Article

Determinants of Effectiveness of Bachelor's in Secondary Education Major in Sciences in State Universities and Colleges in Region III

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Abstract

Science education in the Philippines, particularly in Region III, faces significant challenges due to diverse populations, historical reliance on rote learning, and disparities in resources. These issues contribute to low student performance in science, highlighting an urgent need for systemic reform and an enhanced teacher education program. This study examines how the level of accreditation, leadership practices of the school heads, performance of the science teachers, responsiveness of the curriculum, and scientific literacy of the students influence the effectiveness of the Bachelor of Secondary Education (BSED) major in Sciences in Region III. Effectiveness is measured by graduation rate and board examination passing rate, which are the Commission on Higher Education's (CHED) thrusts for educational quality and excellence. Using a quantitative research method with a descriptive-correlational research design, 188 graduating science education students completed a self-made questionnaire. Data were analyzed using Spearman rho and the likelihood-ratio test. Results show that accreditation level negatively correlates with graduation rates but positively correlates with board examination passing rate. Scientific literacy positively correlates with and predicts graduation and board examination success. Curriculum responsiveness also predicts graduation rates. The study recommends exploring the potential indirect influence of school heads' leadership practices and science teachers' performance on graduation and board examination passing rates.

Keywords: Science Education Effectiveness, Accreditation, Student Outcomes, Scientific Literacy, Curriculum Responsiveness

Introduction

Despite some Filipino students achieving international recognition, science education in the Philippines remains a significant concern, especially in Region III (Central Luzon). This region, a microcosm of nationwide challenges in science education (Calleja et al., 2023), boasts a truly diverse population, encompassing various ethnolinguistic groups such as Kapampangans, Tagalogs, and Ilocanos, each with potentially distinct learning preferences and cultural perspectives that could influence engagement with scientific concepts (Mendoza, Deleña & Demeterio, 2019). This cultural mosaic presents both unique opportunities for leveraging diverse perspectives in science education, perhaps through culturally relevant examples or local indigenous knowledge (Miole, 2024; Castro-Caliboso et al., 2025; Dela Cruz et al., 2025) but also challenges in designing universally practical pedagogical approaches. Furthermore, Region III features a mix of urban and rural schools, alongside well-resourced and under-resourced educational institutions, reflecting the significant disparities in access to quality education.

Historically, the centralized nature of the Philippine educational system, often coupled with a reliance on traditional rote learning methods inherited from colonial influences, has inadvertently contributed to the current state of science education infrastructure and teacher qualifications (Low et al., 2021). This long-standing emphasis on memorization over critical thinking and hands-on experimentation has limited investment in robust laboratory facilities and the continuous professional development of science educators. Recent assessments show that students in this region were also challenged, contributing to results below the national average in science (Alinsunurin, 2021). This underperformance is worsened by limited instructional materials, inadequate laboratory facilities, and a shortage of qualified science teachers (Monta & Perdio, 2025). The ingrained cultural value placed on deference to authority figures, including teachers, can sometimes discourage active questioning and independent scientific inquiry, potentially contributing to issues like low concept retention or difficulty applying scientific concepts in real-world scenarios. These challenges contribute to the country's low rankings in global assessments such as the 2019 Trends in International Mathematics and Science Study (TIMSS), where Filipino students ranked 78th out of 79 countries (Magsambol, 2020). This situation highlights an urgent need for systemic reform in science education. This persistent performance disparity among Filipino students highlights the urgent need for improvement, prompting Higher Education Institutions (HEIs), particularly State Universities and Colleges (SUCs), to strengthen their Bachelor of Secondary Education (BSED) Major in Sciences. Although the Commission guides this program on Higher

Education (CHED) Memorandum Order (CMO) No. 75, series of 2017, which aims to equip students with essential competencies, evidence reveals ongoing challenges. Specifically, Filipino students often demonstrate low concept retention, limited reasoning skills, and difficulty applying concepts to real-life problem-solving (Palines & Ortega-Dela Cruz, 2021). This discrepancy between the intended program outcomes and actual student capabilities suggests the need for enhancements in instructional resources, pedagogical approaches, and curriculum flexibility better to meet the demands of 21st-century learning (Rogayan, 2019; Schneider et al., 2022) and ensures the program's effectiveness.

The effectiveness of the BSED major in sciences is often measured using the CHED's thrusts for educational quality and excellence, which include graduation and board examination passing rates (Al-Haddad, Campbell, & Boone, 2018; Lacanilao & Carpio, 2022). These thrusts are influenced by various factors related to school heads, teachers, curriculum, and students (Laguatan & Abad, 2019). While the roles of school heads (Dellomas & Deri, 2022), science teachers (Abualrob, 2019; Solomo, 2021), curriculum relevance (Toquero, 2020; Victoria, 2022), and program accreditation (Absor & Hairunas, 2022; Campos & Campos, 2022) are recognized for their impact on educational outcomes, a critical knowledge gap persists regarding the determinants, including the level of accreditation, leadership practices of school heads, performance of science teachers, responsiveness of the curriculum, and the scientific literacy of students, that influence the effectiveness of the BSED major in Sciences within SUCs in Region III. This study aims to empirically identify these determinants, focusing on their influence as factors and predictors of CHED's thrusts for educational quality and excellence, which are the graduation and board examination passing rates, to enhance science teacher education and ultimately improve science education outcomes in the region.

Methodology

This study employed a quantitative research method with a descriptive-correlational research design to explore the determinants affecting the effectiveness of the BSED major in Sciences in SUCs in Region III during the school year 2024 to 2025. The study exclusively focused on the 2024 regular academic year-end graduation rate. This specific cohort was chosen to ensure that the most current academic outcomes were reflected. Concurrently, the board passing rate of first-time takers was sourced from the September 2024 Board Licensure Examination for Professional Teachers (BLEPT) of candidates who successfully passed. The decision to include only first-time takers from this examination date was made to directly assess the immediate

effectiveness of the academic program in preparing students for initial professional licensures, thereby providing a clear and consistent basis for evaluating recent program effectiveness.

The study used Cochran's formula to include 188 graduating science education students from SUCs in Region III as the respondents. They were chosen to use stratified random sampling because they have completed most of their academic units and participated in crucial aspects of the program, including field studies and practice teaching. As graduating science education students, they possess the most extensive experience within the program and have had significant interactions with their school heads, science teachers, and the curriculum. It makes them well-positioned to provide valuable insights into the program's effectiveness and educational experiences.

This research utilized a self-made questionnaire reflecting only the respondents' experiences and opinions of their school heads' leadership practices, science teachers' performance, curriculum responsiveness, and scientific literacy. To ensure relevance, the questionnaire was designed explicitly with a science focus, allowing respondents to provide feedback using a five-point Likert scale, ranging from five (strongly agree) to one (strongly disagree). The questionnaire underwent rigorous expert validation and pilot testing to establish its reliability. Expert validation was conducted by esteemed academics who are experts in the field. They ensured the extent to which the developed research instrument comprehensively covers and reflects all relevant aspects and domains of the construction it aimed to measure. Their feedback and recommendations were thoroughly incorporated to enhance the instrument's validity. The instrument was also pilot tested, and Cronbach's alpha was utilized to quantitatively assess its reliability, providing a statistical measure of its internal consistency. All sections in the questionnaire yield scores of at least .924, which exceeds the acceptable standard of .7. Specifically, a few statements from the initial questionnaire were removed after pilot testing to make the questionnaire more reliable and accurate, ensuring it consistently measures what it is supposed to. This process also makes the questions clearer and easier to understand for respondents. The questionnaire becomes shorter and more efficient by eliminating unnecessary items.

In this study, the level of accreditation is treated as an independent variable related to the BLEPT because it reflects the overall program quality before students take the BLEPT. While BLEPT measures graduates' competencies, accreditation reflects the quality of instruction and resources that help students succeed in the examination. Therefore, the level of accreditation may influence BLEPT performance, making it logical to study accreditation as an independent factor influencing BLEPT outcomes. The same is observed in the studies by Gatpandan, Cruz, and Paguta (2023),

Hua (2024), and Baker et al. (2023), where the influence of accreditation on licensure passing rates is determined. Furthermore, collecting perceptions aligned with accreditation indicators enriches understanding of how accreditation-related quality factors affect the graduation rate and BLEPT passing rate from the viewpoint of respondents, supporting a more comprehensive analysis of the relationship between accreditation and graduation rate and BLEPT passing rate.

The secondary data from this study, including the level of accreditation, graduation rate, and board examination passing rate, were obtained using the Freedom of Information (FOI), whereby the involved institutions were easily reached and communicated with. Moreover, the survey data collected from this study mainly came from Google Forms because the graduating science education students were off-campus for practice teaching.

Meanwhile, the study on the effectiveness of the BSED major in sciences aligns with the CHED's focus on educational quality and excellence, which is measured through objective indicators such as the graduation rate and the board examination passing rate. However, the data collected via the questionnaire to identify correlations and predictors were based solely on the students' subjective perceptions and self-reported experiences while taking the BSED major in sciences. It means that the constructions measured, such as students' views on the leadership practices of the school heads, performance of the science teachers, and the responsiveness of the curriculum, reflect how students personally experienced and perceived these elements, rather than being derived from direct or objective assessments of these factors. Consequently, the findings related to predictors of effectiveness are grounded in students' observable experiences and opinions, providing insight into their perspective rather than an external or empirical evaluation of the program's components.

Data from the survey questionnaire were analyzed using Spearman's and the Likelihood Ratio Test (LRT). Spearman's was used to assess whether there are significant relationships between the level of accreditation, the leadership practices of school heads, the performance of science teachers, the responsiveness of the curriculum, the scientific abilities of students, and the effectiveness of the BSED Major in Sciences program in SUCs in Region III, specifically regarding graduation rate and board examination passing rate. LRT was used to determine which among the mentioned variables predict the effectiveness of the BSED major in Sciences in Region III, as measured by the graduation rate and the board examination passing rate. Also, throughout the process, the study prioritized ethical considerations. Upholding

principles such as informed consent, confidentiality, and anonymity was crucial, particularly during data collection.

Results/Findings and Discussions

Factors Affecting the Effectiveness of the BSED Major in Sciences

The use of Spearman-rho at 0.05 level of significance is confined to providing the answer as to whether or not there is a significant relationship between the level of accreditation, leadership practices of the school heads, the performance of the science teachers, the responsiveness of the curriculum and scientific literacy of the students to the effectiveness of the BSED major in Sciences in SUCs in region III regarding graduation rate and board examination.

Table 1: Factors Affecting the Effectiveness of the BSED Major in Sciences as Measured by Graduation Rate

Variables	r	p	Decision
Level of Accreditation	-2.13	.003	Significant
Leadership Practices of the School Heads	0.16	.700	Not Significant
Performance of the Science Teachers	-0.45	.626	Not Significant
Responsiveness of the Curriculum	-0.14	.515	Not Significant
Scientific Literacy of the Students	0.179	.014	Significant

Significant (S) <0.05; Not Significant (Ns) >0.05

A review of Table 1 reveals a mix of significant and non-significant correlations between various institutional and instructional factors and the BSED major in Sciences graduation rates. Most notably, there is a significant negative correlation between the level of accreditation and graduation rates (r = −2.13, p = 0.003). This counterintuitive finding suggests that graduation rates decline as accreditation levels increase.

In contrast, scientific literacy among science education students shows a weak but statistically significant positive correlation with graduation rates (r = 0.179, p = 0.014). Again, the p-value is below the 0.05 threshold, indicating that higher scientific literacy is positively associated with improved graduation outcomes.

On the other hand, several variables showed non-significant correlations with graduation rates. Leadership practices of school heads demonstrated a weak positive correlation (r = 0.16), but this relationship was not statistically significant (p = 0.700). Likewise, performance of the science teachers exhibited a moderate negative correlation (r = −0.45), and responsiveness of the curriculum showed a slight negative correlation (r = −0.14); however, both were statistically insignificant with p-values of 0.626 and 0.515, respectively.

These findings present a complex landscape of factors influencing the graduation rates of BSED Science students. The most striking result is the negative correlation between accreditation level and graduation rates. While accreditation enhances educational quality, it may unintentionally introduce challenges that hinder student progress. Stringent standards increased academic rigor, or administrative burdens, may negatively impact on student retention and completion in highly accredited programs (Heath, Darr, & Acharya, 2022; Malasto, 2023; Adiyaman & Ozmantar, 2023).

Conversely, the positive correlation between scientific literacy and graduation rates underscores the importance of equipping students with strong foundational knowledge and critical thinking skills. This finding supports the notion that student competency in science directly contributes to academic persistence and degree completion (Chamberlain, 2024). Thus, initiatives to strengthen students' scientific literacy will likely yield long-term benefits for graduation outcomes.

Despite strong support in the literature for their importance, the lack of significant correlations for the school heads' leadership practices, the science teachers' performance, and the curriculum's responsiveness suggest that these factors may not directly influence graduation rates in isolation. Instead, their effects could be mediated by other variables such as institutional culture, resource allocation, or student support systems. For instance, leadership may indirectly impact teachers' motivation or foster a favorable school climate (Leithwood, Sun, & Schumacker, 2019). Similarly, individual teacher performance may be constrained by broader systemic limitations such as insufficient resources or rigid curricular structures (Bardach & Klassen, 2020). The curriculum's responsiveness may only be effective when implemented with fidelity and supported by well-trained faculty (Darling-Hammond et al., 2019; Urias, 2022; Vreuls et al., 2023).

Table 2 presents the results of the correlation analysis examining the relationship between the level of program accreditation, leadership practices of school heads, performance of science teachers, responsiveness of the curriculum, and scientific literacy of the students, and the board examination passing rates of BSED major in Sciences graduates from SUCs in Region III.

Among the variables presented, only the level of accreditation demonstrated a statistically significant relationship with board examination performance, showing a strong positive correlation ($r = 0.707$, $p = 0.000$). This result indicates that higher accreditation levels are significantly associated with improved licensure examination outcomes. The findings suggest that accreditation, through its rigorous standards and

quality assurance mechanisms, plays a pivotal role in preparing science education graduates for success in the board examination.

Table 2: Factors Affecting the Effectiveness of the BSED major in Sciences as Measured by Board Examination Passing Rate

Variables	r	p	Decision
Level of Accreditation	0.707	.000	Significant
Leadership Practices of the School Heads	-0.34	.645	Not Significant
Performance of the Science Teachers	-0.33	.656	Not Significant
Responsiveness of the Curriculum	-0.63	.390	Not Significant
Scientific Literacy of the Students	-0.115	.0117	Not Significant

Significant (S) <0.05; Not Significant (Ns) >0.05

In contrast, school heads' leadership practices, science teachers' performance, curriculum responsiveness, and students' scientific literacy did not exhibit statistically significant correlations with board passing rates. It implies that, within this specific context, these variables may not directly influence licensure outcomes when examined individually. Their effects could be indirect or may not have been fully captured through the current measurement instruments. Alternatively, the board examination may prioritize a narrower set of competencies more explicitly aligned with the structured outputs of well-accredited programs.

The importance of accreditation is further underscored by its comprehensive evaluation of critical educational components, including curriculum content, faculty qualifications, instructional resources, and support systems. It collectively enhances graduate preparedness (National Academy of Education, 2024). On the other hand, the weak and non-significant correlation between school head leadership and board performance suggests that leadership may exert its influence more indirectly, such as through shaping school climate and teacher practices, rather than directly affecting students' examination outcomes (Ertem, 2021).

Similarly, the non-significant negative correlation between science teacher performance and board passing rates may point to limitations in the performance metrics used or to the possibility that other factors, such as curriculum design or student characteristics, play a more prominent role (Engida, Iyasu, & Fentie, 2024). Curriculum responsiveness also showed no significant correlation with licensure performance. It may be attributed to challenges translating curricular innovations into measurable student outcomes, especially if implementation fidelity and teacher readiness are lacking (Yow et al., 2021). Interestingly, scientific literacy demonstrated a negative, though non-significant, correlation with board passing rates. It may be

because licensure examinations often emphasize specific content knowledge. At the same time, broader scientific literacy encompasses higher-order thinking skills such as inquiry, reasoning, and critical evaluation, skills not directly assessed in standardized board examinations (Shahzadi & Nasreen, 2020).

Predictors of Effectiveness of the BSED major in Sciences

This study used the Likelihood Ratio Test to determine which among the accreditation level, school heads' leadership practices, science teachers' performance, curriculum responsiveness, and students' scientific literacy predict the quality of secondary science education program in Region III as measured by the graduation rate and board examination passing rate at a 0.05 level of significance.

Table 3: Predictors of Effectiveness of the BSED Major in Sciences as Measured by Graduation Rate

Variables	p	Decision
Level of Accreditation	.000	Significant Predictor
Leadership Practices of the School Heads	.306	Not Significant Predictor
Performance of the Science Teachers	.420	Not Significant Predictor
Responsiveness of the Curriculum	.012	Significant Predictor
Scientific Literacy of the Students	.039	Significant Predictor

Significant (S) <0.05; Not Significant (Ns) >0.05

An analysis of Table 3 reveals that three variables significantly predict the secondary science education graduation rates in Region III. First, the level of accreditation emerged as a strong and statistically significant predictor of graduation rates (p = .000). This finding indicates that higher levels of accreditation are associated with higher graduation rates. Second, the responsiveness of the curriculum was also found to be a significant predictor (p = .012). This finding suggests that a curriculum responsive to students' needs and current educational demands contributes positively to student retention and program completion. Third, the students' scientific literacy significantly predicts graduation rates (p = .039). It implies that higher levels of scientific literacy among students are associated with an increased likelihood of graduating.

In contrast, the leadership practices of the school heads do not significantly predict graduation rates (p = .306), as the p-value exceeds the 0.05 threshold. Similarly, the performance of the science teachers does not show a statistically significant prediction on graduation rates (p = .420).

These findings indicate that among the five variables examined, level of accreditation, curriculum responsiveness, and the students' scientific literacy are the key predictors of graduation outcomes in the BSED major in Sciences in Region III. It highlights the critical role of institutional and curricular quality and students' academic preparedness in supporting timely degree completion. The strong predictive relationship between the accreditation level and graduation rates underscores the importance of robust quality assurance mechanisms that ensure adequate resources, qualified faculty, and effective student support systems (Gonzalez-Bravo et al., 2020).

The significant influence of the responsiveness of the curriculum further emphasizes the value of adaptive, student-centered learning frameworks that align with evolving educational standards and promote academic engagement and persistence (Giray & Kim, 2023). Meanwhile, the role of scientific literacy reflects the necessity of equipping students with analytical, problem-solving, and critical thinking skills essential for academic success (Acut & Antonio, 2023).

Conversely, the non-significant predictive value of the school heads' leadership practices and the science teachers' performance suggests that their effects on graduation rates may be indirectly mediated by other factors such as curriculum implementation, institutional culture, or student engagement. While these elements are undoubtedly vital to educational quality, they may not act as direct drivers of graduation outcomes within the scope of this analysis (Antipolo & Rogayan, 2021; Walag et al., 2022).

Table 4: Predictors of Effectiveness of the BSED Major in Sciences as Measured by Board Examination Passing Rate

Variables	p	Decision
Level of Accreditation	.000	Significant Predictor
Leadership Practices of the School Heads	.219	Not Significant Predictor
Performance of the Science Teachers	.670	Not Significant Predictor
Responsiveness of the Curriculum	.956	Not Significant Predictor
Scientific Literacy of the Students	.005	Significant Predictor

Significant (S) <0.05; Not Significant (Ns) >0.05

The data presented in Table 4 reveal that the level of accreditation is a significant predictor of board examination passing rates for the BSED Major in Sciences in Region III (p = .000, which is less than 0.05). It indicates that higher accreditation levels are associated with better licensure outcomes. Likewise, the students' scientific literacy also emerged as a significant predictor of board examination success (p = .005,

also less than 0.05). It underscores the essential role that students' mastery of scientific concepts and skills plays in achieving licensure success.

In contrast, the school heads' leadership practices, the science teachers' performance, and the curriculum's responsiveness were not found to predict board examination passing rates significantly. The analysis of Table 4 identifies the students' accreditation level and scientific literacy as the two key predictors of licensure success among BSED Science graduates. This finding suggests that strong external quality assurance mechanisms (i.e., accreditation) and the internal cognitive competence of students in science are vital in producing successful examinees.

On the other hand, while leadership, teacher performance, and curriculum responsiveness are undoubtedly important for educational quality, they may exert indirect or mediated effects on licensure outcome effects not directly captured by the statistical model used in this study. It implies that even with a responsive curriculum and highly qualified teachers, board examination success may not be guaranteed without a solid accreditation framework and students' scientific competence.

The significance of the level of accreditation as a predictor reflects the influence of quality assurance mechanisms such as sound academic programs, effective resource allocation, and active student engagement (Hua, 2024). Similarly, the strong predictive power of students' scientific literacy highlights the importance of metacognitive strategies and reading comprehension in mastering scientific content (Cordon & Polong, 2020). In contrast, the limited predictive value of leadership and teaching practices may stem from variability in leadership effectiveness and teacher qualifications (Gatpandan et al., 2023; Engida, Iyasu & Fentie, 2024; Malahay, 2021). Furthermore, the responsiveness of the curriculum alone is insufficient to drive licensure outcomes without adequate implementation, instructional support, and access to resources like laboratories and hands-on activities (Basagre, 2024).

Conclusion

Based on the perception of graduating science education students, results showed a complex influence between the BSED major in Sciences and the CHED's thrust for educational quality and excellence. Improving science education in Region III is not merely an academic objective but a critical endeavor that profoundly contributes to the cultural and historical development of the region and the nation. By fostering a scientifically literate populace, the Philippines can empower its citizens to engage critically with global challenges, innovate solutions rooted in local contexts, and preserve its rich cultural heritage through a deeper understanding of its natural world and traditional practices.

Regarding factors influencing graduation rates, a significant negative correlation was observed with the level of accreditation, suggesting that more stringent standards associated with higher accreditation may inadvertently extend student progression. Conversely, scientific literacy demonstrated a significant positive correlation with graduation rates, indicating that a robust understanding of scientific principles fosters better completion outcomes. Notably, leadership practices of school heads, performance of science teachers, and responsiveness of the curriculum did not show a significant relationship with graduation rates. For board examination passing rates, the level of accreditation was the sole factor with a significant positive correlation. It highlights the critical role accreditation plays in preparing students for professional licensure examinations, likely due to the rigorous evaluation of curriculum quality, faculty qualifications, and instructional resources inherent in higher accreditation levels. In contrast, the school heads' leadership practices, the science teachers' performance, the curriculum's responsiveness, and the students' scientific literacy did not exhibit a significant relationship with the success of the board examination.

Delving into the predictive power of these factors, the level of accreditation, responsiveness of the curriculum, and scientific literacy emerged as significant predictors of graduation rates. However, school heads' leadership practices and science teachers' performance did not significantly predict graduation rates. Similarly, for board examination passing rates, the analysis indicated that the students' level of accreditation and scientific literacy were the most significant predictors. Other factors, including leadership practices of the school heads, performance of the science teachers, and responsiveness of the curriculum, did not significantly predict success in professional licensure examinations.

Based on these findings, several key actions are recommended to enhance the BSED Major in Sciences. A holistic approach is essential to ensure the sustained relevance and effectiveness of SUCs in Region III, beginning with regular, systematic, and culturally sensitive curriculum review and updates that align with stakeholder needs and the unique historical trajectory of Philippine education. Emphasizing practical and applied learning through real-world experiences will boost student engagement and timely graduation, while integrating scientific literacy across diverse courses, coupled with early intervention for struggling students, will cultivate critical thinking and problem-solving skills. SUCs must also diligently monitor graduation and board examination passing rates, using data-driven insights to inform timely interventions, and balance rigorous academics with robust student support services like tutoring, mentoring, and counseling to facilitate student progression. Future

studies should build upon this foundation by employing advanced statistical methods like Mediation Analysis or Structural Equation Modeling for a deeper understanding of indirect influences, conducting longitudinal analyses to track trends over multiple years, and incorporating the perceptions of diverse stakeholders including school heads and science teachers, along with comparisons to accreditation evaluations and student performance ratings, to provide comprehensive insights into program determinants.

Acknowledgement

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