

The Role of Outdoor Learning in Developing Scientific Understanding: A Consequential Educator Success

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Abstract. This study explored the significant role of outdoor learning in enhancing students' scientific understanding, emphasizing how such experiential approaches contribute to educational success from the perspective of educators. It is important to mention that experiential approaches are considered necessary to achieve educational success. By using the qualitative approach, the research collected insights from teachers through interviews to probe their experiences, challenges, and realizations regarding the implementation of outdoor learning strategies. According to the findings, outdoor learning does not only enrich students' understanding of scientific concepts but also triggers their curiosity, critical thinking, collaboration, and environmental concerns that would help them become more aware of their surroundings and environment. Although educators had to deal with challenges such as limited resources, unpredictable environments, as well as time management problems, they found ways of coping with them by being creative, flexible, and collaborating. They used simple tools and shared ideas to solve problems. This study sums up that outdoor learning, in its integration with other learning elements, turns into a powerful instrument for deep and long-lasting scientific understanding, beneficial for learners and teachers. This research has the potential to be published in a reputable journal.

KEY WORDS

1. outdoor learning 2. scientific understanding 3. experiential learning

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1. Introduction

Changes of new learning in school is constant, its goal is to enhance scientific literacy of elementary learners. Though, the traditional classroom environment may be more effective, but it limits the practical experiences of the student. Enriched learning therefore is that outdoor learning that combines physical activities together with the general learning in science has turned out to be very effective in engaging and teaching students. This way can help students to be more engaging, interactive, and motivated in

school. Teachers who manage to create an activity that is fun and educational for the little ones and at the same time an activity that helps them enjoy some quality time with other kids is something parents must be thankful for. In the United States outdoor learning has shown promise in enhancing elementary students' scientific understanding. Professional development programs can effectively prepare teachers to integrate outdoor activities into science and mathematics curricula. Schools can create outdoor learning

environments that address various educational standards while promoting physical activity and nature experiences. Studies have demonstrated that outdoor learning models can significantly improve science learning outcomes for elementary students (Subarkah et al., 2021). Additionally, incorporating ethnoscience-based thematic modules implemented through outdoor learning strategies has proven effective in enhancing students' understanding of scientific concepts (Siswoyo, 2021). These approaches not only enrich students' learning experiences but also help overcome difficulties in comprehending scientific concepts within thematic learning contexts. Overall, outdoor learning presents a valuable opportunity to develop scientific understanding among elementary students in the United States, offering benefits across multiple subjects and promoting engagement with the natural environment. On the other hand, in China, recent studies highlight the benefits of outdoor learning for elementary students' scientific understanding. Outdoor education has been shown to significantly improve students' perceptions of scientific literacy and learning motivation compared to traditional indoor teaching methods (Fan et al., 2024). It also enhances science learning achievement, particularly for students with high naturalist intelligence (Supriadi et al., 2020). To implement outdoor learning effectively, professional development programs for teachers have been successful in improving their skills in designing and integrating outdoor activities into classroom lessons. These findings suggest that outdoor learning can be a valuable approach for developing scientific understanding among elementary students, offering enriched learning experiences and improved outcomes. Furthermore, in Korea outdoor learning plays a significant role in enhancing students' scientific understanding and engagement. Sukisna Suparwoto (2020) demonstrated that outdoor learning positively influences learning outcomes, abstract thinking, and science process skills among vo-

cational high school students. Best et al. (2021) emphasized that outdoor learning fosters experiential learning, promoting scientific inquiry and problem-solving skills in a constructivist environment. Mettis et al. (2022) found that mobile outdoor learning facilitates conceptual change and knowledge transfer, particularly when addressing socio-environmental issues. Furthermore, Haraldsson et al. (2024) highlighted that outdoor learning increases student engagement and motivation, allowing pupils to explore scientific concepts in real-life contexts, which enhances their understanding and application of science. Collectively, these studies underscore the effectiveness of outdoor learning in developing scientific literacy and fostering a deeper connection between students and their learning experiences. In a study conducted in the Philippines, Marpa (2020) concluded that the integration of environmental education is common across subjects such as sciences, social studies, and values education. This integration typically occurred on a weekly basis. Activities that effectively promoted sound environmental practices included lectures, hands-on outdoor learning, and field trips. These activities often involved initiatives such as tree planting, recycling, and greening schoolyards (Kireferessling and Bell, 2020). However, the study also highlighted certain gaps. Most teachers did not explore diverse perspectives on environmental issues with their students, and even when these topics were discussed, students were not encouraged to form their own views and ideas. Despite these challenges, teachers expressed eagerness to integrate environmental education. In addition, in a study conducted by Padillo et al. (2021) in Cebu, it was revealed that outdoor learning, combined with professional development activities for teachers, contributed to mastery in various areas, including instructional planning, instructional delivery, subject matter expertise, rapport with students, and classroom management. Despite these achievements, pro-

professional development activities were perceived to have minimal benefits for the teachers overall (Ajani, 2022). Furthermore, the study found no significant relationship between teaching competencies and professional development activities. The perceived benefits of professional development were largely attributed to personal perceptions and contextual factors rather than the activities themselves (Nguyen et al., 2023). The findings underscore the need for strategic planning, implementation, and evaluation of professional development programs to ensure that teachers derive meaningful benefits. Additionally, the study recommended conducting similar research on a broader scale to validate and expand upon these findings. Also, Sagun and Prudente (2023) stated that the learning environment plays a crucial role in the promotion of school science. Redesigning the science classroom into a metacognitive learning environment is imperative in developing students' 21st century skills in communication, collaboration, critical thinking and creative thinking. In their study they exposed Filipino students to a variety of outdoor learning such as metacognitive activities which allow them to plan, reflect, and evaluate their thinking skills and strategies. This study highlighted the interconnectedness and

interplay of science self-efficacy, metacognitive awareness, metacognitive-orientation of the classroom, and the scientific conceptual understanding of the students. These are crucial constructs in creating and maintaining a metacognitive orientation of the science classroom. The study also shows that science self-efficacy and applying outdoor learning has a vital role in predicting the academic achievement of students. While several studies have examined the impact of outdoor learning on scientific understanding in different regions specifically in Davao Region (Berandoy Villonez, 2024). There is limited research focusing on its implementation in Davao Oriental. Existing literature primarily explores the benefits of outdoor learning from a learner-centered perspective, often neglecting its implications for educator success and professional growth. Research about outdoor learning takes place mainly in developed urban centers while neglecting actual schools located in rural areas such as Davao Oriental. This gap in research underscores the need for localized study that examine how outdoor learning strategies shape both students' scientific understanding and teachers' professional development within this specific context.

1.1. Purpose of the Study—The purpose of this study is to examine the role of outdoor learning in fostering scientific understanding among students and its contribution to educators' professional success. Specifically, the study aims to explore how outdoor learning activities enhance students' comprehension of scientific concepts, as well as how such practices support educators in achieving instructional and developmental goals. By investigating the perspectives and experiences of educators, the study seeks to identify effective strategies for integrating outdoor learning into the curriculum and to highlight its broader impact on teaching success and student engagement. To achieve the purpose, this study will be divided into three main themes. The first one is instructional enactment effectiveness, and the study measures the impact which outdoor learning activities make on the teaching and delivery of science concepts and teaching strategies. The second area is educator experiences, exploring how teachers' participation in outdoor learning contributes to their professional growth, including skills development and increased confidence in instructional planning. Finally, the study will analyze students' results, thereby analyzing the effects of outdoor learning on the ability, reasoning skills and interests of students concerning scientific topics.

1.2. Research Questions—This study explores outdoor learning activities enhance students' comprehension of scientific concepts, as well as how such practices support educators in achieving instructional and developmental goals. Specifically, it seeks to answer the following questions:

- (1) What are the teachers' experiences in developing scientific understanding through Outdoor Learning?
- (2) How do teachers cope with the challenges of developing scientific understanding through Outdoor Learning?
- (3) What educational insight can be drawn from the study?

1.3. Definition of Terms—For a more comprehensive understanding, the following term is defined operationally: Outdoor Learning An active, experiential approach to learning, that involves being outdoors as a central part of the experience. It seeks to use the outdoor environment as a vehicle for transforming the experience into changes in knowledge, skills, behaviors or attitudes.

1.4. Significant of the Study—The study titled "The Role of Outdoor Learning in Developing Scientific Understanding: A Consequential Educators Success" offers valuable benefits for a range of stakeholders: Learners. Students benefit from Corlett's lean thinking in that they stand to enjoy better scientific knowledge through fun and practically-oriented outdoor exercises. These learning experiences lead to thinking and interest and motivation to learn, making them successful and appreciating science. Teachers. The study offers information on how to increase the student's conception of science by engaging in outdoor learning. In particular it provides educators with practical resources in designing, implementing and assessing activities whilst addressing difficulties experienced in this approach. The implications are also useful for professional development so the teachers can find ways to enhance their performance and become more successful in teaching School Administrators. This study provides necessary knowledge to the school leaders to comprehend the relationship between the outdoor learning environment and its benefits on academic achievement. It facilitates the development of policy, programs, and proposals that seek to include outdoor learning in portfolios of curriculum delivery so as to afford students balanced education delivery systems. Policymakers. This will help the policymakers for the improvement of educational policies also gets evidence-based recommendations about the promotion of outdoor learning. While practitioners can utilize the study's results to argue for increased funding and support for practical and outdoor learning in science, policymakers can do the same for the resources, training, and curriculum that would encourage or support such approaches.

1.5. Theoretical Lens—This study anchored the Experiential Learning Theory by Kolb in 1984, it focuses on learning through direct experience, which aligns perfectly with outdoor learning as a method of engaging students in hands-on activities. Experiential learning focuses on the idea that the best ways to learn things is by actually having experiences. Those experiences then stick out in your mind and help you retain information and remember facts. Teachers, creating opportunities for students to have experiences based on the things they are learning about is key. Teachers can help create environments where students can learn

and have experiences at the same time. (Western Governors University, 2020). In addition, David Kolb is best known for his work on the experiential learning theory or ELT. Kolb published this model in 1984, getting his influence from other great theorists including John Dewey, Kurt Lewin, and Jean Piaget. The experiential learning theory works in four stages—concrete learning, reflective observation, abstract conceptualization, and active experimentation. The first two stages of the cycle involve grasping an experience, the second two focus on transforming an experience. Kolb argues that effective learning is seen as the learner goes through the cycle, and that they can enter into the cycle at any time. Concrete learning is when a learner gets a new experience, or interprets a past experience in a new way. Reflective observation comes next, where the learner reflects on their experience personally. They use the lens of their experience and understanding to reflect on what this experience means. Abstract conceptualization happens as the learner forms new ideas or adjusts their thinking based on the experience and their reflection about it. Active experimentation is where the learner applies the new ideas to the world around them, to see if there are any modifications to be made. This process can happen over a short period of time, or over a long span of time. Kolb went on to explain that learners will have their own preferences for how they enter the cycle of experiential learning, and that these preferences boil down to a learning cycle. This theory concludes that experiential learning can allow students to immediately apply things they are learning to real-world experiences. This helps them retain the information better. This study also anchored the Constructivist Learning Theory by Piaget (1970) and Vygotsky (1978). This theory highlights that knowledge is constructed through interaction with the environment, making it ideal for outdoor learning contexts. Supports inquiry-based learning, which is often used in science edu-

cation outdoors. It investigates how outdoor learning environments serve as platforms for students to build and reconstruct knowledge through exploration and inquiry. According to Triantafyllou (2022), constructivist theory aims to answer how individuals develop critical thinking by trying to understand situations. It is very difficult to find a clear and precise definition of what constructivism means. Piaget proposed that children progress through the stages of cognitive development through maturation, discovery methods, and some social transmissions through assimilation and accommodation (Woolfolk, A., 2004 as cited by Sample n.d). He emphasized that hands-on experiences and active exploration, such as outdoor learning, allow children to construct knowledge and deepen their understanding of the world. Vygotsky's theory, on the other hand, stressed the importance of culture and language in cognitive development. He highlighted the role of social interaction and scaffolding within the zone of proximal development (ZPD), which aligns with outdoor learning activities where collaboration and guided exploration enhance learning and problem-solving skills. Figure 1 presents the conceptual framework of the study. It illustrates three interconnected themes. The first theme focuses on the experiences of educators in outdoor learning and how they encounter and address challenges in developing students' scientific understanding. The second theme explores educators' reflections and insights on effective methods for developing scientific understanding. The third theme examines the coping mechanisms of educators in outdoor learning, exploring the strategies they use to overcome barriers in developing students' scientific understanding. These themes collectively relate to educators' experiences in fostering outdoor learning to enhance scientific understanding. Outdoor learning experiences have been shown to positively impact elementary students' science achievement and environ-

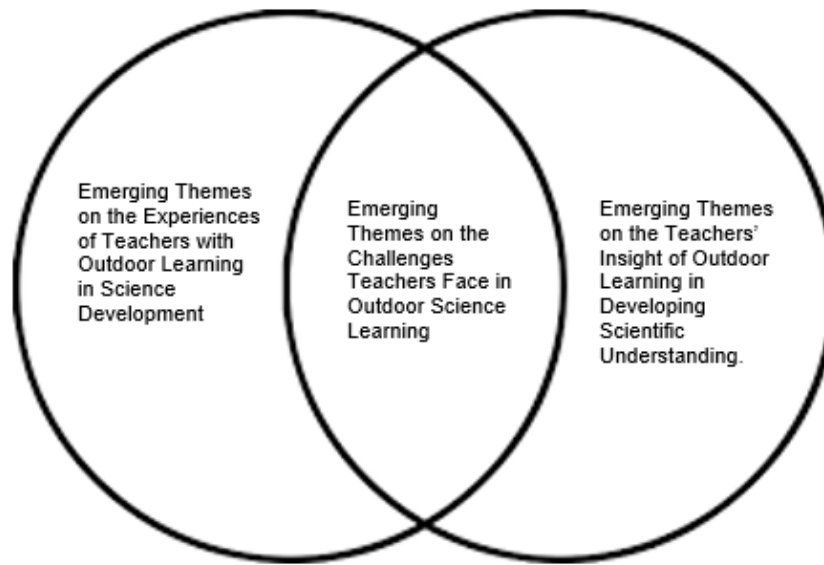


Fig. 1. The Conceptual Framework of the Study

mental attitudes. Activities outdoor can promote scientific literacy and engage children in practical research, although some students may struggle with interpreting results and conclusions. Integrating outdoor education programs can significantly increase physical activity levels and reduce sedentary time among students, while simultaneously improving science learning. To enhance effectiveness, outdoor learning can be combined with local cultural elements

through ethnoscience-based thematic modules, which have been found to improve students' learning outcomes. Regular outdoor learning experiences, implemented by trained teachers in familiar settings like schoolyards, can lead to greater engagement and science achievement. Overall, outdoor education programs offer valuable opportunities to promote physical activity, science learning, and environmental awareness among elementary school children.

2. Methodology

This section outlines the research methods that will be used in conducting the study. I the researcher will present the research participants, instruments, role of the researcher, design and procedure, ethical consideration, social value, informed consent, the vulnerability of the research participants, risk, benefits, and safety, privacy and confidentiality of information, justice, transparency, qualification of the researcher, adequacy of facilities, community involvement, plagiarism and fabrication of the researcher, as well as the data collection. I will utilized a qualitative research approach, specifically employing phenomenology to explore the experiences and perspectives of teachers in outdoor learning in developing scientific understanding of students. This study utilized a qualitative type of research, specifically the use of a research design. According to Awasthy (2020), qualitative research was a process of capturing lived-in experiences of individuals, groups, and society. It was an umbrella concept that involved a variety of methods of data collection such as interviews, observations, focused group discussions, projective tools, drawings, narratives, biographies, videos, and anything that helped to understand the world of

participants. I, the researcher, was an instrument of data collection and played a crucial role in collecting data. The main steps and key characteristics of qualitative research were covered in this paper. The reader would develop an appreciation for methodicalness in qualitative research. The quality of qualitative research was explained by referring to aspects related to rigor and the worthiness of the topic in interpretivist research.

2.1. Philosophical Assumptions—The study's philosophical assumption framework was used to collect, analyze, and interpret data within a specific research field, providing the context for the ensuing results and conclusions. An understanding of the philosophical assumptions behind qualitative research began with assessing where it fit within the overall process of research, noting its importance as an element of research, and considering how to actively write it into a study. These assumptions typically covered ontological, epistemological, axiological, and methodological educational perspectives, as Khalifa and Khalifa (2024) stated. Ontological Assumption

An ontology is a philosophical belief system about the nature of social reality—what could be known and how. The conscious and unconscious questions, assumptions, and beliefs that the researcher brought to the research endeavor served as the initial basis for an ontological position. Ontological assumptions were fundamental beliefs about the nature of reality and human existence that underpinned social research and policy-making. In information modeling, these assumptions ranged from realism to conceptualism, with social realism as a middle ground. In psychiatry, the medical model was based on ontological assumptions of realism, naturalism, reductionism, and essentialism (Marvin White Emerson, 2010; Patil Giordano, 2010, as cited by Abalo-Rodríguez Blithikioti, 2024).

Epistemological Assumptions

An epistemology is a philosophical belief system about who can be a knower. An epistemology includes how the relationship between the researcher and research participant(s) is understood. Epistemological assumptions in stud-

ies highlight the importance of explicitly addressing researchers' perspectives and methodologies. McNeil (2020) emphasizes the need to challenge dominant post-positivist paradigms in social work and substance use research, advocating for critical epistemologies to promote social justice.

Axiological Assumption

The concept of axiological alienation arises when there is a disconnect between human essence and actions, leading to a devaluation of human worth (Ibrahim Çetintaş, 2020). In medical school admissions, axiological analysis can help align institutional values with selection processes, ensuring a focus on social responsibility. Despite the increasing importance of values in various fields, there is no generally accepted theory of values, and they remain elusive. Developing an empirical axiology requires overcoming challenges such as values-as-truisms and hidden values. A multi-dimensional conceptual model of value landscapes, incorporating proximity, intensity, contextuality, and malleability, is proposed to advance the empirical study of values (Matthias Kaiser, 2024). Axiology, the study of values, plays a crucial role in research paradigms and educational processes. In positivist research, axiological assumptions influence the evaluation of findings and study design. Rhetorical Assumption

This assumption describes the reality from the perspectives of research participants is the definition of rhetoric. Instead of focusing on internal validity, external validity, and objectivity, the researcher employs personal voice and qualitative concepts such as credibility, transferability, dependability, and conformability. The researcher utilized the qualitative research method

of phenomenology to explore the experiences, challenges, and insights of school staff and employees in implementing crisis-management strategies. This method was advantageous for addressing complex issues and understanding

real-life experiences (Badil et al., 2023). It enabled researchers to comprehensively understand phenomena, broaden their perspectives, and interpret meanings from the participants' viewpoints (Creely, 2018).

2.2. Qualitative Assumptions—The research employed a qualitative phenomenological approach and utilized the in-depth interview method for gathering data. Barrick (2020) stated that in-depth interviews were a qualitative research technique commonly used in the social sciences to provide comprehensive insights into participants' viewpoints, experiences, and comprehension of their social environments. This method entailed conducting extensive, open-ended discussions with a limited number of participants, allowing for an exploratory approach. Interviews could be structured, semi-structured, or unstructured, with a preference for semi-

structured interviews (Barrick, 2020). Qualitative research interviews were vital in gathering data across various disciplines, particularly in the social sciences (McGrath et al., 2018). These interviews involved posing questions to participants to delve into their perceptions and experiences. They enabled detailed examination from relatively small participant groups and concentrated on the participants' viewpoints (Young et al., 2018). Interviews were essentially social exchanges where researchers posed questions to gather social research data (Roulston, 2018). They were especially valuable for investigating intricate scenarios involving diverse perspectives and values (Hillman, 2022).

2.3. Design and Procedure—The study used a qualitative research design, specifically phenomenology, to interpret the participants' experiences. Depending on the conditions, the participants were invited to take part in a focus group discussion conducted either virtually or face-to-face. Afterward, common themes and patterns from the participants' responses were identified and analyzed. This design was chosen to focus on educators' experiences and challenges in being in a contractual arrangement.

Furthermore, the data collected were analyzed using the thematic analysis method in phenomenological research. Importantly, participants signed an informed consent form before the data collection process began, ensuring that there were no risks for them in the study. Additionally, they had the option to withdraw as participants at any point if they felt uncomfortable. Ethical considerations and health safety

protocols were adhered to throughout the study. Qualitative research was an iterative process that aimed to understand complex human experiences and behaviors by getting closer to the phenomenon studied. It encompassed various data collection methods, including interviews, observations, and focus groups, with the researcher serving as a crucial instrument in this process. The approach emphasized making new significant distinctions and improving understanding within the scientific community. A semi-structured interview guide was used in the study to conduct more in-depth interviews. This tool served as a manual for interviewing suitable participants. Audio recorders were used to transcribe and interpret the interviews more easily. The interview questions were designed to address the research questions and gather additional insights from the participants to help identify themes and meanings for the

study. Research specialists were consulted to address any validity concerns regarding the design and methodology. Expert validators also reviewed and validated the interview guide. The sampling method for selecting research participants was based on the recommendations of the research panels. A referral system based on specific criteria was used to identify qualified educators to participate in the study. This sampling method, known as purposive sampling,

was a non-probability technique used in qualitative research to select participants based on characteristics relevant to the study's objectives (Campbell et al., 2020). In other words, participants were chosen deliberately. The identity of the participants was treated with utmost respect and importance in line with research ethics. The researcher maintained professionalism when interacting with the research participants.

2.4. Research Participants—The participants of this study were teachers from T. Patrio Elementary School in Banay-Banay, Davao Oriental. If the number of participants had not been sufficient, I would have also conducted surveys in neighboring schools within the district, including Banay-Banay Central Elementary School, Rang-ay Elementary School, Cabangcalan Elementary School, San Vicente Elementary School, and Piso Camp Elementary School. I purposively selected at least ten (10) teachers with a minimum of one year of teaching experience using purposive sampling. Additionally, participants had experience in outdoor learning activities and were willing to participate in data collection procedures such as interviews or surveys. Andrade (2020) suggested

that purposive sampling was suitable because it enabled the selection of participants with direct experience in the topic being investigated, thereby guaranteeing the collection of rich and relevant data.

I utilized a purposive sampling design since the participants were chosen based on the criteria or purpose of the study. In qualitative research, purposive sampling—also referred to as judgmental, selective, or subjective sampling—is a non-probability sampling technique that is frequently employed. Using preset criteria pertinent to a specific research goal, participants were selected using this technique (Etikan et al., 2022). Purposive sampling was beneficial when the study's goal was to comprehend a particular experience, occurrence, or setting fully (Campbell et al., 2020).

2.5. Ethical Considerations—I ensured adherence to the American Psychological Association's Code of Conduct (2017), the ethical guidelines established by the Psychological Association of the Philippines (2007), and the DOST Special Order No. 091 s. 2006, in accordance with the Philippine Health Research Ethics Board (PHREB), which served as the country's primary policy-making authority for health research ethics and upheld the universal ethical norms for the protection and advancement of the dignity of research partici-

pants. To ensure that the quality of this research project was based on the researcher's capacity to present readers with a credible claim for their position while providing a balanced presentation of the data, the research was submitted to the Rizal Memorial Colleges Research and Ethical Committee (RMCREC) for review. Ethical considerations were demonstrated through the following elements:

Social Value

I exhibited the social value of this study by exploring the standpoint and experiences of

teachers in developing scientific understanding through outdoor learning. The objectives of the study defined the needs of society, including those of teachers and parents in the community, so they could use the knowledge to gain helpful and relevant insights about their experiences. These insights could help them improve their attitudes and dispositions in life and address the challenges in fostering scientific understanding through outdoor learning. For school administrators and faculty, the study may have helped them become more competent in developing effective learning strategies—creating an environment where every student felt supported. This, in turn, could have had a positive impact on students’ academic performance and helped motivate and facilitate effective learning.

Informed Consent

The purpose of the informed consent in the study was to ensure the participants’ voluntary and deliberate participation. Informed consent was secured before conducting the in-depth interviews. Moreover, the informed consent was primarily administered face-to-face by directly giving and presenting it to the participants. The consent forms were collected in the same manner. Participants indicated their agreement either by signing the informed consent or by placing a check mark if they were unable to disclose their signatures.

Furthermore, the researcher ensured that the informed consent form clearly laid out all the required information about the nature of the study. The form outlined the participants’ complete rights during the data-gathering procedure, including their right to be informed that they were not obligated to answer all questions. The researcher also addressed all participant concerns regarding the study. In addition, the informed consent form was developed with careful consideration of the participants’ cultural, psychological, and social needs.

The Vulnerability of Research Participants

The participants in this study have proven to

be reliable in completing the research tool and are the primary sources of information. Therefore, I ensured that their contact details are available in case there are any questions or uncertainties about the study.

Risks, Benefits, and Safety

I ensured that the participants were aware of any potential risks, benefits, and safety concerns that could arise as a result of their involvement in the study. The data-gathering procedure was implemented through face-to-face interviews, and I ensured that a suitable location was designated for each interview. The location was pleasant, quiet, and away from large crowds so that participants could speak freely without distractions or concerns about their privacy being compromised. In addition, I was willing to conduct the interviews in the participants’ households if that was more convenient for them.

Privacy and Confidentiality of Information

As a researcher, I placed the utmost importance on the right to privacy and confidentiality of the participants. I ensured that all data collected from the participants was kept secure, confidential, and inaccessible to any unauthorized individuals, with access limited solely to me and the participants. Moreover, I ensured that the participants’ privacy and anonymity were protected through the use of code names. All data and information from the participants were safeguarded by me alone, and only I was permitted to store and manage the data. The data was securely compiled and stored on a single device that I personally owned. Upon completion of the study, all soft copies of the data were permanently deleted from the device, and all hard copies were shredded to ensure complete data destruction.

Justice

To embody fairness in the selection process, I selected the participants in accordance with the methods stated in the study. The participants were chosen based on the study’s criteria, which required that they be teachers from Davao

Oriental. Moreover, I used snowball sampling to identify participants. This meant that I selected individuals who met the study's qualifications—specifically, teachers who were available and willing to participate—rather than using a random sampling method.

I placed great emphasis on respecting the choices and responses of the participants, acknowledging their rights, updating them regularly, and addressing any questions they had regarding the study. Additionally, I expressed my gratitude by mentioning them in the acknowledgment section and giving them a token of appreciation for their participation.

Transparency

In order to promote transparency in this research study, I shared the results of the study with the participants. The results were not manipulated by me; I avoided biases and personal interests while analyzing the data and remained objective throughout the research process. I was also open to the opportunity of presenting the study in a forum or research congress. Moreover, I provided a hard copy of the study to the school library as well as to the education office to help disseminate the knowledge gained through this research.

Qualification of the researcher

I am a teacher who is handling junior high school particularly in grade seven, eight, and nine. I was qualified enough to conduct this research study as he already undergoes several research in their past subjects in his college life. Moreover, I was guided by the research teacher and my research adviser to ensure that conducting this study is appropriate.

Adequacy of Facilities

I made sure that a proper venue was pre-

pared for the interview if a face-to-face setting was deemed necessary. The location was pleasant, quiet, and removed from large crowds to allow participants to converse freely without distractions or concerns about their privacy being compromised. I also prepared a proper meal during the interview. If the participants preferred, the interviews were conducted in their homes. I ensured the preparation of these facilities through self-funding.

Community Involvement

I gave the utmost respect to local traditions and culture, as this was integral not only to the research but also to the general public. The participants' engagement in the study was embodied, acknowledged, and empowered. The findings of this study were helpful not only to them but also to future researchers, the community, and, consequently, educational institutions. Additionally, as stated under the ethical considerations, this research refrained from making any judgments about the participants' race, age, gender, religion, or other traditional practices before, during, or after the research interview.

Plagiarism and Fabrication as the researcher

I showed respect for the works and intellectual properties of others by properly citing the authors and rephrasing in my own words what others had stated. Furthermore, I understood the context of each study and refrained from directly copying text from reference papers. I also consistently used citations to indicate when text was borrowed from another source. Moreover, I ensured honesty while working on the manuscript and did not intentionally misrepresent or fabricate data and results, nor did I purposefully present inaccurate conclusions.

2.6. Role of the Researcher—I adopted both observational and interactive roles throughout the study process, beginning with securing formal approvals from the School Division

Superintendent and the heads of participating schools. This ensured that the research was conducted ethically and with the collaboration of the educational institutions involved. By estab-

lishing these professional relationships, I laid a foundation of trust that was essential for maintaining the integrity of the study.

During the data collection phase, I actively engaged in activities such as facilitating in-depth interviews and group discussions, while striving to maintain objectivity in analyzing the collected data. This commitment to objectivity was vital to ensuring that the findings were both

reliable and reflective of the research framework. This approach facilitated a deeper understanding of the participants' lived experiences and insights. Through meaningful dialogues and careful observation of relevant texts, I aimed to construct a comprehensive interpretation of the data that truly reflected the complexities of the participants' realities.

2.7. Data Collection—The following will be the step-by-step process of gathering the data the researcher needs. Asking for the endorsement letter from the Dean. The researcher requested an endorsement letter from the dean, as obtaining this letter is crucial to the research process. It demonstrates that the research adheres to the university's standards of academic conduct and ethical practices. This endorsement grants the researcher permission to collect data from participants and enhances their credibility. When individuals and organizations know that a study has received official approval, they are more likely to cooperate, thereby providing the study with improved access to necessary resources. Asking permission from the School Administrators and Principal to conduct the study in the said educational institution. The researcher wrote a letter to the Superintendent, attaching chapters 1 and 2 as well as the research instrument. The letter also explained the study's objectives and identified the participants. The researcher then waited for the School Administrators and Principal's response before conducting the study. Obtaining consent

from the participants. The participants' permission was requested by the researcher. They received a formal orientation about the study and the process as participants. Conducting the interview. After obtaining informed consent from the participants, the researcher conducted a focus group discussion using a semi-structured interview guide. The participants' demographics were recorded. The researcher also took notes with the participants' consent and recorded the conversations using a cell phone for easy transcription. The researcher actively listened and engaged during the session. Transcribing the responses of the interviewees. The researcher accurately transcribed the interviewees' responses by listening to their answers from the cell phone's audio recorder. Since the participants are encouraged to use a language they are comfortable with, the researcher translated non-English responses into English. Data Coding and Thematic Analysis. After transcribing the data, it was categorized and coded. Subsequently, themes were extracted, and the participants' individual data will be compared and contrasted to identify patterns and trends.

2.8. Data Analysis—In analyzing the collected information, the researcher employed and utilized a thematic analysis. To begin, the researchers carefully transcribed the audio of the participants' answers into a Word document after the interviews. After transcribing, the re-

searchers reviewed every answer to ensure that no information was missing. The next step involved extracting recurrent terms that helped in creating themes. To accomplish this, the researchers used color coding to highlight repetitive words or phrases in the participants' an-

swers. Themes that were related to one another were marked with the same color. After examining and establishing the context, the researchers proceeded to develop the themes that

had emerged. Finally, the researchers provided examples from the data they had gathered to support their claims, explaining how frequently the themes arose and what they represented.

2.9. Framework of Analysis—The framework for this study allowed for flexibility, enabling data collection and analysis to occur simultaneously. Data gathered from contractual teachers were reviewed and organized according to recurring topics and themes related to their experiences, challenges, and insights. Drawing from the steps outlined by Fuchs (2023), the process typically involved six steps: becoming familiar with the data, generating initial codes, searching for themes, reviewing the themes, defining and naming the themes, and producing a report. This process ensured that the analysis remained focused on capturing the teachers' experiences and struggles in working under a contractual arrangement.

Familiarization

In this initial stage, the researcher becomes acquainted with the data by reading and re-reading it while noting any initial analytical observations

Coding

Is a process commonly used in various qualitative analysis methods. It involved creating brief labels for significant data features relevant to the overall research question. Coding is not just a technique for reducing data; it is also an analytical process. The codes represent a semantic and conceptual interpretation of the data.

The researcher will assign a code to each piece of data and conclude this stage by organizing all the codes along with their associated data extracts.

Searching

In this stage, the researcher identified coherent and meaningful patterns within the data that relate to the research question. They finished this stage by categorizing all the coded data according to each identified theme.

Reviewing

The researcher assessed whether the themes effectively communicate a compelling narrative about the data. This involved delineating each theme's essence and exploring their interconnections.

Defining and Naming

The researcher analyzed each theme in detail, identified its core components, and created concise, impactful, and informative titles for each theme.

Producing

A report involved weaving together the analytic narrative and data extracts to tell the reader a coherent and persuasive story about the data.

Figure 2 showed that the framework offers a systematic approach to analyzing qualitative data, ensuring that the results are extracted in an organized manner and interpreted in a meaningful way.

2.10. Trustworthiness of the Study—Researcher should demonstrate that data analysis will be carried out precisely, consistently, and methodically, by documenting, classifying, and outlining the analysis methodologies in sufficient detail for the reader to judge the process'

reliability, Trustworthiness is both a goal and a practice. The Trustworthiness part of a study typically provides evidence for the reader's acceptance that the study is beneficial to them. The study's findings are reliable in light of the fact that the researcher are effortful by detailing

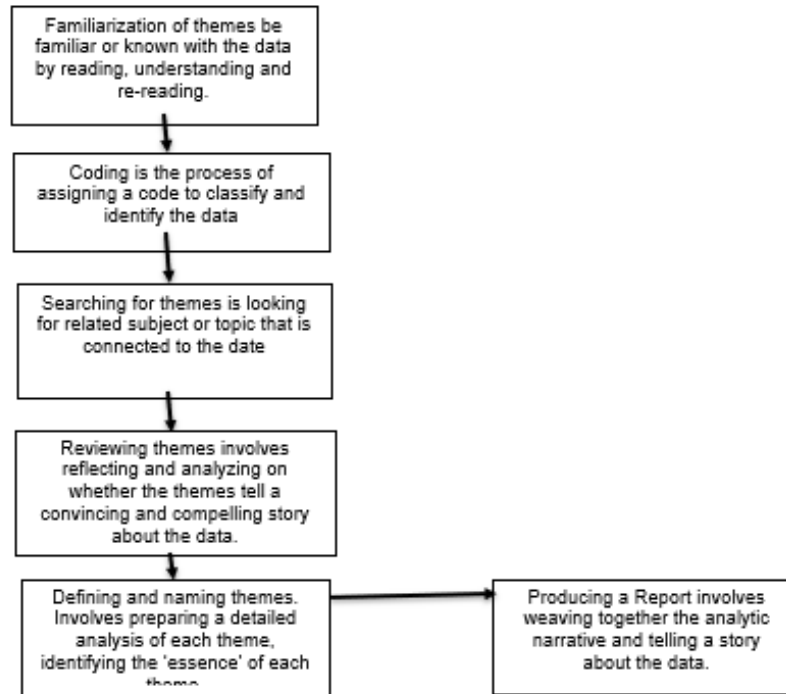


Fig. 2. Analytical Framework of the Study

the methods and procedures used to conduct the research. The researcher made sure that all of the research methods and findings were credible, transferable, confirmable, and dependable.

Credibility

The researchers conformed with the standards for trustworthiness in research ethics, in particular credibility. The study's sources were all trustworthy sources with complete citations, relevant author salutations, and APA referencing, thus, the researchers will feel secure in their conclusions. Also, the results will be evaluated in accordance with the study's ethical guidelines.

Transferability

The attempt to generalize study findings and apply them to diverse settings and contexts is referred to as transferability (Devault, 2020). In other words, the researcher showed that the findings of the research study may be applied to similar situations, groups, and phenomena. To ensure transferability, the researcher ascertained that the study's contexts and outcomes are precise and generalized so that readers can

compare the familiarity of the existing phenomena to other scenarios linked to the study. As a result, the study's findings have the quality to be applied in a similar situation as comparative analysis and recommendation.

Dependability

A researcher can prove dependability by repeating the study in the same context, using the same procedures, and with the same participants. In this study, the data sources and references shall be fully documented and credited so that future researchers can replicate them and use them as a guiding principle for improving this study. The researcher also followed the advice of the research advisor and the panels to establish the dependability of the study.

Conformability

Elo et al. (2014 as cited by Linneberg Korsgaard, 2020) defined conformability as objectivity, or the ability of two or more independent people to agree on the correctness, relevance, or interpretation of facts. Results are reported methodically and meticulously, with special emphasis paid to how data and results are linked.

Importantly, the researcher presented a documented and full copy of the transcribed information that was conducted during the interview. The transcribed information contained non-bias data and exude precision which was generally

written and recorded verbatim. In addition, the researcher informed the participants of the content of the interview and ask for approval for the transcription.

3. Results and Discussion

This chapter presents and discusses the key findings of the study. This research examined how educators utilized outdoor learning as a strategic approach to enhance students' scientific understanding, along with their firsthand experiences, strategies, and challenges encountered during implementation. This chapter serves as a presentation of essential findings that reflect the impact of outdoor learning in science education. The study generated themes through thematic analysis of participant interview data, interpreted through relevant educational and pedagogical frameworks.

3.1. Teachers' Experiences with Outdoor Learning in Science Development—Outdoor learning delivered a reflective and forever-changing experience for teachers with the perfect balance of hopeful possibilities and intrinsic difficulties. It was obvious for many educators that science classes in open-air environment raised students' interests, improved relationships between theory and practice, and encouraged better participation in classes. Fieldwork in the scientific sphere – nature walks, experiments in school gardens and exploration of the local environment – stimulated students

and made abstract scientific notions easier to understand. Teachers also faced problems with unpredictable weather, limited outdoor facility accessibility, and the need to be thorough in preparation to ensure the safety of students and the efficient delivery of relevant curriculum. Nevertheless, the overwhelming majority of participants indicated that outdoor learning significantly improved scientific understanding of students, and it also inspired innovative changes in the teaching methods of the students. Below are the themes that with teacher's experiences with outdoor learning in science development.

3.1.1. Real-World Application of Scientific Concepts—Outdoor learning helps students directly experience and apply scientific ideas, making abstract concepts more concrete and understandable. By engaging with nature and the environment, students can observe real-life examples of scientific phenomena such as plant growth, animal behavior, and weather patterns. This hands-on approach not only deepens their understanding but also allows them to connect theoretical knowledge to everyday experiences, fostering critical thinking and problem-solving skills that are essential for scientific inquiry. Outdoor learning has proven to be an effective strategy in teaching science among Grade

2 learners, as it bridges theoretical knowledge with real-life experiences. Teacher 1 shared that studying ecosystems outdoors allowed students to observe insects, plants, and soil firsthand, resulting in a deeper understanding than textbooks could offer. Likewise, Teacher 4 found that engaging students in planting seeds and observing their growth weekly sparked excitement and helped them grasp scientific concepts more meaningfully. Teacher 5 recalled that outdoor weather observation made Earth science more relatable, as students began to identify patterns and record data like real scientists. Teacher 9 further emphasized that outdoor learning reduces the abstract nature of science; when stu-

dents touch, see, and interact with their environment, the concepts become more concrete and memorable, leading to lasting learning. Outdoor learning can enhance students' engagement, scientific understanding, and motivation in science education. Teachers who successfully implement outdoor learning often hold social constructivist beliefs and value authentic science experiences. Students report that learning is easier outdoors, as they can explore, observe, and discuss scientific concepts in real-life contexts (Haraldsson et al., 2024). Outdoor teaching experiences can improve pre-service teachers' general science teaching skills and their capacity to teach science outdoors (Ma Green, 2021). During the pandemic, teachers in Denmark found that outdoor teaching allowed for more curricular content and teaching from their own mindset, despite initial preparation challenges (Barfod, 2022). These studies suggest that outdoor learning can be an effective pedagogical strategy for developing scientific understanding, though teachers may require support

and professional development to successfully integrate it into their practice. Real-world applications of scientific concepts in education are crucial for enhancing student engagement, understanding, and career success. Integrating situated cognition with explicit instruction can improve retention and generalization of scientific knowledge, particularly for students with disabilities. Incorporating real-life examples and community contexts into science education helps students develop a deeper understanding of scientific concepts and processes, fostering scientific literacy and problem-solving skills. Understanding the Nature of Science is essential for meaningful science education, as it encourages students to view science as a process of knowledge discovery rather than a collection of facts. By applying scientific concepts to real-world scenarios, educators can promote critical thinking, analytical skills, and adaptability in students, preparing them for future challenges in an increasingly technology-driven society.

3.1.2. Enhanced Engagement and Curiosity in Science Learning—Outdoor learning environments boost student interest, encourage inquiry, and increase motivation to learn science through hands-on experiences. When students engage with the natural world, they are exposed to real-life examples of scientific concepts, which sparks curiosity and makes learning more relatable. These environments promote active participation and allow students to explore, question, and experiment in ways that traditional classrooms cannot. Outdoor learning has sparked curiosity and deeper engagement among Grade 2 learners by providing hands-on experiences that classroom settings often lack. Teacher 2 observed that students became more inquisitive during outdoor sessions, quickly understanding concepts like the water cycle through activities that used their natural surroundings. Teacher 3 highlighted

that even simple nature walks encourage scientific inquiry, with students asking questions and forming hypotheses more actively when surrounded by nature. According to Teacher 6, outdoor learning helps break the monotony of traditional classes, making students more focused and less distracted for instance, measuring shadows throughout the day proved to be a simple yet effective method to understand the sun's movement. Teacher 8 noted that even typically struggling or quiet students show improved performance outdoors, sharing how one reserved student confidently led a mini-experiment on leaf decomposition—an opportunity unlikely to occur inside the classroom. Sagun and Prudente (2023) stated that the learning environment plays a crucial role in the promotion of school science. Redesigning the science classroom into a metacognitive learning environment is imperative in developing students' 21st century skills

in communication, collaboration, critical thinking and creative thinking. The significant role of curiosity in enhancing science learning outcomes. Curiosity-driven approaches have been shown to increase student engagement by 25 and improve learning outcomes by 30 (Hunaepi et al., 2024). The Science Curiosity Scale, developed to measure interest in science, predicts engagement with scientific content more accurately than measures of science intelligence or education (Landrum et al., 2016). Strategies that stimulate curiosity, such as creating 'information gaps' and implementing inquiry-based learning, can enhance student motivation and learning. These findings underscore the complex relationship between teaching methods, curiosity, and learning outcomes in science education.

3.1.3. Development of Collaborative and Observational Skills—Outdoor activities promote teamwork and allow students to practice essential scientific skills such as observing, hypothesizing, recording, and analyzing. Working in groups during outdoor lessons helps students build communication, collaboration, and problem-solving abilities, which are crucial in scientific investigations. These activities encourage peer learning, where students share ideas, ask questions, and learn from one another's perspectives. Moreover, being in an open and stimulating environment enhances their focus and creativity, making science learning more enjoyable and effective. Outdoor learning not only deepens understanding of scientific concepts but also enhances collaboration and essential skills among Grade 2 learners. Teacher 7 shared how a group activity on identifying soil types around

the school encouraged students to work together, discuss their discoveries, and even debate possible causes and effects engaging in real-time scientific thinking. Teacher 10 emphasized that outdoor learning goes beyond content delivery; it builds foundational skills such as observation, data recording, collection, and analysis. These core components of scientific inquiry are developed in a more enjoyable and interactive environment, making learning both meaningful and fun. Furthermore, in Korea outdoor learning plays a significant role in enhancing students' scientific understanding and engagement. Sukisna Suparwoto (2020) demonstrated that outdoor learning positively influences learning outcomes, abstract thinking, and science process skills among vocational high school students. Best et al. (2021) emphasized that outdoor learning fosters experiential learning, promoting scientific inquiry and problem-solving skills in a constructivist environment. Mettis et al. (2022) found that mobile outdoor learning facilitates conceptual change and knowledge transfer, particularly when addressing socio-environmental issues. Furthermore, Haraldsson et al. (2024) highlighted that outdoor learning increases student engagement and motivation, allowing pupils to explore scientific concepts in real-life contexts, which enhances their understanding and application of science. Students who participate in outdoor learning will not only improve their scientific knowledge and abilities but also their interpersonal and teamwork skills in which they collaborate with other by involving and engaging.

3.2. Challenges Teachers Face in Outdoor Science Learning—Implementing outdoor learning to enhance scientific understanding comes with several challenges that teachers often face. One major difficulty is the lack of resources and materials needed for effective outdoor instruc-

tion, such as tools, equipment, or access to safe and suitable learning environments. Weather conditions and unpredictable outdoor factors can also disrupt planned activities, making it hard to maintain consistency in lessons. Additionally, teachers may struggle with classroom

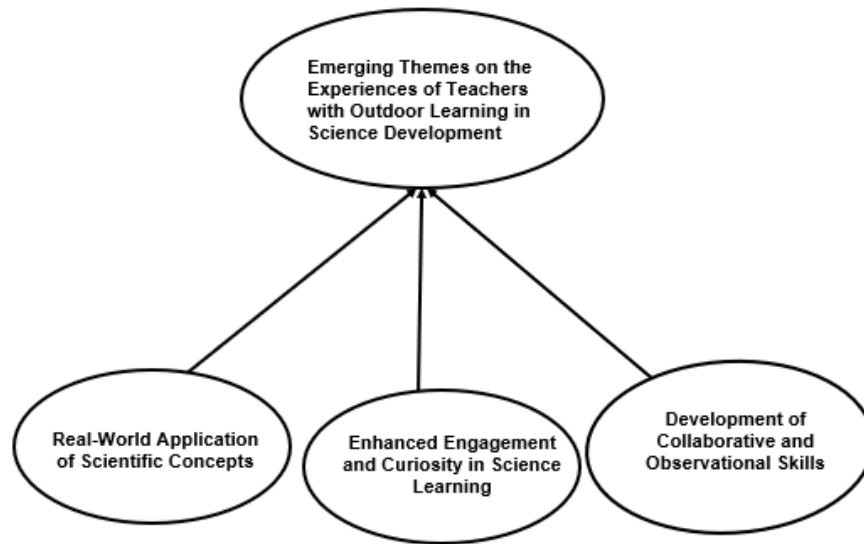


Fig. 3. Emerging Themes on the Experiences of Teachers with Outdoor Learning in Science Development

management in open spaces, as it becomes more difficult to monitor and control student behavior. Aligning outdoor activities with the curriculum and learning objectives can be another concern, requiring extra time and planning to

ensure educational value. Despite these obstacles, many teachers remain committed to using outdoor learning due to its potential to make science more engaging and meaningful for students.

3.2.1. Resource and Environmental Constraints—Might be the reason to the limitations and challenges that prevent schools or teachers from effectively implementing outdoor learning activities. These challenges can affect lesson planning, safety, learning outcomes, and the overall success of outdoor instruction. However, some teachers collaborate to have quality experience in their outdoor activities. Limited resources are a challenge, so Teacher 3 uses what's readily available in nature leaves, rocks, water, and shadows which all become tools for inquiry when used creatively. Teacher 4 collaborates with fellow teachers by exchanging tips, effective locations, and successful activity designs to save time and enhance the quality of the experience. Recognizing time constraints, Teacher 6 integrates outdoor learning into existing lesson plans rather than treating it as a separate activ-

ity, making it part of their daily routine. Meanwhile, Teacher 10 adapts to less-than-ideal environments by transforming even school gardens or parking lots into meaningful spaces for scientific exploration through thoughtful planning and preparation. Despite challenges such as limited resources, time constraints, and non-ideal environments, teachers continue to find ways to implement outdoor learning through creative and practical approaches. Teacher 3 uses natural materials like leaves, rocks, water, and shadows as alternative teaching tools. Teacher 4 collaborates with fellow teachers to exchange tips, effective locations, and activity designs, which helps save time and enhance the quality of learning experiences. Teacher 6 addresses time limitations by integrating outdoor learning into existing lesson plans instead of treating it as a separate task, making it part of their daily

routine. Meanwhile, Teacher 10 adapts to less-than-ideal environments such as school gardens or parking lots by ensuring proper planning and framing. These efforts show that with collaboration, awareness of available surroundings, and adaptability, outdoor learning can still be effective and engaging. Activities like field trips and outdoor experiments deepen scientific understanding and promote environmental awareness, which is vital in a biodiverse country like the Philippines. However, barriers such as high operational costs, time constraints due to rigid curriculums, and standardized testing hinder its implementation. Additionally, limited teacher training and inadequate resources reduce its effectiveness (Novitasari et al., 2023). To overcome these challenges, investments in teacher training, funding, and curriculum adjustments are essential to maximize the impact of outdoor learning. Other obstacles include weather conditions, time constraints, and behavioral management issues. Additionally, schools may struggle with limited facilities and resources for OL implementation. The relative operational costs can

be high, and coordinating with parents may be necessary to address financial concerns. To overcome these challenges, schools should consider providing teacher training, allocating special time for OL, and utilizing available resources in the school environment (Novitasari et al., 2023). Outdoor learning activities, such as field trips and hands-on experiments, enhance students' scientific understanding and raise environmental awareness an especially important goal in the biodiversity-rich Philippines. However, several challenges hinder their implementation. These include high operational costs, strict academic schedules, standardized testing, lack of teacher training, and limited resources. Additional barriers involve unpredictable weather, classroom management difficulties, and insufficient school facilities. Financial concerns may also arise, requiring coordination with parents. To address these issues, schools need to invest in teacher training, adjust the curriculum to allow time for outdoor learning, and make the most of existing school resources. .

3.2.2. Classroom Management in Open Settings—Classroom management in open settings involves maintaining student focus, safety, and discipline during outdoor learning activities such as field trips or lessons held in gardens or school grounds. Unlike traditional classrooms, these environments lack physical boundaries and are filled with distractions like noise, weather changes, and unfamiliar surroundings, which can lead to behavioral challenges. Teachers must set clear expectations, establish safety rules, and plan engaging, structured activities to keep students attentive and well-behaved. Effective supervision and the use of strategies such as grouping or assigning student leaders are also essential to ensure a smooth and productive learning experience outside the classroom. Planning is truly the key, Teacher 1 anticipates pos-

sible weather changes, noise, and distractions, and always prepares backup indoor activities that are still aligned with outdoor learning objectives. Teacher 2 maintains control by setting clear rules before heading outside, establishing structure and routine to help students stay focused even in a less controlled environment. Teacher 5 emphasizes safety by conducting site inspections before the activity and assigning clear student responsibilities to ensure accountability. Meanwhile, Teacher 8 prepares students mentally through short reflection sessions before and after outdoor learning, keeping them focused and connected to the lesson. These strategies ensure that outdoor learning remains effective, safe, and purposeful despite potential challenges. As mentioned above, outdoor learning environments offer valuable opportunities for

enhancing scientific understanding and cross-curricular education. Teachers and prospective teachers recognize the benefits of outdoor learning, including gaining new information, concretizing knowledge, and learning by doing (Uzel, 2020; Elmali et al., 2023). These experiences promote experiential learning, scientific inquiry, and problem-solving skills (Best et al., 2021). Effective implementation requires careful planning, time management, and the teacher's role as a guide. Challenges include paperwork, classroom management, and com-

munity engagement (Elmali et al., 2023). Professional development programs can enhance teachers' skills in designing and integrating outdoor learning activities into classroom instruction. Teachers emphasize the importance of informing students about learning outcomes, preparing plans, and evaluating observations post-activity. Overall, outdoor learning provides a less restrictive environment that allows for cross-curricular activities and the use of natural resources.

3.2.3. Curriculum Alignment and Time Demands—These are significant challenges in implementing outdoor learning. Many school curriculums are rigid and heavily focused on standardized testing, leaving little room for flexible, experiential activities like outdoor lessons. As a result, teachers often struggle to fit outdoor learning into tight schedules while still meeting academic requirements. Without clear connections between outdoor activities and curriculum objectives, these lessons may be seen as extra or non-essential. To address this, schools must integrate outdoor learning into the curriculum, ensuring it supports academic goals while also allocating dedicated time for its implementation. Time constraints can be challenging, so Teacher 6 integrates outdoor learning into current lesson plans instead of treating it as a separate activity making it a natural part of the classroom routine. Teacher 7 sometimes encounters resistance from students or parents, so they make an effort to clearly explain the goals and benefits of outdoor learning. To build trust, they even send brief summaries of what was accomplished during outdoor sessions. Teacher 9 incorporates mobile technology, such as tablets or phones, to document students' observations. This not only helps keep students focused but also allows them to reflect on their experiences using actual data. These strategies show how prac-

tical adjustments, open communication, and the use of technology can effectively support outdoor learning even amid challenges. Implementing outdoor learning in schools faces significant challenges, particularly in curriculum alignment and time demands. Teachers struggle to embed outdoor learning within the curriculum due to performative culture constraints and time pressures. Curriculum and time constraints are frequently reported barriers, along with concerns about safety, costs, and access to training (Harris, 2021). The implementation of outdoor learning requires careful planning, including determining learning competencies, objectives, materials, locations, and estimated time (Novitasari et al., 2023). To overcome these challenges, teachers need support in developing competences to implement outdoor learning effectively (Kiviranta et al., 2023). Solutions include coordinating with parents regarding costs, allocating special time for outdoor activities, providing teacher training, and utilizing learning media in the school environment (Novitasari et al., 2023). Despite these challenges, outdoor learning offers numerous benefits for children's holistic development, health, and well-being (Kiviranta et al., 2023).

Teachers struggle to integrate outdoor activities within curriculum requirements and testing schedules. Time constraints are consistently

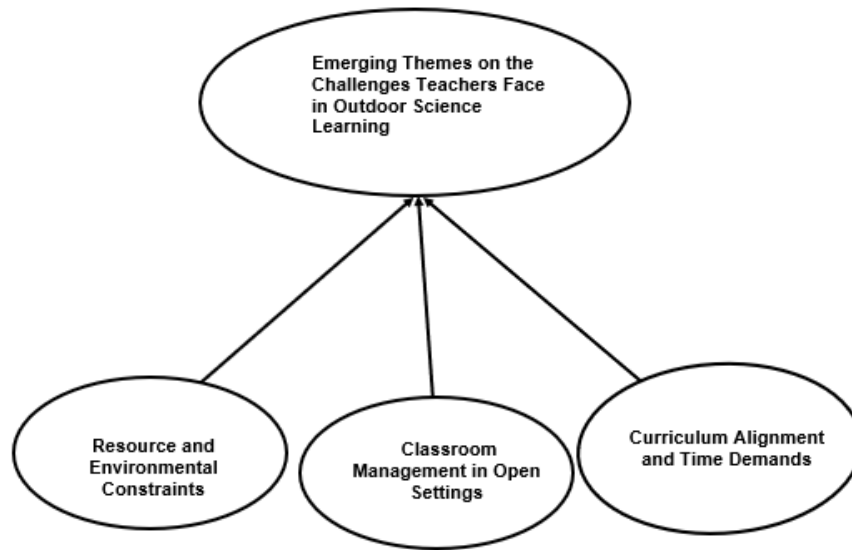


Fig. 4. Emerging Themes on the Challenges Teachers Face in Outdoor Science Learning

reported as a major barrier. Other challenges include funding limitations, lack of administrative support, liability concerns, and insufficient teacher expertise. Despite these obstacles, outdoor learning offers numerous benefits, including improved student engagement, concentration, and well-being. To overcome challenges,

schools employ various strategies such as creative curriculum interpretation, risk-benefit assessments, and professional development for teachers. Successfully implementing outdoor learning requires recognition from education inspectorates of its value in achieving curricular aims and its broader benefits to students.

3.3. Teachers' Insight of Outdoor Learning in Developing Scientific Understanding—Teachers' insight into outdoor learning highlights its valuable role in developing students' scientific understanding. Many educators believe that hands-on experiences in natural environments help students grasp complex scientific concepts more effectively than traditional classroom instruction. By observing real-life phenomena and engaging in experiments outside,

students can better connect theory to practice, which enhances curiosity and critical thinking. Teachers also recognize that outdoor learning fosters environmental awareness and encourages active participation. However, they emphasize the need for proper training, resources, and support to effectively integrate outdoor learning into their science teaching. Below are the themes and responses of teachers towards outdoor learning developing scientific understanding.

3.3.1. Strengthening Conceptual Understanding Through Real-Life Contexts—It allows students to connect academic concepts with everyday experiences, making learning

more meaningful and lasting. When lessons are grounded in real-world situations such as observing plant growth in a garden or measuring objects during a nature walk students are

more likely to understand and retain scientific ideas. These experiences promote critical thinking, problem-solving, and the ability to apply knowledge beyond the classroom. By engaging with tangible examples, learners deepen their comprehension and develop a stronger grasp of abstract concepts, ultimately leading to more effective and practical learning outcomes. Outdoor learning teaches students to observe, inquire, and connect what they see to scientific concepts, building real-world understanding, as emphasized by Teacher 1. Teacher 5 adds that this approach makes learning more memorable, with students vividly recalling outdoor experiences, which strengthens their grasp of scientific knowledge. According to Teacher 10, it also reinforces the idea that learning isn't confined within the classroom when science becomes an experience, it becomes more meaningful. Teacher 7 highlights that flexibility is a key value, as students realize that science can happen anywhere and anytime, not just in laboratories. Outdoor learning teaches students to observe, ask questions, and connect their observations to scientific concepts, fostering a genuine understanding of the world around them. This approach makes learning more memorable, as students often recall their outdoor experiences more vividly, reinforcing their grasp of scientific knowledge. Most importantly, it emphasizes that learning isn't limited to the four walls of a classroom when science is

experienced firsthand, it becomes more meaningful. Flexibility also becomes a key trait, as students realize that science doesn't just happen in labs it can take place anywhere, at any time, and they themselves can be active participants in it. Outdoor and contextual learning approaches have shown promise in strengthening students' conceptual understanding and engagement with science subjects. Mobile outdoor learning can facilitate knowledge transfer and conceptual change, particularly when focused on socio-environmental issues (Mettis et al., 2022). Ethnographic research demonstrates that outdoor learning improves pupils' willingness to participate and helps them develop scientific concepts and skills in real-life contexts (Haraldsson et al., 2024). Contextual learning strategies connect subject matter to students' everyday experiences, enhancing motivation and understanding. The Contextual Teaching and Learning (CTL) model has been found effective in improving primary students' conceptual understanding by associating lessons with their life contexts (Kristidhika et al., 2020). These approaches enable students to explore, observe, and reflect on scientific phenomena in diverse, real-world settings. By engaging in hands-on experiences, students can better grasp abstract concepts, apply scientific knowledge meaningfully, and develop critical thinking, curiosity, and deeper understanding of science.

3.3.2. Enhancing Student Engagement and Motivation—Enhancing student engagement and motivation is key to fostering a positive learning environment. When students are actively involved in their learning, they are more likely to retain information, participate in discussions, and show enthusiasm for the subject matter. Hands-on activities, real-world connections, and interactive teaching methods can spark curiosity and make lessons more enjoy-

able. By incorporating student interests, providing choices, and offering opportunities for collaboration, teachers can increase motivation and create a classroom atmosphere where students are excited to learn and eager to take on challenges. This approach not only improves academic performance but also nurtures a love for learning. These are the responses of teachers regarding to enhancing student engagement and motivation. Outdoor learning instills curios-

ity and promotes lifelong learning—students don’t just memorize, they discover Teacher 2. It also strengthens teacher-student relationships, as learning outside the classroom encourages more interaction, trust, and engagement Teacher 6. One major realization is that science becomes more inclusive through this approach; even students who struggle academically are able to succeed when given practical and exploratory experiences Teacher 3. Research indicates that enhancing student engagement and motivation is crucial for creating a positive learning environment. Key factors include supportive teacher relationships, positive classroom climate, and peer interactions (Firman Sandiarsa, 2024). In online environments, student motivation to learn and self-efficacy are positively associated with

engagement, with self-efficacy partially mediating this relationship (Bedi, 2023). To foster engagement, educators should focus on building supportive relationships, creating inclusive classroom climates, providing diverse resources, and thoughtfully integrating technology (Firman Sandiarsa, 2024). These strategies can contribute to enhanced student motivation, engagement, and overall academic success across various educational settings. Strategies for fostering engagement include providing meaningful learning experiences, offering opportunities for active learning, and creating a safe, conducive atmosphere. These approaches collectively contribute to increased student motivation, engagement, and overall academic success.

3.3.3. Fostering Skill Development and Independent Thinking—Fostering skill development and independent thinking is essential for preparing students for real-world challenges. By encouraging students to solve problems, make decisions, and explore ideas on their own, teachers help them build critical thinking, creativity, and problem-solving skills. Activities that promote hands-on learning, group discussions, and inquiry-based projects allow students to take ownership of their learning, developing both practical and cognitive abilities. As students are given more opportunities to think independently and apply their knowledge, they become more confident in their abilities and better equipped to navigate complex situations both in and outside the classroom. Outdoor learning teaches responsibility not just in managing tools and tasks, but also in caring for the environment Teacher 4. The study highlights that it enhances more than just science skills; it also develops teamwork, problem-solving, and adaptability Teacher 8. Furthermore, it nurtures a deeper appreciation for nature, which is essential in teaching environmental awareness and fostering

sustainable habits Teacher 6. Outdoor learning activities have been shown to positively influence children’s independence development and skill acquisition. Project-based outdoor learning significantly affects the growth of independence in children aged 5-6 years (Abdurakhman et al., 2022). Self-directed outdoor learning approaches provide opportunities for students to develop practical analytical skills and find solutions to field problems independently (Idris et al., 2020). Outdoor learning models can improve student learning outcomes, with abstract thinking abilities, responses to guidance, and science process skills contributing to understanding specific topics (Sukisna Suparwoto, 2020). Furthermore, outbound training in soft skills learning has been found to contribute to social, physical, and academic skill development, helping learners escape the monotony of classroom training (Senguttuvan, 2020). These studies collectively demonstrate that outdoor learning environments foster skill development and independent thinking across various educational levels and subject areas. Outdoor learning activities play a crucial role in enhancing

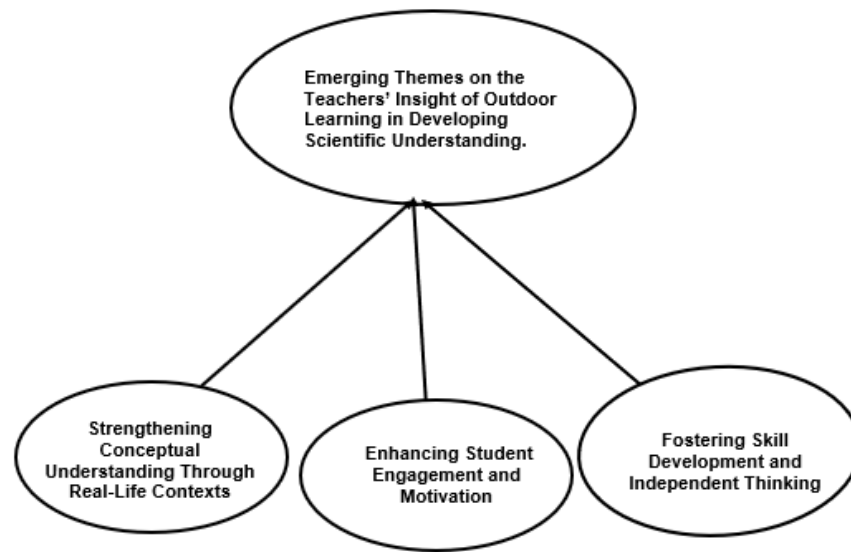


Fig. 5. Emerging Themes on the Teachers' Insight of Outdoor Learning in Developing Scientific Understanding.

children's independence and skill development across various educational levels. These activities, such as project-based and self-directed learning, provide students with the opportunity to develop practical analytical skills, think independently, and solve real-world problems. Outdoor learning also supports the improvement of abstract thinking, science process skills, and re-

sponsiveness to guidance. Additionally, training in soft skills through outdoor activities fosters the development of social, physical, and academic abilities, offering a refreshing alternative to the traditional classroom setting. Overall, outdoor learning environments are instrumental in nurturing independent thinking, skill acquisition, and well-rounded development

4. Implications and Future Direction

This study examined the role of outdoor learning in developing scientific understanding, with a focus on its impact on educator success. The findings highlight the significant contribution of outdoor learning in enhancing students' engagement, fostering independent thinking, and promoting skill development. These insights emphasize the transformative potential of outdoor learning in scientific education and underscore its importance for both teacher effectiveness and student outcomes. The implications of this study offer valuable perspectives for improving educational practices, curriculum design, and future pedagogical strategies.

4.1. Findings—The results of the study connect strongly with both the Constructivist Theory and the Experiential Learning Theory. Teachers shared that outdoor learning helps students better understand science by allowing them to explore, observe, and experience real-

life situations just as the experiential theory explains that learning happens best through doing and reflecting. At the same time, the constructivist view is supported by how students were seen building their own ideas and understanding through hands-on activities outside the

classroom. These findings suggest that science education becomes more meaningful and effective when learners are actively involved and can connect lessons to real experiences. Because of this, schools and educators are encouraged to use outdoor learning more often as a strategy to support deeper scientific understanding. The integration of outdoor learning into scientific education has transformed traditional teaching practices by offering more interactive, hands-on, and engaging experiences for students. Teachers have utilized outdoor environments to enhance students' understanding of scientific concepts through real-life observations, field ex-

periments, and nature-based activities. This approach not only deepens students' conceptual knowledge but also fosters critical thinking, problem-solving, and environmental awareness. Moreover, the study revealed that teachers encounter varying levels of access to outdoor spaces, resources, and training. While some educators effectively incorporate outdoor learning into their curricula, others require additional support and professional development to navigate these activities successfully. This disparity highlights the need for targeted interventions to ensure all teachers have the resources and skills to implement outdoor learning effectively.

4.2. Implications—The study also emphasizes the importance of context in outdoor learning. By utilizing local environments and relevant scientific phenomena, teachers are able to create meaningful connections between classroom content and the students' daily lives. This contextualized approach not only enhances engagement but also makes scientific learning more applicable and relevant. Teachers in resource-limited settings often face challenges, such as inadequate access to outdoor spaces or unpredictable weather conditions, which can hinder outdoor learning opportunities. In response, educators adopt creative strategies, such as using local community areas or virtual outdoor simulations, to engage students and facilitate scientific inquiry. While these methods offer valuable learning experiences, they cannot fully replicate the benefits of direct interaction with the natural world. The study highlights the need for greater investment in outdoor

learning infrastructure, teacher training, and resources to ensure all students can benefit from these impactful educational practices. Despite the numerous advantages of outdoor learning, challenges such as weather disruptions, time constraints, and limited school facilities remain significant barriers. These obstacles require educators to adopt flexible and adaptive approaches to ensure that outdoor learning is consistent and effective. Schools should prioritize creating accessible outdoor spaces and developing programs that support outdoor teaching year-round. Additionally, fostering collaboration between teachers, parents, and local communities can provide essential resources and support for successful outdoor learning experiences. The findings suggest that, while outdoor learning offers immense potential for enriching scientific education, careful planning, adequate resources, and ongoing professional development are crucial for its successful implementation.

4.3. Future Directions—To build on the insights of this study and ensure sustainable improvements in outdoor learning, the following future directions are proposed:

For Teachers. Schools and educational au-

thorities should provide ongoing professional development opportunities that focus on effective outdoor learning strategies. These sessions should include training on how to integrate local environments into the curriculum, manage

outdoor classrooms, and foster inquiry-based learning in natural settings.

School Administrators. Efforts must be made to ensure that all schools, regardless of resources, have access to outdoor learning spaces. This can be achieved by enhancing school grounds, utilizing nearby community spaces, or partnering with local parks and environmental centers to offer regular outdoor learning opportunities.

Policy Makers. Policies should be developed to support the integration of outdoor learning within national curricula, emphasizing its benefits for scientific understanding and environmental education. Funding and resources should be allocated to schools for the development of outdoor classrooms, field trips, and nature-based educational programs.

Community. Engaging the local community, including environmental organizations, local businesses, and parents, can provide additional resources and support for outdoor learning initiatives. Partnerships can lead to community-driven outdoor learning experiences, volunteered field trips, and access to local environmental expertise.

Future Researchers. While this study focused on educators' experiences with outdoor learning, future research should explore students' perceptions and outcomes of outdoor learning. Investigating how outdoor experiences influence their scientific understanding, engagement, and long-term interest in environmental issues will provide a more comprehensive view of the impact of outdoor learning on student development.

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