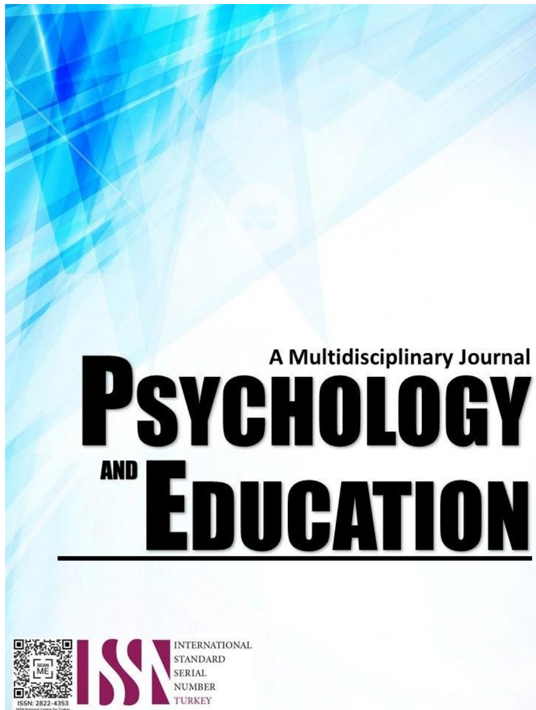
CHALLENGES AND COPING STRATEGIES OF SCIENCE TEACHERS HANDLING NON-SPECIALIZED SUBJECTS



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Research Article

Challenges and Coping Strategies of Science Teachers Handling Non-Specialized Subjects

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Abstract

In modern education, science instruction has shifted toward an integrated curriculum that combines concepts from various disciplines, such as Physics, Chemistry, and Biology. As a result, science teachers, often trained in a specific field of expertise, are now embracing a broader scope of instruction to effectively deliver interdisciplinary lessons. This study explored the challenges science teachers encountered when handling non-specialized subjects and their strategies to cope with these challenges. The descriptive-correlational design explored the challenges and coping strategies of science teachers teaching non-specialized subjects in secondary schools in Bagumbayan, Sultan Kudarat. The respondents were the thirty-two (32) science teachers of secondary schools in Bagumbayan, Sultan Kudarat, for School Year 2024-2025. Science teachers encountered considerable challenges when teaching non-specialized subjects, particularly in terms of professional development and institutional support. The lack of school-based assistance and the need for innovative instructional strategies were the most pressing concerns, while confidence in delivering complex concepts was a moderate challenge. Among coping strategies, adaptive teaching methods and resourcefulness in instructional material development were the most commonly employed. Professional collaboration and continuous learning also played crucial roles in helping teachers navigate these challenges. Regression analysis indicated no significant direct relationship between challenges and coping strategies. However, teaching experience, specialization, and grade level taught showed a moderate positive correlation with the coping mechanisms used by educators. Proposed interventions such as teacher exchange programs, interdisciplinary training, and peer mentoring were identified as essential in strengthening instructional adaptability and support systems.

Keywords: *challenges, coping strategies, non- specialized subjects*

Introduction

The teaching profession is inherently demanding, requiring educators to master their specific subject areas and adapt to various instructional challenges. Globally, teachers are increasingly tasked with teaching subjects outside their primary expertise, often due to curriculum changes, teacher shortages, or initiatives to integrate interdisciplinary approaches (Rebucas, 2022). While this practice aims to provide students with a well-rounded education, it also presents significant challenges for educators, especially in specialized fields like science.

A primary issue arises when science teachers, often trained in one discipline such as Physics, Chemistry, or Biology, are expected to cover an integrated curriculum. This expectation is particularly challenging in early secondary education, where curricula often introduce students to multiple scientific disciplines. In the Philippines, the K to 12 curriculums with its spiral progression approach requires science teachers to teach biology, chemistry, physics, and earth science progressively from grades 7 to 10. Under the MATATAG Curriculum, these expectations have persisted, demanding even greater versatility and adaptability from science educators. However, this is a formidable challenge due to a lack of resources, limited professional development opportunities, and insufficient content knowledge, especially in rural and under-resourced schools.

Understanding the specific challenges science teachers face in teaching non-specialized subjects is essential. These insights can guide the development of policies, curriculum adjustments, and professional development programs to enhance teaching effectiveness. By addressing these challenges, educational institutions can improve support systems for teachers, ultimately benefiting students and leading to better academic outcomes in Science Wallace & Priestley (2017).

Several studies have highlighted the challenges teachers face when handling subjects outside their area of specialization. Mizzi (2019) revealed that science teachers trained in one discipline often struggle with teaching other subjects, which negatively affects their confidence and teaching effectiveness. Similarly, Glaze (2018) emphasized the growing demand for interdisciplinary teaching among STEM educators in countries such as the United States, the United Kingdom, and Australia, presenting comparable difficulties. In the Philippines, implementing the spiral progression approach in the K to 12 curriculums has further exacerbated these challenges, as Moyo and Hadebe (2018) and Naparan et al. (2023) noted. While studies have documented coping mechanisms such as peer collaboration and self-directed learning (Ramirez, 2021; Baraquia, 2022; Hayes et al., 2019), a notable research gap exists in understanding the specific difficulties science teachers face when teaching non-specialized subjects. Addressing this gap is essential to provide targeted support and improve teaching outcomes in this context.

This study aimed to identify the specific challenges science teachers face when handling non-specialized subjects under the K to 12 and MATATAG Curriculum in the Philippines. Furthermore, it sought to explore these educators' coping strategies, providing insights that can contribute to developing effective professional development programs, curriculum adjustments, and support mechanisms tailored to the needs of Science Teachers.

Research Questions

This study explored the challenges science teachers encounter when handling non-specialized subjects and their strategies to cope with these challenges. Specifically, it sought to address the following questions:

1. What is the profile of the science teachers in terms of:
   1.1. specialization;
   1.2. length of service; and
   1.3. grade level taught?
2. What is the extent of challenges do science teachers face when tasked with handling non-specialized subjects, in terms of:
   2.1. content knowledge;
   2.2. instructional strategies; and
   2.3. professional development and support?
3. What is the extent of coping strategies do science teachers use to address the challenges of handling non-specialized subjects, in terms of:
   3.1. professional learning and development;
   3.2. peer collaboration and support networks;
   3.3. adaptive teaching strategies; and
   3.4. resourcefulness and flexibility?
4. Is there a significant relationship between challenges faced by science teachers in handling non-specialized subjects and coping strategies?
5. Does the profile of the teachers affect the level of coping strategies employed by science teachers in response to these challenges?
6. What activities or programs can be proposed based on the results of the study?

Methodology

Research Design

The descriptive-correlational design explored the challenges and coping strategies of science teachers handling non-specialized subjects in secondary schools in Bagumbayan, Sultan Kudarat. This approach examined how teacher profiles, specialization, length of service, and grade level taught, relate to the challenges and strategies employed. It comprehensively analyzed these relationships, offering insights into how teacher characteristics influence their experiences and coping mechanisms. This design helped identify significant relationships and trends, supporting the development of targeted interventions and recommendations for enhancing teacher support and instructional effectiveness. Descriptive correlational design is used in research studies that provide static pictures of situations and establish the relationship between different variables (McBurney & White, 2009).

Respondents

The study's respondents were thirty-two (32) Science teachers handling non-specialized subjects in the secondary schools of the Bagumbayan Cluster. Secondary school teachers are often the ones experiencing out-of-field teaching assignments, particularly in science, where specialization is crucial for effective content delivery. This makes them a vital group to study in understanding the real-world challenges and coping mechanisms employed when teaching non-specialized subjects (Sims & Jerrim, 2020). They were chosen based on the following criteria: a.) Respondents must be currently employed as science teachers in one of the secondary schools within the Bagumbayan Cluster. b.) Teachers should have at least one year of teaching experience to provide informed perspectives on the challenges and strategies of teaching non-specialized subjects. c.) Teachers must be willing to participate in the study and provide honest and comprehensive feedback regarding their experiences and strategies. d.) The selection should include teachers with varying lengths of service, specializations, and grade levels taught within the science curriculum.

This study employed complete enumeration. Complete enumeration sampling is used in surveys and data analysis to examine all possible elements in a finite set. It involves selecting, acquiring, and quantifying a part of the population, intending to provide a representative sample based on specific criteria (Patil, 2010). This study's complete enumeration as a sampling design ensures that every science teacher who handles non-specialized subjects is included, allowing for a comprehensive understanding of their challenges and coping strategies. This approach eliminated sampling bias and fully represented the target population, leading to more reliable and generalizable results.

Instrument

The needed data for this study were gathered using a researcher-made questionnaire. A researcher-made questionnaire integrates all the important information and details needed for the study (Canonizado, 2024). The Self-Evaluation Tool was designed to collect valuable insights into the difficulties science teachers face when handling subjects outside their specialization and the strategies they employ to cope with these challenges.

The self-evaluation tool utilized in this study comprises three distinct sections, each designed to gather comprehensive data related to the research objectives. Part I focused on the demographic profile of the respondents, capturing key variables such as their area of specialization, years of service, and the grade levels they teach.

Part II addressed science teachers' challenges when teaching subjects outside their specialized field. This section is subdivided into three critical dimensions: Content Knowledge, Instructional Strategies, and Professional Development and Support, with each dimension consisting of seven statements that assess specific challenges.

Part III explored science teachers' coping mechanisms in response to these challenges. This section examines four areas: Professional Learning and Development, Peer Collaboration and Support Networks, Adaptive Teaching Strategies, and Resourcefulness and Flexibility, each represented by five statements encapsulating relevant strategies. Together, these sections provide a holistic view of the difficulties encountered and the adaptive measures science teachers take in non-specialized teaching contexts. Through this tool, educators self-assessed their areas of strength and difficulty, providing critical data that could inform the development of targeted support programs and professional development initiatives.

The instruments were tested for 5-panel validity and reliability through Cronbach's Alpha. Its validators were (4) master teachers, and a Public Schools District Supervisor who is a major in science. The Cronbach's Alpha yielded a value of $\alpha = 0.8754$, indicating that the research instruments are reliable. Therefore, they are considered valid.

Procedure

To ensure the successful implementation and conduct of the study, the following steps were undertaken:

The first step involved securing permission from the Dean of the Graduate School at Sultan Kudarat State University to conduct the study. Once endorsed, a formal letter of request was sent to the Schools Division Superintendent and School Heads to obtain their approval. This approval was crucial to ensure compliance with administrative protocols and to gain access to the secondary schools within the Bagumbayan Cluster.

Next, the researcher designed a research instrument to assess the challenges faced by science teachers in teaching non-specialized subjects and their coping strategies. The instrument underwent a rigorous validation process involving a panel of five experts to ensure its content validity. A reliability test was also conducted using Cronbach's Alpha, with a sample of randomly selected science teachers from the Isulan Cluster participating in this phase. This process was essential to ensure the instrument was valid and reliable for the study.

Once the research instrument was validated and tested for reliability, it was distributed to the selected science teachers. The self-evaluation tool allowed teachers to provide insights into the challenges they faced and the coping strategies they employed. This data collection phase was critical for gathering comprehensive and relevant information for the study.

After the self-evaluation tools were completed and returned, the researcher collected and summarized the data. This data was then subjected to appropriate statistical treatments to analyze the results effectively. This analysis provided a clear understanding of the challenges faced by science teachers and the strategies they used to overcome them. These steps, executed systematically, ensured a thorough and practical study, leading to meaningful and actionable insights.

Data Analysis

Pie Graphs were used to describe the profile of the science teachers in terms of specialization, length of service, and grade level taught.

To determine the extent to which science teachers experience challenges handling non-specialized subjects, the Mean and standard deviation were used to measure content knowledge, instructional strategies, and professional development and support. Mean and standard deviation were also used to determine the extent to which science teachers employ coping strategies in addressing these challenges. This was done in terms of professional learning and development, peer collaboration and support networks, adaptive teaching strategies, and resourcefulness and flexibility.

These statistical measures are widely employed in educational research to analyze survey data and interpret patterns in respondents' perceptions (Gravetter & Wallnau, 2020). The use of descriptive statistics like mean and standard deviation allows researchers to summarize large datasets effectively, providing a clear understanding of trends and differences within the study population (Tabachnick & Fidell, 2019).

Pearson Product Moment Correlation was used to determine whether there is a significant relationship between the extent of science teachers' challenges when handling non-specialized subjects and their coping strategies. Also, Pearson Product Moment Correlation analysis determined if the teachers' profiles affect the coping strategies science teachers employ in response to these challenges. This statistical treatment is an appropriate statistical tool for measuring the strength and direction of the relationship between two continuous variables (Schober et al., 2018).

Rank Order Analysis was employed to identify and prioritize the activities or programs that can be proposed based on the study's findings. Rank Order Analysis is a suitable statistical technique for identifying and prioritizing activities or programs based on study findings. This method is particularly useful when dealing with ordinal data, where items are ranked based on their perceived importance, effectiveness, or relevance

Ethical Considerations

In this study, scientific integrity, research validity, and participant rights are all considered. At any time, participants had the choice to participate or not in the study. This implied that everyone participating can do so without being forced or coerced. Every participant was free to stop participating in the study at any time without feeling obligated to do so. There was no requirement that participants give a justification for abandoning the research (Wiles, 2013).

All of the information that participants need to decide about participating were provided to them and made clear to them. Before deciding whether or not to participate, participants were informed about the study's goals, advantages, risks, and funding (Resnik, 2020).

This study used Data Pseudonymization. It was an alternative method where researchers replaced identifying information about participants with pseudonymous, or fake, identifiers (Van den Hoven et al., 2019). Any harm; physical, social, psychological, or otherwise was kept to a bare minimum (Bryman, 2015). The researcher ensured the privacy of the study's findings that this work was free of plagiarism or other research misconduct, and that your results were appropriately represented.

Results and Discussion

This section contains the presentation, analysis, and interpretation of the data gathered in this study.

This study explored the challenges science teachers encounter when handling non-specialized subjects and their strategies to cope with these challenges. The various results are presented in the succeeding tables.

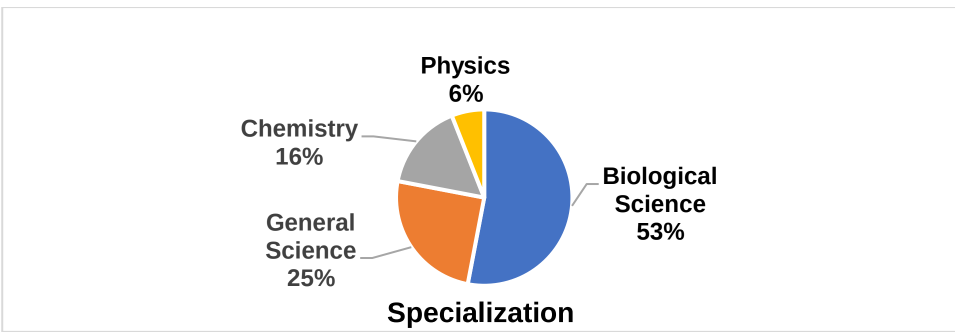

Figure 1. *Profile of Science Teachers in Terms of Specialization*

The figure 1 presents the profile of science teachers based on their field of specialization. Among the 32 respondents, the majority (53%) specialize in Biological Science, indicating a stronger representation of educators with expertise in life sciences. This is followed by teachers specializing in General Science, comprising 25% of the sample. Chemistry specialists account for 16%, while the smallest group, Physics teachers, make up only 6% of the respondents. These findings highlight the distribution of science specializations among teachers, which has implications for teaching effectiveness and content delivery in different branches of science.

The dominance of Biological Science specialists suggests that schools may have a greater availability of educators in this field, potentially due to the perceived accessibility and popularity of life sciences compared to Chemistry and Physics. The lower percentage of Physics and Chemistry specialists may pose challenges in delivering specialized instruction in these subjects, particularly in senior high school and advanced science courses that require subject-specific expertise. General Science specialists, making up 25%, likely teach across multiple disciplines, which may either enhance interdisciplinary teaching or lead to difficulties in addressing more complex subject areas that require deeper specialization.

The predominance of Biological Science majors among science teachers can be linked to program availability in nearby teacher education institutions (DMEPA, 2022). Many colleges and universities—especially in regional and rural areas—offer Bachelor of Secondary Education majors in Biological Science due to higher student demand and easier faculty recruitment.

The figure 2 shows science teachers' profiles based on service length. Among the 32 respondents, half (50%) have been teaching for 6 to 10 years, indicating that a substantial portion of the teaching workforce falls under Career Stage 2, classified as proficient teachers (DepEd Order No. 42, s. 2017). This is followed by teachers with 11 to 15 years of experience, comprising 28% of the respondents. Meanwhile, 13% have been teaching for 16 years or more, while the smallest group (9%) consists of novice teachers with less than five years of experience. These findings highlight the varying levels of teaching experience among science educators and their potential impact on instructional quality and student learning outcomes.

The prevalence of teachers with 6 to 10 years of experience suggests a stable workforce with a strong foundation in pedagogical practices and classroom management. This group likely possesses a balance of experience and adaptability to educational innovations, making them valuable assets in implementing new teaching strategies. The significant presence of teachers with 11 to 15 years of experience further strengthens this stability, ensuring that a considerable portion of educators have advanced expertise in handling curricular changes and diverse student needs. However, the relatively lower percentage of teachers with over 16 years of experience may indicate challenges in retention or fewer opportunities for long-term career advancement in the field.

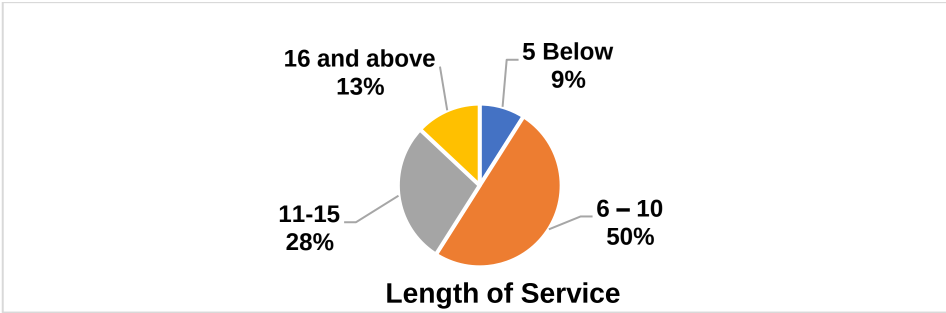

Figure 2. *Profile of Science Teachers in Terms of Length of Service*

The implications of these findings suggest the need for continuous professional development opportunities to enhance the competencies of Career Stage 2 teachers, while also providing structured mentorship programs for novice educators (Darling-Hammond et al., 2017). Schools and policymakers should explore strategies to retain experienced teachers by offering incentives, career growth opportunities, and well-being support systems (OECD, 2021). Additionally, efforts to attract and sustain new entrants into the teaching profession are crucial to ensuring a steady pipeline of skilled educators who can meet the evolving demands of science education (Ingersoll & Strong, 2011).

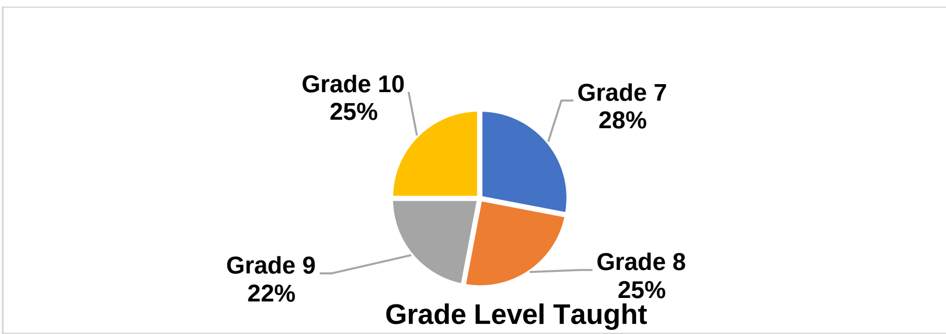

Figure 3. *Profile of Science Teachers in Terms of Grade Level Taught*

The figure 3 highlights the profile of science teachers based on the grade level they teach. Among the 32 respondents, the distribution is relatively balanced across grade levels, with the highest percentage (28%) teaching Grade 7. This is closely followed by teachers handling Grade 8 and Grade 10, each comprising 25% of the sample. Meanwhile, the smallest group, 22%, teaches Grade 9. These findings indicate that science teachers are fairly distributed across different grade levels, ensuring that students at various stages of learning have access to qualified educators.

The slight predominance of Grade 7 teachers suggests that more educators are assigned to the foundational level of secondary science education. A larger teaching force is therefore required to accommodate the influx of students transitioning from elementary education (Department of Education, 2024). The relatively lower percentage of Grade 9 teachers may indicate that fewer teachers specialize in or are assigned to this level, possibly due to subject specialization needs or school staffing decisions.

Table 1 depicts the extent of challenges faced by science teachers handling non-specialized subjects, specifically in terms of content knowledge. The overall mean score of 3.57, with a standard deviation of 1.20, suggests that these challenges are encountered to a greater extent. Among the indicators, the highest-rated challenge is the extensive time required for self-study and preparation (M = 3.97, SD = 1.03). On the other hand, the lowest-rated challenge is limited confidence in delivering complex concepts (M = 3.16, SD = 1.17), which was experienced to a moderate extent.

The high mean score for the need for extensive self-study and preparation suggests that teaching non-specialized subjects significantly adds to the workload of science teachers. This finding aligns with the study of Ingersoll et al. (2021), which highlighted that out-of-field teaching often forces educators to spend additional hours studying content they were not formally trained in, leading to increased stress and burnout. The demand for self-study may also impact instructional quality, as teachers may struggle to cover complex topics with the depth required for student understanding.

Conversely, the lowest-rated challenge, limited confidence in delivering complex concepts, suggests that while teachers may lack specialization in certain subjects, they still possess a foundational understanding that allows them to convey key ideas to students. This finding supports the argument of Shing et al., (2015), who emphasized that pedagogical content knowledge enables teachers to effectively simplify and explain difficult concepts, even in areas outside their primary specialization. However, while confidence levels may not be as critical as other concerns, continuous professional development remains necessary to ensure effective content delivery.

Table 1. *Extent of Challenges of Science Teachers Handling Non-Specialized Subjects in terms of Content Knowledge*

Indicators	*Mean*	*SD*	*Description*
Struggle with a lack of depth in content knowledge when teaching subjects outside their specialization, which can lead to difficulties answering student queries effectively.	3.56	1.41	Greater Extent
Limited confidence in delivering complex concepts.	3.16	1.17	Moderate Extent
Teachers frequently need help connecting new content with prior knowledge due to a lack of familiarity with the subject matter.	3.19	1.35	Moderate Extent
A sufficient understanding of non-specialized subject content can create challenges in creating accurate and meaningful assessments.	3.78	1.04	Greater Extent
The extensive time required for self-study and preparation for non-specialized subjects' places additional pressure on teachers already balancing their regular duties.	3.97	1.03	Greater Extent
Need help aligning the content of non-specialized subjects with the curriculum's expectations, which can hinder student learning.	3.78	0.94	Greater Extent
Feel ill-equipped to address misconceptions in non-specialized subjects due to a lack of in-depth knowledge.	3.56	1.22	Greater Extent
Mean	3.57	1.20	Greater Extent

The overall mean of 3.57 indicates that content knowledge challenges are significant among science teachers handling non-specialized subjects. These findings have important implications for teacher training and curriculum design. Schools and educational institutions should provide targeted content enrichment programs and professional development workshops to help teachers build their subject knowledge. Additionally, mentorship programs and peer collaborations could serve as valuable support systems, reducing the burden of self-study and enhancing instructional effectiveness.

Addressing these content knowledge challenges is crucial for ensuring high-quality science education. UNESCO (2022) suggested, a deep understanding of subject matter is essential for effective teaching and student learning. Therefore, policymakers and school administrators must recognize the difficulties faced by out-of-field teachers and implement strategies to bridge knowledge gaps, ultimately improving science education outcomes.

Table 2. *Extent of Challenges of Science Teachers Handling Non-Specialized Subjects in Terms of Instructional Strategies*

Indicators	*Mean*	*SD*	*Description*
Teachers need help to adapt their usual instructional methods when teaching non-specialized subjects, which may not be as effective for content they are less familiar with.	4.03	1.06	Greater Extent
The lack of diverse teaching strategies specific to non-specialized subjects can hinder teachers' ability to engage students fully.	3.81	1.33	Greater Extent
Teachers often rely on traditional, lecture-based methods outside their specialization, limiting opportunities for active learning and student participation.	3.16	1.42	Moderate Extent
The need to design innovative instructional strategies for unfamiliar subjects adds to science teachers' planning and preparation workload.	4.13	1.13	Greater Extent
Teachers need help developing hands-on activities and experiments for non-specialized subjects, reducing the opportunities for practical learning.	3.94	1.16	Greater Extent
Adjusting lesson plans and differentiating instruction for varying student needs is more accessible when teachers need more experience with the subject's instructional strategies.	4.03	1.15	Greater Extent
Teachers may struggle to effectively integrate technology and multimedia tools into lessons for non-specialized subjects, further limiting student engagement.	3.63	1.39	Greater Extent
Mean	3.82	1.26	Greater Extent

Table 2 demonstrates the extent of challenges faced by science teachers when handling non-specialized subjects, specifically concerning instructional strategies. The overall mean score of 3.82, with a standard deviation of 1.26, indicates that these challenges are encountered to a greater extent. Among the indicators, the highest-rated challenge is the need to design innovative instructional strategies for unfamiliar subjects (M = 4.13, SD = 1.13), while the lowest-rated challenge is the reliance on traditional, lecture-based methods (M = 3.16, SD = 1.42), which was experienced to a moderate extent.

The high mean score for designing innovative instructional strategies underscores the complexity of teaching outside one's specialization. This aligns with the study of Darling-Hammond et al. (2022), which emphasizes that teachers required to teach outside their expertise often struggle to develop creative and engaging lesson plans, leading to increased preparation time and stress. Additionally, teachers face difficulties adapting their usual instructional methods (M = 4.03, SD = 1.06) and differentiating instruction for diverse student needs (M = 4.03, SD = 1.15), indicating the need for flexible pedagogical training.

Conversely, the lowest-rated challenge, reliance on traditional lecture-based methods, suggests that while some teachers default to traditional strategies, they may still attempt to incorporate student-centered approaches. However, research by Koh et al. (2023)

indicates that lecture-based instruction is less effective in science education, particularly when teaching interdisciplinary subjects requiring hands-on learning. Therefore, teachers need support in implementing more active learning strategies tailored to non-specialized subjects.

These findings suggest the need for professional development programs that focus on instructional strategies for non-specialized subjects. Training workshops on differentiated instruction, inquiry-based learning, and technology integration can help teachers become more adaptable and effective. Furthermore, peer collaboration and resource-sharing platforms can provide additional instructional support, reducing the burden on individual teachers.

Addressing these instructional challenges is crucial for ensuring high-quality science education. As Shing et al., (2015) suggested, a deep understanding of subject matter is essential for effective teaching and student learning. Therefore, policymakers and school administrators must recognize the difficulties faced by out-of-field teachers and implement strategies to bridge knowledge gaps, ultimately improving science education outcomes.

Table 3. *Extent of Challenges of Science Teachers Handling Non-Specialized Subjects in Terms of Professional Development and Support*

Indicators	*Mean*	*SD*	*Description*
The lack of specialized professional development opportunities for teaching non-specialized subjects leaves teachers feeling unsupported and underprepared.	4.06	1.08	Greater Extent
Teachers experience a gap in targeted professional training that specifically addresses the challenges of teaching outside their primary area of expertise.	4.03	1.06	Greater Extent
Insufficient institutional support, such as limited access to updated teaching materials or resources, contributes to the difficulty of teaching non-specialized subjects.	4.25	1.14	Greatest Extent
Teachers often feel isolated when teaching non-specialized subjects, as they need access to support networks of colleagues who can provide guidance and advice.	3.97	1.15	Greater Extent
The limited availability of mentorship programs for teachers tackling non-specialized subjects reduces opportunities for peer learning and growth.	4.09	1.12	Greater Extent
School-based support systems may need to adequately address the specific needs of teachers teaching outside their specialization, leaving them to find coping strategies independently.	4.28	0.92	Greatest Extent
Teachers often need help balancing the demands of ongoing professional development with their teaching responsibilities, mainly when such development is not geared towards their needs in non-specialized subjects.	4.19	0.86	Greatest Extent
Mean	4.13	1.04	Greater Extent

Table 3 presents the extent of challenges faced by science teachers regarding professional development and support when handling non-specialized subjects. The overall mean score of 4.13 (SD = 1.04) indicates that these challenges are encountered to a greater extent. Among the indicators, the highest-rated challenge is the inadequacy of school-based support systems in addressing the specific needs of teachers teaching outside their specialization (M = 4.28, SD = 0.92), while the lowest-rated challenge is the sense of isolation due to a lack of access to colleague support networks (M = 3.97, SD = 1.15).

The high mean score for inadequate school-based support systems suggests that institutions may not be providing sufficient targeted interventions to assist teachers handling subjects beyond their expertise. This aligns with the findings of Darling-Hammond et al. (2021), who emphasize that teachers need structured support mechanisms, including training programs and mentoring, to effectively teach outside their specialization. Furthermore, insufficient institutional support, such as a lack of updated teaching materials (M = 4.25, SD = 1.14), further exacerbates the difficulty of teaching non-specialized subjects.

On the other hand, while the lowest-rated indicator, teachers feeling isolated due to a lack of support from colleagues (M = 3.97, SD = 1.15), remains a challenge, it suggests that some teachers may still have access to informal peer support or self-directed learning strategies. However, research by Ingersoll and Strong (2018) highlights that teacher who lack access to collaborative networks often experience burnout and lower job satisfaction, reinforcing the need for structured peer mentoring and community learning approaches.

These findings imply that educational institutions must prioritize professional development programs tailored to the needs of teachers assigned to non-specialized subjects. Providing ongoing training, mentorship programs, and access to updated instructional materials can alleviate the difficulties faced by these educators. Additionally, fostering collaborative learning environments through teacher learning communities and peer support groups can reduce feelings of isolation and enhance instructional effectiveness.

Ensuring that teachers receive adequate professional development and institutional support is critical to maintaining teaching quality and student learning outcomes. As Desimone et al. (2020) suggest, high-quality professional development significantly impacts teachers' ability to adapt instructional strategies, ultimately improving student achievement. Therefore, school administrators and policymakers must address these gaps to create a more supportive teaching environment.

Table 4 shows the overall extent of challenges faced by science teachers when handling non-specialized subjects, categorized into content knowledge, instructional strategies, and professional development and support is featured in Table 8. The findings reveal that all areas were rated to a greater extent, indicating that teachers experience significant difficulties in multiple aspects of teaching beyond their specialization.

Table 4. *Extent of Challenges of Science Teachers Handling Non-Specialized Subjects*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
Content Knowledge	3.57	1.22	Greater Extent	Teachers encounter substantial challenges that regularly affect their ability to teach non-specialized subjects.
Instructional Strategies	3.82	1.26	Greater Extent	
Professional Development and Support	4.13	1.04	Greater Extent	
Overall	3.84	1.19	Greater Extent	

Among the three domains, professional development and support received the highest mean score (M=4.13, SD=1.04), highlighting the most pressing challenge. This suggests that science teachers feel inadequately supported in terms of professional training and access to specialized development programs tailored to teaching non-specialized subjects. The lack of targeted professional development opportunities may leave teachers underprepared, affecting their confidence and instructional effectiveness. According to Darling-Hammond et al. (2020), continuous and specialized teacher training is crucial in ensuring that educators can adapt to teaching multiple subjects effectively. Moreover, research by Desimone and Garet (2015) emphasizes the importance of institutional support and structured mentorship in enhancing teachers' pedagogical competencies in diverse subject areas.

The findings of this study imply that addressing the challenges of science teachers in teaching non-specialized subjects requires a multi-faceted approach. School administrators and policymakers must prioritize professional development programs that provide specialized training, collaborative learning opportunities, and access to instructional resources. Additionally, fostering a supportive school environment where teachers can seek guidance and share best practices can help alleviate the difficulties posed by teaching outside their expertise. Without these interventions, teachers may continue to struggle, ultimately impacting student learning outcomes in science education (Hobbs, 2013; Darling-Hammond et al., 2017; OECD, 2021).

Table 5. *Coping Strategies of Science Teachers in Terms of Professional Learning and Development*

Indicators	*Mean*	*SD*	*Description*
Seek professional development opportunities, such as workshops or online courses, to enhance their content knowledge in non-specialized subjects.	4.34	0.90	Always Observed
Dedicate personal time to studying unfamiliar subjects through self-directed learning to ensure they are prepared for classroom instruction.	4.09	0.86	Often Observed
Pursue continuous learning to stay updated with new teaching methodologies applicable to non-specialized subjects.	4.25	0.95	Always Observed
Engage in reflective practice, analyzing their teaching experiences in non-specialized subjects to identify areas for improvement and growth.	4.06	0.98	Often Observed
Prioritize professional development efforts and recognize the importance of acquiring new skills to effectively manage the demands of teaching non-specialized subjects.	4.28	0.96	Always Observed
Mean	4.21	0.93	Always Observed

Table 5 presents the coping strategies adopted by science teachers to navigate the challenges of teaching non-specialized subjects, particularly in the realm of professional learning and development. The overall mean of 4.21 (SD = 0.93) indicates that these strategies are always observed among teachers. Seeking professional development opportunities, such as workshops or online courses, received the highest mean (M = 4.34, SD = 0.90), highlighting the proactive efforts of teachers to enhance their content knowledge. This finding supports the study by Guskey (2021), which asserts that continuous professional learning positively impacts teachers' instructional effectiveness and confidence. Prioritizing professional development efforts also received a high mean score (M = 4.28, SD = 0.96), indicating that teachers acknowledge the importance of acquiring new skills to meet the demands of teaching outside their specialization.

The lowest mean was recorded for engaging in reflective practice (M = 4.06, SD = 0.98), though still categorized as often observed. While self-reflection is crucial in identifying areas for improvement, the slightly lower rating suggests that some teachers may lack structured opportunities or institutional support to engage in reflective teaching practices. Suphasri and Chinokul (2021) emphasized that reflective practice enhances teaching effectiveness by allowing educators to critically analyze their instructional approaches and make informed adjustments.

These findings suggest that science teachers employ various strategies to overcome the challenges of teaching non-specialized subjects, with professional development playing a crucial role in their coping mechanisms. Educational institutions should reinforce these efforts by providing accessible, targeted training programs and fostering a culture of continuous learning to support teachers in navigating diverse instructional responsibilities (Hobbs, 2013; Darling-Hammond et al., 2017; Avalos, 2011).

Table 6 showcases the coping strategies utilized by science teachers in teaching non-specialized subjects, focusing on professional peer collaboration and support networks. The results indicate that collaboration with colleagues from different subject areas to share insights, lesson plans, and teaching strategies had the highest mean score (M = 4.34, SD = 0.83), categorized as "Always Observed." In contrast, relying on peer networks for emotional and professional support received the lowest mean score (M = 4.03, SD = 0.97), categorized as "Often Observed." The overall mean score for this dimension was 4.17 (SD = 0.88), suggesting that professional peer collaboration and support networks are widely utilized as coping strategies by science teachers to a great extent.

Table 6. *Coping Strategies of Science Teachers in Terms of Professional Peer Collaboration and Support Networks*

Indicators	*Mean*	*SD*	*Description*
Collaborate with colleagues from different subject areas to share insights, lesson plans, and teaching strategies for non-specialized subjects.	4.34	0.83	Always Observed
I rely on peer networks for emotional and professional support, to discuss challenges, and to exchange coping strategies for teaching unfamiliar content.	4.03	0.97	Often Observed
Participating in informal study groups or professional learning communities helps teachers gain confidence in addressing gaps in their knowledge of non-specialized subjects.	4.06	0.95	Often Observed
Seek feedback from peers with experience teaching non-specialized subjects, using this input to refine their instructional approaches.	4.22	0.75	Always Observed
Tap into peer networks for shared resources, teaching materials, and advice on best practices for managing non-specialized subjects.	4.19	0.90	Always Observed
Mean	4.17	0.88	Always Observed

The high mean score for collaboration with colleagues highlights the significance of interdisciplinary cooperation in addressing content knowledge gaps and instructional challenges in non-specialized subjects. Studies have shown that peer collaboration fosters knowledge exchange, enhances pedagogical strategies, and reduces teacher stress (Hargreaves & Fullan, 2020). When teachers engage in cross-disciplinary discussions, they gain diverse perspectives and innovative teaching techniques that improve their confidence and effectiveness in handling unfamiliar subjects (Loughran, 2019).

The lowest mean score, associated with reliance on peer networks for emotional and professional support, suggests that while collaboration is actively practiced for instructional purposes, emotional and professional reliance on colleagues may be less frequent. This finding is consistent with the study by Avalos (2021), which highlights that while peer support is an essential factor in professional development, teachers may hesitate to seek emotional assistance due to concerns about professional competence or self-reliance. This suggests a need for structured mentorship programs and formalized peer support mechanisms within schools to encourage open dialogue about challenges and stressors related to teaching non-specialized subjects.

The overall high mean score (M = 4.17) underscores the importance of peer collaboration as a fundamental coping strategy among science teachers teaching outside their specialization. According to Vangrieken et al. (2022), collaborative learning communities enhance teacher resilience, boost instructional confidence, and promote a culture of shared responsibility in addressing teaching challenges. The findings suggest that institutional support should emphasize fostering professional learning communities, strengthening mentorship programs, and encouraging interdisciplinary partnerships to sustain an effective coping framework for science teachers facing non-specialized teaching assignments (Vescio, Ross, & Adams, 2008; Ingersoll & Strong, 2011).

Table 7. *Coping Strategies of Science Teachers in Terms of Professional Adaptive Teaching Strategies*

Indicators	*Mean*	*SD*	*Description*
Adjust instructional methods to suit the content of non-specialized subjects, developing new ways to engage students and facilitate understanding.	4.31	0.74	Always Observed
Try various teaching approaches, such as project-based learning or flipped classrooms, to adapt to the needs of their students when teaching non-specialized subjects.	4.56	0.56	Always Observed
Differentiation becomes a key strategy as teachers adapt their lesson plans to accommodate students' varying levels of understanding and familiarity with the new subject matter.	4.34	0.79	Always Observed
Integrating technology and digital tools into their instruction as an adaptive strategy enhances learning experiences for students in non-specialized subjects.	4.47	0.67	Always Observed
Seek students' feedback to adjust their methods and improve lesson delivery in response to classroom dynamics.	4.31	0.64	Always Observed
Mean	4.40	0.68	Always Observed

Table 7 reveals the coping strategies employed by science teachers in terms of professional adaptive teaching strategies when handling non-specialized subjects. The findings indicate that science teachers actively adjust their instructional methods to address the challenges posed by teaching outside their area of expertise.

Among the indicators, the highest mean score (M = 4.56, SD = 0.56) corresponds to teachers trying various teaching approaches, such as project-based learning or flipped classrooms, to adapt to students' needs in non-specialized subjects. This suggests that science teachers recognize the importance of employing diverse pedagogical techniques to improve student engagement and learning outcomes. The use of innovative instructional strategies aligns with research by Tomlinson (2017), who emphasizes the role of differentiated and student-centered teaching in fostering deeper understanding among learners, especially in complex subjects.

Conversely, the lowest mean score (M = 4.31, SD = 0.64) was found in the indicator seeking students' feedback to adjust methods and improve lesson delivery. While still rated as "Always Observed," this suggests that while teachers are proactive in modifying instructional strategies, there is still room to enhance feedback mechanisms to better tailor lessons to students' learning needs. According to Hattie and Timperley (2017), incorporating student feedback effectively can significantly improve instructional quality and learning outcomes, as it helps teachers refine their strategies based on actual student experiences.

The overall mean score of 4.40 (SD = 0.68) indicates that science teachers consistently adopt adaptive teaching strategies to navigate the challenges of teaching non-specialized subjects. This finding underscores the resilience and flexibility of educators in ensuring effective instruction despite limited expertise in certain subject areas. Research by Darling-Hammond et al. (2020) highlights the importance of adaptive teaching as a core competency for educators, particularly in dynamic educational environments where subject specialization challenges arise.

The results suggest that professional development programs should emphasize adaptive teaching methodologies to further support science teachers in teaching non-specialized subjects. Schools and educational institutions should facilitate training in innovative instructional strategies, technology integration, and student feedback utilization to empower teachers in their instructional adjustments. Moreover, fostering a collaborative teaching environment where educators can exchange best practices and reflect on their adaptive strategies could enhance their efficacy in teaching beyond their specialization (Darling-Hammond et al., 2022; OECD, 2021; Nguyen et al., 2023).

Table 8. *Coping Strategies of Science Teachers in Terms of Professional Resourcefulness and Flexibility*

Indicators	*Mean*	*SD*	*Description*
Show creativity in sourcing and adapting instructional materials from various platforms, ensuring their teaching in non-specialized subjects remains engaging and informative.	4.50	0.76	Always Observed
Demonstrate resourcefulness by modifying existing resources to fit the needs of their lessons despite having limited access to subject-specific materials.	4.47	0.57	Always Observed
Adjust lesson plans in response to unforeseen challenges, such as lack of time or content complexity in non-specialized subjects.	4.38	0.75	Always Observed
Exhibit problem-solving skills by improvising instructional aids or utilizing unconventional teaching materials when faced with resource shortages in non-specialized subjects.	4.44	0.72	Always Observed
They demonstrate adaptability by continuously revising their approaches to align with their students' specific learning needs, ensuring that even non-specialized content is taught effectively.	4.44	0.67	Always Observed
Mean	4.44	0.69	Always Observed

Table 8 highlights the coping strategies science teachers use in terms of professional resourcefulness and flexibility when teaching non-specialized subjects. The results indicate that the highest mean score (M = 4.50, SD = 0.76) was observed for the strategy of showing creativity in sourcing and adapting instructional materials from various platforms. This finding suggests that science teachers are highly resourceful in curating and modifying content to ensure engaging and informative instruction despite the challenges posed by teaching subjects beyond their specialization.

The lowest mean score (M = 4.38, SD = 0.75) was recorded for adjusting lesson plans in response to unforeseen challenges, such as lack of time or content complexity in non-specialized subjects. Although still categorized as "Always Observed," this relatively lower mean suggests that while teachers strive for flexibility, time constraints and the intricacy of unfamiliar content may pose greater challenges.

Overall, the mean score for professional resourcefulness and flexibility was 4.44 (SD = 0.69), indicating that science teachers consistently employ various adaptive strategies to overcome instructional difficulties in non-specialized subjects. This underscores the critical role of resourcefulness in addressing gaps in subject-matter expertise and enhancing teaching efficacy.

These findings imply that while science teachers exhibit commendable resourcefulness and flexibility, sustained institutional support, including access to instructional materials and professional development opportunities, remains necessary to further strengthen their capacity to teach non-specialized subjects effectively. Schools and educational policymakers should consider implementing structured resource-sharing platforms and collaborative teaching frameworks to optimize instructional practices for teachers handling subjects outside their expertise.

Such adaptability aligns with the study of Mishra and Koehler (2020), which highlights that effective teaching in unfamiliar disciplines requires technological, pedagogical, and content knowledge (TPACK) to optimize learning experiences through diverse instructional resources. According to Darling-Hammond et al. (2021), teachers facing subject-matter limitations often require structured support to navigate content adaptation effectively and ensure meaningful instruction. Research by Konig et al. (2022) affirms that teacher adaptability significantly contributes to effective learning outcomes, particularly in interdisciplinary teaching contexts where pedagogical flexibility is essential.

Table 9. *Summary Table for Coping Strategies of Science Teachers*

Indicators	*Mean*	*SD*	*Description*	*Interpretation*
Professional Learning and Development	4.21	0.93	Always Observed	Strategies were consistently manifested in their actions, words, and outlook, indicating a high and frequent application.
Peer Collaboration and Support Networks	4.17	0.88	Always Observed	
Adaptive Teaching Strategies	4.40	0.68	Always Observed	
Resourcefulness and Flexibility	4.44	0.69	Always Observed	
Overall	4.30	0.81	Always Observed	

Table 9 provides an overview of the coping strategies utilized by science teachers in teaching non-specialized subjects. Among the four domains, Resourcefulness and Flexibility had the highest mean score (M = 4.44, SD = 0.69), indicating that teachers frequently modify instructional materials, adapt lesson plans, and utilize creative problem-solving strategies to overcome content-related challenges. Conversely, Peer Collaboration and Support Networks had the lowest mean score (M = 4.17, SD = 0.88), suggesting that while teachers seek support from colleagues, this strategy is not as consistently applied as others. The overall mean score (M = 4.30, SD = 0.81) reflects that coping strategies are always observed, demonstrating the proactive efforts of science teachers in managing the demands of teaching outside their specialization.

The strong reliance on resourcefulness and flexibility aligns with studies emphasizing the need for adaptability in out-of-field teaching. According to Hobbs (2022), teachers who lack specialized knowledge often compensate by creatively sourcing materials and modifying lesson plans to align with students' needs. Similarly, Shulman (2023) highlights that adaptive strategies, including differentiated instruction and technology integration, enhance teaching effectiveness even in unfamiliar subject areas. However, the relatively lower reliance on peer collaboration suggests that institutional support structures and professional learning communities could be further strengthened to facilitate knowledge-sharing and reduce the isolation experienced by out-of-field teachers (McPhail, 2021).

Overall, the results imply that while science teachers effectively employ coping mechanisms, increased institutional support and structured collaboration opportunities could further enhance their ability to navigate non-specialized subjects. Schools should consider fostering more collaborative professional learning environments to supplement individual adaptive efforts.

Table 10. *Relationship Between the Challenges of Non-Specialized Science Teachers and the Coping Strategies*

SV	*Mean*	*SD*	*r*	*Fcomp*	*p-value*	*Interpretation*
Challenges	3.83	0.92	-0.007	0.04	0.981ns	Not Significant
Coping Strategies	4.30	0.55				

ns: Not Significant at 5% level

Table 10 illustrates the correlation between the challenges encountered by non-specialized science teachers and their coping strategies. The regression analysis yielded a computed F-value of 0.04 and a p-value of 0.981, indicating that the relationship between challenges and coping strategies is not statistically significant at any conventional significance level 0.05. The R-value of -0.007 further suggests an almost negligible correlation between the two variables.

The findings imply that the coping strategies employed by science teachers do not necessarily depend on the intensity of the challenges they face. This suggests that teachers might proactively implement coping mechanisms regardless of how severe their challenges are, possibly due to institutional expectations or personal resilience. According to Hobbs (2022), teachers in out-of-field assignments often develop adaptive skills and strategies independently of their perceived difficulties, relying instead on professional development, collaboration, and resourcefulness to manage instructional demands. Similarly, McPhail (2021) argues that the effectiveness of coping mechanisms is influenced more by access to professional support and prior teaching experience rather than the specific level of difficulty encountered in teaching a non-specialized subject.

Since the challenges do not significantly predict coping strategies, this underscores the importance of structured institutional interventions, such as targeted professional development, mentoring programs, and collaborative learning environments, to further support science teachers handling non-specialized subjects. Schools and education policymakers should focus on strengthening capacity-building efforts rather than assuming that more challenges will naturally lead to better-developed coping strategies (Bauer et al., 2023; OECD, 2021; Avalos, 2011).

Table 11. *Relationship Between Coping Strategies and Profile of the Teachers*

SV	*df*	*SS*	*MS*	*r*	*Fcomp*	*p-value*	*Interpretation*
Regression	3	2.492	.831	.514	3.354	0.033*	Significant
Residual	28	6.935	.248				
Total	31	9.427					

Dependent Variable: Coping Strategies
**: Significant at 5% level*
Predictors (Length in Service, Specialization, Grade Level Taught)

Table 11 shows the results of the regression analysis indicate a moderate positive relationship (r = 0.514) between the combined set of independent variables (specialization, length of service, and grade level taught) and the coping strategies employed by teachers. While this suggests that these factors, to some extent, are related to how teachers cope, the analysis revealed that only length of service had a significant relationship with coping strategies.

This finding implies that the number of years a teacher has been in service is a key factor in predicting the types of coping strategies they utilize. It is possible that more experienced teachers have developed more effective coping mechanisms over time, or that the challenges they face evolve with experience, leading to the adoption of different strategies (Graham et al., 2020). Teachers with more years of experience tend to develop better coping mechanisms through accumulated knowledge and adaptive practices (Smith & Brown, 2021). The non-significance of specialization and grade level taught suggests that, in this model, these factors do not significantly influence coping strategies when length of service is taken into account. Specialization also plays a role, as teachers trained in a specific discipline may find it more challenging to teach subjects outside their expertise, prompting them to seek alternative strategies to manage instructional difficulties (Johnson et al., 2022).

The moderate correlation suggests that while teacher profiles significantly influence coping strategies, external support systems such as professional development opportunities, collaboration with peers, and institutional resources also play a crucial role in helping teachers adjust. This aligns with the findings of Williams & Parker (2023), who emphasized that teachers who participate in mentorship programs and professional learning communities exhibit greater adaptability and confidence in teaching non-specialized subjects.

Table 12. *Proposed Programs and Activities*

Programs and Activities	*Rank*
Teacher Exchange and Shadowing Program	1
Content Enhancement Boot Camps	2
Digital Resource Hub for Science Educators	3
Peer Mentoring and Coaching Program	4
Interdisciplinary Teacher Training Program	5

The results in Table 12 highlight the top five prioritized programs and activities suggested by the respondents aimed at addressing the challenges faced by science teachers in teaching non-specialized subjects. The Teacher Exchange and Shadowing Program ranked highest, indicating the importance of hands-on exposure and collaborative learning. This program allows teachers to observe and learn from their peers who specialize in different fields, enhancing their confidence and competence in teaching non-specialized subjects.

The findings of this study, which identify the teacher exchange and shadowing program as the foremost recommended initiative, are supported by Hanuscin et al. (2021). Their research underscores the effectiveness of cross-disciplinary and collaborative shadowing programs in enhancing the professional learning of science teacher educators. The study highlights the multidimensional benefits of shadowing, encompassing cognitive, practical, relational, and emotional aspects of professional growth. By engaging in shadowing experiences, educators from various career stages and disciplinary backgrounds gain valuable insights into teaching methodologies, curriculum implementation, and pedagogical innovations.

The results emphasize the need for comprehensive professional development initiatives tailored to the unique challenges faced by science teachers in teaching non-specialized subjects. Programs such as teacher exchange, content enhancement boot camps, digital resource hubs, peer mentoring, and interdisciplinary training provide practical solutions to these challenges. The literature supports the effectiveness of these interventions, reinforcing their importance in enhancing teacher preparedness and instructional quality. Implementing these programs can lead to improved teacher confidence, better student engagement, and overall educational effectiveness.

Research supports this approach, emphasizing that job-embedded professional learning fosters pedagogical growth and improves instructional effectiveness (Hobbs, 2020). These initiatives address the challenges of content mastery, instructional strategies, and professional growth. Literature supports their effectiveness, highlighting that peer collaboration, digital resources, structured training, and interdisciplinary approaches enhance teacher competency and student learning outcomes (Darling-Hammond et al., 2017; Ingersoll & Strong, 2018; Mishra & Koehler, 2021).

Conclusions

Based on the findings of the study the following conclusions were drawn:

The study provided insights into the profile of science teachers assigned to teach non-specialized subjects. Findings indicate that the majority have a background in Biological Science, with fewer specializing in Physics. The teaching experience of respondents is predominantly within the Career Stage 2, while their distribution across different grade levels is relatively balanced.

Science teachers encounter substantial challenges when handling non-specialized subjects, particularly in areas of professional development and instructional strategies. The lack of school-based support systems, the need for innovative teaching approaches, and the extensive time required for self-study were identified as major concerns.

To address these challenges, science teachers employed various coping strategies, with adaptive teaching strategies and resourcefulness emerging as the most prominent. The frequent use of diverse instructional methods and creative sourcing of materials underscores teachers' commitment to overcoming subject-related constraints. Additionally, professional learning, peer collaboration, and self-reflective practices play crucial roles in enhancing their instructional efficacy. However, the findings also highlight the need for structured institutional support to further strengthen these coping mechanisms.

The analysis of the relationship between the challenges faced and coping strategies employed revealed no significant correlation, suggesting that the presence of challenges does not directly predict the coping approaches used by teachers.

On the other hand, teachers' profiles, particularly their length of service, were found to have a moderate positive relationship with their coping strategies. It is concluded that experience plays a critical role in shaping how educators navigate the difficulties of teaching non-specialized subjects. Over time, teachers appear to develop more effective strategies, emphasizing the importance of sustained professional growth.

Initiatives such as teacher exchange, content enhancement boot camps, digital resource hubs, peer mentoring, and interdisciplinary training offer practical solutions to address challenges in content mastery, instructional strategies, and professional development.

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