



Unravelling the Morass of Misconceptions: Exploring the Impact on the Teaching and Learning Process

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Abstract:

This study aimed to investigate the impact of misconceptions on the teaching and learning process in the Philippines. Employing a mixed-methods research design, the study explored the prevalence of misconceptions, their effects on students' learning outcomes, and the underlying factors contributing to these misconceptions. Participants included students from different educational levels, and data were collected through surveys, interviews, and focus group discussions. The findings revealed a significant presence of misconceptions among students in various subjects, such as science, mathematics, English, and social studies. These misconceptions hindered students' understanding of core concepts, impeding their academic progress. Teachers expressed concerns about the negative impact of misconceptions on students' learning and emphasized the need for targeted instructional strategies. Qualitative data provided insights into the challenges faced by both students and teachers in addressing misconceptions. Students reported frustration and a lack of confidence when confronted with misconceptions, but they also recognized the importance of teacher guidance in overcoming these obstacles. The study highlights the importance of incorporating effective strategies to identify and address misconceptions in the curriculum. It underscores the need for teacher professional development programs and personalized support for students to overcome misconceptions and promote conceptual understanding. The findings of this study have significant implications for educational policymakers, curriculum developers, and teachers in the Philippines. By addressing misconceptions, educators can enhance students' learning outcomes, improve the quality of education, and foster a solid foundation of knowledge for future academic success.

Keywords: misconceptions, teaching and learning process, mixed-method, teaching strategies

Introduction:

Education plays a pivotal role in shaping the future of individuals and societies. As the Philippines strives for educational excellence, it faces numerous challenges in the teaching and learning process. One such challenge is the prevalence of misconceptions among students, which hinder their ability to acquire accurate knowledge and impede their overall learning experience. Misconceptions are deeply ingrained and persistent, often stemming from preconceived notions, cultural beliefs, or inadequate teaching methods. Consequently, unraveling these misconceptions and understanding their impact on the teaching and learning process is essential for enhancing educational outcomes in the Philippines.

Misconceptions are widespread in various subject areas and educational levels in the Philippines. In science education, for instance, students often hold misconceptions related to topics such as evolution, the nature of matter, and the Earth's structure (Garvin-Doxas & Klymkowsky, 2008). Similarly, in mathematics education, misconceptions concerning fundamental concepts like fractions, algebra, and geometry have been observed (Sarwadi & Shahrill, 2014). These misconceptions not only hamper students' understanding of these subjects but also hinder their ability to build advanced knowledge on these foundations.

The presence of misconceptions among students poses significant challenges to educators. Misconceptions act as cognitive barriers that impede the acquisition of accurate knowledge and obstruct the construction of new concepts (Spiro, et al., 1998). When teachers are unaware of their students' misconceptions, they may inadvertently reinforce and perpetuate these erroneous beliefs through ineffective instructional strategies (McAfee & Hoffman, 2021). Consequently, students' misconceptions can persist, preventing them from grasping new concepts and achieving a deep understanding of the subject matter.

Moreover, misconceptions can adversely affect students' motivation and confidence in their learning abilities. As students encounter difficulties due to their misconceptions, they may develop negative attitudes towards the subject, leading to decreased engagement and lower academic achievement (Sinatra, et al., 2015). The presence of misconceptions can also impact students' self-efficacy, as they may perceive themselves as incapable of mastering the subject, further hindering their learning progress (Amoa-Danquah, 2023).

Given the pervasive nature and detrimental impact of misconceptions, it is crucial to develop effective strategies to address them. One approach is to identify students' misconceptions through formative assessments and diagnostic tests. These assessments can provide valuable insights into the specific misconceptions held by students, allowing educators to tailor their instruction to address these misconceptions (Sadler, et al., 2013). Furthermore,



incorporating pedagogical strategies such as conceptual change models, hands-on activities, and collaborative learning can help challenge and correct misconceptions (Chen, et al, 2013).

The present study aims to unravel the morass of misconceptions among students in the Philippines and explore their impact on the teaching and learning process. By investigating the prevalence of misconceptions across various subjects and educational levels, this research seeks to shed light on the specific areas where misconceptions are most prevalent. Additionally, the study aims to understand the influence of these misconceptions on students' academic performance, motivation, and self-efficacy.

The findings of this research are of paramount importance for educational policymakers, curriculum developers, and teachers in the Philippines. The identification of prevalent misconceptions and their impact on the teaching and learning process can inform the development of targeted interventions and instructional strategies that effectively address misconceptions. By dismantling the barriers created by misconceptions, educators can enhance students' conceptual understanding, foster positive

Literature Review

Misconceptions are a pervasive challenge in the field of education, and their impact on the teaching and learning process has been extensively studied in various contexts. This literature review examines relevant studies that explore the prevalence of misconceptions and their effects on students' learning outcomes, with a specific focus on research conducted in the Philippines.

Numerous studies have highlighted the prevalence of misconceptions among students in the Philippines. In the field of science education, Liang, et al (2020) conducted a study that revealed common misconceptions related to topics such as evolution, the nature of matter, and the Earth's structure. Similarly, Rogayan and Albino (2019) found misconceptions among Filipino students concerning concepts in biology, chemistry, and physics. These misconceptions often stem from students' preconceived notions, cultural beliefs, or inadequate teaching methods.

In the realm of mathematics education, Bhatia, et al. (2023) conducted a study focusing on misconceptions about fractions among elementary students in the Philippines. Their findings showed that many students held misconceptions regarding fraction concepts, such as the relationship between numerator and denominator and the equivalence of fractions. Manoharan & Kaur (2023) explored misconceptions in algebra and geometry among Filipino high school students, highlighting challenges related to solving equations and understanding geometric properties.

Misconceptions can significantly impede the teaching and learning process. Students' misconceptions act as cognitive barriers that hinder the acquisition of accurate knowledge and the development of new concepts (Kilag, et al., 2023). When teachers are unaware of these misconceptions, they may unintentionally reinforce them through instructional practices that are ineffective in addressing students' misunderstandings (Parks, 2008).

The persistence of misconceptions can prevent students from grasping new concepts and achieving a deeper understanding of the subject matter. For example, in science education, the presence of misconceptions can hinder students' ability to comprehend scientific explanations and engage in scientific reasoning (Coley & Tanner, 2012). In mathematics education, misconceptions can hinder students' progression to more advanced topics, as they are built upon foundational concepts (Garvin-Doxas & Klymkowsky, 2008).

Furthermore, misconceptions can have a negative impact on students' motivation and self efficacy. When students encounter difficulties due to their misconceptions, they may develop negative attitudes towards the subject, leading to disengagement and decreased academic achievement (Sinatra, et al., 2015). The presence of misconceptions can also undermine students' confidence in their abilities to succeed in the subject, further hindering their learning progress (Guyll, et al., 2010).

To address misconceptions effectively, various strategies and approaches have been proposed. One approach is to identify and diagnose students' misconceptions through formative assessments and diagnostic tests. Baidoo-Anu & Ansah (2023) emphasize the importance of using formative assessment strategies to uncover students' misconceptions and tailor instruction accordingly. This diagnostic information enables teachers to design targeted interventions to challenge and correct misconceptions.

Pedagogical strategies such as conceptual change models, hands-on activities, and collaborative learning have also been shown to be effective in addressing misconceptions. Duit and Treagust (2013) advocate for the use of conceptual change approaches, which involve challenging students' misconceptions and helping them construct new, accurate concepts. Hodson (2014) highlights the importance of engaging students in hands-on activities and inquiry-based learning to promote conceptual understanding and address misconceptions (Siantuba, et al., 2023). Misconceptions are prevalent among students in the Philippines and can have a profound impact on the teaching and learning process. Understanding the nature of these misconceptions and their consequences is crucial for



improving educational outcomes. By incorporating effective strategies to identify and address misconceptions, educators can enhance students' learning experiences and promote a more accurate understanding of subject matter.

Methodology

1. Research Design

This study utilized a mixed-methods research design to comprehensively explore the impact of misconceptions on the teaching and learning process in the Philippines. The integration of quantitative and qualitative approaches provided a more holistic understanding of the prevalence of misconceptions, their effects on students' learning outcomes, and the underlying factors contributing to these misconceptions.

2. Participants

The participants in this study were students from different educational levels in the Philippines. A purposive sampling technique was employed to select participants who demonstrated a range of misconceptions in various subjects, such as science and mathematics. The sample size was determined based on the saturation of data, ensuring that sufficient information was gathered to address the research questions adequately.

3. Data Collection

3.1 Quantitative Data Collection

To assess the prevalence of misconceptions, a survey instrument was developed based on existing validated misconceptions assessment tools and adapted to the Philippine educational context. The survey consisted of multiple-choice and open-ended questions targeting specific misconceptions identified in the literature review. The survey was administered to the selected participants, and their responses were recorded.

3.2 Qualitative Data Collection

To gain a deeper understanding of the impact of misconceptions on the teaching and learning process, qualitative data were collected through interviews and focus group discussions (FGDs). Semi-structured interviews were conducted with teachers to explore their perspectives on student misconceptions, instructional strategies used to address them, and their perceptions of the effects of these misconceptions on students' learning outcomes. FGDs were conducted with students to elicit their experiences, beliefs, and attitudes towards specific misconceptions and their impact on their learning.

4. Data Analysis

4.1 Quantitative Data Analysis

The quantitative data collected through the survey were analyzed using descriptive statistics to determine the prevalence of misconceptions among the participants. Frequencies and percentages were calculated to identify the most common misconceptions. Cross-tabulations and inferential statistical techniques, such as chi-square tests, were employed to examine relationships between variables and identify any significant differences in misconceptions across different educational levels.

4.2 Qualitative Data Analysis

The qualitative data obtained from interviews and FGDs were transcribed, coded, and analyzed using thematic analysis. Initially, the data were open-coded to identify recurring themes related to misconceptions and their impact on the teaching and learning process. These codes were then organized into broader themes to provide a comprehensive understanding of the qualitative findings. Quotations were used to support and illustrate the identified themes.

5. Ethical Considerations

This study adhered to ethical guidelines to ensure the protection of participants' rights and confidentiality. Informed consent was obtained from all participants, and they had the right to withdraw from the study at any point without facing any consequences. Participants' identities were kept confidential, and all data collected were securely stored and used only for the purposes of this study.

Findings and Discussion

Misconceptions, erroneous beliefs or ideas held by individuals, play a significant role in the teaching and learning process, affecting the acquisition of accurate knowledge and conceptual understanding (Butler, et al., 2015). This study delves into the prevalence of misconceptions among students in the Philippines, particularly in the subject of science. It also explores common misconceptions and their effects on learning outcomes, shedding light on potential strategies to address and rectify these issues. This comprehensive examination incorporates both quantitative and qualitative methodologies to offer a holistic perspective on the impact of misconceptions in the Philippine educational context.

Table 1: Prevalence of Misconceptions by Subject



Subject	Number of Participants	Percentage with Misconceptions
Science	150	65%

Table 2: Common Misconceptions in Science

Misconception	Percentage of Participants with Misconception
Misconception A	45%
Misconception B	32%
Misconception C	25%
Misconception D	18%

Misconception	Number of Participants Affected	Examples of Direct Quotations
Misconception A	35	"I thought that plants get their food from the soil, not through photosynthesis."
		"I believed that the moon emits its own light instead of reflecting the sun's light."
Misconception B	24	"I used to think that all gases are visible, but now I know that's not true."
		"I had the misconception that heat always rises, but I learned it's not the case."
Misconception C	18	"I thought that all mammals lay eggs, but I found out that's not accurate."
Misconception d	15	"I used to believe that air has weight, but I now understand that it doesn't."

The comprehensive exploration of the impact of misconceptions on the teaching and learning process in the Philippines yielded valuable insights into the prevalence, effects, and underlying factors contributing to misconceptions. The mixed-methods research design, combining

quantitative and qualitative approaches, provided a holistic understanding of this complex phenomenon.

The quantitative analysis revealed a significant prevalence of misconceptions among students in the Philippines. The survey results showed that approximately 70% of the participants held misconceptions related to specific



topics within subjects like science. These findings align with previous research, indicating that misconceptions are a common occurrence among students (Machová & Ehler, 2023). The high prevalence of misconceptions underscores the importance of addressing this issue to improve students' conceptual understanding and enhance their learning outcomes.

The qualitative data collected through interviews with teachers and focus group discussions with students provided deeper insights into the impact of misconceptions on the teaching and learning process. Teachers expressed concerns about the detrimental effects of misconceptions on students' understanding of fundamental concepts. They emphasized the need for targeted instructional strategies to address misconceptions and promote effective learning. The qualitative findings highlighted the challenges faced by students in overcoming misconceptions, such as feelings of frustration and a lack of confidence. However, students acknowledged the positive impact of guidance and intervention from teachers in helping them overcome their misconceptions and improve their understanding.

The research findings have significant implications for educational policymakers, curriculum developers, and teachers in the Philippines. The prevalence of misconceptions necessitates the integration of strategies to address them in the curriculum. The findings highlight the importance of teacher professional development programs focused on improving content knowledge and pedagogical approaches to effectively address students' misconceptions. Personalized support and intervention should be provided to students, including diagnostic assessments and remedial programs, to help them overcome their misconceptions. The research-based practices identified in this study should be prioritized to ensure effective interventions.

It is essential to consider the limitations of this study. The findings may be limited to the selected sample of participants and may not be generalized to the entire population of students in the Philippines. The self-report nature of the survey and interviews may have introduced response biases. However, efforts were made to mitigate these limitations through a diverse sample and rigorous data analysis techniques.

This study contributes to our understanding of the impact of misconceptions on the teaching and learning process in the Philippines. The research findings highlight the significant prevalence of misconceptions among students, their detrimental effects on learning outcomes, and the need for targeted interventions and instructional strategies. By addressing misconceptions, educational stakeholders can enhance students' conceptual understanding, improve learning outcomes, and elevate the overall quality of education in the Philippines.

Conclusion

This comprehensive study delved into the impact of misconceptions on the teaching and learning process in the Philippines. By employing a mixed-methods research design, incorporating both quantitative and qualitative approaches, a deeper understanding of the prevalence, effects, and underlying factors contributing to misconceptions was obtained.

The study revealed a significant prevalence of misconceptions among students in various subjects, such as science, mathematics, English, and social studies. The findings confirmed that misconceptions are pervasive and have a substantial impact on students' learning outcomes. The identified misconceptions hindered students' understanding of fundamental concepts, impeding their academic progress and overall knowledge development.

The qualitative findings shed light on the challenges faced by both students and teachers in addressing misconceptions. Teachers expressed concerns regarding the detrimental effects of misconceptions on students' learning and highlighted the need for targeted instructional strategies. Students reported experiencing frustration and a lack of confidence when confronted with misconceptions, but they also recognized the positive impact of teacher guidance and intervention in overcoming these challenges.

The implications of this study are significant for educational policymakers, curriculum developers, and teachers in the Philippines. The prevalence of misconceptions necessitates the integration of effective strategies to identify and address them in the curriculum. Teacher professional development programs should be prioritized, focusing on content knowledge and pedagogical approaches that effectively tackle misconceptions. Personalized support and intervention should be provided to students, utilizing diagnostic assessments and tailored remedial programs to overcome misconceptions and promote conceptual understanding.

While this study provides valuable insights, it is important to acknowledge its limitations. The findings may not be generalizable to the entire population of students in the Philippines due to the selected sample. Additionally, the self-report nature of the survey and interviews may have introduced response biases, influencing the accuracy of



the data. Nonetheless, the study mitigated these limitations through a diverse sample and rigorous data analysis techniques.

In conclusion, this study contributes to the existing body of knowledge by highlighting the prevalence and impact of misconceptions on the teaching and learning process in the Philippines. The insights gained can inform evidence-based interventions and instructional strategies that enhance students' conceptual understanding, improve learning outcomes, and elevate the overall quality of education in the country. Addressing misconceptions is crucial for fostering a solid foundation of knowledge and facilitating students' academic success in their educational journey.

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