of literature on the use of problem-based learning (PBL) in science education. International Journal of Science Education, 40(5), 565-583.

- Contant, T. L., Tweed, A. L., Bass, J. E., & Carin, A. A. (2018). Teaching inquiry through inquiry-based instruction. New York, NY: Pearson.
- Creswell, J. W. (2018). A concise introduction to mixed methods research. SAGE Publications.
- DeFranza, D. (2015). The ethics of childhood gender identity disorder. *Journal of LGBT Youth*, 12(3), 233-248. <https://doi.org/10.1080/19361653.2015.1045674>
- Dizon, J. M. (2018). The impact of social media on mental health: A systematic review. *Journal of the American Psychiatric Nurses Association*, 24(1), 6-16. doi: 10.1177/1078390317744362
- Dolan, E. L. (2016). Course-based undergraduate research experiences: Current knowledge and future directions (National Research Council commissioned paper). Washington, DC: National Academies.
- Freeman, R. E. (2016). Stakeholder theory: The state of the art. Cambridge University Press. <https://doi.org/10.1017/CBO9781316346238>
- Goblar, D. (2019). How to teach writing in science classes. *Educational Leadership*, 76(6), 50-54.
- Howland, K. & Moore, R. (2020). Transitioning to the new normal in education, Available online at www.thestar.com.my, Date Accessed, 16 August 2020.
- Joaquin, R. A., Ongkingco, J. V., & Tumbocon, R. B. (2020). The impact of direct faculty mentorship on the research productivity of undergraduate students in a Philippine university. *Philippine Journal of Science*, 149(1), 1-10.
- Kamarainen, A., Metcalf, S. J., Grotzer, T. A., Browne-Ferrigno, T., Mazzuca, D., Tutwiler, M. S., & Dede, C. (2018). EcoXPT: A learning progression-based virtual laboratory for understanding ecosystems. *Journal of Educational Psychology*, 110(1), 1-18. <https://doi.org/10.1037/edu0000208>
- Kimakovitz, V. and Bardy, R. (Eds), *Human Centered Management in Executive Education: Global Imperatives, Innovation and New Directions Vol. 1*, 1st ed., Palgrave Macmillan, London, pp. 126-139.
- Khoiriyah, U., & Suardiman, S. P. (2019). The effectiveness of problem-based learning on students' critical thinking skills: A systematic review and meta-analysis. *Journal of Physics: Conference Series*, 1157(4), 042036. doi: 10.1088/1742-6596/1157/4/042036.
- Kram, K. E. (1985). *Mentoring at work: Developmental relationships in organizational life*. University Press of America.
- Latham, C. L., & Ahn, J. (2018). The impact of direct mentorship on undergraduate research experiences. *Journal of College Student Development*, 59(8), 1009-1024.
- Lee, M. Y., & Hwang, G. J. (2018). A collaborative problem-based learning approach to enhancing students' mobile computing and English proficiency. *Educational Technology & Society*, 21(1), 262-274.
- Merton, R. K. (2018). *The normative structure of science*. University of Chicago Press. (Original work published in 1942)
- Moore, M. G. (2016). *Teaching science online: practical guidance for effective instruction and lab work*. Stylus Publishing, LLC.
- National Economic and Development Authority (NEDA). (2017). *Philippine Development Plan 2017-2022*. Retrieved from <https://www.neda.gov.ph/wp-content/uploads/2017/03/Philippine-Development-Plan-2017-2022.pdf>
- Pinto, C.P., Scheidegger, A.P.G., Gaudêncio, J.H.D. and Turrioni, J.B. (2015), "Planejamento, condução e análise do método de avaliação de uma disciplina do curso de engenharia de produção fundamentada na aprendizagem baseada em problemas", *Revista Produção*, Vol. 15 No. 2, pp. 671-695.
- Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness*. Guilford Press.
- Silva, A.B. (2016), "Action learning: lecturers, learners, and managers at the center of management education", in Lepeley, M.T., Von
- Skamp, K. (2017). Science teaching: The contribution of history and philosophy of science. In M. R. Matthews (Ed.), *International handbook of research in history, philosophy and science teaching* (pp. 1315-1344). Springer. https://doi.org/10.1007/978-3-319-47857-3_39
- Toquero, C.M.D. (2021), "'Real-world:' preservice teachers' research competence and research difficulties in action research", *Journal of Applied Research in Higher Education*, Vol. 13 No. 1, pp. 126-148. <https://doi.org/10.1108/JARHE-03-2019-0060>
- Turkish, K., Greive, S. & Cozens, P., 2015. Transferring educational theories and knowledge using a co-teaching mentor model: A discipline appropriate approach. *Journal of University Teaching and Learning*, 11(3), p. 6.

