



Exploring the Experiences of STEM Students in Writing Research: Insights, Challenges, and Strategies

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Article Info

Article history:

Received Sep 28, 2024

Revised Dec 1, 2024

Accepted Jan 2, 2025

OnlineFirst Jan 16, 2025

Keywords:

Challenges

Coping Mechanisms

Novice Researchers

Narratives

Strategies

ABSTRACT

Purpose of the study: This study aims to explore and examine the experiences and narratives of thirty-two (32) students from the Philippine Science High School - Ilocos Region Campus (PSHS-IRC) as they engaged in conducting and writing STEM research.

Methodology: The study used a descriptive phenomenological design to explore the research experiences of 32 students from PSHS-IRC. Data was collected via open-ended questionnaires and in-depth interviews. Thematic analysis identified key themes, validated through member checking and intercoder agreement, ensuring reliability and accuracy of insights.

Main Findings: Research writing presents numerous challenges for students, including literature searching, resource limitations, procrastination, motivation, and time management. Key difficulties involve finding credible sources, organizing research, defining problems, and drafting sections like the methodology and conclusion. Strategies such as seeking help, improving sourcing techniques, and prioritizing tasks can mitigate these challenges, enhancing students' research experience.

Novelty/Originality of this study: This study highlights student challenges in research writing, providing insights for educators and administrators to improve research education. The findings also serve as a valuable reference for future studies in STEM education, offering guidance for scholars interested in exploring similar topics and enhancing academic support systems.

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1. INTRODUCTION

Research plays a crucial role in advancing knowledge and understanding of various issues and topics. However, the process of conducting research can be demanding, requiring significant patience and perseverance from researchers [1]. It is essential for students to recognize the importance of their research endeavors and approach them with dignity and resilience. Many students perceive research as a daunting task, often due to their perceived inadequacies. They may struggle with insufficient knowledge or skills, difficulties in collaboration, and challenges in time management [2]. The challenges of research extend beyond individual students; they also impact the educational environment. Incomplete or poorly executed projects can not only jeopardize a student's academic standing but may also lead to disappointment for teachers who invest in their students' success. Thus, it is vital for researchers to approach their projects with diligence and a commitment to quality [3], [4].

In the Philippine education system, students are equipped for rigorous research through a specialized subject known as scientific research, which is part of the senior high school curriculum. This subject aims to cultivate critical thinking and problem-solving skills, essential for students' academic and personal development [5]. Particularly in science high schools, the curriculum emphasizes the importance of research, aiming to enhance students' capabilities and prepare them for future challenges [6].

The Philippine Science High School System, recognized as the premier network of science high schools in the country, sets higher educational standards and expectations for its students. Research is prioritized within their curriculum [7], which can elicit a range of emotions from students. However, a disconnect often exists between the intended integration of research into learning and teaching and the actual outcomes, leading to a gap in students' intellectual growth [8].

While many previous studies have investigated research writing difficulties, most have provided generalized findings without addressing the specific details of the research writing process as experienced by novice researchers. Furthermore, most of these studies have focused on students' challenges in general. Only a limited number of studies have specifically explored the research writing difficulties faced by STEM students. This highlights the need for a more in-depth and comprehensive examination of the research writing challenges encountered by STEM students.

Considering these challenges and related studies, this study seeks to identify and analyze the common difficulties that students face when writing research manuscripts and implementing research methodologies. By addressing these knowledge gaps, the research aims to provide insights into the struggles faced by science high school students in the realm of research. Additionally, this study aspires to serve as a voice for students, highlighting their challenges and offering valuable information for educators and administrators. Understanding these difficulties will enable them to implement strategies to enhance the accessibility and effectiveness of research education. Furthermore, this research may benefit other scholars interested in exploring similar topics, as the findings and conclusions can serve as a reference for future studies in STEM education.

1. 1 Statement of the Problem

This study sought to explore and examine the experiences and narratives of thirty-two (32) students from the Philippine Science High School - Ilocos Region Campus (PSHS-IRC) as they engaged in conducting and writing STEM research.

1.2 Review of Related Literature and Studies

This section presents related literature and studies that explain the concepts necessary for the research. In a study by [9], various challenges faced by students during research were documented through previous studies and narratives. These challenges included difficulties in selecting a research topic [10], lack of funding [11], insufficient knowledge and skills [12], time management issues [13], and obstacles in data collection [14]. The study concluded that research has become increasingly challenging for students due to these difficulties, highlighting the urgent need to address these barriers.

investigated the issues encountered by student researchers during the second semester of the academic year [15]. Surveying and interviewing eleventh-grade students from Particion National High School, the study found that most students struggled with time management and perceived group work as unhelpful, often relying too heavily on their group leaders. Additionally, the lack of knowledge made selecting a research topic difficult, and not all students had access to devices that could facilitate their research. Shared the experiences of a doctoral researcher conducting fieldwork with vulnerable women in rural northern Thailand [16]. The challenges highlighted included selecting a field site, obtaining permission, building trust with participants, maintaining privacy and confidentiality, and managing the researcher's own vulnerability. The study emphasized the importance of critical self-reflection for both novice and experienced researchers, offering practical strategies and insights from the researcher's personal experiences.

Presented reflections from forty-two students regarding their experiences and struggles in research [17]. Three main themes emerged: academic challenges, personal or external difficulties, and issues related to personal problems. These challenges were further subdivided into individual and specific problems. Students' strategies for addressing these difficulties included maintaining personal contact with respondents, cultivating an optimistic attitude, being flexible, staying dedicated and determined, and building self-confidence.

Resert by [18] conducted a study that investigated the challenges faced by Libyan EFL students at Sebha University in writing research papers. The study revealed that student researchers encountered difficulties in identifying research interests, choosing topics, formulating research questions, and reviewing related literature. Additionally, the study pointed out that Libyan teachers often had negative attitudes toward their students' research work due to a lack of appreciation for research, limited motivation, and restricted access to relevant resources.

In another study, [19] explored the challenges faced by undergraduate EFL students in writing problem statements for their research projects. Twenty Jordanian students participated, attempting to formulate problem

statements over the course of one month. Most students struggled with organizing and framing their problem statements, largely due to significant grammar issues, making the task of writing problem statements especially challenging.

Explored the challenges faced by novice research students at the Institute of Education and Research, Punjab University Lahore [20]. Using purposive sampling and in-depth interviews, the study found that students struggled with a lack of expertise, low confidence in research writing, difficulty in finding relevant and up-to-date references, a lack of interest in research, poor understanding of their topics, and insufficient guidance from supervisors.

Examined the problems faced by undergraduate students when writing research projects in English as a Second Language (ESL) [21]. The study, which involved around 60 students from the Department of English and the Department of Computer Science, identified various challenges, including difficulties in topic selection, inadequate knowledge of methodology, trouble locating modern and expert sources, and a lack of interest and guidance in conducting research.

Research problems faced by communication students into three groups: academic difficulties, internal or personal challenges, and external issues [22]. The study also explored how students addressed these problems, with common strategies including personal contact with respondents, developing an optimistic attitude, being flexible, showing dedication and determination, and building self-confidence.

In a study by [23], graduate students identified problems encountered during scientific research and proposed solutions. These included improving research skills, shortening the methodology, careful planning, reaching out to more respondents, and managing time effectively.

Finally, [24] found that students employed various strategies to overcome challenges in thesis writing, such as self-motivation, seeking support from peers and mentors, and managing their time efficiently. These strategies helped students navigate the common difficulties associated with research and academic writing.

2. RESEARCH METHOD

The study utilized a qualitative approach, specifically employing a descriptive phenomenological design. This type of research aims to understand and explore individuals' lived experiences [25]. As Padilla-Díaz [26] explains, descriptive phenomenology focuses on examining participants' personal experiences, requiring detailed descriptions or interpretations of the phenomena they encounter.

The study population consisted of thirty-two (32) students from the Philippine Science High School-Ilocos Region Campus (PSHS-IRC) who were actively involved in conducting research. The study used purposive sampling [27], a non-probability sampling technique where participants are selected based on specific criteria. This method ensured that the chosen participants possessed substantial knowledge and experience in selecting research topics, crafting methodologies, and writing research findings and conclusions, making their insights reliable and relevant. The sample size of thirty-two participants aligns with the recommended number for phenomenological research, and all data collection, including questionnaires and interviews, took place on the school campus.

Open-ended questionnaires were distributed to the students via Google Forms. The questionnaires included two questions that explored the challenges students faced in their research and the strategies they employed to overcome these difficulties. The third question asked respondents to rank the sections of a research manuscript based on the difficulty of writing each part, while the final question sought permission for interviews on school premises. Following the survey, in-depth interviews were conducted with all thirty-two student-participants to gather more meaningful data, using a researcher-made interview protocol. These interviews provided additional insights into the research topic.

Thematic analysis was employed to analyze the collected data. This method involves thoroughly reviewing the data to identify patterns and uncover meanings within participants' responses [28]. Codes were assigned to significant phrases and sentences in the transcribed data, which were then grouped to form overarching themes. These themes were validated through member checking and the use of a critical friend technique [29], ensuring their accuracy. To enhance the reliability of the codes, an intercoder agreement process was implemented. Once the relevant themes were identified, they were discussed and supported by related studies and literature.

3. FINDINGS

In writing the paper, the challenging parts of research were identified and understood. Four themes were discovered and formulated regarding the issues students face in their research, while three themes were developed concerning their mechanisms for addressing these issues.

3.1 Students Difficulty in Writing a Manuscript

Figure 1 displays the research components ranked by students based on the challenges in conducting and writing research.

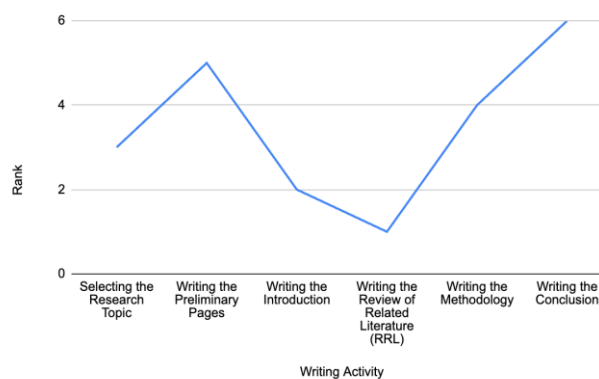


Figure 1. Ranking of research components by writing difficulty

Writing the Review of Related Literature (RRL) emerged as the most formidable task. This suggests that students grapple with the extensive demands of gathering, synthesizing, and accurately citing existing studies relevant to their own work. The complexity of connecting prior research to their study likely requires significant reading and critical thinking [30]. Writing the Introduction ranked second, revealing that students find it particularly challenging to craft an effective introduction. They struggle to provide adequate context and establish a compelling rationale for their research topic, setting the stage for their study [31]. Selecting the Research Topic, indicating that students often face difficulties in narrowing down their interests [32]. This task involves ensuring that their chosen topic is both relevant and manageable, adding another layer of complexity to the research process.

Writing the Methodology was ranked fourth, suggesting that while students find this technical aspect of their research process challenging [33], it is not as daunting as the tasks of reviewing literature or writing the introduction. This indicates a level of familiarity with the mechanics of designing and describing research. Writing the Preliminary Pages, which encompasses essential formal sections like the title page, abstract, and acknowledgments, was ranked fifth. This lower ranking implies that, although these sections are important, students perceive them as less challenging to complete compared to other components. Writing the Conclusion was considered the least difficult task. This suggests that students find it relatively straightforward to summarize their findings and reflect on the implications of their research, bringing their study to a close with clarity and confidence. Overall, the rankings provide valuable insight into the specific hurdles students face, guiding future support and instructional efforts.

3.2 Problems Encountered by Students

Writing and conducting research presents a range of challenges that students frequently encounter. This section discusses the issues identified by students who participated in a survey, analyzing their responses to categorize these challenges into key themes.

3.2.1. Searching for Related Literature and Studies

The most commonly mentioned issue among students is finding relevant literature for their research. This is evident from their excerpts, such as “Searching for literature,” “Searching for RRL (Related Literature Review),” and “Searching for related literature and reliable sources.” Many students’ express difficulty in locating reliable sources online, as indicated by comments like “Searching for credible sources” and “Not all studies found are of good quality and trustworthy.” The overwhelming volume of information available makes it challenging to discern trustworthy sources: “It’s difficult to find trustworthy information given the vast amount available on the internet.” The challenge of searching for literature and topics in research writing, as discussed in the study by Grewal et al. [34], is both crucial and difficult due to limited resources and uncertainty about where to locate them.

Once students find related literature, they also face the challenge of reading and analyzing the texts to determine their relevance. This sentiment is captured in responses such as “The problem I identified in research is finding good studies and analyzing them” and “I need to read [the literature] slowly to truly understand it.” Some participants also noted the scarcity or outdated nature of literature on certain topics, saying, “Lack of recent RRL” and “Few and untrusted references.” Despite these struggles, students persist in completing their reviews of related literature.

3.2.2. Insufficiency of Resources and Equipment

Research often requires specific equipment, apparatus, and materials for methodology or data analysis. However, these specialized items can be difficult to procure, as reflected in responses like “Unavailable resources [because they are not available in PSHS-IRC]” and “Difficulty finding uncommon equipment.” Delays in material delivery also hinder research progress: “Material delivery delays [leading to delays in conducting the methodology].” Even when resources are available, some students face technical issues, with comments such as “Problems with the equipment to be used in research” and “Unexpected issues with the necessary tools.” These complications can waste valuable time and negatively impact their research methodologies. Conducting research with severely limited resources is undeniably challenging. However, researchers can greatly improve their output and the quality of their work by sharing resources, fostering collaboration both locally and internationally, developing sustainable research initiatives, and optimizing study concepts and designs [35].

3.2.3 Procrastination and Motivational Hurdles

Procrastination is a widespread challenge that affects people of all ages, including students. Many students acknowledge it as a barrier to their productivity, with comments like “Loss of motivation [in doing research],” “Procrastination [resulting in delayed completion of tasks],” and “Loss of motivation.” The interviews revealed that laziness often contributes to this loss of motivation. While different students may have various reasons for their procrastination, laziness frequently emerges as a common factor. Procrastination is often framed as a failure of self-regulation, but this perspective shifts the focus to its motivational underpinnings [36].

3.2.4 Challenges in Time Management and Restricted Research Time

Time-related issues, whether stemming from a shortage of time or ineffective time management, are challenges faced by all students, particularly those with impending deadlines. Students mentioned comments like “Lack of time,” “Lengthy process [of conducting research],” “Late submissions [due to all requirements being due at the same time],” and “Overwhelming workload alongside research.” These insights suggest that both time scarcity and poor time management contribute to their challenges. Resolving these issues could significantly decrease the likelihood of students facing time constraints. Poor time management can result in missed deadlines, incomplete projects, and wasted resources [37].

3.3 Strategies and Mechanisms Employed by Students

In response to these challenges, students have developed various strategies to navigate their research processes.

Students recognize the importance of seeking assistance from others. As indicated by comments such as “Consulting experts,” “Asking or consulting with a research adviser,” and “Asking someone knowledgeable about what I'm researching,” they often turn to friends, classmates, or family members for support. Engaging others in their work allows for valuable feedback and guidance.

To tackle difficulties in finding sources, students have implemented several strategies. Their responses illustrate this proactive approach: “Searching for related literature on well-known scholar-friendly websites,” “Allocating time and using apps like Google Scholar,” and “Using online databases and libraries with specific keywords and filters.” They also emphasize the importance of verifying information, stating, “Continuously searching for sources to make the research more reliable,” “Comparing different pieces of information,” and “Finding the correct link to research studies.” They recognize that major newspapers and magazines provide trustworthy information due to their rigorous publishing standards.

Deciding how to prioritize tasks is another significant challenge in research. Students often struggle with planning the sequence of tasks, as highlighted in comments like “Trying to plan which tasks to do first,” “Allocating time [for tasks],” and “Forcing myself to start.” Setting SMART goals—Specific, Measurable, Achievable, Realistic, and Time-sensitive—can help streamline their efforts. Once goals are established, students can identify which tasks are most important and devise strategies to accomplish them one at a time.

Research writing is a complex journey filled with numerous challenges that significantly affect students' abilities to complete their projects effectively. These obstacles can be grouped into several key themes: literature searching, resource limitations, procrastination, motivational hurdles, and time management issues.

One of the most pressing challenges students faces is finding reliable and recent literature sources. They often struggle to identify literature that is both relevant and credible. This difficulty is compounded by the subsequent task of reading and assessing the relevance of the identified works to their research topics, as well as understanding how these sources contribute to the overall narrative of their manuscripts. Once literature is gathered, students frequently find it hard to analyze and incorporate these citations into their Review of Related Literature (RRL), which requires careful organization to maintain structural integrity while integrating diverse sources. This resonates with the findings of Hei and Maya [38], who noted that students encounter difficulties in reading and analyzing literature.

As they move into the introduction section of their manuscripts, students report that identifying the research problem is one of the most daunting tasks. This crucial component articulates the specific issue the research intends to address. Following this, they struggle with writing the Scope and Limitations, detailing both

the breadth of their research and its inherent constraints. Composing the Background of the Study poses additional challenges, as it requires students to provide essential context. Drafting the Objectives of the Study, which outline intended goals, is also a significant hurdle. Although writing the Significance of the Study is considered less daunting, it remains a vital component of their work. These challenges align with findings from Maznun et al. [39], who emphasized the difficulties students face with writing background sections, theoretical frameworks, and problem statements.

When it comes to selecting a research topic, students often find it easier to specify a particular focus than to identify a broader area of investigation. [40] highlighted that students struggle with both aspects of topic selection, though they did not specify which was more challenging.

In the methodology section, students face challenges in elaborating on their research design and data collection methods, underscoring the complexity of this part of the writing process [40]. Within the preliminary pages, writing the abstract is often viewed as the most challenging task, requiring students to condense their entire research into a limited word count. Additionally, organizing the Table of Contents, Figures, or Tables proves difficult, while writing the Acknowledgments is generally seen as the least challenging task. Conversely, crafting the conclusion presents its own set of challenges, particularly in citing literature, analyzing gathered data, and formulating meaningful recommendations. [41] identified these tasks as common struggles, alongside difficulties in presenting a cohesive stance and organizing content.

Another significant hurdle is the insufficient availability of resources and equipment necessary for conducting research. Even when students manage to find resources, they often encounter unexpected technical issues. [23], [35] emphasize the critical need for appropriate materials, as shortages can lead to wasted time and hinder research progress. Procrastination adds another layer of complexity, often resulting in delayed task completion. Many students report feelings of decreased motivation towards their research, which aligns with [21], who identified lack of interest as a significant barrier. A common thread of laziness emerges as a recurring factor that negatively impacts productivity.

Time management challenges are universally acknowledged, particularly for students facing tight deadlines. The overwhelming workload, with multiple assignments due simultaneously, exacerbates this issue. [23], [2] highlight the importance of effective time management in alleviating these pressures and ensuring students can meet their research commitments. To navigate these multifaceted challenges, students have developed various strategies. Many students actively seek assistance from experts or research advisers, recognizing the value of collaboration. [34] noted that a significant percentage of students report seeking help with their assignments, highlighting the importance of mentorship in the research process.

In addressing difficulties in finding literature, students have adopted more effective sourcing techniques. They increasingly utilize scholar-friendly websites and online databases, honing in on relevant studies through specific keywords and filters. Additionally, they emphasize the importance of verifying sources to ensure the reliability of their research [42]. Moreover, students recognize the necessity of organizing their research responsibilities to enhance task management. Comments reveal the importance of prioritizing tasks, with techniques such as setting SMART goals (Specific, Measurable, Achievable, Realistic, and Time-sensitive) helping to streamline their efforts [43].

The challenges students encounter in writing and conducting research are complex and interconnected. However, by employing effective strategies such as seeking help, improving sourcing techniques, and organizing their responsibilities, students can mitigate these challenges and enhance their overall research experience. Understanding these issues is crucial for educators and institutions aiming to support students in their academic endeavors, ultimately fostering a more productive and fulfilling research process [44].

Based on the recent findings of the study, common challenges in research writing were identified, including literature searching, resource limitations, procrastination, and time management. However, a novelty gap exists, as most studies tend to generalize these issues without addressing the specific struggles faced by novice researchers throughout the writing process. Furthermore, limited attention has been given to the unique challenges encountered by STEM students, such as handling technical frameworks and data-driven methodologies. The interplay between these challenges, including resource scarcity and motivational hurdles, also remains underexplored. While coping strategies have been discussed, their effectiveness has not been thoroughly evaluated. Addressing these gaps through focused and in-depth research can provide actionable insights to better support students, particularly in specialized fields like STEM.

4. CONCLUSION

The conclusion of this study is that writing scientific papers presents various challenges, such as difficulty in finding literature, limited resources, procrastination, low motivation, and ineffective time management. These obstacles indicate the need for targeted interventions to improve the quality of the research process and students' learning experiences. Support in information literacy, guidance, library observation, mentoring through

mentorship programs, and research design and data analysis training are essential to help students overcome technical barriers. In addition, time management and gradual task completion strategies need to be instilled to encourage productivity and reduce feelings of that much. This study recommends that educational institutions should integrate information literacy and scientific writing training into the curriculum, Hold mentorship programs that connect students with experienced researchers, Provide training and resources for research design, data analysis, and methodology.

ACKNOWLEDGEMENTS

The researcher is deeply grateful to the thirty-two students of the Philippine Science High School-Ilocos Region Campus who shared their experiences and stories as data for this study.

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