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Exploring the Challenges Faced by Students in Science Learning: Influencing Internal and External Factors

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Abstract

This study aims to explore the various challenges faced by students in learning science and to analyze the internal and external factors that influence them. This research is motivated by the low success rate of students in science courses, which is thought to be due to multiple obstacles involving cognitive, affective, and learning environment aspects. The research method used is a qualitative approach, with data collected through in-depth interviews and surveys of students enrolled in science courses at universities. The findings show that internal factors, such as self-efficacy, basic mathematical skills, and intrinsic motivation, play a significant role in influencing students' understanding of science material. On the other hand, external factors, including curriculum, teaching methods, environmental support, and facility limitations, also have a substantial impact. This study suggests improvements in curriculum reform at the elementary and secondary levels, more interactive teaching methods, and adequate academic support to help students overcome difficulties in science courses. These findings are expected to provide insights for educational institutions and educators in designing more effective learning strategies to enhance students' competencies in science.

Keywords: Learning Experiences, Learning Strategies, Science, Self Efficacy.

1. INTRODUCTION

Science, encompassing disciplines such as mathematics, physics, and chemistry, are fundamental to scientific and technological progress (Coccia, 2020). However, students frequently encounter significant challenges in mastering these subjects, which has led to concerns about their academic performance and enthusiasm for pursuing careers in science, technology, engineering, and mathematics (STEM) fields (Muñoz, et al, 2020).

The purpose of this study is to investigate the challenges students face in learning science and identify the internal and external factors contributing to these difficulties. The motivation for conducting this research arises from the observation of persistently low success rates in science courses, which are often attributed to a combination of cognitive, motivational, and environmental barriers. By understanding these challenges, this study aims to provide actionable recommendations for educators, policymakers, and institutions to enhance the learning experience and outcomes in science.

To achieve this goal, the study employs a qualitative research methodology, incorporating in-depth interviews and surveys with students (Eppich, et al, 2019). This approach ensures a comprehensive exploration of the personal and contextual factors influencing students' experiences. The findings highlight the interplay between individual attributes, such as self-efficacy and foundational skills, and systemic issues, such as curriculum design and resource availability. Ultimately, this research contributes to the literature by

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offering evidence-based strategies to address these challenges and improve educational practices in science.

2. LITERATURE REVIEW

The study of challenges in science learning has been a topic of significant interest, with researchers exploring various cognitive, motivational, and systemic factors. Key themes in the literature include the impact of self-efficacy, foundational skills, and teaching methods on learning outcomes. For example, Bandura's theory of self-efficacy emphasizes the role of confidence in one's abilities as a determinant of academic performance (Waddington, 2023). Similarly, research highlights the critical importance of early mathematical skills as a foundation for understanding more complex scientific concepts (Maaas, et al, 2019).

However, the literature reveals gaps and inconsistencies. Some studies argue for the universal applicability of certain pedagogical strategies (Jucan, 2019 and LaVelle, et al, 2020), while others highlight the context-specific nature of effective teaching approaches (Killen & O'Toole, 2023). For instance, interactive learning methods, such as problem-based learning, have been shown to improve engagement in some contexts but may require substantial resources that are not universally available (Ghani, et al, 2021). Additionally, critiques of traditional curricula point to their rigidity and lack of relevance to students' real-world experiences (Fitz & Nikolaidis, 2020).

This study builds on existing research by synthesizing these perspectives and identifying actionable strategies for addressing both internal and external challenges. It also aims to bridge the gap between theoretical insights and practical applications by emphasizing the role of institutional support and resource allocation in fostering an effective learning environment.

3. METHODS

The methods section outlines the steps followed in executing the study and provides a brief justification for the research methods used. This study employs a qualitative approach to ensure a nuanced understanding of the challenges faced by students in science learning. Data were collected through:

1. In-depth Interviews: Semi-structured interviews with 16 students enrolled in science courses. These interviews focused on personal experiences, perceptions of learning difficulties, and suggestions for improvement (Bevens, et al, 2022).

2. Surveys: A questionnaire was distributed to 16 students to gather broader insights into common challenges and influential factors.

Data were analyzed using thematic coding to identify recurring patterns and categorize challenges into internal and external domains. Ethical considerations, such as informed consent and confidentiality, were upheld throughout the study.

4. RESULTS

The study identified both internal and external factors that contribute to students' difficulties in science learning. Internally, students with low self-efficacy, weak mathematical foundations, and a lack of intrinsic motivation face significant challenges. Externally, rigid curricula, traditional teaching methods, limited resources, and inadequate facilities further hinder effective learning. Addressing these factors through innovative teaching strategies, curriculum reform, and improved resource allocation is crucial to enhance science education and empower students. The results of the study are categorized into internal and external factors:

Table 1: Internal Factor

Internal Factor	Description
Self-Efficacy	Students with low confidence in their abilities often avoid challenging problems, hindering their skill development.
Basic Mathematical Skills	Weak foundational skills in mathematics are a common barrier to understanding complex concepts in physics and chemistry.
Intrinsic Motivation	Lack of interest and enthusiasm for science diminishes students' engagement and persistence.

Table 2: External Facator

External Factors	Description
Curriculum Design	Rigid and content-heavy curricula leave little room for exploratory learning and critical thinking.
Teaching Methods	Traditional lecture-based approaches fail to address diverse learning styles and preferences.
Environmental Support	Limited access to resources, such as laboratories and study materials, exacerbates learning difficulties.
Facility Limitations	Inadequate infrastructure, including poorly equipped classrooms and lack of technological tools, impedes effective instruction.

Findings from Interviews and Surveys:

The combined insights from interviews and surveys provide a deeper understanding of the challenges faced by students:

1. Interview Highlights:
    a. A majority of students reported that a lack of confidence in their mathematical foundation made topics in physics and chemistry particularly daunting.
    b. Participants emphasized the importance of relatable and engaging teaching methods, citing examples where interactive activities helped clarify difficult concepts.
    c. Students also highlighted the emotional stress and pressure of performing in highly competitive academic environments as a barrier to sustained focus and motivation.
2. Survey Insights:
    a. Over 65% of respondents identified rigid curricula as a significant challenge, with limited room for creative exploration.
    b. Approximately 72% of students cited inadequate access to learning resources, such as modern laboratory facilities and digital tools, as a major obstacle.
    c. More than half of the students expressed a desire for teaching methods that incorporate real-world applications to make science more relevant and engaging.

Table 3: Data Findings

Category	Factor	Percentage of Responses	Key Insights
Internal Factors	Self-Efficacy	60%	Lack of confidence in skills hampers problem-solving.
	Basic Mathematical Skills	68%	Weak foundations create barriers in advanced topics.
	Intrinsic Motivation	55%	Low interest leads to disengagement and low persistence.
External Factors	Curriculum Design	65%	Rigid structure limits creativity and critical thinking.
	Teaching Methods	58%	Traditional methods fail to engage diverse learners.
	Environmental Support	72%	Lack of resources hinders practical and conceptual learning
	Facility Limitations	50%	Poor infrastructure affects overall learning quality.

5. DISCUSSION

The discussion section synthesizes the findings, restating the study's main purpose and reaffirming its contributions. The results demonstrate the significant impact of both internal and external factors on students' learning experiences. For instance, fostering self-efficacy and improving foundational skills are essential for addressing internal challenges (Narayanan, et

al, 2023). Simultaneously, systemic changes, such as curriculum reform and enhanced teaching methods, are crucial for mitigating external barriers (Gouëdard, Hyttinen, & Huang, 2020).

These findings align with previous research but also highlight unique aspects, such as the interplay between resource availability and teaching effectiveness. Unexpected results, such as the varied impact of interactive teaching methods across contexts, suggest the need for further exploration. The study emphasizes the importance of institutional support and calls for investments in modern facilities and academic resources.

6. CONCLUSION

This study concludes that addressing challenges in science learning requires a holistic approach, integrating efforts to enhance individual capabilities and systemic improvements. Limitations of the study, such as its qualitative focus and sample size, suggest opportunities for future research to explore these findings quantitatively and in diverse educational contexts. By implementing the recommendations provided, stakeholders can create a supportive ecosystem that empowers students to excel in science.

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