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Teaching Strategies in Science: Uncovering Competence of Teachers

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Abstract. This study uncovered the teaching strategies of Tudaya Elementary School, Sta. Science teachers. Cruz North District. It aimed to draw significant information on teachers' strategies, challenges, coping mechanisms, and insights into enhancing their competence. Ten (10) teachers participated in the study. This study used a phenomenological approach to extract the participants' ideas. The in-depth interview was employed to gather some information about their respective experiences. Using the thematic analysis, the following themes emerged: the teaching strategies of Science teachers delved into heightened student engagement, development of critical thinking proficiency, and tailored differentiation for personalized learning. The coping mechanisms of teachers in addressing challenges captured the themes of being resilient and solution-focused, starting with a hook and adaptive teaching and differentiation. The insights drawn from the study's findings focused on continuous learning, collaborative learning communities, and supportive school culture. The study showcased that employing diverse teaching strategies significantly enhances teacher's competence. It highlighted the importance of a versatile skill set for effective science instruction. Educators and educational institutions should tailor professional development programs to encompass a variety of teaching strategies.

KEY WORDS
1. Teaching strategies 2. competence 3. differentiation 4. critical thinking proficiency
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1. Introduction

A good level of teachers' competence can realize the educational purpose and policy in the assessment. This assessment process requires all subject teachers to be implementers to collect evidence about student learning. Teachers' competence includes demonstrating the successful use of the knowledge/skills by modeling to the students. The teacher evaluates student acquisition. If necessary, the teacher provides remedial opportunities for acquiring the knowledge/skills. In this regard, science concepts use techniques. They can use prior conceptions and student interests to promote new learning—resources for instruction- and the students will be able to develop and apply science principles in and out of school. In the global, professional competence may offer a third route to understanding teacher success. Based on definitions from several domains, competence can be defined as the skills, knowledge, attitudes, and other variables that form the basis for mastery of specific situations (Epstein Hundert, 2002; Klieme et al., 2008)).

According to this approach, skills, knowledge, and attitudes are not innate but learnable and, thus, teachable. Teachers' professional development should be redefined for sustainability. Education's aims change very quickly depending on the demands of the era, which require more capability. These demands directly affect the educational system. Teachers are responsible for operating the educational system, and they need strong and efficient professional competencies (Kress, 2013). Building science competence is the ability to do something, whether it is a simple task or complex analysis, with accuracy, efficiency, and reliability. Competence has an important influence on meta-cognitive ability. Competence can be thought of in several different ways; how we view competence significantly shapes how competency standards are used and assessed. As the performance of tasks is something that can be readily described, the common sense but naive view of competence equates it with the successful performance of a set of discrete tasks. Competency standards are then thought of as objective descriptions of the set of tasks. Competence denotes the ability to do something or the ability for a task. Many policymakers around the world have tried their best to revise and improve science education by altering the curriculum based on the perception that creating a new curriculum will influence teachers to shift from their traditional routines in the classrooms, making students learn far better in science (Cuban, 2012). To cope with global challenges in science education experienced by many countries worldwide, especially the Philippines, reforms in education are continually occurring (Canakan, 2017). The general perception of science in the Philippines and the aforementioned predicaments of Philippine education severely limit how most public schools can teach science to their students. The lack of classrooms limits the conduciveness of lectures to students; public schools that lack classrooms oftentimes compensate by holding classes at their multipurpose gymnasiums, with their makeshift classrooms separated only by curtains. Students there can hear the chatter all over the place and end up listening not only to their teacher's lecture but also to the lecture from the adjacent classroom. Textbooks and learning materials are also critical. If they are bland and unengaging, how can students flip through their pages with interest? The lack of laboratories also damages the quality of education, limiting teachers to lectures and reporting activities for students instead of lab experiments that show how the concepts work in real life. Filipino students are bombarded with theories and terminologies, which are not necessarily the things that make science exciting. Scientists do not memorize and regurgitate information; they ask questions, predict outcomes, and perform experiments. With these limitations in science teaching, one cannot help but wonder how our countrymen perceive science. The average Filipino who does not work in a science-related industry has likely never related the concept to his or her everyday life. The word 'science' itself seems distant and elusive, only being applied to people who spend most of their days in the lab or in the classroom. When you hear the word 'science', what comes to mind? Probably, it's a bunch of concepts from biology, such as evolution or the oft-repeated statement that "the mitochondria is the powerhouse of the cell." Regarding chemistry, you might remember mixtures, compounds, and elements. In physics, you would probably imagine a blackboard full of equations and symbols, with Albert Einstein patiently and painstakingly trying to make you understand them. Although Science teachers are equipped with the necessary competencies, they need to improve their knowledge, attitude, and skills to enhance, improve, and explore their teaching practices, especially in handling today's 21st-century learners. This study endeavors to appreciate teachers' strategies for building Science competence. To know whether

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the teachers' strategies or motivation has created an impact on the students in delivering his or her science lesson. This study is conceptualized in this premise, and so far, I have not yet encountered research that deals with teachers' strategies for building Science competence. The researcher wanted to discover strategies for teaching science to uncover teachers' competence. Thus, this study finds meaning and significance.

1.1. Purpose of the Study—The study of this phenomenological inquiry explores teachers' experiences in employing different strategies while teaching Science, which is one way of uncovering their competence. In particular, the study unfolds and conceptualizes strategies and motivation to make Science lessons productive and innovative. At the outset, this research also considers how to find ways when laboratory materials and equipment are not available where. Science is known as the systematic study of the structure and behavior of the physical, social, and natural worlds through observation and experimentation. Including its key to innovation, global competitiveness, and human advancement. Moreover, this study aims to uncover teachers' challenges in teaching Science. It should take into account both the distinct advantages and their possible disadvantages. Henceforth, this study endeavors to develop insights from the findings of the information data gathered. The insights drawn from this study are helpful in contributing propositions for the reasonable and logical implementation of teachers' strategies to develop their competence.

1.2. Research Questions—They aim and guide to explore the lived experiences of teachers' strategies to develop their competence, including the challenges that they encounter. This study sought to answer the following research questions:

(1) What are the teaching strategies of science teachers to enhance their competence?
(2) How do teachers cope with enhancing their science competence?
(3) What educational management insights can be drawn from the findings of the study?

1.3. Definition of Terms—To fully understand the terms used in this study, the following are defined operationally: Teacher Strategies are key actors who shape the learning environment and whose main tasks include motivating students to learn. Teachers can differ in the way in which they try to motivate students to learn and their motivational strategies, as well as in how teachers' personal beliefs and contextual factors relate to their self-reported autonomy-supportive or controlling motivational strategies. Science Competence refers to the ability and willingness to use the knowledge and methodology employed to explain the natural world, identify questions, and draw evidence-based conclusions. Competence in technology is viewed as applying that knowledge and methodology in response to perceived human wants or needs.

1.4. Significant of the Study—This study may find significance in the following: Department of Education. Ensure the significance and relevance of teachers' strategies in developing their science competence. DepEd would implement motivating strategies for teachers, which may be directed at individual students or the whole class; motivational efforts may be in their design of the classroom environment, direct intervention, or explicit instructional and interpersonal strategies. Persistent in the pursuit of Science competence across curriculum learning areas. This study may contribute to the department's aspiration to help teachers guide their

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students' learning. This study may serve as a reference to the department in enhancing the teachers' strategies in learners learning towards the impact of science competence. School administrators. This study may help school heads design teacher training that furthers their science competence while guiding their learners. The findings may serve as a reference in creating strategic proposals for teachers to develop their student-responsiveness in building Science competence. Teachers are the one who understands the potential and the needs of students. An ideal result of teachers' motivating efforts is the individual student's intrinsic and self-regulated motivation. Effort is intrinsic when student learning is driven from within, and it is self-regulated when the student plans, monitors, and adapts reasons, choices, and actions systematically to optimize learning. The teacher takes responsibility for monitoring the learners' progress, designing classroom activities, setting grading policies, and facilitating the classroom's operation. Students have a great deal of control over their motivation. However, teachers, administrators, and the school system's culture and climate also profoundly influence students' self-perceptions related to their motivation. As recipients of the teachers' strategies, a peer-supportive environment was characterized by students doing their best work and caring about learning. This study may widen the students' perspectives on the essence and purpose of science subjects. It may help broaden their commitment to learning by working independently and collaborating intensely with others.

1.5. Theoretical Lens—According to the principles of Jerome Bruner's Theory (Bruner, 1977), instruction comes in three ways these are readiness, in which the Instruction must be concerned with the experiences and contexts that make the student willing and able to learn; spiral organization, which the Instruction must be structured so that the student can easily grasp it and last but not the least is the principle that going beyond the information given in which Instruction should be designed to facilitate extrapolation and or fill in the gaps. The spiral progression approach has main philosophies: constructivism, progressivism, and behaviorism. A major theme in the theoretical framework of Bruner is that learning is an active process in which learners construct new ideas or concepts based on their current/past knowledge. Regarding instruction, the instructor should encourage students to discover principles by themselves and engage in an active dialog. The curriculum should be organized in a spiral manner so that students continually build upon what they have learned. Teachers' competency in teaching secondary science with the spiral progression approach can be achieved through assessment of science teachers' competence in teaching Secondary Science with Spiral Progression Approach and comparing the relationship of the profile of the teacher to the teachers' competency by the profile of the teachers and teachers' pedagogy in teaching science with Spiral Progression Approach. This study was also anchored on the Building System Theory. Modern systems theory is an expansive body of knowledge with many branches. A system is an integrated assembly of interacting elements designed to carry out a predetermined function cooperatively (Gibson, 1960). A system is an integrated network of interacting elements, receiving certain inputs and producing specific outputs, given certain constraints (Chappelle, 1966). Systems theory, at its fundamental level, is a belief that the world comprises a set(s) of interacting components and that those sets of interacting components have properties that do not exist within any of the smaller units when viewed as a whole. A systems approach is es-

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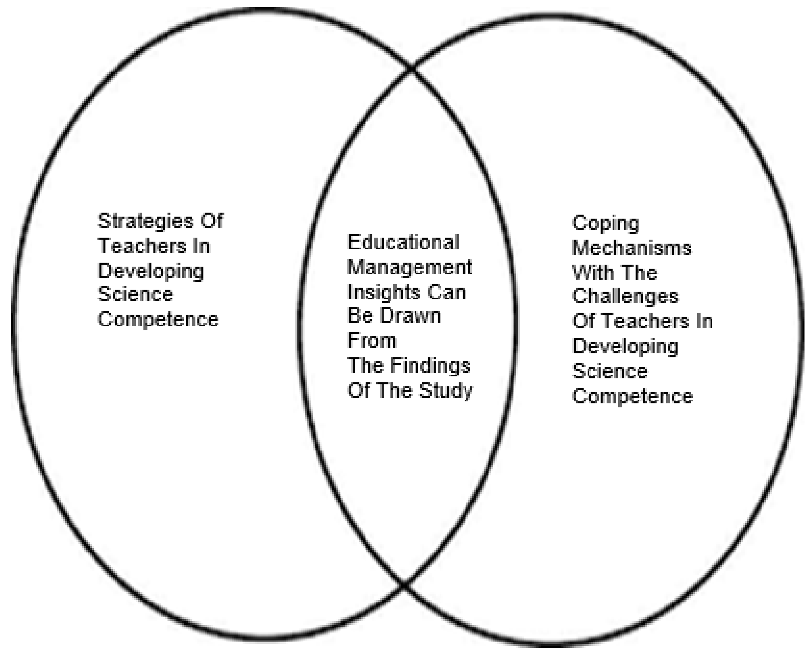

Fig. 1. The Conceptual Framework of the Study

sentially a way of organizing observations, a way of thinking about related objects and processes, a way of talking about (labeling) the parts (components) of a system, and an outcome from systematically considering systemic phenomena. Systems thinking is essential to building science because it helps simplify problems by classifying them according to standard types. There were millions of buildings, and their diversity would be overwhelming were it not for the systems approach. This approach is derived from general systems theory, and the basic characteristics common to all systems are essential to keep in mind when applying building science(Allen, 1996). The idea of the building as a system springs from modern systems theory and the application of building science principles to building behavior and performance. The building as a system concept is a relatively new development in building science. It resulted directly from introducing a systems approach to building science practice in the 1960s. Establishing a collaborative and innovative environment within educational institutions is paramount for fostering teacher competence, particularly in science. By investing in supportive ecosystems that encourage collaboration, experimentation, and sharing of best practices, educational managers can elevate the quality of science education. Shown in Figure 1 is the interconnection between the two research questions, the Strategies of teachers in developing science competencies, and the coping mechanisms with the challenges of teachers in developing science competence that would result in the common denominator, which is insights learned from the experiences of educational management insights can be drawn from the findings of the study. A good level of teachers' competence can realize the educational purpose and policy in the assessment. This assessment process requires all subject teachers as an implementer to collect evidence about student learning.

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2. Methodology

This chapter presents the method, research participants, data collection, role of the researcher, data analysis, trustworthiness of the study, and ethical considerations. This study explores facts and knowledge that necessitate the consequent design and implementation, as this chapter elaborates.

2.1. Philosophical Assumptions—The philosophical assumption is a framework used to collect, analyze, and interpret the data collected in a specific field of study. It establishes the background used for the following conclusions and decisions. Typical philosophical assumptions have different types and are elaborated below. Ontology. This part of the research pertains to how the issue relates to the nature of reality. According to Creswell (2012), reality is subjective and multiple, as seen by the study participants. The ontological issue addresses the nature of reality for the qualitative researcher. The reality was constructed by individuals involved in the research situation. Thus, multiple realities exist, such as the realities of the researcher, those of individuals being investigated, and those of the reader or audiences interpreting the study. In this study, the researcher relied on the voices and interpretations of the participants through extensive quotes and themes that reflected their words and provided evidence of different perspectives. The participant's answers to the study were coded and analyzed to build and construct the commonality and discreteness of responses. The researcher carefully coded the participants' responses to ensure the reliability of the result. The researcher upheld the authenticity of the responses and prohibited personal bias as the study progressed. Epistemology refers to awareness of how knowledge claims are justified by staying as close to the participants as possible during the study to obtain firsthand information. Guba and Lincoln, as cited by Creswell (2012), state that, on the epistemological assumption, the researcher would attempt to lessen the distance between themselves and the participants. It was suggested that, as a researcher, it was expected that time was spent in the field with participants, and the researcher would become an 'insider'. It is assumed that the researcher established a close interaction with the participants to gain direct information that shed light on the knowledge behind the inquiry. Axiology refers to the role of values in research. Creswell (2012) states that the role of values in a study was significant. Axiology suggests that the researcher openly discuss values that shape the narrative and include their interpretation in conjunction with participants' interpretation. The researcher upheld the dignity and value of every detail of information obtained from the participants. The researcher understood the personal and value-laden nature of the information gathered from the study. The researcher preserved the merit of the participants' answers and carefully understood the answers in the light of the participants' interpretation. Rhetoric meant reporting reality through the eyes of my research participants. The researcher used personal voice and qualitative terms such as credibility, transferability, dependability, and conformability instead of internal and external validity and objectivity. Patton (2000) defined phenomenology as an inquiry that asks," What was the structure and essence of the experience of his phenomenon for these people? This research study aimed to work well with this definition in trying to understand the teachers' experiences in employing teaching strategies to build their competence. Guba (2007) pointed out that the researcher needs to prepare for an investigation greater in depth and breadth than the offered description implied. He suggested that the information be viewed as" the tip of the

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iceberg." The researcher implemented the qualitative research method of phenomenology to explore the teachers' experiences, particularly the strategies and challenges they faced in developing their science competence. Burns and Grove (2003) stated that phenomenology was a philosophy, an approach or perspective to living, learning, and doing research. Phenomenological research aims to capture lived experiences, find meaning that may or may not be known to the person who experienced them, and describe the phenomenon through a composite narrative. For the qualitative researcher, the only reality was the reality of the participants involved in the research situations constructed.

2.2. Qualitative Assumptions—A phenomenological approach was chosen for this study, using qualitative methodology. This study used an in-depth interview. The researcher conducted the interview using an interview guide made by the researcher, which the participants answered based on their experiences and practices related to this study. An in-depth interview is a qualitative research technique involving intensive individual interviews with a few respondents to explore their perspectives on a particular idea, program, or situation (Boyce Neale, 2006). Interviews were primarily done in qualitative research and occur when researchers ask one or more participants general, open-ended questions and record their answers. A phenomenological approach was used to gain a broader insight. Phenomenology was an approach to qualitative research focusing on the commonality of a lived experience within a particular group. The fundamental goal of the approach was to arrive at a description of the nature of the particular phenomenon for investigatory inquiry. (Creswell, 2013).

2.3. Design and Procedure—The study utilized a qualitative research method employing a phenomenological qualitative design. According to Lester, phenomenological research was concerned with studying experiences from the individual's perspective, "bracketing" taken-for-granted assumptions and usual ways of perceiving. The phenomenological approach was based on a paradigm of personal knowledge and subjectivity. It emphasized the importance of personal perspective and interpretation. Thus, it was powerful for understanding subjective experiences, gaining insights into participants' motivations and actions, and cutting through the clutter of taken-for-granted assumptions and conventional wisdom. Qualitative research was mainly associated with words, language, and experiences rather than measurements, statistics, and numerical figures. It refers to the inductive, holistic, epic, subjective, and process-oriented methods used to understand, interpret, describe, and develop a theory on phenomena or settings. It was a systematic, subjective approach to describing life experiences and giving them meaning (Burns Grove, 2003). The phenomenological research design selected in this study was used to collect data on the strategies and challenges of teachers in developing their science competence. This research approach deepened the understanding of nature and the meaning of everyday experiences. According to Corbetta (2003), the phenomenological research design is a qualitative type of research for which interviews provide an in-depth method that can grant access to deep knowledge and explanations and help to grasp the subject's perspective. Bryman (2012) posited that personal and detailed stories could be told through interviews or face-to-face discussions, focusing on how the interviewee understands and explains different phenomena.

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The researcher aimed to draw an in-depth study of the teachers' lived experiences as to their strategies and challenges in developing science competence. Qualitative research was interested in understanding how people interpret their experiences, how they construct their worlds, and what meaning they attribute to their experiences" (Merriam, 2009). This form of research will provide a deep understanding of the subject and results in enhanced explanatory power. The researcher becomes "a part of the world they study; the knower and the known are taken to be inseparable" (Hatch, 2002). Because of the researcher's involvement, however, "much qualitative research is subjective. . . " (Wrench, Thomas-Maddox, Richmond, and McCroskey, 2008) Bloomberg and Volpe (2008) described qualitative research as "idea generation." Its design was proposed up front, but it is open and emergent rather than rigid and fixed to permit exploration. It purposefully used small samples. It takes place within natural contexts, and real-world situations are studied as they unfold. Its framework allows for flexibility and creativity. The qualitative research explored and described teachers' strategies and challenges in developing science competence. The research technique used was a modified van Kaam method described by Moustakas (2000) based upon recorded and transcribed interviews using semi-structured questions to capture the teachers' experiences on the strategies they have used and the challenges they have encountered to develop competence. Specifically, phenomenology was the study of the subjective experiences of others. It researched the world through another person's eyes by discovering how they interpret their experiences. It describes the meaning of the lived experiences of several individuals about a concept or a phenomenon. Phenomenology explores the structures of consciousness in human experiences, as Polkinghorne (2000) noted. This involved procedures which the qualitative researchers should follow. First, the researcher wrote research questions that would explore the meaning of life experiences for individuals and asked individuals to describe these experiences. The researcher collected data from individuals who had experienced the phenomenon under investigation, typically via lengthy interviews. Next, the data analysis involved horizontalization, which extracted significant statements from transcribed interviews. The significant statements were transformed into clusters of meanings according to how each would fall under specific psychological and phenomenological concepts. Moreover, these transformations were tied up together to make a general description of the experience – both the textual description of what was experienced and the structural description of how it was experienced. The researcher incorporated the meaning of the experience here. Finally, the report wrote such that readers understand better the essential, invariant structure of the essence of the experience. Conversely, several challenges have been pointed out. The researcher required a solid grounding in the philosophical guidelines of phenomenology. The subjects selected in the study were individuals who had experienced the phenomenon. The researcher needed to bracket their own experiences and observations, which was difficult. The researcher also needed to decide how and when their observations were incorporated into the study. Accordingly, Hycner, (2008) phenomenology in business research studies ideas were generated from the abundant amount of data using induction and human interests, as well as stakeholder perspective may have their reflection on the study. A study exploring science teaching strategies among teachers via conducting in-depth interviews was a relevant example for research with a phenomenology philosophy. Advantages associated with phenomenology include a better understanding of meanings attached by people and its contribution to developing new theories. Its disadvantages include difficulties with

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analysis and interpretation, usually lower levels of validity and reliability compared to positivism, and more time and other resources required for data collection (Hycner, 2008). Similarly, Schutz (2010) stressed that the purpose of the phenomenological approach is to illuminate the specific to identify phenomena through how the actors perceive them in a situation. In the human sphere, this translates typically into gathering 'deep' information and perceptions through inductive, qualitative methods such as interviews, discussions, and participant observation and representing it from the perspective of the research participant(s). Phenomenology is concerned with the study of experience from the perspective of the individual, 'bracketing' taken-for-granted assumptions, and usual ways of perceiving. Epistemologically, phenomenological approaches were based on the paradigm of personal knowledge and subjectivity and emphasized the importance of personal perspective and interpretation. As such, they were dominant in understanding the subjective experience, gaining insights into people's motivations and actions, and cutting through the clutter of taken-for-granted assumptions and conventional wisdom. The researcher aims to employ phenomenological methods of qualitative research since the focal point of this study is to investigate and explore the teachers' experiences in developing science competence.

2.4. Research Participants—The key informants of this study were the elementary grade teachers of Sta. Cruz, North District, Division of Davao Del Sur. The researcher utilized ten (10) Science teachers for qualitative participants in an in-depth interview (IDE) randomly selected from the different grade levels of Tudaya Elementary School under Sta. Cruz, North District. Data were collected through the one-on-one interview process and qualitative survey instruments. The researcher utilized the purposive sampling design since the participants were chosen based on the criteria or purpose of the study. It was also known as judgmental, selective, or subjective sampling. The selection of the participants was purposefully done to ensure that the findings were authentic (Marshall, 1996).

2.5. Ethical Considerations—Ethical considerations were of paramount importance in the design of this research study. The researcher needed to consider several ethical issues about the research participant groups addressed in this fieldwork. Ethical considerations can be specified as one of the most critical parts of the research. The researcher must also adhere to promoting the aims of the research, imparting factual knowledge, truth, and prevention of error. Social Value In this study, the researcher focused on teachers' strategies and the challenges they encountered while developing their science competence. Thus, the social problem that pushed the researcher's interest was the challenges the teachers encountered while developing their science competence. This study could serve as a basis for the higher authorities to create more programs and resolutions from which classroom teachers could benefit. Informed Consent, gaining the trust and support of research participants is critical to informed and ethical academic inquiry and phenomenological research (Walker, 2007, as cited by Pellerin, 2012). All participants were given an informed consent form before scheduling the interviews and participating in the phenomenological research process. Each participant was required to provide a signed personal acknowledgment, consent, and an indication of a will-

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ingness to participate in the study release. The purpose of the informed consent letter was to introduce the research effort, provide contact information, articulate the study's intent, request voluntary participation by the recipients, and identify the anticipated information that the informants are expected to provide. All participants were then required to sign and return the consent letter to the researcher before participating. In the conduct and practice of this study, the Treaty Principle of Participation, as cited by McLeod (2009), was adhered to. The invitation to participate will ensure that participation in the research is entirely voluntary in nature, and based on an understanding of adequate information. The participant recruitment and selection were lodged in the appendices of this study. The Vulnerability of Research Participants in this study were deemed capable of answering the research instrument because they were all professional teachers in public elementary schools. Thus, the researcher then assured the participants that they could easily be reached through their contact number and address in case there were any clarifications or questions about the study. Risks, Benefits, and Safety In this study, the researcher and the respondents were free of coercion, undue influence, or inducement. Moreover, respondents were provided with the contact numbers of the panel chair or panel members if they had queries related to the study. This was done to answer the respondents' possible questions. Furthermore, if respondents experienced possible discomfort and inconvenience while answering the questions, they were not compelled to participate in any manner. Further, the researcher had to ensure the respondents were safe during the survey and interview. Thus, the distribution of the questionnaire was conducted in a safe venue and administered at a convenient time. The dominant concern of this study is the Treaty Principle of Protection, as reflected in the respect for the rights of privacy and confidentiality and the minimization of risk. This was done by assigning pseudonyms for each informant so as not to disclose their identity. The possibility of a degree of risk inherent to this was minimized by taking all reasonable steps to guarantee participant confidentiality. Privacy and Confidentiality of Information was the study of the Data Privacy Act of 2002 to ensure that the data cannot be traced back to their real sources to protect participants' identities. Thus, utmost care was taken to ensure the anonymity of the data sources. Hence, any printed outputs that were carried out from this study were kept anonymous. Furthermore, all the issues were considered to avoid a conflict of interest between the researcher and the respondents. Any misleading information and representation of primary data findings in a biased way must be avoided. Justice. The respondents were informed of the researcher's role and their corresponding role during data gathering. They were then briefed that they had to answer the survey questions honestly and that any communication about the research should be honest. Similarly, they were informed that they would benefit first from the study's results. Transparency. The results of the study could be accessed by the respondents and heads of the participating schools because the information is available and is placed on CD or other storage devices, which can be requested from the researcher. Also, by learning about the study's results, classroom teachers would be aware of the significance of the study and its contribution to their well-being. Further, each participant was advised that they have the right to withdraw their information at any time up to the completion of the data collection process and that they can request to be allowed to verify their transcript after the interview. The participants could amend or remove any information they felt might identify them. The researcher reserved the right to use pseudonyms and change names and non-significant dates to protect the participant's identity in all sub-

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sequent data analysis and reporting. Qualification of the Researcher: The researcher ensured the necessary qualifications to conduct the study. The researcher had completed the academic requirements and passed the comprehensive examination before thesis writing, the last requirement to obtain the researcher's master's degree. They were qualified to conduct the study physically, mentally, emotionally, and financially. Also, the advisee-adviser tandem ensures that the study will be completed. Adequacy of Facilities: The researcher strived to complete the study successfully within the specified time and ensured they had the necessary resources. Likewise, the technical committee would help enhance the paper by giving suggestions and recommendations. The researcher also had to ensure he had enough funds to continue and finish the research. Community Involvement: The researcher showed respect for the respondents' local traditions, culture, and views in this study. Moreover, this study would not involve any use of deceit in any stage of its implementation, specifically in the recruitment of the participants or methods of data collection. Furthermore, the researcher deemed it necessary to express their great pleasure for their whole-hearted participation in this study. Plagiarism and Fabrication as the researcher. The researcher respected other works by adequately citing the author and rewriting what someone else has said in their own way. Understood the study context and avoided copying and pasting the text verbatim from the reference paper. Always use quotes to indicate that the text has been taken from another paper. Similarly, they would assure them of honesty in working on the manuscript and that there was no intentional misrepresentation in the study and making up of data or results or purposefully putting forward conclusions that were not accurate.

2.6. Role of the Researcher—The researcher wrote a letter asking permission from the Schools Division Superintendent. After this, another permission letter was secured and submitted to the participants. Upon approval, I used the data collection forms prescribed in the qualitative design. In this study, an in-depth interview was recorded. The researcher needed to understand the subjective interaction between the study participants. The researcher heavily relied on naturalistic methods (interviewing and audio recording) and the interpretive paradigm. Interpretive approaches rely heavily on naturalistic methods like interviewing, observation, and analysis of existing texts. These methods ensured an adequate dialog between the researchers and those with whom they interacted to construct a meaningful reality collaboratively. Yin, as cited by Aquilam (2014), suggested numerous forms of data collection, including documents, archival records, interviews, direct observation, participant observation, and physical artifacts. In order to have legitimate and trustworthy data on teachers' pedagogical innovations, the researcher conducted an in-depth interview and focus group discussion. This interview explored teachers' experiences with strategies and challenges while developing their science competence. The participants were encouraged to express their answers most comfortably. The interview with the teacher was transcribed word for word. Lastly, the researcher analyzed the data collected using discourse analysis and thematic analysis. Creswell (2007) suggested that, in the study's success, the data were stored to be easily found and protected from damage and loss.

2.7. Data Collection—

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To ensure safe educational continuity and acknowledge the challenge of COVID-19, this study adhered to the Department of Health (DOH) Administrative Order No. 2020-0015, or the Guidelines on the Risk-Based Public Health Standards for COVID-19 Mitigation, cited by the IATF to aid all sectors in all settings in implementing non-pharmaceutical interventions. The following was the step-by-step process of gathering the data needed. Asking permission from the Schools Division Superintendent. The researcher asked permission from the Schools Division Superintendent to conduct the study in the identified school. The researcher sent a letter addressed to the Schools Division Superintendent with Chapters 1 and 2 attached, together with the research instrument, which explains the study's objectives and the identification of the participants. The researcher waited for the response of the SDS before conducting the study. Asking permission from the school heads. After securing the approval of the SDS, the researcher sent letters to the principals of the schools explaining the study to be conducted in their schools. Obtaining consent from the participants. The researcher asked permission from the participants. They were formally oriented about the study and the process they would undergo as participants. Conducting the interview. The researcher conducted the in-depth interview using the interview questionnaire. The profile of the participants was taken, notes were jotted down, and conversations were recorded using a sound recorder for ease of transcription. The researcher carefully listened and responded actively during the interviews. The researcher precisely transcribed the interviewees' responses by recalling their answers from the sound recorder. Since the participants used their vernacular language, the researcher translated it into English. Data Coding and thematizing. After the transcription, the data were categorized and coded. Then, themes were extracted, and individual participant data were compared and contrasted. The researcher then conducted a second round of interviews (FGD) to corroborate any data that needed further explanation and input from the participants; additional information gathered was examined thoroughly and integrated into the existing body of data. After this, data were compared and contrasted between the participants to develop patterns and trends.

2.8. Data Analysis—In this study, thematic analysis was utilized to analyze the gathered data. The researcher analyzed the answers of the participants from the conducted interviews using Creswell's Model, specifically the identifying of themes approach. According to Creswell (2012), themes in qualitative research are similar codes aggregated together to form a major idea in the database. Familiarization with the data was common to all forms of qualitative analysis. The researcher immersed herself in and became intimately familiar with their data, reading and re-reading it and noting any initial analytic observations. Coding was also a common element of many approaches to qualitative analysis, involving generating pithy labels for important features of the data relevant to the (broad) research question guiding the analysis. Coding was not simply a data reduction method but also an analytic process, so codes capture a semantic and conceptual reading of the data. The researcher would code every data item and end this phase by collating all their codes and relevant data extracts. Searching for themes was a coherent and meaningful pattern in the data relevant to the research question. The researcher would end this phase by collating all the coded data relevant to each theme. Reviewing themes. The researcher reflected on whether the themes tell a convincing and compelling

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story about the data and began to define the nature of each theme and the relationship between the themes. Defining and naming themes: The researcher prepared a detailed analysis of each theme, identifying the 'essence' of each theme and constructing a concise, punchy, and informative name for each theme. Writing-up involves weaving together the analytic narrative and data extracts to tell the reader a coherent and persuasive story about the data, and contextualizing it in relation to existing literature.

2.9. Framework of Analysis—The framework analysis of this research was flexible to allow the researcher to either collect all the data and then analyze it or do data analysis during the collection process. The data were sifted, charted, and sorted in the analysis stage under key issues and themes. This involves a five-step process: (1) familiarization, (2) identifying a thematic framework, (3) indexing, (4) charting, and (5) mapping and interpretation (Ritchie Spencer, 1994). Familiarization refers to the process during which the researcher will be familiarized with the transcripts of the data collected (i.e., interview or focus group transcripts, observation, or field notes) and gain an overview of the collected data (Ritchie Spencer, 1994). In other words, the researcher becomes immersed in the data by listening to audiotapes, studying the field, or reading the transcripts. Throughout this process, the researcher becomes aware of key ideas and recurrent themes and notes them. Due to the sheer volume of data that can be collected in qualitative research, the researcher may be unable to review all the material. Thus, a selection of the data set was utilized. The selection would depend on several aspects of the data collection process. For example, the mix of methods used (e.g., interviews, documents, observations), The second stage of identifying a thematic framework occurs after familiarization when the researcher recognizes emerging themes or issues in the data set. These emerging themes or issues may have arisen from a priori themes; however, at this stage, the researcher must allow the data to dictate the themes and issues. The researcher used the notes taken during the familiarization stage to achieve this end. The key issues, concepts, and themes expressed by the participants formed the basis of a thematic framework used to filter and classify the data (Ritchie Spencer, 1994). Indexing means identifying data portions or sections corresponding to a particular theme. This process was applied to all the textual data that has been gathered (e.g., transcripts of interviews). For convenience, Ritchie and Spencer recommend that a numerical system be used to index references and annotate them in the margin beside the text (1994). Qualitative data analysis tools were ideal for such a task. The final stage, mapping and interpretation, involved the analysis of the key characteristics as laid out in the charts. This analysis should be able to provide a schematic diagram of the event/phenomenon, thus guiding the researcher in their interpretation of the data set. At this point, the researcher is cognizant of the objectives of qualitative analysis: "defining concepts, mapping range and nature of phenomena, creating typologies, finding associations, providing explanations, and developing strategies" (Ritchie Spencer, 1994, p. 186). Once again, these concepts, technologies, and associations reflect the participant. Therefore, any strategy or recommendations made by the researcher echo the true attitudes, beliefs, and values of the participants.

2.10. Trustworthiness of the Study—

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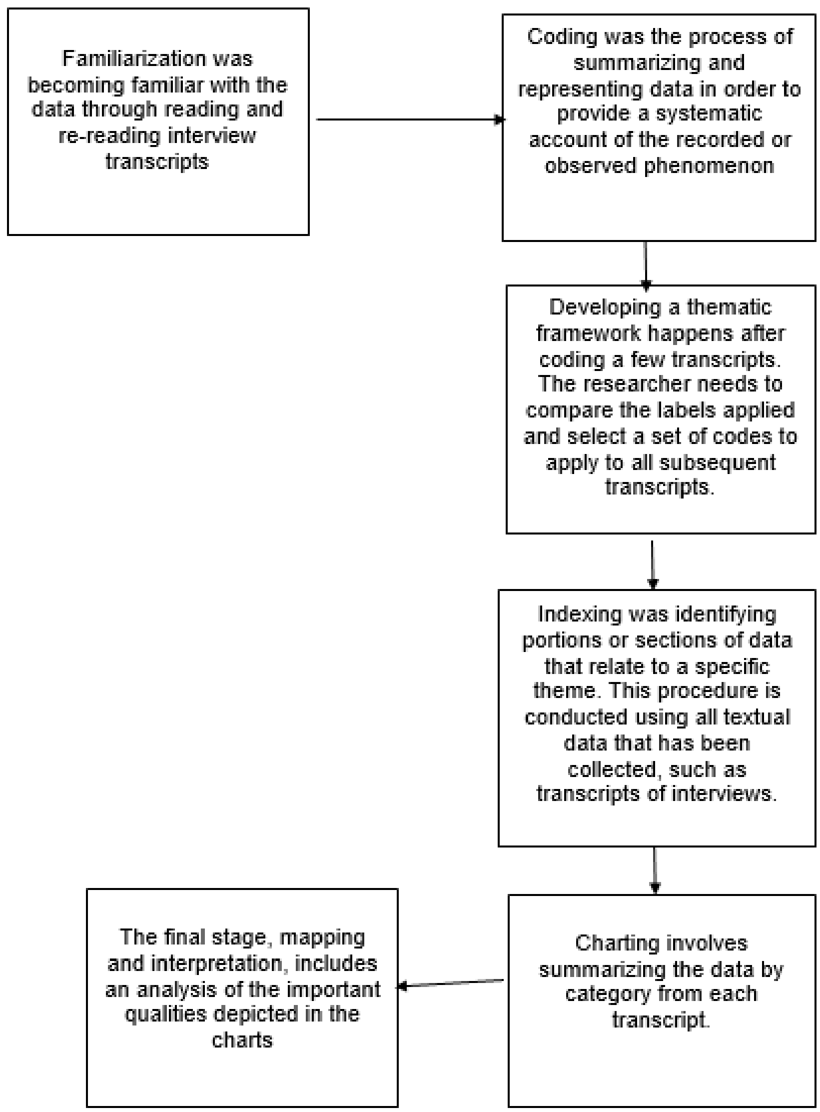

Fig. 2. Analytical Framework of the Study

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The concepts of validity and reliability would relatively be foreign to the field of qualitative research. Qualitative researchers substitute data trustworthiness instead of focusing on reliability and validity. Trustworthiness consists of the components such as credibility, transferability, dependability and conformability (Harts, 2016). Credibility refers to the extent to which a research account is believable and appropriate, with particular reference to the level of agreement between participants and the researcher. The notion of credibility is most often associated with the framework presented by Yvonna Lincoln and Egon Guba. Transferability the degree to which the results of qualitative research can be transferred to other contexts or settings with other respondents. The researcher facilitates the transferability judgment by a potential user through thick description. Dependability is the extent to which the study could be repeated by other researchers and that the findings would be consistent. In other words, if a person wanted to replicate your study, they should have enough information from your research report to do so and obtain similar findings as your study did. Conformability refers to the objectivity of research during data collection and data analysis. There needs to be congruency between two or more independent persons about the accuracy, relevance, or meaning of the data (Polit Beck, 2012). Conformability also indicates a means to demonstrate quality.

3. Results and Discussion

This part of the study dealt with the research questions and their answers based on the responses of the participants. The participants unfolded their experiences as they employed their teaching science strategies to enhance their competence.

3.1. Strategies Of Teachers in Developing Science Competence—Implementing tailored teaching strategies in science education has yielded significant outcomes in terms of the competence and efficacy of educators. Notably, these strategies have pronounced impacted the development of science competence, teachers' challenges, and insights drawn from the study's findings. Implementing effective teaching strategies in science is crucial for uncovering and enhancing the competence of teachers, ultimately leading to improved student learning outcomes. Utilizing active learning and inquiry-based strategies often results in increased student engagement. When students actively participate in hands-on experiments, discussions, and problem-solving activities, they become more interested and invested in the subject matter. This engagement can lead to better retention of information and a deeper understanding of scientific concepts.

3.1.1. Heightened Student Engagement—Using active learning methodologies, including hands-on experiments and interactive discussions, has substantially increased student engagement. Students actively participating in the learning process have demonstrated heightened enthusiasm for the subject matter, leading to a more interactive and dynamic classroom environment. Create science-related word games like crossword puzzles, word searches, or flashcards to reinforce vocabulary and concepts. Make it enjoyable and challenging to enhance learning. Act out scientific processes, historical events, or different roles in a scientific context. Engage with peers to simulate scenarios related to the lesson, which can help you understand and remember the content. Utilize diagrams, charts, graphs, infographics, or mind maps to

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represent scientific concepts visually. Incorporate colors, symbols, and labels to enhance comprehension and retention. Sport-Based Learning: Create science-related games or challenges that incorporate sports elements. For example, design a game where you relate physical principles like motion or energy to sports movements or activities. Incorporate a blend of these strategies based on the specific science lesson and your learning style. Experiment to find what works best for you and adapt as needed to enhance your understanding and enjoyment of the subject matter. Another participant claimed that incorporating hands-on experiments and demonstrations into my lessons stands as a fundamental pillar in my teaching methodology. This approach is undeniably paramount, substantially elevating my students' comprehension and appreciation of scientific principles. It transforms the traditional classroom into an interactive laboratory where students engage directly with the subject matter, fostering a deeper understanding. The essence of this strategy revolves around aligning these hands-on experiences with the specific learning objectives of the curriculum. Careful consideration is given to selecting experiments that seamlessly connect to the topics being taught, ensuring a harmonious fusion of theory and practical application. Safety precautions and protocols are rigorously adhered to, prioritizing a secure learning environment. Clear and explicit instructions on the proper handling of materials and equipment are imparted, emphasizing the importance of caution and responsible conduct during the experiment. Initiating with a demonstrative prelude captures students' attention and curiosity, offering a glimpse into the intriguing aspects of the experiment. As I guide them through each step, elucidating critical points, the excitement and anticipation in the room palpably rise. Active involvement of students during the experiment is at the core of this approach. They are encouraged to immerse themselves in the process, manipulating variables, making measurements, and documenting data. This hands-on engagement not only solidifies their understanding but also ignites a genuine passion for scientific inquiry. Moreover, the integration of follow-up activities and assessments solidifies the practical learning process. Students are challenged to reflect on the experiment, analyze the results, and synthesize the knowledge acquired. This ensures that the experiment's impact endures, weaving seamlessly into their comprehension of the subject matter.

3.1.2. Development of Critical Thinking Proficiency—Inquiry-based and problem-based learning have proven effective in fostering critical thinking and honing problem-solving skills. Students engaged in these strategies have showcased enhanced analytical abilities, demonstrating a greater aptitude for deciphering intricate scientific problems and proposing viable solutions. ”Cooperative Learning, Lecture, and Inquiry-Based Experimentation” represent a trinity of teaching methodologies, each possessing its distinct essence and contributing to a multifaceted educational experience. Together, they form a dynamic approach that caters to various learning styles, fostering a holistic understanding and appreciation for the subject matter. Cooperative learning embodies the symphony of collaboration and shared learning. Within this methodology, students collectively immerse themselves in peer interaction and collective growth. The classroom metamorphoses into a forum where ideas intermingle, perspectives intertwine, and knowledge amplifies through dialogue. This approach not only cultivates teamwork and critical thinking but also celebrates diversity, as each student contributes a unique hue to the vivid tapestry of learning. A lecture, while a traditional pedagogical method, is the cornerstone of the structured dissemination of knowledge. In this setting, the instructor

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orchestrates the flow of information, directing the course of the lesson. It's a carefully choreographed performance where concepts and theories are articulated precisely and clearly. The lecture offers a platform where the instructor acts as a guide, illuminating the students' understanding path. It stands as an efficient means to introduce foundational knowledge and set the stage for deeper exploration. Inquiry-based experimentation invokes the spirit of exploration and discovery. It beckons students to traverse the realm of curiosity, to question, hypothesize, and experiment. It transforms the classroom into a laboratory, where students don the hats of scientists eagerly investigating the wonders of the natural world. Through this hands-on engagement, they grasp the theories and the scientific method itself, embedding critical skills essential for their academic journey and beyond. The beauty of employing this trinity lies in its versatility. A well-structured lesson may commence with a lecture, offering a foundational understanding of the topic. Following this, cooperative learning might come into play, allowing students to share their perspectives and consolidate their understanding. Finally, inquiry-based experimentation crowns the lesson, enabling students to apply what they've learned in a real-world context. In essence, this triad epitomizes a dynamic educational philosophy that adapts and evolves, acknowledging the multifaceted nature of learning. It is a testament to the fact that education is not a singular path but a rich tapestry woven from various threads of teaching methodologies, resulting in a comprehensive and engaging learning journey for students. This deals with Socratic Questioning and Discussions, where research findings by Tsai and Chuang (2016) underscores the effectiveness of Socratic questioning and discussions in developing critical thinking in science. Encouraging thoughtful discussions and asking probing questions stimulate analytical thinking and help students evaluate evidence and draw logical conclusions (Ennis, 2012) and Analyzing Real-World Phenomena Studies by Osborne and Dillon (2015) suggest that analyzing real-world phenomena develops critical thinking skills in science. Presenting students with authentic, complex problems and encouraging them to analyze and solve them sharpens their critical thinking abilities (Perkins et al., 2013).

3.1.3. Tailored Differentiation for Personalized Learning—The integration of differentiation strategies has enabled a personalized approach to education, accommodating diverse learning styles and abilities within a heterogeneous classroom. As a result, educators have witnessed a notable increase in student engagement and achievement, ultimately contributing to uncovering individual competencies. Assessment is a critical part of the teaching and learning process, as it allows you to gauge how much your students have grasped the concepts and skills being taught. Use ongoing, real-time assessment during lessons to check for understanding. This can include quizzes, polls, class discussions, and observations. Provide immediate feedback to students, highlighting areas of strength and areas that need improvement. Ask open-ended questions requiring students to explain their understanding rather than providing simple yes/no or one-word answers. Use probing questions to delve deeper into their understanding and encourage critical thinking. Have students write a brief response to a question or prompt related to the lesson before leaving the classroom. This helps you quickly assess their understanding. Ask students to create concept maps or diagrams illustrating their understanding of a topic. This visual representation can reveal their mental models and connections between concepts. At the end of a lesson, ask students to write for one minute about the most

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important thing they learned during the lesson. This can provide insights into what they found most salient. Incorporate opportunities for students to assess and provide feedback to their peers' work. This can help students understand assessment criteria and develop a deeper understanding of the subject matter. Use quizzes and tests to evaluate understanding of specific content and concepts. Make sure to cover a variety of question types (multiple-choice, short-answer, essay) to assess different levels of understanding. Observe students during activities and group work to assess their engagement, collaboration, and understanding of the task. Have students maintain a portfolio of their work, including drafts, final projects, and reflections. This provides a holistic view of their progress and understanding over time. Please encourage students to assess their understanding through reflection exercises. Prompt them to identify what they have learned, what they still find challenging, and what steps they can take to improve. Tailor these strategies to suit your classroom environment, subject, and your students' age group. The key is to use a variety of assessment methods to gain a comprehensive understanding of students' learning and tailor the teaching accordingly. To enhance independent engagement, flipped classroom strategies can be employed. In this approach, students review instructional content independently outside of class, often through video lectures or online materials. Classroom time is then used for interactive discussions, problem-solving, and application of concepts. This empowers students to take ownership of their learning and seek clarification on challenging areas. Inquiry-based learning is highly effective in encouraging curiosity and active involvement. By posing thought-provoking questions and guiding students to explore the answers through research and critical thinking, educators ignite a passion for learning. This approach nurtures creativity, analytical thinking, and a deeper understanding of the subject matter. Tiered Assignments research by Tomlinson and Imbeau (2005) supports the use of tiered assignments for personalized learning in science. Providing different levels of assignments based on students' readiness levels ensures that each student is appropriately challenged, fostering individual growth and understanding (Moon et al., 2008). Adaptive Learning Technologies research findings studies by Lajoie (2009) demonstrate the effectiveness of adaptive learning technologies in tailored differentiation. Utilizing adaptive platforms that adjust content and pace to match individual student needs allows for personalized learning experiences and improved science competence (Picciano, 2012). By employing these research-backed strategies, teachers can effectively develop science competence in students by enhancing engagement, promoting critical thinking, and tailoring differentiation for personalized learning. These approaches contribute to a more enriched and effective science education experience, preparing students to excel in the subject and apply their knowledge in diverse contexts. Based on Figure 3 above, three themes emerged from the responses of the participants, which were heightened student engagement, development of critical thinking proficiency, and tailored differentiation for personalized learning. Developing science competence among students is a crucial educational goal. It fosters heightened student engagement, nurtures critical thinking proficiency, and employs tailored differentiation for personalized learning.

3.2. Coping Mechanisms With The Challenges In Enhancing Competence Of Teachers —The field of education is ever-evolving, requiring educators to adapt to new methods and strategies to effectively teach their students. In the realm of science education, teachers face nu-

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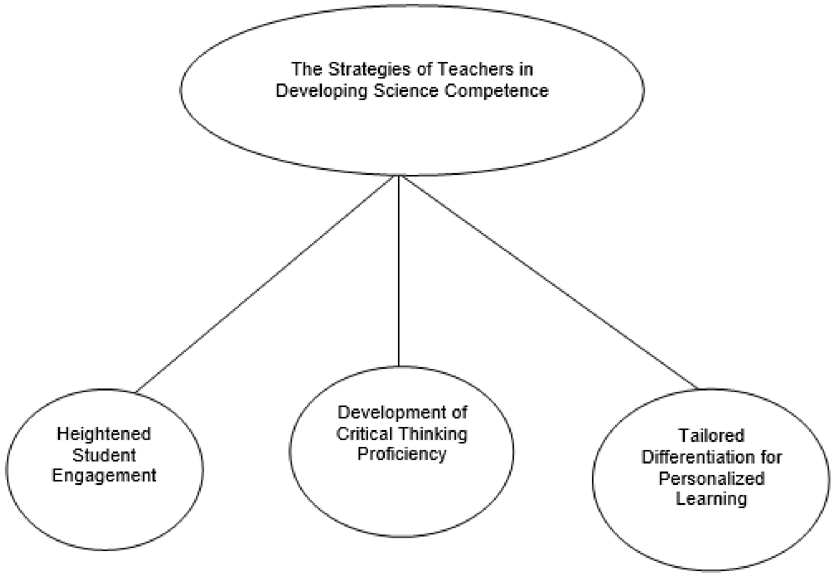

Fig. 3. Emerging Themes On The Strategies Of Teachers In Developing Science Competence

merous challenges when trying to demonstrate their competence. This essay explores various teaching strategies in science and how educators can cope with these challenges to unveil their true competence. Science education benefits greatly from active learning methodologies, such as experiments, group discussions, and hands-on activities. Teachers can demonstrate their competence by utilizing these strategies to engage students actively in the learning process. However, the challenge lies in effectively managing and implementing these activities, considering constraints like time and resources. Teachers can plan ahead, ensuring proper alignment of active learning strategies with the curriculum. Collaboration with colleagues and sharing of resources can help address resource constraints and enhance the overall learning experience. Integrating technology and multimedia into science teaching can enhance comprehension and engagement. However, many teachers face challenges related to limited access to technology, inadequate training, or insufficient technological infrastructure in their schools.

3.2.1. Resilient and Solution-Focused— Teachers can adapt existing curricula to fit the available resources and design lesson plans that require minimal textbook usage. This might involve creating resource packets, handouts or utilizing online materials to supplement the lack of textbooks. By optimizing the use of available resources, such as articles, scientific journals, and educational websites, teachers can provide a rich learning experience for their students, nurturing critical thinking and research skills. Project-Based Learning (PBL): Implementing project-based learning allows students to explore scientific concepts in a practical and hands-on manner. Even without textbooks, students can conduct research, gather data, and present their findings, fostering a deeper understanding of the subject matter. PBL encourages creativity and problem-solving, aligning with the principles of scientific inquiry while minimizing the reliance on traditional textbooks. Encouraging students to collaborate and learn from each other can compensate for the lack of textbooks. Students can share their knowl-

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edge, exchange ideas, and collectively gather information from various sources. Teachers can guide and facilitate these collaborative learning experiences, enhancing their competence in managing and optimizing the use of available human resources. The participants also like to modify their strategies in the face of educational challenges like the absence of quality textbooks, inadequate equipment, large class sizes, limited instructional resources, insufficient training for educators, and lack of administrative support, it is vital to design science lessons that captivate and engage students. This essay outlines effective strategies to craft lessons that not only enhance learning but also sustain students' interest, fostering a lifelong curiosity for science. Create hands-on, simple experiments and demonstrations using readily available materials. By involving students directly, this approach sparks curiosity and cultivates a genuine interest in the subject, even in the absence of sophisticated equipment. Integrate real-world applications of scientific concepts to demonstrate relevance. Present case studies, success stories, or local examples that students can relate to, making the subject matter more engaging and relatable. Utilize multimedia presentations, videos, and interactive online resources to supplement the lack of textbooks and inadequate equipment. Visual aids can effectively convey complex ideas and maintain students' attention. Encourage peer teaching and group discussions to facilitate collaborative learning. Students can share their understanding of the topic, exchange ideas, and collectively solve problems. This approach enhances student engagement and promotes a deeper comprehension of the subject. Transform lessons into educational games or quizzes to inject an element of fun and competition. Games not only capture students' interest but also motivate them to actively participate and excel in their understanding of scientific concepts. Despite challenges such as limited resources and inadequate support, engaging and effective science lessons are possible through creativity, adaptability, and a student-centered approach. By incorporating experiential learning, real-world applications, interactive multimedia, collaborative activities, gamification, and student-led projects, educators can cultivate a passion for science within their students. Advocating for administrative support and continuous training ensures that teachers have the tools and encouragement needed to implement these strategies successfully. Ultimately, fostering a love for science is about igniting curiosity and inspiring a lifelong journey of discovery and learning.

3.2.2. Start with a Hook—Encouraging collaborative learning and incorporating peer review processes allow science teachers to witness firsthand the collaboration, communication, and leadership skills of their students. This approach also offers opportunities for teachers to collaborate with colleagues and engage in constructive feedback sessions, further refining their competence.In today's diverse classrooms, educators face the challenge of managing a wide array of student needs and abilities. Tailoring teaching strategies to accommodate this diversity is essential to ensure equitable learning outcomes for every student. Implement differentiated instruction by modifying content, process, and product based on students' readiness levels, interests, and learning profiles. Offer varied assignments and activities that allow students to choose how they demonstrate their understanding, catering to individual learning preferences and abilities. Encourage collaborative learning experiences where students work in groups to complete tasks, discuss concepts, and help one another. Assign roles within groups to ensure that all students contribute and benefit from the collective effort, promoting mutual under-

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standing and support. Provide multiple means of representation, engagement, and expression, allowing students to access, engage with, and demonstrate their understanding of the content in various ways. Individualized Learning Plans (ILPs) develop ILPs for students with diverse needs, outlining personalized goals, strategies, and accommodations based on their abilities and challenges. Regularly review and update ILPs in collaboration with students, parents, and specialized support staff to ensure tailored support and optimal progress. Utilize a mix of visual, auditory, kinesthetic, and interactive instructional methods to cater to diverse learning preferences. Integrate visuals, multimedia, hands-on activities, discussions, and interactive demonstrations to enhance comprehension and engagement. Implement frequent formative assessments to gauge student understanding and adjust teaching strategies accordingly. Provide timely and constructive feedback, focusing on strengths and areas for improvement, to guide each student's learning journey. Foster a trusting and open relationship with each student, understanding their unique needs, interests, and motivations. Create a safe and inclusive environment where students feel comfortable expressing their challenges and seeking assistance. Embracing diversity and tailoring teaching strategies accordingly enhances academic achievement and cultivates a sense of belonging and empowerment among students with varying abilities and backgrounds.

3.2.3. Adaptive Teaching and Differentiation—Tailoring teaching strategies to accommodate diverse learning styles and abilities is vital for determining a teacher's competence. Utilizing adaptive teaching methods and differentiation techniques allows educators to observe their capability to modify instruction to meet the unique needs of each student. Another participant stressed that navigating the educational journey with non-reading students who struggle with absenteeism and basic English comprehension poses a considerable challenge when dealing with science lessons. Overcoming these obstacles requires tailored strategies and a compassionate, patient approach. Begin by conducting thorough assessments to understand each student's capabilities, gaps in knowledge, and learning styles. Develop individualized learning plans that address their specific needs and tailor teaching strategies accordingly. Start with teaching fundamental English vocabulary and Science terms using visuals, flashcards, and interactive activities to enhance comprehension. Introduce basic phonics to help students recognize and sound out simple words. Incorporate engaging language games and interactive activities, such as word bingo, charades, or storytelling sessions. These activities encourage participation and build confidence in using Science in a fun and enjoyable way. Implement peer-assisted learning, where proficient English-speaking students pair with non-readers to practice speaking and comprehension. This fosters a supportive environment and promotes peer interaction. Allocate time for daily reading-aloud sessions, focusing on correct pronunciation and enunciation. Encourage students to read aloud confidently, correct their pronunciation gently, and provide positive reinforcement. Conduct small group instruction to ensure personalized attention. This allows for targeted teaching, addressing individual challenges and progress in learning English. Involve parents and the local community in the learning process. Organize workshops or informational sessions to help parents support their children's English learning journey at home. The pursuit of enhancing science teaching competence is undoubtedly a demanding journey, riddled with obstacles. Limited resources, including access to up-to-date textbooks, labora-

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tory equipment, and advanced technology, pose significant challenges. Additionally, time constraints due to a packed schedule further exacerbate the difficulties. This essay delves into effective strategies to surmount these hurdles and advance science teaching competence, transcending resource limitations and time constraints. Innovate and adapt teaching methodologies that make the most of the available resources. For instance, utilize everyday materials as teaching aids and improvise experiments to demonstrate scientific concepts. Curate and organize digital resources to align with the curriculum, enabling students to access relevant content despite the scarcity of physical textbooks. Focus on key learning outcomes and prioritize essential topics in the curriculum to make the most of limited time. Streamlining objectives allows for more in-depth study and better understanding of fundamental concepts. Strive to strike a balance between covering the syllabus and providing students with a deeper comprehension of critical scientific principles. Integrate science lessons with other subjects to maximize learning opportunities within a limited timeframe. Interdisciplinary approaches can enhance understanding and engagement among students. Seek virtual or bite-sized professional development opportunities that accommodate tight schedules, such as online workshops, webinars, and self-paced courses. While the challenges of limited resources and time constraints can seem insurmountable, innovative approaches and a proactive mindset can make a significant difference. By maximizing available resources, embracing technology and online platforms, prioritizing teaching objectives, integrating learning, and advocating for professional development, educators can rise above the hurdles and continually enhance their science teaching competence. In doing so, they empower themselves to inspire the next generation of curious and knowledgeable scientists. The framework summarizes the coping mechanisms for the challenges of developing the competence of teachers. Based on Figure 4 above, three themes emerged from the participants' responses: resilient and solution-focused teaching, starting with a hook, and adaptive teaching and differentiation. These themes are critical in addressing challenges related to uncovering teacher competence in the field of science education. Let's delve into each theme and discuss how they can be applied to enhance teaching strategies and cope with challenges. Resilience in teaching involves the ability to bounce back from challenges and setbacks, maintaining a positive attitude and commitment to the educational process. Solution-focused teaching emphasizes finding practical solutions to problems. In the context of science education, this could involve professional development, which encourages teachers to participate in regular professional development programs that enhance their resilience and problem-solving skills. Workshops on stress management, coping strategies, and reflective teaching practices can be beneficial. Establish mentorship programs where experienced educators can guide and support newer teachers, helping them navigate challenges and develop resilience in their teaching approach. Reflective Practice: Encourage teachers to reflect on their teaching experiences, identifying both successes and areas for improvement. Teachers can refine their strategies by focusing on solutions and learning from challenges and becoming more resilient.

3.3. Educational Management Insights Drawn from the Study—The participants shared their educational management insights and it was narrowed down into one to generate the themes. These themes were carefully analyzed and formulated based on informants' accounts

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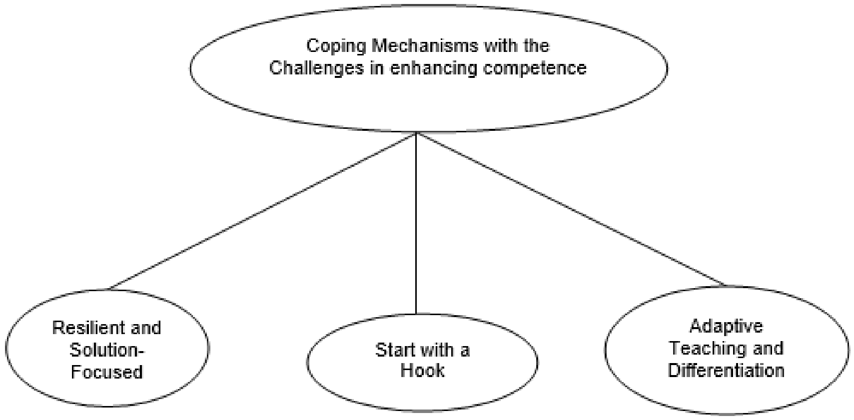

Fig. 4. Emerging Themes On Coping Mechanisms With The Challenges In Enhancing Competence

and reflections. The study on teaching strategies in science aimed at uncovering the competence of teachers in educational management revealed critical insights. These insights shed light on the effective management practices that support teacher competence in science education. Let's delve into the educational management insights drawn from the study. The subthemes are shown below:

3.3.1. Continuous Learning—Offering continuous professional development opportunities and a culture of lifelong learning significantly contributes to teacher competence in science education. Educational managers should prioritize and invest in ongoing professional development programs, workshops, and training sessions tailored to science educators. This fosters an environment where teachers continuously enhance their knowledge and teaching methods and stay updated with the latest advancements in the field of science. Research by Inan and Lowther (2010) emphasizes the significance of continuous professional development in enhancing teacher competence. Engaging in ongoing learning opportunities allows teachers to stay updated with the latest research, methodologies, and technologies in science education. Educational managers should facilitate access to regular workshops, conferences, and online courses related to advancements in science education. Encourage teachers to pursue advanced degrees, attend webinars, and participate in learning communities to foster a culture of continuous learning. Studies by Dana (2013) highlight the value of action research and reflective practice in promoting continuous learning. Engaging in action research projects enables teachers to evaluate their teaching methods and make data-driven improvements. Promote action research initiatives within the school, encouraging teachers to research their teaching practices, share findings, and implement improvements. Provide mentorship and guidance to enhance the quality of research and its impact on teaching.

3.3.2. Collaborative Learning Communities—Establishing collaborative learning communities and promoting a culture of collaboration and knowledge sharing among educators is pivotal for enhancing teacher competence. Educational managers should create platforms

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and opportunities for teachers to collaborate, share experiences, and exchange best practices. By fostering a collaborative culture, educators can learn from each other, implement successful strategies, and collectively enhance their teaching competence in science. Absolutely, being open to innovation and actively supporting teachers in adopting new, effective approaches is pivotal for advancing the educational experience. Let's delve into how educational management can incorporate these insights for the betterment of both teachers and students. Foster a culture where teachers feel encouraged to experiment with innovative teaching methods and technologies. Provide a safe space for trial and error. Acknowledge and celebrate teachers who successfully implement innovative approaches, showcasing their achievements as examples for others to follow. Offer regular training sessions and workshops to equip teachers with the skills and knowledge required to adopt and effectively implement new approaches. Provide specialized training in utilizing educational technologies effectively, ensuring that teachers are adept at integrating them into their teaching. Allocate resources for acquiring new tools, technologies, and teaching materials that align with innovative approaches, promoting their adoption. Encourage collaboration among teachers from different subjects, fostering the sharing of innovative approaches and interdisciplinary teaching. Establish a community of practice where teachers can collaborate, share experiences, and collectively brainstorm innovative ideas to enhance student engagement and understanding. Facilitate projects that involve multiple teachers working together, integrating various innovative strategies to create engaging and comprehensive learning experiences. Encourage teachers to collect regular feedback from students regarding the new approaches. Use this feedback to make necessary adaptations and improvements. Involve students in the innovation process by seeking their input on the teaching methods and technologies that engage them the most. Ensure that educational leaders are accessible and approachable, fostering an environment where teachers feel comfortable discussing and seeking guidance on innovative ideas. Educational leaders should be vocal advocates for innovation, emphasizing its importance and the positive impact it can have on the educational experience. Address challenges and roadblocks faced by teachers during the adoption of new approaches promptly. Provide solutions and support to overcome these obstacles. By embracing innovation and supporting teachers in integrating new approaches that enhance student engagement and understanding, educational management can create a dynamic and thriving educational ecosystem. This not only enriches the learning experience but also prepares students for a future where adaptability and innovation are highly valued.

3.3.3. Supportive School Culture—A supportive school culture that values teacher well-being, encourages innovation, and provides a conducive environment for growth is fundamental in uncovering teacher competence. Educational managers need to cultivate a positive and supportive school culture. This includes recognizing and celebrating teachers' efforts, providing constructive feedback, and fostering an environment where teachers feel motivated to experiment with innovative teaching strategies. A supportive culture ultimately contributes to a higher level of competence and commitment among science educators. Establishing a collaborative and innovative environment within educational institutions is paramount for fostering teacher competence, particularly in the field of science. By investing in supportive ecosystems that encourage collaboration, experimentation, and sharing of best practices, ed-

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ucational managers can elevate the quality of science education. Additionally, dedicating resources to enhance technological infrastructure is equally vital. Establish open communication channels where teachers can freely discuss ideas, challenges, and innovative approaches. Regular meetings, both formal and informal, should be held to facilitate such discussions. Encourage collaboration not only within the science department but also across various disciplines. Cross-disciplinary discussions can lead to novel approaches and perspectives in teaching science. Designate physical spaces within the school where teachers can come together for discussions, planning sessions, and collaborative projects. These spaces should inspire creativity and brainstorming. Create a centralized digital platform where teachers can share lesson plans, teaching resources, and successful strategies. This repository should be easily accessible and user-friendly. Organize workshops and seminars where teachers can present their innovative teaching methods and experiences. This not only fosters knowledge sharing but also boosts teachers' confidence. Implement a system to acknowledge and celebrate teachers' successes in science education publicly. Recognize outstanding contributions, innovative practices, and positive impacts on student learning to boost morale and create a culture of appreciation and support. By integrating these research-backed strategies into educational management practices, educational leaders can effectively uncover and enhance teacher competence in science education. These strategies promote continuous learning, collaboration, and a nurturing school culture, providing a holistic approach to improving teaching effectiveness and student achievement. The following framework summarizes educational management insights from participants' experiences. Figure 5 shows three themes from the participants' responses: continuous learning, collaborative learning communities, and supportive school culture. Analyzing the provided information, three significant themes have emerged from the study regarding educational management insights. Participants highlighted the importance of continuous learning in educational management. This involves ongoing professional development, skill enhancement, and knowledge acquisition for educators, administrators, and other stakeholders in the education system. The study emphasizes the need for educational leaders to foster a culture of continuous learning, staying updated with the latest educational trends, research, and innovative practices. This theme suggests that a dynamic and evolving educational environment requires educators and administrators to adapt, learn, and grow continuously to meet the changing needs of students and the education system. The study identified the significance of fostering collaborative learning communities within educational settings. This theme emphasizes the importance of collaboration among educators, students, parents, and other stakeholders. Building a sense of community and encouraging collaboration can lead to improved communication, enhanced problem-solving abilities, and shared knowledge. Educational leaders should facilitate opportunities for collaborative learning, encourage teamwork, and establish platforms for effective information sharing and mutual support. This theme underscores the belief that a cohesive and collaborative community can positively impact educational outcomes and the overall learning experience.

4. Implications and Future Directions

Exploring teaching strategies in science and unraveling teachers' competence reveals several implications and potential future directions. Understanding the impact of these strategies on

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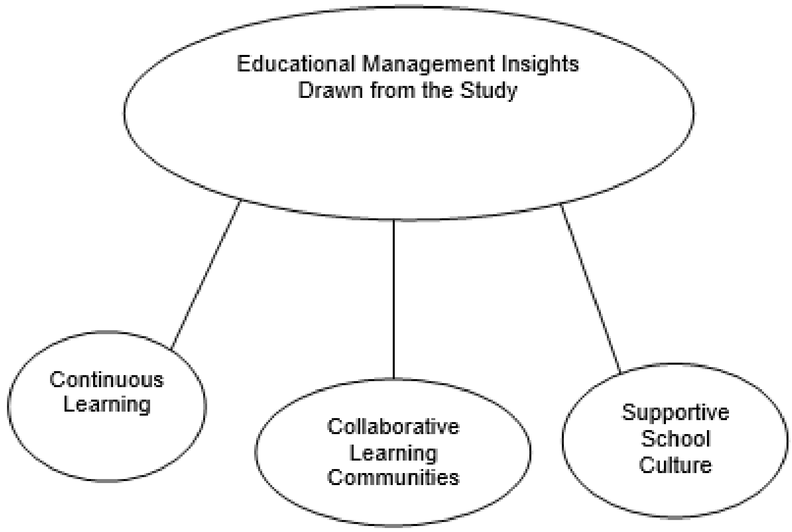

Fig. 5. Emerging Themes On The Educational Management Insights Drawn From The Study

teaching effectiveness was critical for advancing science education.

4.1. Findings—This chapter delves into the implications of the study's findings and suggests future pathways to optimize teaching strategies and enhance teacher competence in science education. This chapter underscores the critical role of diverse teaching strategies in enhancing teaching competence and improving science education. By acknowledging these implications and charting future directions, the education community can advance toward more effective and inclusive science instruction, fostering a generation of scientifically literate individuals. This chapter presents a brief overview of the study followed by implications based on the study's findings. Future directions in the field of teachers' experiences were also discussed here.

4.2. Implications—The study aims to gather information on the teaching strategies of science teachers to enhance their competence. Emerging themes were drawn in each of the phenomena in the conceptual framework of this study. Regarding teachers' strategies, three themes emerged from the participants' responses: heightened student engagement, development of critical thinking proficiency, and tailored differentiation for personalized learning. Developing science competence among students is a crucial educational goal. It fosters heightened student engagement, nurtures critical thinking proficiency, and employs tailored differentiation for personalized learning. These three themes form the foundation of effective science education, ensuring students grasp scientific concepts and apply them critically and adaptively. Student engagement is fundamental to effective science teaching. Engaging students in learning promotes curiosity, motivation, and a deeper understanding of scientific principles. Teachers can employ various strategies to heighten student engagement in science. Critical thinking is an essential skill for scientific literacy and problem-solving. It enables students

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to evaluate information critically, analyze evidence, and construct well-reasoned arguments. Teachers can employ strategies to develop critical thinking proficiency among students, like Socratic Questioning, which encourages students to think critically by asking open-ended questions that provoke thought and stimulate discussion. This approach promotes deeper understanding and analysis of scientific concepts. Every student is unique, with varied learning styles, strengths, and needs. Tailored differentiation allows teachers to address these differences and adapt instruction to suit individual students. Strategies for personalized learning through tailored differentiation include offering a range of resources and activities that cater to different learning styles and abilities. Allow students to choose activities that align with their interests and strengths. Design assessments that align with each student's progress and abilities. Tailor evaluation methods to ensure students are challenged appropriately and can showcase their understanding effectively. Create small groups based on students' learning needs. Provide targeted instruction and support within these groups, addressing specific challenges or enhancing strengths. Enhancing science competence among students requires a multifaceted approach encompassing heightened student engagement, developing critical thinking proficiency, and tailored differentiation for personalized learning. Teachers play a crucial role in employing strategies that foster these themes, enabling students to acquire scientific knowledge and develop the skills and attitudes necessary for a deeper understanding and lifelong appreciation of science. Through these strategies, educators can empower students to be critical thinkers, proficient problem solvers, and enthusiastic learners in science. Meanwhile, on the coping mechanisms with the challenges, themes such as resilient and solution-focused, start with a hook and adaptive teaching and differentiation. The themes mentioned—resilient and solution-focused teaching, starting with a hook, and adaptive teaching and differentiation—are critical in addressing challenges to uncovering teacher competence in science education. Resilience in teaching involves the ability to bounce back from challenges and setbacks, maintaining a positive attitude and commitment to the educational process. Solution-focused teaching emphasizes finding practical solutions to problems. This could involve professional development in science education, which encourages teachers to participate in regular professional development programs that enhance their resilience and problem-solving skills. Workshops on stress management, coping strategies, and reflective teaching practices can be beneficial. Establish mentorship programs where experienced educators can guide and support newer teachers, helping them navigate challenges and develop resilience in their teaching approach. Reflective Practice: Encourage teachers to reflect on their teaching experiences, identifying successes and improvement areas. Teachers can refine their strategies by focusing on solutions, learning from challenges, and becoming more resilient. Starting with a Hook beginning a lesson with a captivating "hook" or engaging introduction can stimulate students' interest and curiosity, setting a positive tone for the rest of the lesson. Start a lesson with a fascinating science experiment or demonstration related to the day's topic. This can intrigue students and make them eager to learn more. Begin with a real-world scenario or a news article related to the scientific concept that would be taught. Show students the relevance and application of what they were about to learn. Use storytelling techniques to introduce the topic, incorporating elements of suspense or curiosity that entice students to explore the subject further. Recognizing that students have diverse learning needs and abilities, adaptive teaching and differentiation involve tailoring instruction to meet individual learning styles and levels of readiness. Use formative as-

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sessments to gauge students' understanding and adapt your teaching based on the results. Modify your approach to address misconceptions and provide additional support where needed. Employ various teaching strategies, such as group work, hands-on experiments, multimedia presentations, and interactive discussions. This caters to different learning preferences and allows students to engage with the material in diverse ways. Develop personalized student learning plans, outlining specific goals and strategies to accommodate their unique learning needs and strengths. Regularly revisit and adjust these plans based on student progress and feedback. Incorporating these themes into science education can help create an environment in which teachers are better equipped to uncover their competence, adapt to challenges, and create engaging learning experiences for their students. Regarding the educational insights drawn from the study's findings, three themes also emerged from the participants' responses: continuous learning, collaborative learning communities, and supportive school culture. Analyzing the provided information, three significant themes have emerged from the study regarding educational management insights. Participants highlighted the importance of continuous learning in educational management. This involves ongoing professional development, skill enhancement, and knowledge acquisition for educators, administrators, and other stakeholders in the education system. The study emphasizes the need for educational leaders to foster a culture of continuous learning and stay updated with the latest educational trends, research, and innovative practices. This theme suggests that a dynamic and evolving educational environment requires educators and administrators to adapt, learn, and grow continuously to meet the changing needs of students and the education system. The study identified the significance of fostering collaborative learning communities within educational settings. This theme emphasizes the importance of collaboration among educators, students, parents, and other stakeholders. Building community and encouraging collaboration can improve communication and enhance problem-solving abilities and shared knowledge. Educational leaders should facilitate opportunities for collaborative learning, encourage teamwork, and establish platforms for effective information sharing and mutual support. This theme underscores the belief that a cohesive and collaborative community can positively impact educational outcomes and the learning experience. The third identified theme was the significance of cultivating a supportive school culture. This involves creating an environment where all stakeholders feel valued, respected, and supported. A supportive school culture encourages open communication, trust, empathy, and a sense of belonging among educational community members. Educational leaders play a crucial role in shaping and maintaining this culture, which directly impacts the well-being and job satisfaction of educators and the overall academic success of students. This theme suggests that a positive and supportive school culture is fundamental for the effective functioning of an educational institution and for achieving the desired educational outcomes. These themes collectively contribute to the broader understanding of effective educational management, highlighting the importance of continuous learning, collaboration, and a supportive school culture in promoting excellence and success within the education system. Educational leaders may consider integrating and prioritizing these themes in their strategies and practices to enhance educational management and improve the quality of education. The study showcases that employing diverse teaching strategies, including hands-on experiments, inquiry-based learning, lectures, and cooperative learning, significantly enhances a teacher's competence. It highlights the importance of a versatile skill set for effective science instruction. Educators and

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educational institutions may tailor professional development programs to encompass a variety of teaching strategies. Offering opportunities for teachers to enhance their expertise in employing these strategies was vital for continued growth and improved classroom practices. Educational stakeholders should allocate resources and provide support to ensure teachers have access to the necessary materials, technology, and training to implement various teaching strategies effectively. This includes funding for laboratory equipment, digital tools, and training workshops. The study underscores the significance of inclusive education, emphasizing that teaching strategies may be adapted to cater to diverse learning styles and abilities. Future directions may focus on promoting inclusive practices that engage all students effectively.

4.3. Future Directions—The findings of this study may be relayed appropriately and used by the significant people for whom this research was intended. For policymakers. Future research may explore integrating advanced technology into science teaching, such as virtual reality and artificial intelligence. Investigating how these technologies can enhance engagement and understanding would be instrumental in shaping future teaching strategies and conducting longitudinal studies to track the long-term impact of diverse teaching strategies on students' academic performance and career choices in science-related fields. This would provide valuable insights into the sustained effectiveness of these approaches. For school administrators. They may focus on interdisciplinary teaching strategies that bridge science with other subjects like arts, humanities, and social sciences. Interdisciplinary approaches can foster a holistic understanding of complex scientific phenomena and encourage creative thinking. Comparative studies across different countries or educational systems could offer insights into the effectiveness of teaching strategies in various cultural and socio-economic contexts. Understanding how strategies perform across diverse settings can inform global best practices. Teachers may expand their teaching strategies and tailor teacher training programs to address the nuances of employing different teaching strategies. Providing in-depth training on hands-on experiments, inquiry-based learning, and cooperative teaching methods can equip educators with the necessary skills to implement these strategies effectively.

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