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Effectiveness of Natural Science Teaching: How to Implement Effective Natural Science Teaching Strategies into Basic Education Especially Fifth Grade?

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ABSTRACT

This study aims to examine the teaching effectiveness of natural science teachers in basic education, particularly for grade five (5), using a new learning paradigm that aligns with the 2014 national curriculum for basic education. The researcher conducted this research at the fifth-grade primary schools of Central, Catholic Primary Schools of Saint Domingos Sávio, and CAFE School. This study employed a qualitative research method, utilizing a descriptive approach. Which present description related to the data. The data collection method involved interviews and observations related to natural science teaching strategies and their implementation in basic education. The subject that involved were science teachers and students 'from five grades. The sampling technique used was purposive sampling. The study employs thematic analysis as the data analysis method. The research results indicated that fifth-grade teachers have implemented learner-centred strategies; however, their implementation is not perfect. Nevertheless, this approach is effective because it enhances children's learning in science and boosts their understanding and scientific self-empowerment.

Keyword : Natural Science Teaching, Teaching Strategies, Basic Education, Fifth Grade

1. Introduction

A teaching strategy serves as the essential foundation for teachers to effectively address and respond to the specific needs of a situation or issue to achieve an objective. In the area of teaching and learning, strategies are operational techniques that teachers implement to help students learn to achieve specific objectives. The objective of the learning strategy is to facilitate the implementation of prepared learning activities that transmit scientific knowledge and promote students' self-empowerment in science.

Generally, schools implement two strategies: one is teacher-centred, and the other is student-centred learning. In this teacher-centred strategy, the teacher acts as both an informant and an evaluator. The

learner's task is to passively receive information and decorate it. However, the strategy that positions students at the centre of learning emphasises that teachers act as facilitators while pupils actively explore science, thereby learning, developing scientific capacity, and applying science in their daily lives (Huba and Freed, cited in Jiang, n.d.).

Scientific capacity refers to the strength of knowledge, attitudes, and abilities that individuals develop through observation, asking questions, and learning how to collect, analyse, and communicate information (Suastiningsih, Wiarta, & Tirtayani, 2017). Scientific competence is the ability to apply scientific understanding to interpret and make appropriate decisions regarding the natural environment and how it is affected by human actions (Chávez, Neira & Lacalle-Calderon, 2021). Therefore, in the process of transmitting science through teaching strategies, it is necessary to emphasise the importance of scientific self-empowerment for students.

Many teachers in Timor-Leste are still centralised in the implementation of teacher-centered learning strategies. So, the teacher is the nucleus of the whole learning process, and the student is the person who is expected to 'receive' what the teacher transmits (Alam, 2023). The term 'receives' here refers to passive learning, which results in students struggling to learn science effectively and actively for themselves (Magobe, 2024, December 24). The root of the problem explained above is that many teachers do not come from a good, correct, and accurate education process, and who can be held accountable as science teachers? Many teachers lack training in the new paradigm's science teaching strategies. Many teachers rarely get learning opportunities to enhance their knowledge of how to implement effective teaching strategies. Many teachers will ignore his teaching spirit. Many teachers are not creative. Many schools in Timor-Leste are lacking in natural science facilities and space for laboratories. Given these reasons, it is essential to train teachers in professionalism and instill in them a strong new learning paradigm to meet the needs of 21st-century students in Timor-Leste.

Moreover, having professional teachers in Timor-Leste primary schools is important for creating new paradigms of natural science learning that foster student engagement. It is also important to emphasise that it is necessary to develop students' own creativity and learning activities in the natural sciences for their integration and independent scientific self-empowerment. Therefore, the new paradigm of learning that needs to be implemented is to teach students to be active, creative, and critical of their learning through teaching strategies based on student-centred instruction. The new learning paradigm is a modern concept for implementing student-centred learning (Ahmed, 2013). This research focuses on the reasons for the continued use of traditional, teacher-centered learning methods in Timor-Leste schools, as well as the new paradigm for implementing student-centered teaching strategies, particularly in natural science education.

The goal of this research was to examine the primary school teachers' new ways of implementing the primary school curriculum effectively. The following research questions drive this study: Firstly, how much are teachers using the new learning model from the 2014 national curriculum for primary education? Lastly, how effectively do they instruct students in natural science, fostering independent, creative, and critical learning? According to the curriculum of elementary school (2014), the teacher's responsibility is to understand the student's personality and needs and then modify their teaching strategies accordingly to enhance the effectiveness and significance of learning in the classroom. This research encourages all primary school science teachers to adopt student-centred learning strategies instead of teacher-centred ones.

2. Literatur Review

2.1. Definition, Position, Division and Function of Natural Science

The origin of the term science comes from the Latin scientia, meaning knowledge (Violatti, 2014, May 28). Therefore, the definition of natural science is the study of learnt knowledge about nature. The focus lies on acquiring knowledge about nature or worldly objects to understand the cycle of life and the occurrences of the world's existence. Therefore, science is the process of exploring the world with an open mind (Guzzo & Garcia, 2015).

According to Chamberlain (2021, August 9), science is a systematic way of understanding the world, built on tested and proven ideas rather than assumptions or beliefs. On the other hand, science also explains what is right and wrong according to the indications that people observe in nature (Chamberlain, 2021, August 9). Thus, science is a gatherer and store of explanations for how and why things happen in nature, based on the clues it provides (da Silva, 2022). In the same vein, da Silva (2022) presents the idea that science constitutes knowledge about nature, which arises from the interaction between human senses and the world. To put it another way, we derive existing knowledge from the activities of observation and research, which we conduct through experimentation to develop relevant and responsible theories.

The national curriculum of basic education includes natural science as a subject. This subject is an important and compulsory part of the field of education because through the subject of natural science, learners can explore and know about everything around them (Natural Science Curriculum in the National Curriculum of Basic Education First and Second Cycle [KNEB I&II], 2014). Therefore, natural science has its division. Areas such as chemistry, physics, earth sciences, astronomy, and biology comprise the natural sciences (KNEB I & II, 2014). In other words, science is a discipline composed of physics, biology, chemistry, geology, astronomy, mineralogy and meteorology (KNEB I & II, 2014).

What are the benefits of learning natural science? Learning natural science is to develop students' knowledge of how to practise the meaning of the knowledge itself and increase their scientific capacity (Suastiningsih, Wiarta, & Tirtayani, 2017; Candrasekaran, 2014). These authors also added that students learn science best by doing, not by passively receiving information, where students can learn and actively participate in both physical and mental activities during learning (Suastiningsih, Wiarta, & Tirtayani, 2017; Candrasekaran, 2014).

2.2. Natural Science Teaching Objectives

In general, the objective of teaching natural sciences is to help students think logically about everyday reality and solve practical problems, as well as promote the intellectual development of students (University of Paulista State [UNESP], n.d.; Filho, Santana & Campos, 2011). Another, and more important, objective is for children to engage with a specific type of knowledge, which is acquired through the approach of scientific knowledge (Camargo, Blaszko & Ujiie sita iha Lopes & Martins, 2019). This approach does not solely concentrate on imparting scientific facts or content. Instead, it emphasises using the scientific method, like observing, asking questions, forming hypotheses, experimenting, and drawing conclusions, as a way to learn. The goal is to help students develop critical thinking, inquiry skills, and a more profound understanding by engaging them in the actual processes' scientists use to discover knowledge (Suastiningsih, Wiarta, & Tirtayani, 2017).

2.3. Strategies and Teaching Strategies

The success of the education system depends on the effective use and functioning of learning strategies to achieve educational objectives. As the online encyclopaedia [KBBI] explains, strategy involves smart planning and the wise use of people to accomplish a clear purpose (Badan Pengembangan dan Pembinaan Bahasa, n.d.). Strategy is viewed as a guiding concept, encompassing the means and paths chosen, as well as an evaluation that leads to a path aimed at enhancing objectivity towards the intended purpose (Nickols, 2011).

In the world of education, teaching requires a strategy because it is a strategic action specifically designed to intentionally promote learning for students. A teaching strategy is a carefully designed plan of action to achieve learning objectives (Tripathi, 2020). Teaching strategies refer to the approaches used in the classroom to ensure that students remember information and acquire the skills needed to set and achieve realistic long-term goals (Aini, 2024).

Therefore, teachers need to implement strategies based on the specific needs of each lesson, which can help both teachers and students engage in the learning process effectively and actively. A teaching strategy is a method or technique used by educators to effectively teach and achieve specific learning objectives, commonly referred to as a teaching method (Malik, 2012). Teaching should not only aim to encourage beliefs supported by evidence but also to develop students' ability to gather evidence and assess it for themselves (Rajagopalan, 2019). A teaching method is a learning strategy, which teachers use to achieve the objective of teaching itself. Geoffrey defines teaching methods as ways that teachers apply to deliver material and develop student competencies in learning (Cited in Tripathi, 2020).

In the etymological sense, teaching methods refer to the approaches used to convey or cultivate scientific knowledge in students through learning activities (Malik, 2012). This requires teachers to identify differences in teaching techniques, select the most effective processes, and adapt their methods to the characteristics of students during instruction to ensure success in the educational process (Mazzioni, 2013).

2.4. Implementing Effective Natural Science Teaching Strategies

Teaching is a strategy that accumulates various methods throughout the learning process to achieve the learning objective itself (Malik, 2012; Mazzioni, 2013). Therefore, teachers need to implement learner-centred teaching strategies in primary schools, especially for grades five. This strategy is characterised by allowing students to actively participate in the classroom, to build new science that they have learnt, to allow pupils to explore new science, to experiment, to research, to discover, to explain, to develop their interest in learning, and to think scientifically and logically (Bertens, 2015).

The following methods facilitate the implementation of a learner-centred strategy:

2.4.1. Experimental Method

The experimental method is important in the discipline of natural sciences. The experimental approach invites students to actively participate in observation, experimentation, and data evaluation activities to understand scientific concepts independently (Dulyapit & Khalifatullah, 2025). Here, students practice or experiment using local objects or materials. In science, students can't just listen; they need to investigate, test, and observe to achieve scientific and logical results. Dewi et al. (2021) showed that students who learn through this method have higher understanding and improved student learning outcomes than those who learn through explanation (cited in Qomariyah, Safina, Fatiah, Chairunnisa, Widayanti, & Rahmadhar, 2025). Ahmad et al. (2022) revealed that through this method students can develop their critical thinking and problem-solving skills (Cited in Dulyapit & Khalifatullah, 2025).

2.4.2. Demonstration Method

Demonstration is an effective way to teach by combining visual, practical, and verbal instruction (Malik, 2012). The demonstration method is a way of teaching students to show objects or processes about something relevant to the topic they are learning through concrete information (Zulkifli, Kristiawan, & Sasongko, 2022), which can help students clearly understand the ideas, concepts, and principles that the teacher demonstrates through visualisation (Basheer, Hugerat, Kortam, & Hofstein, 2017). In a demonstration, the teacher needs to show an object and explain the process of doing something so that students can see it directly and understand the lesson they receive. Therefore, to implement this method, teachers need to prepare materials relevant to the content taught so as to show something concrete for students to observe, thus creating interest in learning from students, and pupils can also demonstrate what they understand (Basheer, Hugerat, Kortam, & Hofstein, 2017). Additionally, this method can stimulate students to become more actively involved in the learning process, enhance their experiences, and assist them in memorising information for a longer duration (Zulkifli, Kristiawan, & Sasongko, 2022).

2.4.3.Problem-Solving Method

The Problem-Solving Method (PSM) is the method that stimulates learners' thinking (Sari, Sutarto & Lisdiana, 2021). It expects learners to freely think and acquire knowledge with their thinking skills (Yamin & Syahrir cited in Sari, Sutarto & Lisdiana, 2021). In this activity, learners examine the problem and seek ways to identify solutions (Sari, Sutarto, & Lisdiana, 2021). This method stimulates learners to develop their creative and critical thinking skills (Sari, Sutarto & Lisdiana, 2021). This method requires teachers to encourage students to think with their creative intelligence (Candrasekaran, 2014). This approach aims to nurture moral intelligence, moral awareness, and rational consciousness (Candrasekaran, 2014). This method, which supports the development of 21st-century learning, focuses on problem solving (Hendri, 2020, cited in Sari, Sutarto & Lisdiana, 2021). The problem-solving method is important in the science discipline because science is taught with an effective learning process that provides excellent understanding so learners can apply it in real life (Walfajri & Harjono, cited in Sari, Sutarto, & Lisdiana, 2021).

2.4.4. Discovery Method

Discovery means finding something. Nurdin, Hanafy, and Mustami (2019) define discovery learning as an instructional technique in which children encounter a problem during the teaching and learning process. On the other hand, Nurdin, Hanafy & Mustami (2019) define discovery learning as students taking charge of their learning through exploration and thinking. They can explore the information through investigation or questioning, research, and solving problems (Resmawati, Prabowo, & Munasir, 2018). This approach means that students learn to find their answers to problems (Hulu & Telaumbanua, 2022). The goal is to encourage students to explore various sources of information to solve problems

while also training them to identify facts, formulate concepts, and draw general conclusions or theories that help explain the phenomena they encounter. (Nurdin, Hanafy, & Mustami, 2019). They can obtain additional information and develop their own knowledge (Nurdin, Hanafy & Mustami, 2019).

In addition, the advantage of this method is that it can arouse students' curiosity and active participation in the learning process. The discovery learning model in the context of science encourages students to learn independently, develop a willingness to learn, and gain the ability to investigate (Resmawati, Prabowo, & Munasir, 2018). Researchers also found that using the discovery learning method influences student learning outcomes, especially in terms of improving students' cognitive, affective, and psychomotor aspects (Resmawati, Prabowo, & Munasir, 2018).

2.4.5. Discussion Method

The discussion method is a method that leads students to a problem and to solve the problem (Bless, Rahayu, & Asrul, 2024). In the process of solving problems, students will share ideas or experiences with each other and determine decisions or solutions together (Ratnadi, 2019). The discussion method is a way for students to interact with each other by working together to analyse, debate, and solve problems. A teacher's responsibility in discussion is to guide students so that they understand what they are going to solve and provide them time to talk, control students in groups, train them to listen to each other, and help them when they face difficulties (Bless, Rahayu, & Asrul, 2024). The philosophy of this method is that discussion facilitates the learning process, allowing students to interact, learn from one another, and share experiences and information. This method is effective in teaching science learning because it can help students think deeply about the lesson and develop scientific thinking (Ratnadi, 2019).

2.4.6. Question-and-Answer Method

The question-and-answer method is a teaching method in which students learn by asking questions (Malik 2012). Students can ask questions related to the lessons they have learnt or plan to learn. Malik (2012) adds that this method also provides students with the opportunity to ask questions about any doubts they have regarding the information they receive. By asking questions, students can enhance their critical thinking skills, focus, and eagerness to learn (Santoso, Yuanita & Erman, 2018). The question asked of the student should also be an open-ended question to make the students think deeply to give an answer. According to Trover (2023, April 25), the advantages of the activity of asking questions are that students can clarify their thinking and understanding of the concept they are learning, help teachers to know the student's understanding, provide students the opportunity to demonstrate their knowledge and mastery of the topic they are learning and create interaction between teacher and student and student and student.

2.4.7.Site Visit Method

The site visit method is a teaching method that takes students out to visit a place or object that is related to the lesson they are learning (Malik, 2012). Malik (2012) added that through visiting places, students can research a subject or object, so pupils can learn from what they research and observe to increase self-knowledge in the area they learn. Malik (2012) says that students must be taken out to observe the object or what they get from the theory. Learning is not only in the classroom but can take place outside. Through this visit, students can deepen their understanding of the lesson by observing real-world examples or concrete objects (Malik, 2012). This type of learning fosters students' interest in education and enables them to explore distant aspects of their environment (Oluwayimika & Adeoye, 2023).

2.4.8. Method of Providing Services

The method of providing services is a teaching method implemented in the learning process, where the teacher provides services to students to do and deliver to the teacher (Malik, 2012). On the other hand, the service they receive is to make a presentation or demonstration in class (Malik, 2012). Through their work, students can help themselves learn and remember what they have been taught (Malik, 2012). Teachers can provide this service both in groups and individually. Students can complete their homework anywhere, typically at home. The teacher should provide this service to stimulate student learning and activity. The purpose of giving academic homework to learners is to develop student performance, reinforce the topic that has been taught in class, develop self-discipline and the ability to learn independently and be able to review and practice the topics learnt (Rosário, Núñez, Vallejo, Nunes, Cunha, Fuentes & Valle, 2018).

Therefore, students who do a lot of homework achieve excellent performances in school. This task can further develop students' self-knowledge, which is critical for processing information (Rosário, Núñez, Vallejo, Nunes, Cunha, Fuentes & Valle, 2018).

2.5. Impact of Effective Strategy Implementation on Natural Science Teaching Process

In the learning process, teachers must employ various teaching strategies, as these strategies serve as essential components of effective learning (Mazzioni, 2013). Therefore, to transmit lessons, it is important that teachers have effective teaching strategies that are orientated to learning objectives and attract to cultivate a positive learning will or rational awareness to help students learn during lessons (Candrasekaran, 2014). Therefore, an effective strategy for the learning process involves a learner-centred approach. This strategy transforms the classroom into a space where students take ownership of their learning, meaning pupils actively participate and build their own knowledge, and teachers become facilitators who support growth, understanding, and meaningful progress (Elkhidir, 2023). This means that during the learning process, teachers need to use a variety of student-centred strategies to help students learn efficiently and effectively. In this way, it can also achieve the objectives that have been defined (Elkhidir, 2023). Teaching methods require variety to meet students' needs in the learning process. For example, students can learn quickly when using demonstrations, but some students cannot learn quickly when explaining or asking questions (Elkhidir, 2023). This approach can also encourage learners to think creatively by using problem-solving methods such as brainstorming, concept mapping, or research (Indarasati, Abadi & Lukito, 2019).

The literature indicates that students in classes that implement learner-centred learning make greater progress in mathematics, the English language, and art compared to other groups (Kaput, 2018). Teachers can enhance this implementation by receiving training on the application of effective teaching strategies. Therefore, teachers can assume academic responsibility for successfully implementing learner-centred strategies in the classroom to enhance student learning. Additionally, teachers require both software and hardware resources as references to help them obtain information that enhances their ability to teach natural science effectively

3. Research Methods

This research applied a qualitative method with a descriptive approach. A qualitative method is a research method used to explore, discover, and understand the real problems of individuals, groups, or society (Creswell, cited in Roosinda et al., 2021). Ramdhan (2021) defines qualitative descriptive research as a method that describes data from the field and provides descriptions based on research evidence. The information from the data presented is detailed and reliable (Creswell, cited in Roosinda et al., 2021). This research method elaborates data through observation, interviews, and documentation.

3.1. Research Subject

Arikunto (2011) defines the research subject as an individual who provides relevant data for the study. This study researcher used a purposive sampling method to select the study participants. This method can be used on a small number of samples that align with the research targets and can provide the necessary data for the researcher (Sugiyono, 2013). This technique allows researchers to select participants based on specific criteria relevant to the study. Therefore, the participants of this study consist of five (5) teachers: one from School Number 1-Baucau (EFN.1-Baucau), two teachers from Saint Domingos Sávio Catholic School, Baucau (EKSDS), and the other two teachers from CAFE Baucau School. These five teachers are responsible for the natural science subject in the fifth grade. These teachers provided the primary data for the research.

3.2. Data Collection Techniques

Data collection techniques are an essential step in research. It allows the researcher to collect data. In qualitative research, data collection techniques include observation, interviews, and documentation (Sugiyono, 2019). Therefore, this research also accumulated data through interviews and observations to show systematic evidence on the implementation of effective natural science teaching strategies in basic education, especially for grade five (5).

An interview is a process of collecting research data through direct encounters (Cresswell, cited in Rianto, 2020). Therefore, in this research, the researcher conducted interviews with natural science teachers, especially 5th-grade students, in individual interviews. This interview used structured questions to investigate teachers' feelings and experiences of teaching science, the current strategy implemented in natural science lessons, and its advantages. However, the study enquires about teachers' perspectives on effective teaching strategies, the implementation of complementary learning experiences, and their future expectations regarding natural science teaching strategies.

Observation serves as a method to gather data directly related to the research subject (Rianto, 2020). In this research, the researcher observed the teachers who teach natural science lessons to 5th-grade students to verify the information obtained from the interviews. Therefore, the items that the researcher focused on to observe are about the current strategy implemented in science lessons and science teaching strategies that are effective by teachers. However, the researcher focused on the teaching spirit of the teachers, the participation of the students, their progressive learning, and future strategies for teaching natural science.

3.3. Data Analysis Techniques

The researcher applied a thematic analysis technique after collecting all the data. (Kiger & Varpio, 2020). A researcher arranged this data in a thematic table to identify the theme, code, and important ideas. By conducting thematic analysis, the researcher can understand and extract meaningful data that is relevant to the research question, resulting in credible findings for the research subject (Nowell, Norris, White, & Moules, 2017).

4. Results and Discussions

3.1 *Results*

Based on the results of the interview data, five teachers in the primary school for grade five (5) reported that they are happy when teaching science lessons because they can explore the natural world. In addition, they can share their knowledge with students to develop their understanding of natural science.

In their teaching, five of them also implemented learner-centred strategies (LCS), which is the philosophy of the new curriculum. Learner-centred strategies (LCS) that the teachers implement include asking questions, demonstrating concepts, facilitating group work, assigning individual tasks, conducting observations, leading discussions, solving problems, and guiding presentations.

The advantages of the student-centred strategy are that students are happy to learn, actively engage in it, feel comfortable learning alongside the teacher, and are free to express their ideas; they can also discover information relevant to natural science issues on their own. Additionally, by implementing this strategy, students can develop their knowledge and understanding in science lessons, become aware of what they are learning, and cultivate critical thinking skills. A teacher's perspective on how to implement effective strategies is learner-centred. I actively engage students in activities, implementing the previously mentioned strategy along with other effective strategies like discovery learning and experiments.

These teachers have attended training focused on LCS, and they know that it is necessary to involve students maximally through LCS. Teachers have implemented strategies using the various methods they initially mentioned. But the difficulty they face is the lack of teaching materials, reference books, internet connections, and school facilities, such as tables and chairs that do not support student-centred activities. On the other hand, students with smaller numbers still have low spirits and uncontrolled attitudes.

Despite these problems, five teachers are aware that this strategy is effective: getting students involved in activities, making them think deeply, and gaining knowledge in science. Teachers recognise their ongoing need for training to further empower themselves and effectively implement learner-centred strategies, which will enhance their teaching and support their children's future learning in science.

The results of personal observation data for the five teachers showed that they implemented learning centres strategies, including asking questions, making observations, demonstrating concepts, interacting with materials, facilitating discussions, solving problems, and conducting both individual and group work presentations.

The strategy they implemented followed the right steps. This strategy makes students actively participate in learning activities. Students are actively observing, analysing, and expressing their ideas. They also work with their peers to share ideas and explore learning content. They then present the results in large groups. Their strategies implemented are mostly effective and respond to student learning. Many students can understand

the learning content from their established strategies. Their responses to the questions demonstrate a solid understanding. In their implementation, most teachers also show the spirit of teaching and thus stimulate students' willingness to participate and learn. However, there are a few students who exhibit minimal motivation and an uncontrolled attitude. Such pupils will not pose a significant barrier as long as the teacher effectively manages their attitude. Therefore, based on my observations, the effective strategy recommended for future implementation is learner-centred. If the teacher continues to implement this strategy, then students will make better progress in their learning every day and develop their scientific knowledge.

3.2 Discussions

Learner-centred strategies are approaches to learning that teachers currently use in their teaching to respond to the paradigm of the 21st century (Ahmed, 2013). Therefore, according to the data, five teachers also stated that in their teaching and learning, they use student-centred strategies. This strategy represents a teaching philosophy that aligns with a new curriculum and supports the principles of 21st-century learning. A learner-centred strategy is an approach that enlivens the classroom and engages students (Rao, 2020). In this approach, students play an active role in the learning process to discover science, and teachers function as facilitators (Ahmed, 2013). The data also show that teachers gave students more opportunity to explore science rather than listen.

The author's presentation suggests that by implementing student-centred strategies, students will become more engaged in class, eager to learn, capable of expanding their knowledge, and capable of making progress in their learning (Rao, 2020). Based on interviews and personal observation, it also showed that traditional teaching strategies do not meet the needs of consumers in the 21st century, especially in the education sector. Therefore, teachers consciously understand that effective teaching strategies are learner-centred. Fifth-grade educators are currently implementing these strategies. Evidence also indicates that the implementation of the strategy makes children happy to learn and actively participate in expressing ideas; they have the opportunity to explore science through observation, discussion, and questioning. This strategy effectively addresses children's learning needs and enhances their scientific capacity. Additionally, through LCS, students enjoy learning science in the classroom and enhance their understanding of the subject. According to Rao (2020), LCS helps students develop various learning skills and acquire meaningful knowledge that will benefit them throughout their lives. This evidence suggests that teachers expect students to respond to the presented theory.

The implementation of student-centered strategies also depends on school facilities, internet connections, learning facilities, and students' character. These elements also stand in the way of implementing strategies that promote student success. The presented data indicates that the previously mentioned issues contribute to the difficulties teachers encounter when implementing the strategy. Therefore, schools and teachers also need to be creative in arranging school materials and facilities, which may hinder the effectiveness of implementing learner-centred strategies. However, it's crucial to emphasise that implementing the learner-centred strategy effectively requires the learner's's spirit, which enhances learning in the classroom. Additionally, teachers must effectively manage students' attitudes, as negative attitudes can hinder their learning. Therefore, teachers need to develop their scientific and creative intelligence capacities (Candrasekaran, 2014) through training on how to teach students effectively to be active, creative, and critical in natural science lessons.

Specific teacher training, particularly in teaching methods and technical scientific skills, is essential across all areas of the curriculum and educational levels (Alexandre & Oliver-Trobat, 2004). Through this training, a teacher enhances his or her knowledge, gains new insights, discovers new methodologies, and adopts new values, which are gradually applied to his or her personal and professional lives. Therefore, the interplay between theory, practice, reflection, and action is crucial (Khaksar, Yaghoobi, Jahanshahi & Nawaser, 2011). Therefore, based on the interview data, teachers were asked to continue receiving training to train themselves so that they can establish teaching strategies that meet the needs of science learning to help students learn science lessons well, encourage student learning and help students learn in peace. When these

issues are processed properly and accurately, the learning process can achieve objectives according to the curriculum based on scientific self-empowerment and creative intelligence.

Finally, this research presents that the future strategy that needs to be implemented in science teaching and learning to empower students' scientific knowledge is the learner-centred strategy. This strategy gave space to students' efforts to involve themselves actively, explore more, think critically, and develop their scientific understanding and capacity.

4. Conclusion

A strategy is a technique or way that a teacher implements to carry out a planned activity to help students learn a lesson. The best strategy to implement is learner-centred. This strategy allows students to take an active part in the learning process and not be passive listeners. They can find out for themselves, experiment, analyse, and generate critical thinking. This process helps students develop a more profound understanding of scientific concepts. The teacher is no longer a transmitter but a guide and facilitator for the student in his activities.

Therefore, data from interviews and observations indicates that teachers are implementing student-centered strategies that align with curriculum needs. They use and apply learner-centred strategies by asking questions, observing, solving problems, discussing, working in groups and individually, and making presentations. They are aware that students are not just subjects to receive but active subjects to explore science in depth. This strategy can significantly benefit students' learning by enhancing their knowledge, understanding, and skills in science lessons. In addition, this strategy encourages students to be willing to learn and reflect on their learning to develop scientific understanding.

Thus, the results also indicate that the only effective strategy that was implemented in the fifth grade for learning in natural sciences is the learner-centred strategy. This strategy can meet students' learning needs in science lessons and respond to 21st-century learning approaches. This strategy can help students learn science more effectively and enhance their scientific self-awareness.

Based on the findings of this research, researchers recommend the following actions to the relevant parties:

1. The Ministry of Education should facilitate training on student-centred learning strategies for teachers at each school.

2. Teachers should engage in self-training to acquire knowledge of student-centred learning strategies for effective implementation in grade five and other grades across various subjects.

3. School leaders seek opportunities for all teachers to receive training on learner-centred teaching strategies.

4. The Ministry of Education continues to monitor, evaluate, and provide early feedback on how to improve if teachers do not implement effectively the strategies they have learnt.

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