

Challenges, Coping Mechanisms, Motivation, and Support Needs for Out-of-Field Science Teachers in Western Mindanao

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Received June 16, 2024; Revised July 17, 2024; Accepted July 24, 2024

Abstract Science education holds significant importance in helping students make sense of the world and develop critical scientific inquiry skills. This study aims to investigate the experiences of out-of-field teachers teaching high school science subjects in Western Mindanao, specifically exploring their challenges, motivation, coping mechanisms, and support needs. By understanding these factors, strategies and interventions can be developed to improve the teaching practices and performances of out-of-field teachers, ultimately enhancing science education in the Philippines. This study employed a qualitative research design, specifically, descriptive-phenomenological approach. Results revealed that the challenges non-science teachers encounter when teaching science courses range from a lack of resources and training to challenges regarding confidence and teaching efficacy. The coping mechanisms employed by non-science teachers demonstrate their resourcefulness and flexibility in handling difficulties related to teaching scientific subjects. By highlighting the reciprocal relationship between teacher motivation and student success and highlighting the significance of fostering professional development, nurturing passion, and creating supportive learning environments in science education, intrinsic rewards helped non-science teachers overcome challenges to teach science.

Keywords: non-science teachers, science education, Philippine-education, phenomenology

Cite This Article: Daril Jane B. Edulan, and Maria Teresa M. Fajardo, "Challenges, Coping Mechanisms, Motivation, and Support Needs for Out-of-Field Science Teachers in Western Mindanao." *American Journal of Educational Research*, vol. 12, no. 7 (2024): 271-281. doi: 10.12691/education-12-7-8.

1. Introduction

Quality education is essential for the continued development of a nation and makes a contribution to its economic advancement and societal well-being [1,2]. As widely acknowledged in research, education stimulates creativity, increases productivity, and enhances the quality of life for citizens in a country [3,4]. This supports the notion that the quality of an educational system in a country has a significant impact on its development [5]. The Philippines, similar to many other nations, faces challenges guaranteeing the excellence of education. The country's worldwide competitiveness in education is rather low [6], exacerbated by the constantly dropping rankings in the Program for International Student Assessment (PISA) [7].

It is noteworthy that science education has a crucial role in enabling pupils to understand the world and cultivate essential scientific inquiry skills [8]. Its relationship between a nation's economic success and competitiveness is an emphasis in studies related to national development [9]. However, science performance in the Philippines, including other third-world countries, has been deteriorating

[10]. This decline in ranks for the past 10 years indicates an immediate need to address the difficulties encountered in science education within the nation.

There is tangible evidence that establishes an association between the quality of teachers and the academic achievement of students [11]. Teachers' crucial role in shaping a more educated future generation was acknowledged as well [12]. This emphasizes the association between the quality of education and the quality of teachers, who are usually evaluated in terms of their training, experience, and competence in the subject matter [13]. Despite the crucial role teachers play in developing a well-educated generation, there is an alarming shortage of teachers in the country, particularly in the field of science [14]. This is also one of the reasons for the insufficient number of the needed hired specialists, initiating out-of-field teaching, where teachers teach subjects outside their specialization [15,16]. Research suggests that out-of-field teaching in a science classroom results in students' reduced involvement and poor academic performance [16].

The status of education necessitates studies to contribute to the improvement, if not advancement, of the educational status of the country, particularly in the field of science. The issues and concerns accompanied by engagement in out-of-

field teaching also require equal attention in research. These teachers have not been included in the education sector's priorities nor have been given full support from the start of teaching the subject outside their field. Therefore, it is essential to look into their experiences. By examining the experiences of out-of-field teachers (OFTs), we may create means and design interventions to enhance their teaching practices and performances. This will ultimately lead to an improvement in science education in the Philippines.

This study seeks to explore the experiences of teachers who are teaching high school science in Western Mindanao, despite being non-science specialists. Specifically, the study examined the challenges, motivations, coping strategies, and support requirements of these teachers in teaching science subjects at the high school level.

In particular, the purpose was to answer the following research questions:

- (1). What are the challenges experienced by out-of-field teachers when teaching science subjects?
- (2). What are the coping strategies out-of-field teachers employ when teaching science?
- (3). What are out-of-field teachers' experiences that motivate them to continue teaching science?
- (4). What support do out-of-field teachers need when teaching science subjects?

2. Research Methodology

2.1. Research Design

This study employs a qualitative research methodology, specifically adopting a descriptive-phenomenological approach. The approach is considered suitable for addressing the research questions, particularly in exploring the challenges encountered by non-science teachers when teaching science subjects, the strategies they use to overcome these difficulties, the motivations that keep them teaching science subjects, and the support they require to teach science subjects effectively.

The descriptive phenomenological design, commonly employed in social science research to investigate and articulate individuals' experiences, is deemed appropriate for this study [17]. This design allows a thorough exploration and depiction of the lived experiences of non-science teachers when teaching science subjects. Accordingly, this will enable an in-depth and authentic presentation of the findings and a humanistic analysis of the experiences.

2.2. Research Instrument

A semi-structured interview was employed in this study. The interview questions were developed based on the research questions and subjected to scrutiny by experts in both qualitative research and science education. Despite preparing a set of interview questions, they did not restrict the participants' responses but rather acted as a guide for the researchers, consistent with the nature of the approach employed. A semi-structured interview was followed due to its ability to provide flexibility and facilitate the exploration of emerging ideas and themes throughout the interview [18]. This approach also grants participants the

freedom to express their ideas fully without any pressure to arrive at a specific understanding or conclusion about their experiences in teaching science subjects.

2.3. Data Gathering Procedure

In order to gather data for this study, a written letter of permission was addressed to each qualified participant. The participants were then invited to participate in an individual interview through email, with attached informed consent and interview protocol. A separate individual interview was conducted through Zoom, which was then recorded. The interview process adheres to Bevan's (2014) suggested phenomenological interview methodology [19]. After individual interviews, focus group discussions followed to encourage self-disclosure among the participants, allowing for a comprehensive understanding and deeper exploration of their experiences teaching science subjects [20,21]. A total of seven participants underwent individual interviews and were part of the focus group discussion, considering the richness of responses and saturation of the data. The transcription and coding of the data were then checked by peers and members to ensure trustworthiness in both the presentation and discussion of the findings.

2.4. Analysis of Data

The qualitative data were analyzed following the qualitative thematic analysis suggested by Sundler et al. (2019) for descriptive phenomenological studies [22].

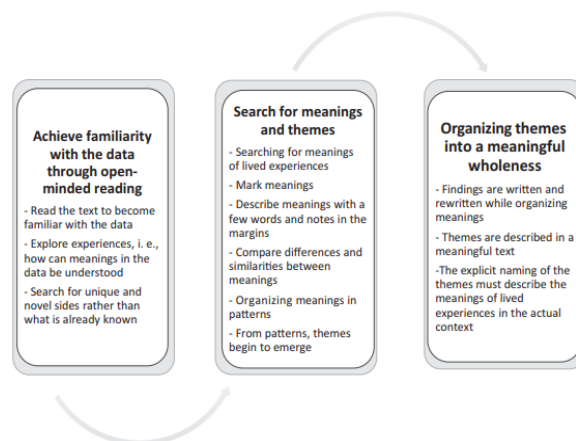


Figure 1. Summary of Thematic Analysis in Sundler et al. (2019)

The preparatory phase involves transcribing the recorded audio from a recorded Zoom meeting. Linguists then translated the transcriptions into English and checked them. Before undergoing analysis, the participants themselves checked the transcriptions. Qualitative thematic analysis was then implemented to identify key concepts and generate subthemes during the coding process. The first step involved carefully reading and comparing the words, phrases, and sentences to become familiar with the data and understand the context so meaningful units that displayed patterns could be easily determined. Line-by-line coding was then conducted to determine meaningful codes, which were then grouped and combined through ongoing concept comparison

analysis to generate subthemes. Relationships between subthemes were then evaluated to identify conceptual patterns. The results, including the coding process, were then deliberated by a group of experts.

Considering the qualitative nature of the study, several limitations were also taken into account while interpreting the results. Consistent with the subjective nature of qualitative research and moving away from the quantitative standard of representativeness, this study acknowledges that its findings may not apply to the entire Philippines or even Western Mindanao. Given the data saturation, the sample size is smaller, and there is no direct observation because this study relies on the participants' narratives and interpretations of their own experiences [17].

3. Results and Discussion

Specific Challenges Faced by Out-of-field Teachers when Teaching Science Subjects

When given the responsibility of teaching science courses, out-of-field teachers encounter several challenges. Three primary themes were associated with these challenges. The first theme centers on the need for more support and resources, especially concerning the insufficient apparatus and materials needed for experiential learning. The second theme emphasizes a need for more training and experience in science, highlighting problems with professional growth, formal education, and, particularly, difficulties with complex scientific subjects like chemistry. The third theme deals with non-science teachers' concerns about confidence and teaching efficacy, including how effective they believe they are in the classroom and how unprepared they feel while teaching difficult science subjects.

Theme 1: Lack of Resources and Support

The lack of modern textbooks, working laboratory apparatus, and advanced multimedia resources are major hindrances to the efficient presentation and investigation of scientific ideas. This lack of resources limits opportunities for practical learning and hands-on experimentation, both of which are essential for developing a thorough comprehension of scientific concepts. Because of this, scientific education quality is frequently reduced, which lowers student engagement and achievement in the field. The following are their responses.

"There's a lack of apparatus. Though in the books there are steps in the experimentation, because of the lack of apparatus, we innovate.....There's no books, sometimes, only teachers have books. In our school, because we are not the big school...only a few left as they (neighboring big school) have a bigger population." (P1)

These challenges faced by the participants are supported by recent studies that focus on resource discrepancies in education. According to the OECD, insufficient access to educational resources, such as laboratory apparatus and textbooks, significantly hampers students' ability to engage in effective learning, particularly in science education [23]. Additionally, UNESCO research highlights that inadequate educational

resources in underfunded schools force people to innovate out of need, but frequently at the expense of equity and quality in education [24]. Furthermore, the World Bank reports that schools with fewer resources, particularly in lower-income regions, struggle to provide a comprehensive educational experience, resulting in students being at a disadvantage compared to their peers in better-funded institutions [25].

The teachers also face challenges due to limited financial resources, particularly in accessing necessary materials or resources for learning. It explores how financial constraints force individuals to improvise alternative solutions to meet educational needs and the resilience and creativity of an individual in directing educational challenges amidst financial limitations, highlighting both the barriers and innovative strategies that emerge in response to economic constraints. To note,

"It is even me who took the initiative and used my personal money to make wood tables as my laboratory tables.....We conducted experiments on stage, because it is really hard to have experiments with just one group." (P1)

This result is in line with a study by Brown and Jones [26], which found that students' educational experiences are greatly impacted by financial constraints, which frequently force them to improvise and discover alternate means to acquire educational resources. Second, differences in school finances lead to unequal access to laboratory materials and equipment, which forces teachers and students to come up with innovative ways to accomplish learning objectives, according to a report by the National Center for Education Statistics [27]. Last but not least, a Pew Research Center poll revealed that a sizable portion of teachers and students report utilizing their own money to augment the resources provided in the classroom, demonstrating the pervasive influence of financial hardship on educational practices along with outcomes [28].

Theme 2: Insufficient Training and Background

Teachers and students face challenges when it comes to insufficient training and background in the field of science. Others were just forced to teach science, even if their fields of expertise were not science related. Yet, as emphasized in the narrative of the interviewees, they have no choice because these are the most needed in the schools where they are assigned. With this, teachers find it difficult to deliver effective and comprehensive instruction. As per comments during the focus group discussion,

*"Lack of formal education and training in science.....affected our confidence in teaching science."
"...we do not have a background in science or had limited knowledge in the subject."*

Teachers perceived their confidence and efficacy in teaching science as seriously compromised by the lack of formal education and professional development in the field. This is in line with a study by Darling-Hammond et al., [29], which emphasizes that teachers who haven't had much experience with a subject typically feel less

qualified and can't teach as well. Moreover, Banilower et al. [30] stress that ongoing professional development is crucial for enhancing instructors' science content understanding and pedagogical approaches, which will improve student learning outcomes.

Additionally, non-science teachers concentrate on the specific challenges that teachers and students encounter while facing difficult scientific concepts and subjects. It draws attention to the challenges associated with comprehending, teaching, and learning particular areas of science, which are frequently made worse by insufficient preparation and experience. It looks at how these difficulties can cause comprehension gaps and impair students' general academic success in scientific courses. Accordingly,

"Chemistry in particular, is the hardest area in science for me, I find it so hard to teach." (P2)

"Specific topics in chemistry, it is the most challenging to teach, such as chemical equations, organic and inorganic chemistry, bonding reactions." (FGD)

Teachers recall that they face major obstacles in their attempts to teach complicated subjects, primarily related to their lack of training and experience in chemistry and other relevant science content. This is in line with the study by Nakhleh [31], who discovered that chemistry instructors often struggle with abstract concepts and require more specific training in order to boost their efficacy as teachers. Furthermore, a National Research Council report emphasizes that there is a need for enhanced professional development programs that focus on challenging areas within scientific education to support teachers in developing a deeper understanding and more effective teaching strategies [32].

Theme 3: Teaching Efficacy and Confidence Issues

This theme focuses on challenges experienced by teachers when it comes to maintaining their self-confidence and teaching efficacy.

Low confidence and efficacy in the classroom greatly impacted the mode of instruction, student engagement, and overall academic performances. The factors that may address the said themes include personal experiences, professional development opportunities, and support systems. As noted:

"We leave those topics we find hard to teach, we do not discuss them and just pass them.....If we do not know the topic, we proceed to the next topic, and that is wrong, but it's the reality." (P1)

Out-of-field teachers' concerns about the efficacy of teaching and their level of confidence significantly affect teachers' methods of instruction and students' educational experiences. This accords with Bandura [33], that the opinions of teachers about how to teach challenging subjects and their commitment to excellence are highly influenced by their perceived performances. Additionally, studies conducted by Woolfolk Hoy and Spero [34] demonstrate the link between avoidance behaviors and poor teacher efficacy as well as ineffective teaching approaches. This highlights the necessity of focused

interventions and professional development to increase teachers' competence and self-assurance when teaching difficult topics.

Also, it explores the feelings of insecurity and anxiety that teachers encounter when they come across content or situations where they feel more like students themselves than confident educators. OFTs' believe that they are not well prepared or lack mastery in their subject areas, as shown in the following excerpts,

"I need to study and research in YouTube, Google, and others." (P2)

"It's like I am a student in science, struggling at first, much more in chemistry." (P3)

The participants feelings of inadequacy frequently lead them to seek out internet resources for self-directed study, which negatively affects their confidence and effectiveness as teachers. This is consistent with a study by Amasha et al. [35], which highlights how teachers trying to improve their content knowledge and teaching skills are increasingly depending on digital platforms like YouTube for professional development. It was then supported by the study by Aguirre and Mertz [36] that teachers find teaching students science subjects like chemistry, difficult, as well as the outcomes for the need for professional development.

These challenges encountered by out-of-field teachers are generally due to a lack of resources such as materials and apparatus, thus preventing the students from being exposed to hands-on learning experiences as an important tool for understanding scientific concepts.

Coping Mechanisms of Out-of-Field Teachers Employed to Address the Challenges they Face When Teaching Science Subjects

When out-of-field teachers are faced with challenges in teaching science subjects, they adopt coping mechanisms such as utilizing external resources, seeking professional development and support, as well as devising innovative and adaptive teaching strategies.

Theme 1: Utilizing External Resources

Out-of-field teachers often use external learning resource materials to integrate them into their lesson plans and improve their teaching strategies. Most of them are dependent on digital platforms just to supplement their teaching resources. These platforms offer readily available, advanced content to clarify complex scientific concepts, facilitate lesson planning, and provide students with the visual aids they need to understand the subject matter. However, they made sure that the internet sources they use in their classes are of good quality, relevant, and align with both student needs and educational goals, as evidence by the statements made by the participants,

"I search on YouTube, research, and read from the internet." (P1)

"I watch YouTube, research in Google and some ideas from the internet." (P2)

As per current research conducted by Aguirre and Mertz [37], teachers, especially those non-science teachers who have limited resources, often use the internet as their

guide in teaching. This includes the use of Google and YouTube to supplement their knowledge on a certain subject matter.

Aside from digital platforms, out-of-field teachers also utilize textbooks and other supplementary materials to help them facilitate effective teaching and learning. Thus, developing a deeper understanding and increasing the level of engagement among learners. Some participants stated,

"I go to YouTube, study it." (P4)

"We employed various strategies ...using supplementary resources or textbooks." (FGD)

Studies have consistently indicated the growing significance of digital resources such as YouTube in learning environments. For instance, Thompson's [38] research emphasizes how YouTube and other platforms offer adaptable learning choices that satisfy the requirements of different learners and boost engagement. Teachers see supplemental textbooks as crucial for providing comprehensive and varied teaching materials that support students' unique learning requirements in the classroom, according to Smith and Johnson's [39] research.

Theme 2: Seeking Professional Development and Support

The second theme delves into the challenges that the participants have when attempting to improve their teaching efficacy through professional development and assistance. It shows, per participants' accounts, that their access to resources, mentorship, and continuous training, which may enhance teaching strategies and student outcomes, is limited. Mentors are useful in addressing problems related to science teaching, even when out-of-field teachers' accounts of their experiences reveal limited opportunities for subject-area specialized training, insufficient administrative support, and a lack of mentorship.

Attending workshops and training sessions is an essential way for teachers to advance their careers. It gives educators the chance to improve their teaching techniques, pedagogical expertise, and subject matter expertise. By participating in workshops, educators can learn about innovative teaching methods, collaborate with colleagues, and get advice from professionals in related fields. The following quotes encapsulate this realization:

"There are seminars, sometimes, which I think of big help... I attended, in my 20 years of teaching, a few times only, and I see that it really helped me a lot." (P1)

"The respondents employed various strategies,...attending professional development workshops or training sessions, although limited." (FGD)

The replies from the teachers emphasize how professional development helps them at every stage of their employment and encourages ongoing development. They stress how crucial it is to keep investing in comprehensive professional development initiatives in

order to support educators and improve teaching methods. According to a well-established research in education, professional development helps to enhance teacher effectiveness, student engagement, and educational quality, as a whole [29,30].

Teachers perceived that by seeking support from seasoned mentors or colleagues, they may be able to exchange ideas, discuss best practices, and even get constructive criticism. In their interview responses, they state,

"If I'm not ashamed, I ask other teachers from other schools to help me specifically with topics, I find hard to understand." (P1)

"I really wanted to have mentors but then we are all non-science majors there teaching science." (P5)

According to Darling-Hammond et al. [29], peer collaboration improves professional development and the quality of instruction. Also, Banilower et al. [30] stress the importance of mentoring in improving teachers' pedagogical content knowledge and skills. The accounts emphasize the teachers' need for mentorship programs and a collaborative learning environment to improve their performance in teaching science.

Theme 3: Innovative and Adaptive Teaching Strategies

This theme focuses on innovative and adaptive teaching strategies employed by teachers to engage students effectively, particularly in subjects where they might lack the necessary teaching materials or specialized training. It underlines how important it is for instructional methods to be adaptive and flexible to satisfy the needs of diverse students and encourage a deeper understanding of scientific concepts. In their interview responses, participants stated.

"I make my own activity that levels to their understanding. Example, kinds of Volcanoes, I made an activity using sand." (P3)

"I innovate by myself. Good thing is that grade 7 is easy and it's engaging with the students." (P5)

The value of innovative techniques used by teachers, showed how unique and designed instruction may help students overcome challenges in learning, as reflected in the participants' teaching experiences. Studies reveal that teachers often resort to creating their own lesson plans and activities when they have fewer resources available to them [24]. According to research demonstrating the advantages of practical and hands-on learning approaches, this activity is crucial for enhancing scientific students' knowledge and engagement [23]. Additionally, innovative methods of instruction that adapt lessons to each student's needs are essential for improving scientific education and ensuring that all students have access to excellent learning opportunities [32].

Self-study and preparation are proactive measures that out-of-field teachers take to enhance their subject matter expertise and efficacy as educators through self-directed learning. It also represents self-directed learning in completing the gaps in professional development and supporting effective teaching strategies. As they stated,

"I can cope up through study, watching videos to the topic." (P3)

"So what I did, I study it." (P4)

Out-of-field teachers find pursuing self-directed learning and professional development important to overcome their lack of competence and confidence in science instruction. This is consistent with the study of Smith [39], which demonstrates how vital it is for teachers to utilize online resources, like videos, to comply with the competencies, thus increasing their teaching effectiveness. As mentioned by Johnson and Brown [40], self-study and independent learning help teachers improve their abilities in teaching to adapt to challenges they may encounter in the classroom.

Out-of-field Teachers Motivation to Continue Teaching Science Subjects Despite the Challenges they Encountered

The motivation of non-science teachers' are categorized into three themes: Passion and Calling, Professional Growth and Learning, and Student Appreciation and Impact.

Theme 1: Passion and Calling

The first theme centers on the motivation of teachers associated with passion and commitment to choose their careers as educators. Teachers looked into how their passion and sense of duty sustain them to impart knowledge, foster students' growth throughout difficult times, and build a solid foundation within themselves along with their duties and responsibilities.

The positive effects that science education has on students' lives and the intrinsic rewards that come from seeing their students' development, comprehension, and excitement for science help non-science teachers find personal fulfillment and meaning in their work. In spite of the difficulties they may encounter when teaching unfamiliar subjects, teachers view their role as influencing students' futures and encouraging a love of learning. The satisfaction that comes from witnessing students understand scientific ideas and grow as critical thinkers highlights the significant influence that educators have on molding the next generation of educated science people. As one of the interviewees said:

"Aside from the salary, it may be my passion. I think it's my calling... I like seeing my students saying they learned from me, and amazed.....I was overwhelmed when my student told me that I'm the reason why she enrolled BSEd Science... my teaching has a big impact on this student."(P1)

This anecdote describes the perception of the teacher's influence on the student's career aspirations and educational journeys, beyond imparting subject knowledge. In line with Participant 1's perspective, a study by Aguirre and Mertz [37] indicates that teachers frequently find intrinsic benefits in their work, such as personal satisfaction and a sense of making an impact in students' lives. The value of educators' impact beyond academic instruction is further supported by research by Smith and Johnson [41], which highlights the importance

of teacher-student connections in boosting student engagement and achievement.

Furthermore, out-of-field teachers perceived that student engagement and learning reflect on how motivated they are, citing the impact their teaching has on student engagement and learning outcomes in science subjects. It emphasizes how teachers find fulfillment in creating interactive and meaningful learning experiences that captivate students' interest and enhance their understanding of scientific concepts. These are expressed in their answers during the interview.

"The students themselves motivated me to go on teaching... They are the reason to go on teaching.....I witnessed that they also applied it in the real-world setting." (P1)

The participant's insights highlight how teachers' motives are shaped and how practical application of knowledge enhances their efficacy when teaching science. Research by Smith and Johnson [42] examines how teachers' views of student involvement and application of knowledge have a beneficial impact on their commitment to teaching and job satisfaction. This is further supported by research by Darling-Hammond et al. [29], which shows how teacher satisfaction and morale are greatly boosted by meaningful learning experiences and student achievement.

Theme 2: Professional Growth and Learning

This theme emphasizes the ongoing acquisition of knowledge and abilities required for both professional and personal growth. It highlights the importance of lifelong learning, adaptability, and the proactive acquisition of new competencies to stay relevant in an ever-evolving job market. It includes formal education, mentoring, on-the-job training, and efforts for self-directed learning.

Emphasis is placed on the transforming effect of teaching on the person imparting the information for personal growth through teaching. Individuals can acquire self-assurance, improve their capacity for critical thought, and discover a greater sense of meaning and fulfillment through the teaching process. Additionally, teaching promotes a mutually beneficial learning environment in which the sharing of knowledge and experiences benefits students as well as teachers, advancing both parties' general development on both personal and professional levels. As stated,

"I still continue to teach... it's like a challenge to myself... I'm also learning." (P2)

"When I attended a training once about science, I realized that science is really fun." (P4)

These claims are consistent with a study by Huang and Hsu [43], which found that teachers who participate in professional development activities report having improved their material knowledge and teaching skills, both of which benefit their students. Furthermore, a Smith and Lewis [44] study discovered that subject-specific professional development programs help rekindle teachers' enthusiasm for their subjects, resulting in more creative and enthusiastic teaching methods.

Moreover, the theme also highlights the importance of

collaborative teaching techniques to enhance instructional practices and student outcomes. By sharing ideas and innovative approaches, teachers may be able to adopt best practices, integrate innovations, and implement distinctive teaching strategies that are designed based on the needs of the students. From one of the participants,

"The love of teaching and sharing my knowledge... I can assess myself that, wow! even when it's not complete and my experiments were not that fancy, they appreciated it.....they appreciated the activities I gave them because it was new to their experience." (P3)

The out-of-field teacher's statement is in line with the study on the benefits of feedback and creativity in the classroom [45]. This makes learning more engaging and relevant, where teacher implementors see an increase in student engagement and motivation [45]. Also, the essence of student-feedback and teacher-reflection in professional development is highlighted because teachers who proactively respond to students' input are better capable of adapting their lessons according to their needs and preferences, respectively [46].

Theme 3: Student Appreciation and Impact

This theme emphasizes how educators can be inspired, feel more satisfied in their work, and have their teaching techniques validated by their students' professions of gratitude and positive responses. It also looks at how students and teachers have an equal connection in which teachers' efforts have a big impact on students' growth and learning. Students' appreciation acts as a strong motivator for teachers to keep coming up with new ideas and giving all to their work.

Affirmation and curiosity of students examines the dual role of student feedback and inquisitiveness in shaping effective teaching practices and fostering a dynamic learning environment and how positive reinforcement and validation from students can boost teachers' confidence, motivation, and sense of accomplishment. Simultaneously, the natural curiosity of students drives educators to continuously seek new knowledge and innovative teaching methods to satisfy and stimulate their learners' interests. As the participants expressed,

"It's the students, the way they affirm and their eyes were so curious and amazed every class, that motivates me to still continue." (P5)

"What motivates are the students... their curiosity and eagerness to learn." (FGD)

Out-of-field teachers perceive student engagement as inspiring, and emphasize its importance in educational settings. This is supported by a study on the positive influence of student motivation and interest on teachers' job satisfaction and commitment to their profession [47]. When students exhibit curiosity and eagerness to learn, it not only validates educators' efforts but also fosters a dynamic and rewarding classroom environment [48]. This mutual interaction between teacher and student motivation creates a positive feedback loop, enhancing the overall educational experience and promoting continuous improvement in teaching practices [49].

A sense of responsibility drives non-science teachers to feel accountable for their students' learning and well-being. This subtheme underscores the ethical and professional commitment teachers have to provide quality education, foster a supportive learning environment, and guide their students' academic and personal growth. It highlights how a strong sense of duty can influence teaching practices, encouraging educators to go above and beyond to meet their students' needs. This sense of accountability not only helps teachers feel fulfilled personally and professionally since they can see the results of their hard work and dedication. As stated,

"We do not have a choice so we strive so our students can still learn from us." (FGD)

This is consistent with the significant role that educators' sense of accountability plays in student achievement. High student level of engagement and effective teaching practices are common among those teachers who possess a strong sense of professional responsibility [50]. Furthermore, Day and Gu's [51] research indicates a significant relationship between teachers' moral and ethical obligations, with their resilience and ability to overcome challenges in the classroom. The studies mentioned support the experiences shared by the FGD participants, which demonstrate their strong sense of responsibility driven to overcome challenges, thus resulting in a more productive and fulfilled teaching and learning process.

Support Needs of Out-of-field Teachers in Order to Effectively Teach Science Subjects

The following themes describe the support needed by out-of-field teachers to teach science courses effectively: 1) Access to Resources and Equipment, 2) Professional Development and Training, and 3) Mentorship and Collaborative Support.

Theme 1: Access to Resources and Equipment

Accessibility to resources and equipment is one of the out-of-field teachers perceived support needs to improve their efficacy of instruction. This includes technology, laboratory equipment, and measurement tools. The participants mentioned the difficulties they faced, specifically, obsolete or insufficient resources and equipment, and how these difficulties hindered hands-on learning, and student participation, as well as the whole educational process. As they conversed,

"Due to the fire, we do not have materials anymore. That's why it is more on theoretical, no application." (P1)

"We need a complete science instruments, apparatus, materials to use in hands-on experiments, especially microscopes." (P3)

This showed that teachers are forced to rely largely on theoretical instruction when they lack the essential tools, which can lower student engagement, comprehension, and excitement in science. The participants' worries about the effects of inadequate science equipment on instruction are supported by recent studies. Smith and Jones [42] claim

that having access to the right scientific equipment greatly improves students' learning experiences by enabling them to carry out experiments and see phenomena with their own eyes, which improves their memory and comprehension of scientific concepts. In addition, a study conducted by Lee and Chen [52] discovered that students performed better and showed greater interest in science courses in schools with well-equipped science labs than in those with limited resources. Based on participant experiences and the requirement for sufficient resources to enable effective science teaching, these studies show that investing in science equipment is essential to creating an interactive and engaging learning environment.

To teach science properly, teachers need the right teaching resources. Textbooks, lab guides, visual aids, and digital materials that enhance learning objectives fall under this category. Sufficient instructional resources are necessary to clarify difficult scientific ideas, involve students in interactive learning, and promote a thorough comprehension of the material. The availability of these resources has a direct impact on teachers' capacity to create engaging lesson plans, carry out research, and deliver high-quality instruction. Lack of teaching resources could make it difficult for teachers to convey material in a relevant and interesting way, which could affect students' interest in and performance in science. As stated by participants,

"There'll be assistance from DepEd like providing us the materials for this topic, or learning competency-based seminars." (P5)

"We're in need of more resources, textbooks, and materials." (FGD)

The findings of the study were consistent with current research highlighting the role that resource availability has in educational attainment [36,41]. Adequate teaching resources are essential for successful instruction and student engagement, especially in resource-intensive topics like science [36]. Similarly, Smith and Johnson [41] point out that instructors' instructional capabilities and confidence are greatly increased by professional development opportunities such as competency-based seminars. These investigations support the experiences of the participants and show how important well-resourced learning environments are for promoting efficient teaching and learning.

Theme 2: Professional Development and Training

Using organized learning opportunities, this theme focuses on the ongoing development of teachers' abilities and knowledge. It presents the need for continuous professional development initiatives and training sessions that will provide out-of-field teachers with the most recent innovations in technology, subject matter expertise, and pedagogy. Teachers who get effective professional development believe that they are able to improve student learning outcomes, improve their instructional techniques, and feel more confident.

Giving teachers specialized training for the areas they teach requires content-specific training. Through focused professional development opportunities, teachers' subject matter competence and teaching skills are improved,

assisting teachers in gaining a deeper comprehension of the curriculum, keeping up with industry advancements, and learning pedagogical approaches unique to their subject matter. As they expressed,

"I really need content-based training, and also materials and equipment/apparatus so I may conduct laboratory experiments in our class." (P2)

"I have received training, yes, but only a few. Of these few, only minimal engage specifically with science teaching." (P3)

This suggests that although there are chances for professional development, there is an urgent need for science instructors to receive more thorough and content-focused training. This need is supported by research, since teachers' instructional practices and students' outcomes in scientific education are greatly improved by content-specific professional development [29]. Furthermore, Desimone and Garet [53] stressed that consistent, topic-specific training improves teachers' expertise, which improves student engagement and performance. These studies demonstrate how important it is for teachers to get targeted professional development in order to close the gap between their existing methods and the requirements of good scientific instruction.

Out-of-field teachers express initial orientation programs and continuing technical assistance as a need, as well as providing educators with the skills and knowledge they need to implement new curricula successfully, make use of educational technologies, and handle challenges in the classroom. Teachers are usually introduced to new pedagogical approaches and resources during the orientation of new curricula, but ongoing support and technical assistance provided to guarantee successful teaching practices are limited, if not absent. As mentioned,

"We also received professional development, but then again it was selective and limited. Also, if we received equipment and apparatus, but we do not know how to use them." (P1)

"We're interested in participating in professional development programs, or communities focused on supporting non-science-specialized teachers in teaching science." (FGD)

These are in line with research that highlights the importance of specialized professional development in raising teacher effectiveness and improving student outcomes [54]. Studies also show how crucial it is to provide teachers with continual training and assistance to enhance their confidence and methods of education, especially when it comes to more specialized subjects like science [55]. By addressing these gaps with focused programs, non-specialist instructors can be better equipped to teach science, which will eventually improve student learning outcomes and experiences.

Theme 3: Mentorship and Collaborative Support

This theme shed light on the need for the existence of collaborative support networks and mentorship connections to help non-science teachers who are new to a subject area by offering them support, professional growth,

and encouragement. Mentoring is the process by which seasoned educators assist beginners in developing their teaching abilities and self-assurance in teaching science by providing advice and insights. Collaborative networks, such as peer learning groups or communities of practice, enable teachers to share resources, best practices, and information.

Mentorship programs may organized efforts intended to offer direction, assistance, and chances for professional growth to non-scientific instructors who are assigned to teach science courses. Through these programs, novice teachers are paired with more seasoned mentors who provide guidance, support, and advice. In this context, mentoring programs may close the knowledge gap in science education by assisting educators in developing their mastery of the subject matter, their use of instructional methodologies, and their ability to lead a classroom. As individuals stated,

"As I'm new, same with others, materials, lesson plans, more training and seminars, and then a group or mentors so I may ask them." (P4)

"Someone you can learn from about the topic, specifically the content because I'm not confident with the new topics in the new curriculum, they are so hard." (P5)

The researchers' findings indicated that mentorship plays a role in helping educators adjust to new teaching environments and boost their confidence and competence in providing high-quality education. Han and Weiss's [56] study found that mentorship significantly contributes to the professional development of new teachers by offering opportunities for reflective practice, practical guidance, and emotional support. The study conducted by Wang and Odell [57] brought to light the importance of mentors in enhancing the instructional practices and pedagogical topic knowledge of new teachers.

Additionally, this theme emphasized how teachers can gain a great deal from the available tools, and inspiration offered by administration and peer mentorship, when they experience challenges in teaching subjects that are not familiar to them. Peer mentorship is a cooperative approach where seasoned colleagues share their knowledge and expertise, thereby developing a sense of camaraderie among teachers. Administrative assistance, on the other hand, is needed to make sure that teachers have the adequate resources, opportunities for professional development, and logistical support, to teach science subjects effectively. These are clear from the participants' responses:

"Also, typical support or technical assistance, from the administrators. Lucky to those who have received technical assistance." (P1)

"We also recognized the importance of online training and preferred features such as content-focused learning and active learning." (FGD)

Recent research highlighted strategies and support systems that could possibly impact educational contexts. For instance, Zhang and Liu's [58] research demonstrated that student outcomes and teacher effectiveness can be significantly enhanced by addressing issues on limited

resources, and providing technical assistance and support. Furthermore, a study by Brooks and King [59] showed the effects of training for professional development to meet the particular needs and preferences of teachers.

4. Conclusion

This study explored the experiences of out-of-field teachers in Western Mindanao following the tenets of qualitative research and interpreted themes that highlight the challenges out-of-field teachers faced, the strategies they used to cope, the motivating experiences that drove them to continue teaching science despite not being specialists, and the needs expressed to support and improve science teaching.

Out-of-field teachers perceived instructing science courses as challenging considering the lack of resources and support, insufficient training and background, and teaching effectiveness and confidence issues. These challenges not only contribute to a lower standard of education but may also pose detrimental effects on student performances.

The coping mechanisms employed by non-science teachers when faced with challenges include the utilization of external resources, seeking professional development and support, and integrating innovative and adaptive teaching strategies.

To overcome challenges they encountered, the non-science teachers are motivated through their passion and calling, professional growth and learning, and student appreciation and impact.

Non-science teachers need the following support in order to teach science subjects effectively: access to resources and equipment; professional development and training; and an understanding of the importance of mentorship and collaborative support.

Although the study did not include a large number of participants, it followed a credible qualitative procedure and highlighted transferable results; thus, shedding light on the lived experiences of out-of-field teachers teaching high school science subjects within the context of Western Mindanao.

5. Recommendation

Thus, it is recommended to invest in science equipment, increase training opportunities, and establish trustworthy mentorship programs and peer collaborative support in schools and districts with out-of-field teachers teaching science subjects with similar challenges in context. This may help improve the delivery of science in teaching and learning among non-science teachers.

Out-of-field teaching may only be considered a last resort where no alternative exists in cases where non-specialists encounter similar experiences with the study's subjects. Inductive training specific to science teaching may be required before placing newly-hired non-science teachers in schools that may assign them science teaching responsibilities. Although non-science teachers with experience can handle situations and remain motivated, newly-hired teachers may find it more challenging.

Non-science teacher-participants in this study should be placed in a comprehensive intervention program. This can be achieved by setting up an online platform or community that encourages peer interaction and offers readily available mentoring. As they gain coaching, the space will enable the sharing of resources between science professionals and non-science teachers, encouraging communication and idea sharing. Additionally, by promoting collaboration, teachers would be better equipped to handle difficulties and look to their colleagues for solutions to the problems at hand. The training can be integrated into the community to improve the pedagogical expertise and subject matter that is taught when teaching science.

ACKNOWLEDGEMENTS

The authors would like to express their deepest gratitude to the participants, and Department of Science Education, University of Science and Technology of Southern Philippines for the support extended to finally complete this study.

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