Reflections Beyond Implementation:
Evaluation of the Project -Based Learning in the Research Curriculum of the Philippines Science High School– Luzon Campuses

Leo Peter Dacumos

School of Advanced Studies, Saint Louis University and Philippine Science High School - Cordillera Administrative Region Campus, Philippines

Dorothy Silva

School of Teacher Education, Saint Louis University, Philippines

Abstract

STEM schools have put priority on establishing research education as a core program that enables students to choose a topic of their choice, identify a problem, and find a solution to it through experimentation and other modes of data collection. At the Philippine Science High Schools, one of its key goals is to foster a research culture among its scholars, who will help to strengthen the country's academic and scientific workforce and contribute to its success in the future. To improve instructional teaching, project-based learning (PBL) approach has been utilized in many academic courses. A cache of studies has delved on the use of project-based learning approach many academic courses but the research education. This research project aimed to evaluate the implementation of project-based learning (PBL) in the STEM Research curriculum of the Philippine Science High School – Luzon campuses. Select teachers from the Philippine Science High School have shared their thoughts through the qualitative interview tool. The use of qualitative interview tool is aimed to explore their thoughts and opinions regarding the various aspects of project-based learning (PBL) implementation within the PSHS research curriculum. Thematic analysis using phenomenological reduction show emerging themes highlighting the benefits, challenges, and things that needed to start to improve implementation of the project-based learning approach within the research curriculum of PSHS system.

Keywords: *Critical Thinking Skills; Improving; STEM-PjBL*

INTRODUCTION

Research Education and the Philippine Science High School System

One of the significant courses created to strengthen and intensify the student's critical thinking and problem-solving abilities is the creation of research education in specialized high schools. Hence, STEM schools have put priority on establishing research education as a core program that enables students to choose a topic of their choice, identify a problem, and find a solution to it through experimentation and other modes of data collection.

Specialized high schools have prioritized research education to bolster students' critical thinking and problem-solving capacities. As Kettler and Puryear (2018) highlight, the distinctive features of STEM high schools over traditional ones are research mentorships and apprenticeships with expert faculty. Thomas

(2000) also emphasizes the importance of research in STEM schools not only to enhance students' capabilities but also as a foundation for future STEM professionals.

Recognizing the need for enhanced STEM education, the Philippine government introduced the Engineering and Science Education Program. This initiative is the first step to revamp STEM education at the basic education level, with over 150 high schools, primarily public, adopting the STEM curriculum. The Department of Education focuses on expanding the STEM high school system, while the Department of Science and Technology established the Philippine Science High School (PSHS) system, emphasizing STEM education.

The PSHS system, under Republic Act No. 8496, was crafted to offer a rigorous curriculum in science, mathematics, and research. The intention is to provide significant financial support for student projects, especially in lab work and research logistics. PSHS aims to inculcate a research culture among its scholars, fostering inquiry skills and scientific investigations. These scholars, through the curriculum, are prepared for STEM careers, aiming for holistic development, global perspective, and nationalistic sentiments. The six-year program focuses on creating empowered learners ready to tackle STEM courses and to become responsible global citizens.

Prioritizing critical and creative thinking, the Research, Policy, and Academic Division (RPAD) has implemented a comprehensive research curriculum. This program equips students for science and engineering careers, intertwining the research process with integral concepts while emphasizing academic integrity (Approved Resolution No. 2020-09-88).

Project-based Learning (PBL) vs. Traditional Project in Research Education

Traditional projects dominate many academic courses, especially in research education, with a structured, guideline-driven approach (Winnen, 2016). They focus on individualized completion of specific tasks, often resulting in written reports or presentations based on predefined topics (MyPBL Works, n.d.).

Conversely, both project-based learning (PBL) and traditional projects require students to complete projects to enhance topic comprehension. Yet, they differ in several ways:

a. **Approach:** Traditional projects provide students with specific topics and detailed guidelines for execution, emphasizing task completion within set parameters (TeachThought Staff, 2019). PBL adopts a student-centric model, emphasizing scientific inquiry, collaboration, and critical thinking, letting students address real-community issues (Thomas, 2000).

b. **Authenticity:** Traditional projects might not always connect to real-world relevance, prioritizing classroom-specific knowledge (TeachThought Staff, 2019). PBL targets real-world, authentic problems, making the learning experience more meaningful (Hung, 2008).

c. **Role of Teachers: In** traditional projects, teachers instruct, monitor, and evaluate (MyPBL Works, n.d.). PBL positions teachers as facilitators, promoting critical thinking, teamwork, and reflection (Savery, 2006).

d. **Disciplinary Integration:** Traditional projects might focus on a singular discipline, leading to isolated learning (MyPBL Works, n.d.). PBL integrates multiple disciplines, enabling students to see cross-disciplinary connections (Larmer & Mergendoller, 2010).

e. **Assessment:** Traditional methods evaluate based on the final product using checklists or rubrics. PBL emphasizes continuous evaluation, assessing various project stages with criteria like critical thinking and collaboration (Bell, 2010).

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Project-based Learning and its Applications

Project-based learning (PBL) is a pedagogical approach where students actively participate in real-world and personally meaningful projects. Rather than relying on traditional lectures and tests, students collaborate on projects, applying their knowledge to address intricate issues or create tangible outputs. PBL has been integrated into basic education subjects to transition from conventional instruction methods.

In mathematics, PBL facilitates active participation in learning (Savery, 2006). With math often seen as intricate (Langoban, 2020), PBL fosters collaboration, making mathematical ideas more relatable and boosting academic performance (Daro et al., 2011; Boaler, 2002).

In science, PBL enhances the classroom environment and learning experience. Hugerat (2016) reported a more positive classroom atmosphere with this approach. It enables students to contextualize scientific concepts through investigations rather than mere theoretical knowledge. Several researchers ranked PBL among the best methods for improving science learning quality, allowing students to apply their scientific knowledge to self-identified problems (Barron et al., 1998; Wolk, 1994).

Research Gap

Studies have acknowledged the benefits of PBL across Mathematics (Boaler, 2002; Savery, 2006; Serin, 2019) and Science (Barron et al., 1998; Wolk, 1994). It has also been linked to enhanced learning attitudes in Social Studies (Cifti, 2015; Ilter, 2014; Diffily, 2002) and English (Bas, 2011), improved classroom dynamics (Hugerat, 2016), and active engagement in the educational process (Savery, 2006). PBL's interdisciplinary nature enhances knowledge application across subjects (Poonpon, 2017).

While there's evidence for PBL's efficiency in numerous subjects, its effectiveness in teaching research courses remains underexplored. Existing literature mainly evaluates PBL in terms of academic achievement, attitudes, motivation, and classroom environment. Little research focuses on PBL's integration into curricula or uses a curriculum evaluation model for assessment. Notably, there's a paucity of studies on PBL's application in the research curriculum of the Philippine Science High School (PSHS) (Hung, 2008; Savery, 2006; Larmer & Mergendoller, 2010). It warrants exploration of PBL's extent in PSHS's research curriculum and the potential dominance of traditional project methods. Empirical research in this or similar institutions would be valuable.

Research Objectives

This research project aimed to evaluate the implementation of project-based learning (PBL) in the STEM Research curriculum of the Philippine Science High School - Luzon campuses. Specifically, this study answered the following:
1. What are the benefits of implementing project-based learning in teaching research?
2. What are the challenges in implementing project-based learning in teaching research?
3. What are the things that need to start in implementing project-based learning in teaching research?

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RESEARCH METHOD

Research Design

This study incorporated a descriptive-phenomenological design. This design was used to investigate the perceptions of the teachers as to their experiences in implementing the research curriculum and how project-based learning is integrated into the STEM research curriculum.

Population and Locale of the Study

The participants of this study were the STEM Research teachers of the Philippine Science High School - Luzon campuses. Teachers were selected through a combination of random and snowball sampling methods to ensure a generalizable result, and a truthful-sample selection system was generated. The criteria in the selection of the participants had to: 1) be affiliated with DOST's Philippine Science High School System (PSHSS); 2) be among the research teachers of PSHS Luzon campuses; 3) be involved in the implementation, that is, the teaching of the STEM research curriculum; and 4) have knowledge of the content of the curriculum from its objective down to the different evaluation methods implemented.

Data Gathering Tool and Procedure

The study uses a qualitative questionnaire to examine PSHS research teachers' views on project-based learning (PBL) within the PSHS curriculum. The tool focuses on PBL's benefits ("roses"), challenges ("thorns"), and areas for growth ("buds"). Through teachers' responses, the study seeks a deeper understanding of PBL perceptions in the PSHS research context.

A permission letter was sent to the Office of the Executive Director (OED) of PSHS, seeking endorsement from the Campus Director of PSHS-CARC. After a review by the Academic Research Committee (ARC) and an endorsement from PSHS-CARC, the OED issued Memorandum No. 115, s.2023, endorsing Mr. Leo Peter Dacumos' data collection across eight Luzon PSHS campuses. An email detailing the study and procedures, along with OED's approval documents, was forwarded to these campuses.

This interview tool is specifically designed to delve deeper into the perspectives of the research teachers of PSHS. The objective is to investigate their perspectives and viewpoints regarding different facets of incorporating project-based learning (PBL) into the research curriculum of PSHS. Specifically, the qualitative interview instrument concentrated on understanding three elements: the positive aspects or strengths of PBL (referred to as "roses"), the obstacles or challenges related to its implementation (referred to as "thorns"), and the possibilities or potential for PBL development and enhancement (termed as "buds").

Particularly, to enable the teacher respondents to answer in elaborate detail, the questions for the interview were open-ended. Key questions for the interview include the following: 1) What are the benefits of implementing project-based learning in teaching research?; 2) What are the challenges in implementing project-based learning in teaching research?; and 3) What are the aspects that need to start in implementing project-based learning in teaching research?

Treatment of Data

Thematic analysis using phenomenological reduction. A phenomenological reduction was used for the extended responses/texts from the interview through a repertory grid. This is to observe cool and warm analyses of the data gathered from the participants' responses. The cool analysis part consisted of significant verbatim statements from the participants. The cool analysis was crucial since the coding

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process was tagged from these significant points. The coding process and categorization of codes will constitute the warm analysis. Coding identifies specific responses that are repeated in many instances, something that the interviewee deemed necessary, and things that surprised the interviewer, among others (Saldana, 2009), by putting specific labels. Generated codes were categorized into groups. These categories were named into specific themes and subthemes.

The results of the thematic analysis were subjected to a member-checking procedure via correspondence. This procedure is critical as it allows the participants of the study to be approached by the researcher to check the "accuracy and consistency of interpretation" (Lincoln & Guba, 1985). The trustworthiness and truthfulness of the emerging themes and insights will be established through this process.

FINDINGS AND DISCUSSION

Benefits of PBL Implementation (Roses)

Through an in-depth qualitative analysis of their statements, four major themes emerged as significant in shaping their perspectives. These themes included Synergistic Connections: Fostering Collaboration and Interpersonal Bonds, Quest for Ingenuity: Igniting Critical Thinking and Problem-Solving, Empowering Explorers: Nurturing Learners' Autonomy and Agency, and Agents of Impact: Inspiring Personal Relevance and Community Engagement. The study's results highlight the complexity and diversity of teachers' perspectives and shed light on the potential advantages of project-based learning within the context of the PSHS research curriculum.

Synergistic Connections: Fostering Collaboration and Interpersonal Bonds. From the qualitative analysis, a key theme was the importance of collaboration and relationship-building in project-based learning. Teachers underscored how teamwork deepens understanding and enhances the learning journey. At PSHS, the research curriculum mandates groupings, maximizing student collaboration. Collaboration at PSHS bolsters students' ability to contribute, communicate, and resolve disagreements. Lee et al. (2015) found that group social skills reduce conflicts and boost cooperation. Another dimension highlighted was the benefit of PBL in relationship-building with the community. As Bergeron (2022) noted, PBL nurtures student communities and integrates them into broader learning ecosystems. PSHS students, through PBL, engage with external experts, paving the way for their future careers.

Quest for Ingenuity: Igniting Critical Thinking and Problem-Solving. From the teachers' qualitative feedback, a notable theme was that PBL in the research curriculum fosters critical thinking and problem-solving. Through PBL, students at PSHS engage in intricate tasks, demanding higher-order thinking. A teacher mentioned, "In PBL, students critically analyze problems, pose questions, and craft solutions." This approach encourages them to address real-world community issues using varied perspectives. Research by Issa & Khataibeh (2021) confirms PBL's efficacy in enhancing critical thinking compared to traditional methods. Critical thinking enables students to assess information, discern patterns, and form logical connections, vital for their research endeavors.

Empowering Explorers: Nurturing Learners' Autonomy and Agency. The third major theme that surfaced from the teachers' significant statements was the development of learners' autonomy and agency from project-based learning implemented within the research curriculum at PSHS. Teachers recognized that the project-based learning approach, when integrated into the research curriculum, empowers students to take ownership of their learning and become active participants in the research process.

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A teacher noted, "Project-based learning empowers students with choices in their learning journey." This PBL approach turns students into autonomous learners, making decisions about their research with minimal teacher guidance. Studies by Bagheri et al. (2013) confirm PBL's role in fostering self-directed learning and autonomy. Swars et al. (2007) argue that cooperative learning, integral to PBL, emphasizes building interdependence and group evaluation skills. At PSHS, students plan their research, progressing from Research 1 through 3, and utilize self and peer-evaluations. This approach heightens learners' agency, as they self-reflect, assess, and regulate their progress (Lenz & Larmer, 2020).

Agents of Impact: Inspiring Personal Relevance and Community Engagement. The final theme from the teachers' feedback was the value of personal relevance and community engagement in the PSHS's project-based learning (PBL) research curriculum. Teachers observed that linking students' projects to real-world issues boosts authentic learning experiences.

A teacher mentioned, "Students address problems meaningful to them and their communities, learning even from setbacks". PBL's strength lies in its focus on issues significant to students (Mark, 2016). Allowing students to choose topics tied to their interests ensures sustained motivation (Poth, 2016).

Community engagement is another PBL highlight. One teacher noted, "Students collaborate with experts, explore community sites, and discuss with community members." At PSHS, students consult with STEM institutions, including DOST branches and universities. Engaging with stakeholders offers students deeper insights and broadens future career paths (Larmer et al., 2015).

Agency, as defined by Lenz & Larmer (2020), is proactive and seeks meaningful action. It's not just about self-directed learning but impacting the broader community. As one teacher put it, "PBL drives students to be change-makers, addressing community challenges." This aligns with the PSHS's goal of applying science for community benefit (Marfal, 2017).

Challenges of PBL Implementation (Thorns)

The research teachers of PSHS who participated in this study expressed different viewpoints regarding the difficulties of implementing the project-based learning approach within the research curriculum at the Philippine Science High School. The significant statements made by these teachers highlighted four key themes: PBL, Road to High Autonomy...For All?; PBL, fostering personal relevance...resources ready?; PBL, engaging community collab...why unpredictable?; and PBL, unraveling student engagement... does it totally?

PBL, Road to High Autonomy...For All?

A primary theme from research teachers' statements is the challenges of independence and autonomy in PSHS's project-based learning (PBL) curriculum. Many teachers voiced concerns about students' readiness for independent work. Although PBL promotes autonomy, not all students are naturally self-driven. A teacher mentioned, "Some students need more guidance to develop their autonomy in projects." Brooks (2016) agrees that not every student is prepared for collaborative and self-directed tasks. Transitioning from traditional projects to a self-directed approach can be daunting. Another teacher observed, "Students, unfamiliar with PBL, often don't utilize their autonomy." Effective transition to PBL requires clear expectations and guidance (Brandt, 2020). Providing structured support can help students grow in autonomy over time (Dolman et al., 2016). Kirschner et al. (2010) noted that guidance is essential until students gain enough prior knowledge. Implementing scaffolding strategies can boost autonomy in PBL as students progress in their research projects.

PBL, fostering personal relevance...resources ready? The second theme from teachers' statements

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revolves around resource constraints and collaboration limitations in the PSHS's project-based learning curriculum. While PSHS receives ample government funding for STEM, the personalized nature of projects can lead to resource shortfalls. Teachers noted that students sometimes choose topics needing materials outside the PSHS's scope. As one teacher said, "The budget constraints can make it tough to support diverse projects."

Furthermore, collaboration with external partners like experts and organizations is crucial for PBL's success. However, teachers highlighted challenges in this area. A teacher mentioned, "While PBL emphasizes community collaboration, when such partnerships falter, projects can fail." Such limitations can compromise the project's depth and access to specialized resources and facilities (McGrath et al, 2009).

PBL, engaging community collab…why unpredictable? The theme emphasizes challenges in community engagement and project unpredictability within PSHS's PBL research curriculum. Teachers noted that while students actively seek community involvement, external factors can disrupt these collaborations. A teacher mentioned, "Success in collaboration isn't just about students' efforts." Factors like stakeholder availability, commitment, or integration challenges can impede smooth collaboration (Melaville et al., 2006). Moreover, unforeseen events or logistical issues can derail a project's trajectory. To address this, improved communication with community stakeholders is essential, alongside setting clear partnership expectations (Melaville et al., 2006). Additionally, teachers should foster student adaptability to ensure project success.

PBL, unraveling student engagement… does it totally? The theme addresses challenges concerning student engagement within the PBL framework. Many teachers are concerned about sustaining student interest throughout research projects. As one teacher pointed out, initial enthusiasm can fade over time due to factors like project complexity, lack of relevance, or insufficient support (Yan et al., 2023). While PSHS teachers encourage students to choose topics aligned with their interests, some struggle to stay engaged. Issues like unclear goals, limited resources, or overwhelming workloads can contribute to disengagement. PSHS's broad curriculum might compete with research projects, suggesting a need for coordinated scheduling across courses. Another hurdle is students' difficulty in pinpointing their interests. As a teacher mentioned, it's challenging when students say they have no interests. With the initial research course offered in Grade 10, students might still be exploring passions. Therefore, beyond autonomy, there's a strong need for guidance, scaffolding, and support in helping students choose and remain committed to their research topics (Poth, 2016).

Opportunities for PBL Implementation (Buds)

The research teachers of PSHS who participated in this study expressed different viewpoints regarding the opportunities of implementing the project-based learning approach within the research curriculum at the Philippine Science High School. The significant statements made by these teachers highlighted three key themes: Investing in Limitless Possibilities: Enhancing Research Funding and Facilities, Igniting the Spark: Training Educators as PBL Mentors, and Breaking the Mold: Redesigning Curriculum for Project Visionaries.

Investing in Limitless Possibilities: Enhancing Research Infrastructure and Resources. The first theme from PSHS research teachers' statements pertains to the need for better research funding and facilities in implementing the PBL approach. Teachers emphasized improved infrastructure, notably through augmented funding for lab facilities. As one teacher mentioned, appropriate financial support could lead to advanced equipment and upgraded infrastructure. While PBL allows students to pursue unique

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research interests, the current system sometimes lacks necessary materials. Investing in facilities ensures a conducive environment for impactful research (Pareek, 2019), allowing hands-on experimentation and development of STEM skills.

Teachers also highlighted the need for diverse resources to support students throughout their research. Many campuses lack access to premium research databases like ScienceDirect and EBSCOhost (Personal Correspondence, June 03, 2023). While free resources exist, they may not match the quality and depth of premium databases (Spinella, 2008; Tenopir, et al., 2015). Tools like Grammarly, Turnitin, and platforms like Zoom could further enrich students' research experience, allowing them to delve deeper into their chosen topics.

Igniting the Spark: Training Educators as PBL Mentors. The second theme that emerged from the significant statements of the research teachers at PSHS regarding the implementation of project-based learning (PBL) in the research curriculum is the need for teacher training on PBL implementation. The second theme focuses on the teachers' perspectives regarding their own professional development and acquisition of knowledge and skills in implementing PBL effectively in their research teaching practices.

Several teachers highlighted the importance of comprehensive teacher training that will specifically address the implementation principles and strategies of PBL, particularly when integrated within the Research curriculum of PSHS. According to one teacher, "[Teacher] training sessions should focus on the principles and strategies of project-based learning, providing teachers with the necessary knowledge and skills [to guide students through the research process effectively]." This suggestion highlights the need for professional development opportunities that should equip the research teachers with the necessary skills, pedagogical tools, and techniques in order to implement PBL in the research curriculum effectively. According to Grossman et al. (2019), growing professionally requires teachers to develop an intensive professional learning program focused on student-centered instructions and redesigning of preservice teacher programs around student-centered practices. Several PBL studies and courses underscored the importance of teacher training, particularly in integrating learning approaches in teaching (Grossman et al., 2019; Molina-Torres, 2022; PBLWorks, 2023). Particularly, PBL teacher training can enhance (1) the familiarity of teachers with PBL principles, (2) PBL instructional guidance, (3) assessment and feedback, and (4) classroom management.

Breaking the Mold: Redesigning Curriculum for Project Visionaries. The last theme that emerged from the viewpoints of research teachers at PSHS regarding the implementation of project-based learning (PBL) in the research curriculum is the call to decongest the curriculum competencies. This theme focuses on the perspectives of teachers regarding the need for curriculum revision to create space for students to engage in fully-conceptualized projects and laboratory experiences.

Under the Curriculum Under the Remote and Blended Learning (CRBL) of PSHS, STEM Research 1 is teeming with learning competencies to introduce the basic concept of research, research ethics, types of research, literature search technique, source discrimination, and identification, among others which are congested into the first quarter (PSHS CRBL, 2020). Furthermore, students are expected to write their introduction to their study during the same quarter. Teachers express dissatisfaction with the expectation of having a fully developed research topic in the first quarter of the academic year, which they are then expected to continue working on in subsequent quarters and in Research 2 and 3 (in the following years). They argue that this expectation is unrealistic due to the limited time available for topic conceptualization, which is further exacerbated by the congested curriculum of STEM Research 1. As a result, they believe that students may struggle to develop comprehensive and meaningful research topics within these constraints.

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As stated by one teacher, "Decongest the curriculum competencies for STR 1 to allow students to have more time in conceptualizing the project they wish to pursue". Teachers recognized that project conceptualization is a crucial phase in the research process, particularly in Research 1, as it allows students to identify the central and specific problem from their community that they wish to solve. Also, as Research 1 is generally their first time doing research, the idea of doing research and identifying their research interest can take a lot of time.

Furthermore, another teacher stated, "Streamlining the curriculum, removing non-essential elements, and prioritizing key learning outcomes, students will have additional time and flexibility to delve into their chosen research projects." Sergio (2011) argued that there is a need to streamline the curriculum to ensure the effective delivery of competencies. After all, it is the quality and not the quantity of competencies within the curriculum that must be considered to ensure better outcomes. By decongesting the curriculum, students would have more time and flexibility to delve into their chosen research topics, build a stronger foundation of their knowledge of the topic, and develop possible innovative solutions.

Additionally, the teachers emphasized the importance of laboratory exposure for students as it provides them with the necessary knowledge and skills that they can use in their respective research, particularly during the data collection phase. According to one teacher, "Involve students in laboratory settings; they will gain valuable experience in executing research protocols, utilizing scientific instruments, and collaborating with peers." A decongested curriculum can provide more time for hands-on laboratory experiences that will enable them to develop and apply research skills and techniques more effectively. Ultimately, one of the expected outcomes of the 6-year secondary basic education curriculum of PSHS is for PSHS graduates to "be holistically developed as they master competencies and skills through a decongested curriculum" (The 6-year PSHS Curriculum, n.d.).

CONCLUSIONS

The conclusions for the objectives of the study on the evaluation of the project-based learning approach implementation within the Research curricula of Philippine Science High School are based on the findings on the perception of the research teachers. The conclusions are as stated below:

1. Teachers perceive that the integration of PBL within the research curriculum of PSHS encourages students to collaborate and build peer and community relationships, develops their critical and problem-solving skills, improves their autonomy and agency, and promotes their engagement and connection to their own research projects and community and cultivates a sense of community responsibility.
2. Teachers perceive that the integration of PBL within the research curricula of PSHS faces challenges as students may have difficulty adapting immediately to the demands of this approach, particularly on their autonomy and independence, limitations brought about by resources constraints and limitations in collaboration, engagement with the community and unpredictability of the implementation, and sustenance of the student's engagement and interest within the project-based learning.
3. Teachers perceive that the integration of PBL within the research curricula of PSHS requires things to improve its implementation, particularly in enhancing the research infrastructure and resources, teacher training on PBL, and decongesting the preparatory Research course to enable better conceptualization of projects and time for laboratory skills training.

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RECOMMENDATIONS AND FURTHER RESEARCH

Based on the abovementioned conclusions, the following are hereby recommended:

1. Maintain the continuous integration of PBL within the research curricula with a focus on sustaining its presence in the identified learning objectives, learning experiences, and their organization and evaluation methods.
2. Ensure that the integration of PBL within the research curricula is sustained to enhance further the students' collaboration and peer and community relationships, critical and problem-solving skills, autonomy, agency, student engagement, and agency.
3. Address the challenges faced by Problem-Based Learning (PBL) in its integration within the research curriculum of PSHS.
   a. PBL shows promise in fostering autonomy, but since some individuals may struggle to adapt to it initially, it is necessary to incorporate elements of the traditional project approach to provide guidance until they can become independent.
   b. Strengthen collaboration mechanisms and structures, including clear guidelines and protocols in PSHS's research curriculum to address problems in collaboration with external stakeholders and resource constraints.
   c. Ensure tighter and clearer communication with community stakeholders that will include specific parameters as to the extent of expectations, benefits, and risks, among others, to facilitate successful collaboration and implementation of the student's research project.
   d. To address the problem of students engagement and interest dilemmas, there is a need for PSHS to establish collaborative planning, particularly on schedule, within the research courses and other academic courses of the PSHS from Grade 10 to 12 to identify possible conflicts, align and coordinate academic requirements of the PSHS courses, and allocate time to accomplish these requirements.
4. Improve the implementation of a project-based learning approach within the research curricula of PSHS based on the suggestions of the teachers.
   a. Enhance research infrastructure and resources to facilitate effective implementation of PBL.
   b. Provide a comprehensive teacher training program on PBL to equip the research teachers with the necessary knowledge and skills to implement this approach effectively.
   c. Decongest the preparatory Research course to allow students to conceptualize better and fully grasp their understanding of their identified research interest and topic idea and allot more time for laboratory skills training.
5. For future researchers, the following is hereby recommended:
   a. Conduct additional research to delve deeper into the implementation of PBL in various subjects and grade levels, particularly exploring its effectiveness.
   b. Conduct a longitudinal study to examine the long-term impact of PBL on the research skills of the students and overall academic performance.
   c. Explore effective approaches for training teachers, particularly the ones teaching research in PBL methodologies and strategies.
   d. Conduct comparative studies to compare the effectiveness of PBL with other teaching approaches while focusing on the four Tylerian domains; that is, learning objectives, learning experiences, organization of learning experiences, and evaluation methods.

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