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Research Article

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Teachers' Perspectives on the Challenges and Use of Educational Video in Third Cycle Science Instruction in Timor-Leste

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Abstract

This study aims to explore science teachers' perspectives on the use of educational videos, identify how videos are used in the teaching and learning process, and analyse the challenges teachers face when integrating videos into science instruction. Researcher employed a descriptive qualitative approach using purposive sampling. The participants included Grade 7 natural science teachers, Grade 7 students, and the school director from Central Basic School Mary Wilson. The research realizes between June 2026 and September 2026. Data were collected through semi-structured interviews, classroom observations, and documentation, and analysed using thematic and content analysis. Data credibility was ensured through member checking. The findings indicate that teachers have positive perspectives on the use of educational videos in third-cycle science instruction. Educational videos support learning by visualising scientific concepts, facilitating students' understanding and exploration of science, improving memory retention, increasing classroom participation, and enhancing learning motivation. Teachers also use videos interactively to make science lessons more dynamic and engaging. However, challenges remain, particularly limited access to laptops and difficulties related to student behaviour during video-based learning activities. Overall, this research contributes to developing innovative, interactive, and effective science teaching strategies and supports the integration of technology and digital media into science education in Timor-Leste.

Keywords: *Teacher perspectives, Educational video, Science instruction, Third-cycle education, Timor-Leste.*

1. Introduction

Natural science is an important discipline in the National Curriculum of Basic Education in Timor-Leste, because this area gives students the opportunity to understand nature, the environment, and scientific phenomena around them. Based on the National Basic Education Curriculum, natural science includes scientific knowledge areas such as physical science, chemistry, earth science, astronomy, and biology. Natural science learning not only focuses on the acquisition of knowledge but also guides students to develop the capacity of observation, investigation, critical thinking, problem solving, and application of scientific knowledge in everyday life. Therefore, natural science teaching needs to link scientific concepts with students' experiences, environment, and local reality so that learning can be concrete, relevant, and meaningful (Ministry of Education, 2014).

This orientation is also relevant to the third cycle, especially the 7th grade, as a stage where students begin to encounter deeper and more complex scientific content. At this level, students not only know and memorize scientific terms or facts but also understand the relationship between concepts, explain natural phenomena, interpret information, and use evidence to support their thinking. Because some scientific concepts in 7th grade involve processes and phenomena that are not easy to observe directly, the way teachers use instruction is an important aspect to facilitate students' understanding.

The National Curriculum for Basic Education (2014) emphasizes learning that promotes students' active participation through observation, investigation, practical activities, discussion, critical thinking, and problem solving. In this approach, students not only receive information from the teacher but must engage in the process of seeking, exploring, interpreting, and applying knowledge. The curriculum also emphasizes the link between learning and students' previous experiences, the environment, and local reality. Thus, the implementation of the curriculum in the classroom requires the use of instructional strategies and resources that can provide opportunities for students to see, explore, and understand scientific phenomena in a concrete way.

In this context, the role of the teacher becomes very important. Teachers are not only responsible for transmitting curriculum content but also for planning learning activities, choosing strategies, and using resources appropriate to learning objectives and student needs. In natural science instruction, the use of learning media can help teachers present scientific concepts and phenomena that are difficult to demonstrate directly in the classroom. Hapanti, Hikmah & Basuki (2024) explained that learning media has an important function in the instructional communication process, especially to facilitate students' understanding of the subject being taught.

With the development of digital technology, learning media are now not limited to books, posters or conventional materials but include a variety of digital resources, such as animations, simulations and educational videos. Integrating technology in education can provide opportunities for the teacher to diversify instructional strategies and for students to access and interact with information through multiple modalities. Zhou (2024) stressed that technology plays an important role in the development of society and can support human activities, including education. In the field of education, technology can

influence the way teachers teach and the way students learn. Gómes & Galan (2020) also pointed out that technology, including educational video, has the potential to support the education and learning process. In addition, Guggemos & Seufert (2021) emphasise that technology integration can influence the way teachers organise the teaching process and the content presented in the classroom.

Among these digital resources, educational video has important potential to support natural science instruction. Video can integrate images, motion, narration and sound to present information in both visual and auditory ways. Through video, students can observe scientific phenomena, processes, demonstrations or simulations that are difficult or impossible to observe directly in the classroom. Pardana and Hidayati (2024) presented that educational video can facilitate the teaching-learning process and help transmit information in a clear and detailed manner. Thus, video can be a bridge between theoretical explanation and visual representation, helping students understand how a scientific process or phenomenon occurs.

The use of video is especially relevant in natural science instruction in 7th grade because some scientific subjects involve abstract concepts and processes that are not easy to see directly. Animation and simulation in video can help represent processes in situations that cannot be demonstrated directly in the classroom. Videos can also connect scientific concepts to real-life situations, so students can see the relationship between scientific knowledge and their environment. Naimah (2022) added that educational videos can support conceptual understanding by transforming abstract concepts into easily observable representations.

In addition to providing support for comprehension, educational videos can be used as part of active learning. Krebs et al. (2024) showed that educational videos can increase students' interest in learning content and can support the learning process when accompanied by guiding questions. These questions can stimulate students to watch carefully, think and respond to the information presented in the video. Thus, the use of video in the classroom should not be limited to viewing activities but can be integrated with questions, discussions, learning activities and reflection to promote student cognitive engagement. Kuhlmann et al. (2024) also showed that student active cognitive engagement during instructional video use was related to STEM (science, technology, engineering and mathematics) learning outcomes. With this strategy, video can become a pedagogical tool that helps students observe, analyse and construct their understanding of scientific concepts.

However, the effectiveness of educational video depends not only on the technical quality of the video but also on the way the teacher selects and integrates the video into the instructional process. The teacher needs to consider the learning objectives, curriculum content, age and level of understanding of the students, the duration of the video, and the activity that will be done before, during, and after watching the video. La Torre and Désiron (2024) emphasize that the use of instructional video in the classroom needs to consider the way the video integrates with the pedagogical process and learning objectives. They showed that the videos selected by the teacher did not all apply multimedia principles that support student cognitive processing. Therefore, the role of the teacher is important to select and integrate video with appropriate instructional planning. Thus, video itself does not guarantee that learning will be effective; its effectiveness also depends on the quality of the video and the way the teacher plans and implements its use in the teaching process (La Torre & Désiron, 2024).

In practical implementation, the use of educational video may also encounter limitations. These limitations may include the availability of electricity, computers or projectors, access to the internet, the availability of appropriate digital materials, the condition of school infrastructure, and the capacity of teachers to use and integrate technology with pedagogy. Therefore, the availability of technology alone is not sufficient to ensure effective integration in the classroom. There is also a need for teacher preparation, institutional support, and resources appropriate to school reality.

In the Timor-Leste context, these considerations are important because the implementation of the National Curriculum in the classroom needs to be adapted to local conditions and realities. The curriculum guides natural science learning towards observation, investigation, hands-on activities, and connection with the environment and student experiences (Ministry of Education, 2014). However, when laboratory facilities, instructional materials, or opportunities for live demonstrations are limited, digital resources such as video can be considered as one of the alternatives to support the presentation of scientific phenomena and processes. At the same time, the use of video needs to consider the availability of resources and technological realities in schools so that its integration can be realistic and sustainable.

Therefore, it is important to understand not only the theoretical potential of educational video but also the reality of how teachers use this resource in natural science instruction. Teachers directly plan the lesson, choose the material, determine how the video will be used, and guide the students during the learning process. Their perspectives can provide important information about the benefits they see, forms of video use, types of activities that accompany video, and challenges they face during implementation.

Based on these contexts, this research focuses on exploring teachers' perspectives on the use of educational video in natural science instruction for third-cycle students, especially 7th grade students, in Timor-Leste. This research seeks to understand how teachers use educational video, the benefits they see in the instructional process, and the factors that facilitate or hinder the implementation of educational video in the classroom. Through understanding the experiences and perspectives of teachers, the results of this research can contribute to the understanding of the implementation of digital resources in natural science instruction and can be the basis for the development of pedagogical strategies relevant to curricular objectives and the reality of education in Timor-Leste.

1.1. Research Question

1. What are the perspectives of primary school science teachers on the use of educational video in third-cycle science instruction?
2. How do teachers use educational videos in third-cycle science instruction?
3. What challenges do teachers face when integrating educational video into third-cycle science instruction?

1.2. Research Objectives

The purpose of this research is to:

• Explore and understand teachers' perspectives on the use of educational video in third-cycle science instruction.

• Identify teachers' ways of using educational video in third-cycle science instruction.

• Know the challenges teachers face in integrating educational video into third-cycle science instruction.

2. Literature Review

2.1. Multimedia Learning Theory

Multimedia learning theory is a relevant theoretical basis for understanding how students learn information when content is presented through a combination of verbal and visual elements. In the context of education, multimedia and educational video can be important tools to support students' understanding, especially when the learning content involves abstract concepts, processes or phenomena that are difficult to observe directly. Therefore, an understanding of the concept of multimedia and the principles of the Cognitive Theory of Multimedia Learning is important to explain the potential of educational video in the teaching-learning process.

2.1.1. Multimedia concept

Multimedia refers to the combination of various forms of media such as text, images, audio, graphics, video and animation, which are integrated into a digital medium to convey information (Zhou, 2024). The combination of these elements allows information to be presented not only through verbal form but also through visual and auditory representations. Thus, multimedia can provide different ways for students to receive and process information during the learning process.

In education, the use of multimedia can help improve communication between teachers, content and students, and facilitate understanding of learning materials. This is especially important in fields such as science and mathematics, which often involve abstract concepts, symbols, processes or phenomena that are difficult to understand through verbal explanation alone (Naimah, 2022). When information is presented with a combination of verbal, visual and auditory elements, students can acquire different representations of the content learned. Therefore, multimedia can be considered as a tool that has the potential to facilitate the knowledge construction and understanding process of students.

2.1.2. Educational video in the learning process

Educational video is a form of multimedia that integrates visual and auditory elements to convey information and learning content. Video can present images, motion, words, audio, animation, demonstration, and simulation at the same time. Because of these characteristics, educational videos can be a support tool for teachers to present materials in a dynamic and easy way for students to follow.

In the learning process, educational video has the potential to facilitate understanding, especially when the content learned is abstract, complex, or not easy to observe directly. Through video, scientific concepts or phenomena can be presented with images, movement, animation, and simulation so that students can see a concrete representation of the content they are learning. Basri, Thamrin, Jalinus, Abdullah, & Usmeldi (2023) and Naimah (2022) showed that the use of video can facilitate the learning process, increase clarity in subject presentation, and enhance students' motivation to participate in the learning process.

In science learning, this video feature becomes relevant because some scientific concepts and phenomena require observation, demonstration, or visual representation to be properly understood. Thus, educational video can be a bridge between theoretical concepts and reality, helping students connect new knowledge with experiences and phenomena that occur in their environment.

2.1.3. Benefits of multimedia for comprehension and retention

The use of multimedia, especially educational video, can benefit students' understanding and retention of information. When content is presented through a combination of verbal and visual elements, students may be given the opportunity to process information through multiple forms of representation. This process can help students understand difficult concepts and recall information learned (Naimah, 2022). Comprehension and retention of information are also important in science learning because students need to not only memorise terms or definitions but also understand the relationship between concepts, processes and phenomena. Educational video can help this process through visual and auditory presentations that allow students to see and hear information in an integrated form. Thus, the use of multimedia can support students in constructing conceptual understanding and retention of learned knowledge.

However, the benefits of multimedia do not depend only on the elements used. The way these elements are organised and presented is also important. When there is too much text, images, audio or animation, it is irrelevant, or poorly organised, it can cause cognitive load and make it difficult for the student to concentrate on the main information. Therefore, the use of multimedia requires pedagogical planning and consideration of the processing capacity of students. This aspect can be understood through the Cognitive Theory of Multimedia Learning.

2.1.4. Cognitive theory of multimedia learning

The Cognitive Theory of Multimedia Learning (CTML) was developed by Richard E. Mayer and is an important theory to explain how people learn when information is presented through multimedia. According to Mayer (2024), multimedia learning involves the processing of information through a cognitive system that has two main channels, the verbal/auditory channel and the visual channel. Each channel has a limited capacity to process information, and effective learning occurs when students select relevant information, organise it and integrate it with prior knowledge. Thus, Bouchey, Castek & Thygeson (2021) also applied the principles of the Cognitive Theory of Multimedia Learning and explained that words and images are processed through different channels, and the student must organise and integrate these representations into knowledge.

Based on this theory, when students watch educational videos, information does not enter the memory as one. Visual elements, such as images, animation and movement, are processed through the visual system while words and sounds are processed through the verbal/auditory system. Students need to select relevant information from these representations, organise the information in a mental structure and integrate it with the knowledge they already have. This process helps the student build a mental representation and understanding of the content learned.

CTML is also based on three main assumptions, namely dual-channel assumption, limited-capacity assumption and active-processing assumption. The dual-channel assumption refers to the idea that people process information through both the visual channel and the verbal/auditory channel. The limited-capacity assumption shows that each channel has a limited capacity to process information at a time. While the active-processing assumption shows that effective learning requires the student to be actively involved in selecting relevant information, organising information and integrating new information with prior knowledge (Mayer, 2024).

In the context of educational video, these assumptions are important because video combines images, movement, words, and audio. When these elements are appropriately organized and focused on relevant information, students can use available cognitive capacity to build understanding of the content. However, when the video contains too much information, irrelevant decorative elements, or a disorganized presentation, the student may experience difficulties in information processing. Therefore, the quality and way educational videos are developed and used in the classroom is important to consider.

On the basis of CTML, the use of educational video in science learning can be considered as a tool that has the potential to facilitate conceptual understanding, especially for abstract concepts and phenomena that are difficult to observe directly. The combination of visual and verbal representations can help students build connections between new information and prior knowledge. Thus, the CTML provides a theoretical foundation for understanding how educational video can support the learning process and why the way information is presented becomes important in the use of video in the classroom.

In this research, CTML was used as a theoretical lens to understand the potential of educational video in science instruction. The theory helps analyze how multimedia elements in video, such as images, audio, text, animation, and movement, can support students' understanding and processing of information. Furthermore, the theory also helps consider the limitations that may arise when video is used out of line with multimedia learning principles. Therefore, the CTML not only explains the benefits of educational video but also provides a basis for understanding the conditions and ways of using video that can support learning effectively.

2.2. Teacher Perspectives on the use of Educational Video in Third-Cycle Science Instruction

Teacher perspective refers to the way teachers see, understand, interpret and evaluate the teaching-learning process and pedagogical practice in the classroom. Soysal (2025) explained science teachers' perspectives through their understanding of scientific knowledge, learning, science concepts and science teaching. Thus, the teacher's perspective is not only about personal opinion but also includes knowledge, experience and the way teachers interpret and implement teaching practices in the reality of the classroom.

According to Xu, Reis & Lodge (2025), the science teacher perspective is important in understanding how teachers view the purpose and practice of science education, especially in the development of student scientific creativity. Their study showed that teachers' understanding of science teaching can influence the way they plan and conduct learning activities in the classroom. Therefore, in research on teacher perspectives on the use of educational videos, perspective can refer to the way teachers view the usefulness, benefits, limitations, facilities and challenges of using educational videos to support science instruction.

In the context of contemporary education, the teacher is not only the main source of information but also a facilitator who guides students to actively participate in the learning process. Mayer (2024), through the contemporary development of the Cognitive Theory of Multimedia Learning, emphasises that learning depends on how students process and organise information received, especially when information is presented through multimedia. With this perspective, teachers need to plan learning activities according to the objectives, student capacity and the nature of the content to be taught. The teacher perspective is very important because teacher attitudes, understanding and pedagogical decisions can determine how learning resources and strategies are integrated in the classroom. In science education, teachers need to consider the opportunities and challenges of digital strategies so that students can understand scientific concepts well.

2.2.1. Teacher preparation in the use of educational video

The teacher plays an important role in planning and implementing the use of educational video. Video effectiveness depends not only on the quality of video content but also on how teachers select, prepare, and integrate videos with learning objectives and classroom activities. Therefore, teacher preparation can be considered as an important phase before video is implemented in the teaching-learning process. This preparation can be divided into two interrelated aspects, namely technical preparation and pedagogical preparation. Technical preparation focuses on the availability and readiness of the tools and resources needed to present the video. While pedagogical preparation focuses on video selection, activity planning, teaching strategies, and student assessment. The combination of these two aspects is important to ensure that the use of video is planned and can respond to learning objectives. Ackermans, de Koning, and Jarodzka (2025) emphasize that instructional video can be an important part of learning, but its effectiveness also depends on the way the video is developed and integrated with strategies that support student processing and engagement.

2.2.2. Educational video selection

Video selection is one of the most important steps in planning the use of educational video. Teachers need to identify and select videos that are appropriate to the learning objectives, curriculum content, age, and level of understanding of students. The selected video needs to provide clear, relevant, and directly related information to the topic to be taught. The length of the video should also be considered to avoid students losing attention due to the video being too long.

Brame (2016) emphasizes that effective educational videos should be of appropriate duration, have clear content, and be integrated with interactive activities. Video used solely as entertainment, unconnected to learning objectives, may not have a significant impact on student understanding. Therefore, teachers need to watch the video before presenting it to students and evaluate its quality, relevance, clarity of language and image, duration, and contribution to the learning objective.

2.2.3. Technical preparation and learning resources

In addition to content selection, teachers need to prepare tools and technical resources that support video presentations. These tools may include a television or projector, laptop, sound system, power source, and internet access, including Starlink or internet packages when video requires online access. Preparation of these instruments should be done before the class begins to ensure that the video can be presented well and to avoid technical interruptions during the learning process.

The effectiveness of the use of educational video depends not only on the content of the video but also on the technical conditions that support its implementation. When there are problems with electricity, audio, projectors, laptops, or internet connections, interruptions can reduce students' attention and participation. Truss et al. (2024) explained that technical problems or videos that are not easy to access and use can lead to disengagement in the student. Therefore, technical preparation and pedagogical planning are important to minimize obstacles that may interfere with the learning process.

2.2.4. Lesson plan and pedagogical preparation

Pedagogical preparation is another important aspect in the use of educational video. Teachers need to prepare lesson plans that show learning objectives, content, teaching strategies or methods, student activities, and forms of assessment. The lesson plan can serve as a guide to integrate the video with the learning process before, during, and after the video presentation.

In the pre-video phase, the teacher can introduce the topic, activate students' prior knowledge, and ask guiding questions. During the video, students can be guided to observe important information, answer questions, or make notes. After the video, the teacher can organize discussions, questions and answers, practical activities, or tasks for students to analyse and apply the information they learn. Brame (2016) recommends that educational videos should be integrated with learning objectives and interactive activities so that students do not just watch videos passively but actively engage in the learning process.

2.2.5. Multimedia principles in video presentation

The way educational video presents information also has an influence on students' processing and understanding. Mayer (2017) explained that students can learn better when verbal and visual information are used together and organized according to the principles of multimedia learning. Therefore, educational videos need to avoid irrelevant information and decorative elements that can increase cognitive load.

Principles such as signaling, segmenting, coherence, temporal contiguity, and spatial contiguity are important to organize information in educational videos in a way that can support the learning process. Signaling helps students' direct attention to important information; segmenting divides complex content into smaller parts for easier processing; coherence helps reduce or eliminate irrelevant information, while temporal contiguity and spatial contiguity help students integrate verbal and visual information related to appropriate time and position (Candido, Cattaneo, & Petko, 2025).

Studies of instructional videos have also shown that these principles are important in the design of educational materials, as clear organization of information can help reduce extraneous processing and direct the student to important aspects of the content (Candido et al., 2025). Therefore, teachers need not only look at the quality of video content but also need to consider the structure and way visual and verbal information is presented. Video that focuses on the learning objective, organizes the content in clear segments, uses visual/verbal cues, and avoids irrelevant elements can support students to concentrate on the main concept.

The use of educational video in third-cycle science instruction can be considered as a process that involves more than just video presentation. This process requires the teacher's understanding of appropriate video selection, technical preparation, pedagogical planning, and integration with active learning activities and assessment. Each aspect is interrelated and contributes to the effectiveness of video use in the classroom.

Thus, educational videos can provide students with the opportunity to observe scientific phenomena, understand abstract concepts, increase motivation, and engage in learning activities. However, these benefits do not happen automatically. Video effectiveness depends on teacher competence, video quality and relevance, availability of technical resources, lesson planning, and pedagogical strategies used.

2.3. The Use of Educational Video in Third-Cycle Science Instruction

The use of educational video in third-cycle science instruction is a pedagogical strategy that can support the improvement of the quality of the teaching-learning process. In the development of digital technology today, audiovisual media, including educational video, have become an important resource that can be integrated into the teaching process. This is especially relevant in science learning because science subjects involve concepts, processes, and phenomena that are sometimes abstract or difficult to observe directly in the classroom. Through video, scientific information can be presented with a combination of visual and auditory elements, such as images, animation, movement, narration, and demonstration, so that students can get a concrete representation of the content they are learning.

According to Mayer (2024), multimedia learning involves processing information through visual and verbal channels that have limited capacity. When images and words or audio are used in an appropriate way, students can construct mental representations of the content and understand the information better. In the context of science instruction, educational video can be used to present scientific processes, experiments, and natural phenomena that are difficult to realize or observe directly in the classroom, such as volcanic eruptions, solar system movements, chemical reactions, or other scientific processes that require special equipment. Thus, video can be a bridge between abstract concepts and observable reality, helping students understand scientific content in a concrete way.

In addition to supporting comprehension, the use of educational video can also contribute to student motivation, attention, and participation. Hede (2002) showed that the use of multimedia, including video, can increase students' motivation and attention in the learning process. When students can see pictures, movements, and demonstrations through video, they can develop more interest and willingness to participate in learning activities. However, educational videos should not be considered as a tool to entertain students only. Its use needs to have a clear pedagogical purpose and be integrated with learning activities in order to contribute to learning outcomes.

Therefore, the effectiveness of the use of educational video depends not only on the quality of the video but also on the way the teacher plans and integrates the video with the pedagogical strategy. Educational videos are more effective when students do not just watch and listen passively but actively engage through thinking, discussion, investigation, experimentation, and problem-solving activities. In this perspective, student-centered learning becomes an important basis for the integration of educational video in science instruction.

2.3.1. Student-centered learning strategies in the use of educational video

Student-centered learning is a pedagogical approach that gives students the opportunity to actively engage in the construction of their knowledge. In this approach, students not only receive information from the teacher but also participate directly in thinking, discussion, investigation, problem solving, and reflection activities. Goodwin (2024) explains that student-centered teaching methods consider students as active participants in the learning process and include approaches such as activity-based learning, investigation, cooperation, problem solving, and projects. Kong and Wang (2024) also pointed out that student-centered pedagogy can promote active, interactive, constructive, and reflective learning, which contributes to the development of student cognitive capacity and improved learning outcomes.

In the context of science learning, student-centered strategies can be implemented through various teaching methods, such as experiments, discussion, research or inquiry, question and answer, problem-based learning, demonstration, and contextual learning. These methods provide opportunities for students to observe phenomena, analyze information, investigate problems, express ideas, compare evidence, and apply scientific concepts in real situations. Cooper et al. (2024) showed that student-centered science learning not only promotes student participation but also emphasizes the construction of scientific understanding and the use of knowledge to explain scientific phenomena. Han et al. (2024) also showed that the implementation of the 7E method based on active inquiry learning can promote active learning, student interest, the ability to answer complex questions, and the innovation capacity in science learning. Therefore, a student-centered approach can be an important basis for engaging students in the process of investigation, problem solving, and scientific knowledge construction.

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In the aspect of educational video use, Vonschallen et al. (2024) reported through an experimental study with 102 secondary-level students that the use of educational videos in science learning units produced even more significant learning gains compared to purely text-based learning materials. In another study, Navarro et al. (2024) showed that the development and use of video capsules in environmental science learning can support active learning and contribute to the improvement of students' academic outcomes and transversal competence development. Thus, the use of educational video in science instruction can be integrated with a student-centered approach, as video can be a resource to stimulate observation, discussion, investigation, reflection, and construction of scientific knowledge.

In using educational video, the student-centered strategy can be organized into activities before, during, and after the video presentation. Before the video is presented, the teacher can use questions, problems, or real situations to activate prior knowledge and guide students on the information they need to see. During the video, students can make observations, record important information, or find answers to guiding questions. After the video, students can participate in a discussion, experiment, research, demonstration, problem solving, or other interactive activity. In this way, video is not only a source of information but also a pedagogical resource that supports active learning and can enhance student learning outcomes.

2.3.1.1. Integration of educational video with experiment methods

Experimentation is an important method in science learning because it gives students the opportunity to learn through observation and direct experience. Through experiments, students can observe phenomena, test ideas, conduct investigations, collect evidence and apply scientific concepts. Thus, experiments can help students understand the relationship between theoretical concepts and phenomena that occur in reality. Such activities are coherent with the principle of active learning, which emphasizes the student's direct involvement in the learning process. Cooper et al. (2024) stressed that student-centered science learning emphasizes students directly engaging in scientific practice, constructing and using knowledge to understand the phenomenon. Furthermore, Han et al. (2024) showed that the active inquiry learning approach can engage the student in the investigation and problem-solving process, and support the development of their scientific understanding and competence. Therefore, the use of experiments in science classrooms can be effective strategies to promote active participation and understanding of scientific concepts from direct experience.

In integrating educational video with experiment method, video can be used as an introduction to practical activities. Before starting the experiment, the teacher can present a short video that shows the process or phenomenon to be investigated. The video should be directly related to the purpose and content of the experiment, so students can understand the procedure, identify what needs to be observed and prepare their minds before carrying out the activity. Brame (2016) emphasized that educational videos will be more effective when they have clear learning objectives and are integrated with activities that engage the student.

The experiment activity has its preparation phase that the teacher does before the experiment activity is executed. This preparation includes the definition of objectives, learning content, instructions, guiding questions and materials to be used. When using video as support material, teachers need to ensure that the video is short, relevant and clear, so that students can focus on important information. This preparation is important so that students understand what needs to be done, what needs to be observed and how to record the results.

During the experiment activity, the teacher's role changed from the main source of information to the facilitator of learning. The teacher monitors the activity, observes the students' progress, and gives guidance when needed. When students encounter difficulty, the teacher can use guiding questions or scaffolding to help them find the answer on their own, rather than giving the answer directly. This way can stimulate students to think independently, analyze evidence, and develop problem-solving skills. After the experiment, students can discuss and present the results in pairs or groups. Each group can explain their observations, compare results, and give reasons based on the evidence they find. The teacher can facilitate discussion by linking experimental results to video content and scientific concepts. In the final step, the teacher draws conclusions, clarifies misconceptions, and helps students link learning to situations in everyday life. In this way, the video and the experiment are not two separate activities but rather part of an interconnected learning process.

2.3.1.2. Educational video integration with discussion and collaboration

Discussion is a learning activity that gives students the opportunity to exchange ideas, express opinions, give reasons and seek mutual understanding of a problem or issue. In this process, students can learn through interaction with peers and teachers. Lim et al. (2025) pointed out that discussion in the science learning process can help students to share ideas, interact constructively and develop deep understanding through peer collaboration. The results of their study in biology and physics also show that combining self-study with discussion can promote student learning outcomes and cognitive engagement. Furthermore, Chen (2025) explained that science classroom discussions can provide opportunities for students to identify uncertainty, collaborate with peers, compare different interpretations and construct understanding together. This process helps students to become active participants in the construction of scientific meaning and develop their student agency. Thus, discussion can be considered an important strategy in student-centred learning because it promotes interaction, exchange of ideas, reasoning about evidence and collective construction of scientific knowledge.

In using educational video, discussion and collaboration can be used to avoid students being passive receptors. Before the video, the teacher can present guiding questions or problems that students need to consider during the presentation. During the video, the teacher can pause important parts to give students the opportunity to respond, comment or discuss. After the video, the discussion can continue to help students interpret the information and connect the video content to their experiences. The questions prepared by the teacher need to be linked to the video content and also to the real situation relevant to the students. These questions should not be limited to knowledge but can stimulate students to analyse, compare, interpret, reason and reflect. Hu and Chiu (2024) showed that using a questioning strategy in a video about scientific enquiry can engage students in the learning process and give them the opportunity to develop scientific knowledge, understanding of scientific enquiry and investigation capacity. The study compared videos with open questions, closed questions and video only and showed the importance of integrating questions in learning videos. Thus, questions and discussions can be an important part of active learning and formative assessment, as student responses and ideas can provide evidence of their level of understanding and help teachers adapt instruction to learning needs. Poerwanti et al. (2024) also emphasised that formative assessment in science learning can be used to monitor student progress and provide information to the teacher about their understanding during the learning process.

After the teacher asks a question, students can answer individually, discuss in pairs, or work in groups. In group discussions, students can share ideas, compare answers, and learn from peer perspectives. When students are given the opportunity to ask their own questions, respond to peer questions, and justify their views, the learning process becomes more interactive. Lim et al. (2025) showed that the combination of self-study and discussion can promote science learning, especially when students are engaged in exchanging ideas and peer interaction. Discussion gives students the opportunity to explain their thinking, compare understanding, and construct knowledge through social interaction. Lim et al. (2025) and Chen (2025) also pointed out that collective discussion in science classrooms can help students engage in the sensemaking process, consider different perspectives, and develop student agency. Thus, question and answer activities, pair discussions, and group work can transform students from passive receptors into active participants in the knowledge construction process.

2.3.1.3. Integration of educational video with research or inquiry

Inquiry is a learning approach that gives students the opportunity to investigate problems, seek information, analyze evidence, and build their understanding. In the process of inquiry, students are actively involved in formulating questions, planning and conducting research, analyzing data or evidence, and developing explanations based on research results. Muhamad Dah et al. (2024), through a systematic literature review on open inquiry in science learning, showed that this approach can support the development of conceptual understanding, motivation, positive attitudes toward science, scientific skills, and thinking skills. The results also showed that inquiry provided opportunities for students to explain scientific phenomena, interpret data and evidence, and develop the capacity to do scientific investigation. Furthermore, Eymur and Çetin (2024) pointed out that student engagement in scientific inquiry, development of evidence-based arguments, peer discussion, and writing of research reports can support the development of scientific literacy. Thus, inquiry-based learning can be considered an important strategy in science learning because students not only receive information but are directly involved in the process of investigation, using evidence and constructing scientific understanding. In the context of educational video use, teachers can use video as an initial source to introduce a scientific problem or phenomenon. Before watching the video, the teacher can present questions or problems that students need to answer. During the video presentation, students can identify relevant information and

record evidence. After the video, students can do pair or group research to find additional information from relevant sources.

In the research process, students can compare sources, analyze information, and elaborate answers to given problems. Research results can be presented to the class, and other students can ask questions or make comments. The teacher facilitates this process and helps students evaluate the information they receive. After discussion, the educational video can be used again as a resource to reinforce concepts and help students link research results with visual and verbal representations. In this way, video and research can be integrated to promote research capacity, critical thinking, and scientific understanding.

2.3.1.4. Educational video integration with interactive methods

Interactive methods are learning approaches that emphasize questions, answers, and interaction between teacher and student and between student and student. In this approach, students not only receive information but also engage in the process of questioning, answering, discussing, and reflecting. Hu and Chiu (2024) showed that the questioning strategy in videos on scientific inquiry can promote student engagement in the learning process, as the questions provide students with the opportunity to think, respond, and interpret the scientific content presented in the video.

In the use of educational video, teachers can prepare questions that are related to the content of the video and the real situation. Questions can focus on facts and concepts but can also stimulate students to analyze, interpret, compare, and reason. During the video presentation, the teacher can pause the relevant part to give students the opportunity to respond or discuss. After the video ends, students can respond individually, discuss in pairs, or work in groups. They can also raise questions and issues they have about the content. Wong, Richland, and Hughes (2025) showed that questioning directly integrated into learning videos can support active engagement, self-regulation, and student thinking processes. Thus, questions and interactions during and after the video can provide evidence to the teacher of students' understanding and opportunities to provide feedback at appropriate times.

Thus, interactive methods can transform the use of video from a mere viewing and listening activity to a learning activity that engages students directly. Video can be a starting point for questions, discussion, reflection, and investigation, so students become active participants in the learning process. This approach can also help students to not only understand the information presented in the video but also to analyze, interpret, justify, and apply the knowledge in relevant situations.

2.3.1.5. Integration of educational video with problem-based learning (PBL)

Problem-Based Learning (PBL) is a learning approach that organizes the learning process through problems and collaborative activities, in which students work together to discuss, share knowledge, and develop a deep understanding of the topic being learned. In PBL, students are actively involved in the discussion and learning process, while the teacher plays an important role in facilitating and guiding the interaction and learning process in the group. A study of PBL tutoring showed that direct interaction between student and tutor can support in-depth discussion, collaborative learning, and the development of social connections during the learning process (Chim et al., 2024).

In integrating PBL with educational video, the teacher can present the problem or situation before the students watch the video. The problem should be related to the learning topic and provide guidance on the information that students need to find. During the video, students observe and record information, facts, and evidence that can help them solve problems. After the video, students can work in groups to analyze the information, find additional sources, and develop solutions. Each group can present their solution to the class. The teacher facilitates discussion, provides feedback, and clarifies relevant scientific concepts. With this process, video becomes not only a source of information but also a resource that stimulates students to investigate, think critically, collaborate, and solve problems. Suh et al. (2024) also pointed out that the integration of digital resources and problem-based learning strategies can support student engagement, collaboration, and problem-solving capacity development. Thus, the use of video in PBL can transform audiovisual content into a stimulus for students to analyze problems, search for evidence, discuss with peers, and construct solutions based on scientific knowledge.

2.3.1.6. Integration of educational video with demonstration method

The demonstration method is a learning method in which the teacher or student directly demonstrates an object, process, or activity to facilitate understanding of the concept being learned. In science learning, demonstration is important because some scientific concepts and processes are difficult to understand through verbal explanation alone. Visual representations and demonstrations can help students observe phenomena and understand the relationship between scientific concepts and processes. Shao, Tang, and Zhang (2024), through the study of science learning, compared the contribution between video watching and hands-on experiments and showed that video activities and hands-on experience have different contributions to the science learning process. This shows that video can be used as a means to present scientific phenomena or processes before or together with practical activities.

Educational video can be integrated with the demonstration method because it can present images, movements, narration, and concrete processes at the same time. Video can be used to demonstrate experiments, scientific processes, or phenomena that are difficult to realize directly in the classroom. In situations where a demonstration is difficult to accomplish due to lack of materials, equipment, or appropriate conditions, video can be an alternative to show the process. Students can watch the video, observe the steps, and then discuss or perform the relevant practical activity. The video can also be reviewed when the student needs to understand a part that is not clear. Vonchallen et al. (2024) showed that educational videos in science teaching can produce significant learning increases compared to purely text-based learning materials. The study involved 102 high school students and used pre-tests and post-tests to measure learning outcomes.

Thus, the video demonstration method can be a useful strategy to visualize the scientific process, especially when direct experiments or demonstrations are not easy to realize in the classroom. However, video need not be used as a substitute for hands-on activities in all situations. Shao, Tang, and Zhang's (2024) results support the importance of considering videos and

hands-on experiments as resources that can complement each other in science learning. Thus, the teacher can use the video to prepare students before the activity, demonstrate the difficult process, and then give students the opportunity to discuss, make observations, and apply their knowledge in practical activities.

2.3.1.7. Educational video integration with contextual learning

Contextual learning is an approach that links learning content with the situation, experience, and reality of students' daily lives. In science teaching, this approach is important because some scientific concepts are abstract and students may have difficulty learning these concepts without connection to reality. Güth and van Vorst (2024) explained that context-based learning in science education uses authentic contexts to emphasize the relevance of knowledge to the world outside the classroom and create learning opportunities that connect knowledge with real situations. Their study also showed that when the learning context matches the characteristics of students, the context can contribute to situational interest and student satisfaction in learning.

Educational video can be a bridge between abstract concepts and concrete reality. Teachers can choose videos that present natural phenomena, everyday situations, experiments, environments, and social or technological activities related to science topics. When the student watches the scientific phenomenon or process in the video, they can make connections between theoretical concepts and real situations. Labude et al. (2024) showed that educational videos in science teaching are used to support the learning process and can integrate scientific content with visual representations, which helps students understand information about scientific phenomena and processes.

With this approach, students can understand that science is not just theoretical knowledge learned in books but is related to phenomena and problems that occur in everyday life. Contextual learning emphasizes the importance of linking scientific knowledge to situations and experiences that students encounter in everyday life. In this perspective, students do not learn scientific concepts as abstract knowledge but learn through situations and problems that are relevant to their reality. This approach can stimulate students to actively engage in learning, collaborate with peers, and apply scientific knowledge to understand and solve problems. Thus, as Arık Güngör and Saraçoğlu (2024) pointed out, using context in science learning can connect scientific concepts with situations and problems relevant to student learning. Based on this idea, the integration of educational video with contextual learning can be a means of presenting real situations or scientific phenomena in a visual form so that students can see the relationship between scientific concepts and reality, analyze problems, discuss with peers, and apply the knowledge they learn to concrete situations.

2.3.2. The relationship between educational video and active learning

Educational video can be an important tool to support student-centered learning when it is integrated with activities that promote active student participation. Video by itself does not guarantee effective learning, as the student can passively watch and listen to the information. Therefore, the teacher needs to plan how the video integrates with the activity before, during, and after the presentation. Labude et al. (2024) explained that the use of educational video in science teaching also depends on the way students and teachers use video in the learning process, including video selection and forms of use that are coherent with learning objectives.

Integrating the video with the experiment gives students the opportunity to turn observation from the video into hands-on experience. Integration with discussion and collaboration allows students to exchange ideas and construct understanding together. Integration with research or inquiry provides opportunities for students to search for information, analyze evidence, and solve problems. While integration with interactive methods promotes questions, answers, interaction, and reflection. Shao, Tang, and Zhang (2024) stated that watching videos and doing hands-on experiments can make different contributions to science learning, which supports the idea that videos can be integrated with practical activities and can enhance student learning experiences. Thus, educational video can be used as a resource that links visual representations with learning activities that activate students.

In the Cognitive Theory of Multimedia Learning (CTML) perspective, Mayer (2024) continues to develop and update the idea of how people learn from multimedia messages. This theory is based on the principle that the human information processing system has channels for visual and verbal/auditory information, and each channel has limited capacity. Learning also involves active cognitive processes, such as selecting relevant information, organizing information, and integrating new representations with prior knowledge. Therefore, the organization of information in video needs to consider the way students process the content. A video that is clear, focuses on learning objectives, and avoids unnecessary information can help students focus on important aspects and construct understanding. In addition, questions or activities inserted during the video can stimulate students to actively process information. Wong, Richland, and Hughes (2025) state that video-integrated questioning can be used as a pedagogical strategy to promote active learning, self-regulation, and critical thinking.

Student-centered learning strategies in the use of educational video can be understood as a process that gives students the opportunity to actively engage in observation, thinking, interaction, investigation, and application of knowledge. In the context of science, educational video can be integrated with experiment methods, discussion and collaboration, research or inquiry, and interactive methods. Each method has a different function, but they all have the common goal of transforming the student from a passive receptor to an active participant in the learning process. The results of Vonschallen et al. (2024) showed that educational videos can produce significant learning gains compared to purely text-based learning materials, although the effect also depends on the form and conditions of video use.

Thus, the implementation of educational video requires systematic pedagogical planning. The teacher needs to determine the learning objectives, select the relevant video, prepare guiding questions, organize activities before, during and after the video, and assess students' understanding. Labude et al. (2024) emphasized the importance of considering how videos are used in the science learning process and the criteria used by teachers and students when selecting and using educational videos. With this approach, video is not only a means of transmitting information but also a pedagogical resource that

integrates experience, research, discussion, collaboration, and reflection. Thus, the use of educational video can support active, interactive, and student-centered science learning.

2.4. Benefits of Educational Video in Science Instruction – Third Cycle

Educational video is one of the digital learning media that can support and facilitate the teaching-learning process in the classroom. In science instruction, the use of video can provide students with the opportunity to see and hear information about scientific concepts, processes and phenomena that are often difficult to observe directly. Through visual and auditory representation, video can help teachers present content in a concrete, clear and attractive way. Thus, educational video is not only a means of transmitting information but can also be part of a pedagogical strategy to support student understanding, motivation and participation. Brame (2016) emphasises that the effectiveness of educational video depends on three important aspects, namely cognitive load management, student engagement and active learning.

In the context of third-cycle science instruction, the benefits of educational video can be seen from various aspects, including the ability to increase student interest and attention, support conceptual understanding, stimulate motivation, promote classroom interaction, support teacher teaching quality and increase student participation. These benefits are not automatic results of video use; they also depend on the quality of the video, the learning objectives, the way the teacher integrates the video and the pedagogical activity that accompanies its use.

2.4.1. Increase student interest in learning

Interest in learning refers to the attention, desire, and willingness of students to engage in learning activities. This interest can be influenced by the way teachers organize classes, the teaching strategies used, the nature of learning activities, and the media integrated into the teaching process. When teachers use educational videos that are relevant to the subject and appropriate to the student's level, the visual and auditory elements in the video can help attract and maintain their attention to the learning content. Labude et al. (2024) presented that educational video becomes an important part of science teaching, but its contribution to learning also depends on the way the video is selected and used in pedagogical activities.

Videos that have a clear purpose, relevant content, and an easy-to-follow structure can help students maintain attention during the learning process. However, the use of video does not have to be limited to student viewing and listening. Wong, Richland, and Hughes (2025) indicate that questions integrated directly into the video can increase the opportunity for students to engage in the process of thinking, self-regulation, and learning. Strategies such as pausing the video in relevant parts, asking questions, discussing, or giving short assignments can help students pay attention to important information, reflect on the content they see, and actively engage in the learning process.

In addition, Güth and van Vorst (2024) explained that the way the learning context and the opportunity for students to engage in activities can influence situational interest and student satisfaction. This is relevant to the use of educational videos because videos can present phenomena, situations, and problems that are linked to the reality of students. When the video content is relevant to their experiences and learning activities, giving them the opportunity to respond, discuss, and investigate, the video can be a stimulus to generate interest and engage students in learning.

Thus, educational video can be a stimulus to support student interest, especially when its content is relevant, clear, and appropriate to the learning objectives and when integrated with activities that give students the opportunity to observe, think, ask questions, discuss, and reflect on the content presented. Therefore, student interest depends not only on the use of video but also on the quality of content and the pedagogical way teachers use video to engage students in the learning process.

2.4.2. Enhancing conceptual understanding

Conceptual understanding refers to the student's ability to understand, explain, and make connections between learned concepts. In science, some concepts are abstract and involve processes or phenomena that are not easily observed directly. When these concepts are presented through verbal explanation only, students may have difficulty forming a mental representation of the content being learned. In such situations, educational video can be a tool that supports understanding, because it can present images, animations, movements, demonstrations, and simulations of scientific processes or phenomena. Mayer (2024) explained in the Cognitive Theory of Multimedia Learning perspective that multimedia learning involves information processing through verbal/auditory and visual representations, and effective learning occurs when the student is actively engaged in selecting, organizing, and integrating new information with prior knowledge. Thus, visual representations in video can help students create mental images and understand the relationship between elements in scientific phenomena.

With this perspective, video can help transform abstract content into visuals that are easier to understand, especially when the scientific process cannot be observed directly in normal situations. When video presents movement, change, or interaction between elements, students can observe processes that are difficult to understand through words or verbal description alone. Vonchallen et al. (2024), through an experimental study in science education, showed that students who learned with educational videos obtained significant learning gains, compared to text-based learning conditions only. This supports the use of video as an additional representation to support the comprehension process in science learning.

In addition to video, integration with experiment activities is important to support conceptual understanding. The student can watch the demonstration or process of the experiment in the video and then do the experiment themselves to observe, compare, and analyze the results. This process gives students the opportunity to connect visual observations with practical experiences and scientific concepts. Shao, Tang, and Zhang (2024), in the study of video watching and hands-on experiments in science learning, showed that both can make different contributions to learning. This result suggests that video and practical activities can be used as complementary resources, as video can help students observe and understand the process, while hands-on experiments give students the opportunity to engage directly in observation and investigation.

Therefore, when teachers choose and use videos that are relevant to the subject, content, and learning objectives, videos can become a bridge between abstract concepts and concrete reality. Through visual observation, discussion, and practical activities,

students can develop mental representations, make connections between theory and evidence, and understand scientific concepts and processes more deeply. Thus, the pedagogical value of video depends not only on its ability to show images or animation but also on how the teacher integrates video with activities that involve students in the process of thinking, observation, investigation, and application of knowledge.

2.4.3. Enhancing learning motivation

Learning motivation refers to the force or stimulus that drives students to engage in learning activities and continue to seek knowledge. In the science teaching process, motivation is important because students need interest and willingness to participate in activities, especially when learning content involves abstract concepts or complex processes. The use of educational videos can be one of the strategies to stimulate student motivation, especially when the video has content that is relevant, interesting, and appropriate to their level of understanding. Video can present experiments, natural phenomena, simulations, or real situations that are difficult to observe directly in the classroom. Such visual experiences can arouse students' curiosity and willingness to learn and participate in learning activities.

Liao, Chen, and Shih (2019), in their study on the use of video in learning, showed that instructional video, when integrated with collaborative learning, can support intrinsic motivation and the science learning process. This shows that the motivational benefits of video can be enhanced when video is not used alone but is integrated with interaction and learning activities. Thus, educational videos can be used not only to provide information but also to create learning experiences that stimulate students to watch, listen, analyze, ask questions, and seek answers. In this way, video can contribute to the development of students' motivation and engagement in science learning.

2.4.4. Enhancing classroom interaction

Interaction in the learning process refers to the process of students interacting with teachers and peers through questions, answers, discussions, collaboration and exchange of ideas. In the context of educational video use, video can be a stimulus to create interaction when the teacher integrates it with learning activities that involve students directly.

When students watch the video, the teacher can stop at the important part to ask students to explain what they see, make predictions about what will happen, or discuss the reasons for the phenomenon presented. Such strategies can stimulate students to think deeply, express their ideas and listen to the perspectives of peers. Brame (2016) recommended that educational videos should be integrated with activities that promote active learning, including questions and activities that engage the student directly with the video content.

In addition to teacher-student interaction, video can also be integrated with collaborative learning. Students can work in pairs or groups to discuss content, compare observations and solve problems based on the information they get from the video. Liao, Chen and Shih (2019) pointed out the importance of the combination between instructional video and collaboration in supporting motivation and the learning process. Thus, the use of educational video can be a means of creating a learning environment that promotes interaction, exchange of ideas and co-construction of knowledge.

2.4.5. Improving teacher teaching quality

The quality of teaching depends not only on the knowledge of the teacher but also on the preparation, planning, pedagogical strategy, and learning resources used. In this context, educational video can be a resource that supports teachers to present content in a structured, visual, and auditory manner. Video can also help teachers show processes, images, demonstrations, or scientific phenomena that are difficult to realize directly in the classroom. However, the use of video alone does not guarantee teaching quality. Brame (2016) stated that the effectiveness of educational video depends on cognitive load management, student engagement, and active learning. Therefore, teachers need to choose videos that are appropriate to the learning objectives, science content, and student understanding level. The teacher also needs to plan activities before, during, and after the video presentation, such as guiding questions, discussions, experiments, or reflective tasks.

With this planning, video can complement teachers' teaching strategies and help clarify concepts, demonstrate processes, and organize information. Therefore, educational video should be considered as a pedagogical resource that supports the role of the teacher, not as a replacement for the teacher in the teaching-learning process.

2.4.6. Increasing student participation

Student participation refers to the active involvement of students in the learning process, such as observing and analyzing videos, answering questions, expressing ideas, discussing with colleagues, making predictions, performing activities, and applying learned concepts. This participation is important because students not only receive information but are directly involved in the process of knowledge construction. The use of educational video can increase opportunities for participation when the teacher transforms the video viewing activity into an interactive activity. Students can observe the video with a specific objective, identify important information, ask questions, discuss in groups, and present their observations or interpretations to the class. Brame (2016) emphasizes that effective educational video should promote active learning and student engagement, not turn students into passive spectators.

In science instruction, teachers can use video as a starting point for activities such as experiments, discussions, research, demonstrations, or problem solving. When students engage in these activities, they have the opportunity to observe, think, analyze, discuss, and apply knowledge. This process can help develop their critical thinking, collaboration, and conceptual understanding capabilities. Therefore, educational video can be a means of increasing student participation when used with clear planning and integrated with learning activities that provide space for the student to actively engage.

Educational video has the potential to provide multiple benefits in third-cycle science instruction. These benefits include increasing student interest, supporting conceptual understanding, stimulating learning motivation, promoting classroom interaction, supporting teacher teaching quality, and increasing student participation. However, these benefits do not depend solely on the availability or use of video in the classroom. Video effectiveness also depends on the quality and relevance of content, learning objectives, student understanding level, teacher preparation, teaching strategies, and learning activities integrated with video. When video is used only as a

means of transmitting information, students can become passive recipients. However, when video is integrated with questions, discussions, experiments, research, demonstrations, collaboration, and problem solving, students are given the opportunity to actively engage in the learning process.

Thus, educational video can be considered as a potential pedagogical resource to support science instruction, as it can help students understand scientific concepts, increase interest and motivation, promote interaction and participation, and support teachers in content presentation. With planned and appropriate use, educational video can contribute to the development of an active, interactive, relevant, and meaningful science teaching-learning process.

2.5. Challenges of Integrating Educational Video in Third Cycle Science Instruction

Educational video is one of the technology resources that has the potential to support the science learning process, especially in understanding concepts, developing student interest and motivation, and diversifying teaching strategies. Through video, students can see and hear information about scientific concepts, processes and phenomena that are often difficult to observe directly in the classroom. However, the integration of educational video in science instruction, especially at the basic education level, is not an easy process, as it depends on the availability of infrastructure, equipment, access to the internet and electricity, teacher competence, time, content quality and pedagogical planning.

Research on technology integration in education shows that lack of resources, infrastructure, teacher training, technical support and time can be barriers to the use of technology in the classroom. Francom (2020), through a study of technology integration barriers in K–12 schools, identified time as a persistent barrier and also highlighted access to equipment, training, and technical support. Therefore, the integration of educational video needs to consider not only technological aspects but also pedagogical conditions, teacher capacity and school context.

2.5.1. Technological infrastructure and equipment limitations

Infrastructure and equipment limitations are one of the main challenges in educational video integration. The use of video in the classroom requires equipment such as a computer or laptop, a projector or television, speakers, electricity, and, in some situations, internet access. When this equipment is not available, insufficient, or not functioning properly, teachers may face difficulties in implementing video-based learning activities. De Freitas and Spangenberg (2019) identified technology infrastructure, time constraints, professional training, and leadership support as barriers to ICT integration in education. This shows that the availability of equipment alone is not sufficient; the equipment also needs to function properly and have appropriate technical support.

In schools facing electricity problems, this challenge can be compounded. When electricity is not available or stable, the teacher may not be able to project the prepared video. Such interruptions can disrupt learning activities, waste time, and reduce student opportunities to engage in planned activities.

2.5.2. Internet and online resources access limitations

Internet access can also be an important challenge when the teacher relies on online resources to search, view, or download educational videos. Weak or unstable internet can make the video search and download process slow. When the teacher relies on streaming, connection issues can cause buffering or interruptions during class. This situation can affect the continuity of learning activities and reduce the time available to students. UNICEF Timor-Leste (2024) reports that the challenge of ICT infrastructure and internet connectivity will continue in Timor-Leste, especially in rural areas, and some schools do not have ICT infrastructure or do not have mobile network coverage. UNICEF also emphasizes that in rural areas, access to ICT equipment and internet and electricity connections are not always reliable. UNICEF Timor-Leste (2024) shows that ICT access conditions are not the same in all schools, and efforts to strengthen digital infrastructure and teacher capacity will continue. UNICEF also reports that in rural areas, access to ICT equipment, the internet, and electricity will be challenging. Therefore, it is not appropriate to assume that all schools in Timor-Leste have the same internet, electricity and digital equipment.

To reduce dependence on the internet during class, teachers can download videos before class and store them on computers, mobile phones or other media. This strategy can help ensure that learning activities can continue even if the internet connection is unstable. This practice is especially important in school contexts where internet access is limited, as video stored on the device can be used without the need for continuous streaming. In the Home Schooling program experience, digital resources are also combined with different mediums, including television, radio, e-books and printed materials, to ensure that students who are not digitally connected will be able to access learning materials.

2.5.3. Teacher capacity and competence

Teacher capacity to use technology is an important factor in the effectiveness of educational video integration. This competence is not limited to the ability to connect a computer to a projector or open video but includes the ability to search, evaluate, select, prepare, and integrate video for learning purposes. Teachers may find a video that is technically good, but if the video content is not related to the learning objectives or the teacher does not know how to integrate the video with pedagogical activities, the benefits of the video may be less. De Freitas and Spangenberg (2019) present that lack of technological knowledge can be a barrier to ICT integration, and therefore teachers need continuous professional development.

Nelson, Voithofer, and Cheng (2019) also pointed out that technology knowledge and institutional support can influence the way educators integrate technology with content and pedagogical practices. This shows that the responsibility for technology integration lies not only with the individual teacher but also requires support from the school and the education system. Therefore, teacher training needs to include technical and pedagogical aspects. In the technical aspect, teachers need to have the ability to use laptops, computers, projectors, speakers, the internet, and online resources. In the pedagogical aspect, teachers need to have the capacity to select relevant videos, organize the use of videos according to learning objectives, and integrate videos with questions, discussions, practice, and research activities.

2.5.4. Video selection and quality control

The selection of educational videos is an important challenge in the teaching process, because not all videos available on the Internet are suitable for use as learning media. Mohamed and Samur (2025) stated that there is a need for a systematic evaluation process to filter instructional videos, as the quality of videos available on the internet varies and some may not meet the instructional and cognitive criteria necessary for learning. Therefore, teachers need to consider the content and accuracy of information, relevance to learning objectives, level of difficulty, duration, language, and audio and image quality before selecting videos to use in the classroom. Navarrete et al. (2025) also identified audio, visual aspects, text, student activity, interactivity, and instructional design as important features that need to be considered in learning-based videos. Thus, video selection should be based on its quality, pedagogical relevance, and correspondence with learning objectives.

Brame (2016) emphasizes that effective educational video needs to consider three aspects, namely cognitive load management, student engagement, and active learning. Thus, videos that are too long, contain too much information, or are not organized with a clear structure may cause students to face difficulties in processing and understanding the information. In addition, Kuhlmann et al. (2024) stressed that the use of instructional videos needs to consider student active cognitive engagement, as learning through video is not just viewing content but involves processing and integrating information. Because the cognitive system has limitations, the presentation of information in video needs to be organized in such a way that it does not add unnecessary cognitive load. In addition to cognitive aspects, technical aspects such as audio quality, duration, video structure, and accessibility on the device are also important in maintaining students' engagement.

Fiorella and Mayer (2018) also pointed out that the way video content is organized is important for learning. Video segmentation can help the student process the information in small chunks, while the appropriate visual perspective can help the student focus on the relevant information. Therefore, the teacher needs to choose a clear video, focus on important concepts and, when necessary, divide the video into small segments. In addition to pedagogical quality, teachers also need to consider technical quality, such as image clarity, sound, language, and duration. A video that is technically good but irrelevant to the learning objectives is not necessarily pedagogically beneficial.

2.5.5. Video relevance to curriculum and learning objectives

Another challenge is ensuring that the video used in the classroom matches the curriculum and learning objectives. Educational videos cannot be chosen just because they have beautiful images, good audio, or interesting content. Teachers need to see if the information in the video is relevant to the science subject the student is learning and if the video can help achieve the defined competencies or learning outcomes. Nelson, Voithofer, and Cheng (2019) demonstrated that technology knowledge and institutional support influence the way educators integrate technology with pedagogical content and practice. This shows that the use of technology needs to be linked to content and pedagogical objectives.

Therefore, when teachers choose educational videos for natural science, they need to consider curriculum content, learning objectives, student age, level of understanding, and local context. Video should help students understand the material and develop the planned competencies, not create information that is irrelevant or contrary to the content taught by the teacher.

2.5.6. Language and adaptation to student contexts

The language used in the video can be a challenge for students, especially when the language used in the video is not the same as the language that students commonly use in the learning process. A video may have relevant scientific content, but if the vocabulary, scientific terms, or way of explanation is too complicated for the student level, they may face difficulties in understanding the main message. Martin and Graulich (2024) emphasize that students learning science in additional languages come from a variety of linguistic and cultural backgrounds, and the use of language familiar to the student can help them express their thoughts and develop knowledge of scientific content.

Therefore, teachers need to consider linguistic aspects when choosing educational videos. When the video uses a foreign language or scientific term that is new to the student, the teacher can prepare the student before class by explaining important terms, providing context for the topic, or preparing guiding questions. The teacher can also use subtitles, pauses, and additional explanations to help students understand the content. Studies of educational videos with subtitles have shown that subtitles in a language familiar to students can support comprehension, help students understand content, and reduce cognitive load when learning through video. During the video, the teacher can stop at important parts to clarify, and after the video, they can have a discussion so that students connect scientific terms with the concepts they learn.

In addition to the linguistic aspect, adaptation to the student context is also important. Videos that show examples, environments, objects, or situations that are familiar to students can help them make connections between science content and their everyday lives. Relevant context can help students interpret new information based on their prior knowledge and experience. Therefore, teachers need to consider not only the technical quality of the video but also its linguistic, cultural, and pedagogical relevance. Labude et al. (2024) pointed out that teachers and students need to develop the capacity to evaluate and select quality educational videos, including considering how the video can be used appropriately in the science learning process.

In the Timor-Leste context, linguistic aspects and adaptation to student reality need to be considered carefully, as students may have different linguistic and cultural experiences. Therefore, teachers can adapt the use of video by explaining in a language that students understand well, translating or explaining important scientific terms, using subtitles when available, and linking video content to phenomena or situations that students can observe in their environment. This approach can help reduce language barriers and make it easier for students to make connections between video messages, scientific concepts, and their everyday experiences.

Thus, the effectiveness of educational video depends not only on the quality of image, sound, or animation, but also on linguistic adaptation, context relevance, and student level. Videos that have clear language, appropriate scientific terms,

relevant visual representations, and connections to student reality can be pedagogical resources that help facilitate understanding and engagement in science learning.

2.5.7. Time management and learning planning

Time is an important resource in the teaching and learning process. In the use of educational video, time management becomes important because the teacher needs to divide time between the video presentation and the pedagogical activities that accompany the video. A video that is too long or not well planned can occupy a lot of time and reduce the time available for the student to discuss, analyze, and apply the concept learned. Francom (2020) identified time as a persistent barrier in integrating technology in schools. Therefore, teachers need to plan the use of video before class. Planning may include selecting a video, checking the duration, viewing the content before class, preparing questions, setting a time to stop the video, and preparing an activity after viewing the video.

The teacher can also divide the video into small segments and stop at important moments to ask questions or discuss. Fiorella and Mayer (2018) pointed out that segmentation is one of the strategies that can support learning through video. Thus, the main goal is not for the student to watch the video for a long time, but for the video to be a resource that supports the student to understand and apply scientific concepts.

2.5.8. Active student participation and ways of using video

Another challenge is ensuring that the student does not become a passive receptor during the video activity. When the teacher projects the video from beginning to end without questions or activities, students can only watch the video but not engage in the deep process of the content. Brame (2016) emphasized that effective video use needs to promote student engagement and active learning. Therefore, teachers can combine video with discussion, dialogue, questions, observation, practice, and presentation. Before the video, the teacher can ask guiding questions; during the video, the teacher can stop at an important part to ask the student to explain or make a prediction; after the video, students can discuss, summarize, and connect the information with the material learned.

In science learning, this approach is important because students can use video to explore phenomena, compare results, discuss ideas, and connect scientific concepts with reality. Thus, video not only facilitates access to information but can also create opportunities for students to develop critical thinking, communication, collaboration, and conceptual understanding skills.

2.5.9. Institutional support and technology sustainability

The effectiveness of educational video integration also depends on the support of schools and educational institutions. A teacher may be willing and able to use technology in the teaching process, but without appropriate equipment, infrastructure, maintenance, and technical support, the implementation of technology may face difficulties. UNICEF Timor-Leste (2024) shows that in Timor-Leste there will be many schools that lack appropriate ICT infrastructure, and some rural areas do not have reliable internet and electricity connections. This situation shows that the use of technology in education needs to consider not only the availability of the device but also the condition of the infrastructure that supports its use.

Schools need to develop teacher support mechanisms, including equipment availability, technology maintenance, technical support, and training opportunities. Teacher training is important because the availability of equipment alone does not guarantee that technology will be used effectively in the classroom. In 2024, the Ministry of Education, with the support of UNICEF and INFORDEPE, will conduct practical training on the use of ICT for teachers in schools in Ainaro, Ermera, and Likisa. The program also includes providing computers, tablets, and other ICT equipment, improving classrooms, and supporting internet connection.

At the institutional level, the Ministry of Education and relevant agencies can contribute through infrastructure development, continuing education, provision of equipment, and development of teacher support systems. For example, in December 2024, UNICEF will deliver ICT equipment to the Ministry of Education, including 32 laptops, 31 smart televisions, 300 tablets, 30 generators, and 32 projectors, which will be distributed to 30 schools in Ainaro, Ermera, and Likisa. The program also includes capacity-building workshops for teachers to develop their skills and competencies in the use of digital equipment.

The sustainability of technology in schools, thus, requires consideration of infrastructure and support that can ensure long-term use of technology. In the UNICEF Timor-Leste document (2024), the Home School experience shows that resilient learning systems need to integrate high-tech and simple technology solutions, including printed materials, radio, television, video, and online platforms. This combined approach can help ensure continuity of learning when internet access or digital infrastructure is unstable.

Evidence from Timor-Leste in 2024 shows that efforts to digitalize education involve combining equipment, connections, and teacher training, not equipment alone. Therefore, institutional support can be considered as an important element in the implementation of educational video and digital technology in schools. When schools and educational institutions provide appropriate infrastructure, training, maintenance, and technical support, teachers can be better positioned to integrate educational video with teaching activities. With planning that considers local conditions and school needs, the use of technology can become a sustainable part of the teaching-learning process, rather than just an activity that depends on projects or temporary support.

2.5.10. Video usage control and guidance

In addition to infrastructure and teacher capacity, schools can also develop guidance on the selection and use of educational videos. This guidance can help teachers ensure that the video used in the classroom is appropriate for the age and level of students, relevant to the curriculum, has the right content and supports the learning objectives. Labude et al. (2024) pointed out that teachers and students need to develop media-didactic competencies to be able to select and use educational videos in a quality and reflective way in science learning.

Teachers need to evaluate content, language, duration, image and sound quality, and the relationship between the video and the material to be taught. Video selection guides may include criteria such as relevance to the curriculum, accuracy of content, appropriateness for student age and level, easy-to-understand

language, appropriate duration, audio and picture quality, and opportunity to integrate the video with learning activities. Bitzenbauer et al. (2024) showed that the selection process of educational videos for science teaching can often be influenced by superficial aspects such as thumbnail, duration, title, or familiarity with the channel, while the quality of explanation needs more systematic evaluation. Therefore, teachers need to watch the video themselves and evaluate its pedagogical quality before using it in the classroom.

This guidance can also help avoid the use of video as an independent activity. Video needs to be integrated with questions, discussion, observation, practice activities, and reflection to give students the opportunity to engage with the content. In the study of educational video in science teaching, Labude et al. (2024) present that the way video is used in the learning process is important and that the teacher needs to consider the context and pedagogical purpose when using video resources.

Educational video integration in science instruction faces various challenges, including infrastructure and equipment limitations, internet and electricity access, teacher capacity and training, video quality selection and control, relevance to the curriculum and learning objectives, language and adaptation to student context, time management and planning, and active student participation. These challenges show that the effectiveness of educational video use does not depend solely on the availability of technology but on a combination of appropriate infrastructure, teacher competence, content quality and relevance, pedagogical planning, institutional support, and student engagement. Labude et al. (2024) emphasized the need to strengthen teacher and student competencies in the evaluation and use of educational video, while Bitzenbauer et al. (2024) pointed out the importance of a systematic selection process to identify appropriate videos for teaching purposes.

Thus, in third-cycle science instruction, teachers need to prepare and use videos with clear learning objectives, adapt to student age and level of understanding, link video content to curriculum and student context, and integrate video with interactive strategies. On the other hand, schools and relevant institutions need to provide support in terms of training, infrastructure, equipment, maintenance, and technical support. With collaboration between teachers, schools, and educational institutions, challenges in video integration can be managed with systematic planning and guidance. Thus, educational video can be a pedagogical resource that supports student science understanding, participation, and learning, provided its selection and use are based on learning objectives, content quality, and appropriate pedagogical strategies.

3. Method

3.1. Research Type

This research used a qualitative approach with a descriptive design to understand and describe teachers' perspectives on the use and challenges of integrating educational video in third-cycle science instruction in Timor-Leste. The qualitative approach is appropriate for this research because it allows the researcher to directly explore the experiences, thoughts, opinions, and perceptions of teachers about the use of educational video in the teaching and learning process. Through this approach, the researcher not only sought to know whether teachers use educational video or not, but also sought to understand how and why teachers use video, the benefits they see, the challenges they face, and the support needed to improve the use of video in science learning.

Tersiana (2022) explained that qualitative research focuses on understanding the phenomenon based on the reality that occurs and data obtained directly from the participant. Sumilih et al. (2025) further stressed that qualitative research allows the researcher to understand and interpret the phenomenon based on the perspectives and experiences of the participant in a natural context. This idea is reinforced by Hall and Liebenberg (2024), who explain that qualitative description focuses on producing direct, clear, and rich descriptions of experiences and events, without the need to make complex theoretical interpretations or abstractions. Therefore, descriptive qualitative design is appropriate for this research, because the main objective is to describe and understand how teachers integrate educational video in the science teaching process, activities that accompany the use of video, benefits obtained, and challenges that arise during the learning process. Villamin et al. (2025) also emphasized that qualitative descriptive design can use qualitative methods with flexibility but requires rigorous planning and implementation to produce clear and relevant results. Based on these considerations, the descriptive qualitative design in this research allows the researcher to organize, describe, and interpret data according to participant experience and the real context of the teaching and learning process.

3.2. Research Subject

The research subject is an important part of the research process because it is the main source for the researcher to collect information relevant to the subject being studied. In qualitative research, the main objective is not to involve a large number of participants but to obtain quality, relevant, and in-depth data on the phenomenon to be investigated. In qualitative research, subjects selected without large quantities are important according to criteria.

Ahmad and Wilkins (2025) explained that purposive sampling is a common strategy in qualitative research, which allows the researcher to select participants based on the specific purpose and criteria of the research, considering the capacity of the participant to provide relevant and rich information. In qualitative research, the number of participants does not need to be large, because the main attention is on the depth and relevance of the information obtained. Therefore, in this research, the researcher used the purposive sampling technique to select participants who have relevant experience and knowledge about the integration of educational video in the science teaching process. This selection allowed the researcher to obtain appropriate information to describe and understand the practices, benefits, and challenges that teachers face during the use of educational video. Thus, participant selection was based not only on availability but also on their direct engagement with the phenomenon under study.

Therefore, in the research entitled “Teachers' Perspectives on the Challenges and Use of Educational Video in Third Cycle Science Instruction in Timor-Leste," the main participants were seventh-grade natural science teachers (7th grade) and 8 students in 7th grade as key subjects. In addition, the researcher also involved the director of Central Basic School Mary Wilson as an additional informant. Thus, participants were selected

based on relevance, experience, and direct involvement with the research subject. This selection allowed the researcher to obtain in-depth data on teacher perspectives, the use of educational video, benefits, challenges, and support needed to implement educational video in third-cycle science instruction.

3.3. Data Collection Techniques

In qualitative research, data collection techniques must be adjusted to the purpose and nature of the phenomenon being studied. The data collection techniques used in this research are interviews, observations and documentation. These techniques allow the researcher to obtain information directly from the participant through interviews, observe practices and interactions in natural contexts, and analyse documents relevant to the research topic. Klingebiel et al. (2024) showed that a combination of data collection methods, including interviews, observations and document analysis, can be used to gain multiple perspectives on the phenomenon and support the process of data triangulation. Based on this idea, this research combines interviews, observations and documentation to understand in detail how teachers integrate educational video into the science teaching process and to compare information from different data sources.

3.3.1. Interview

Interviewing is an important technique in qualitative research because it allows the researcher to hear directly from the informant about their experiences, perspectives, opinions and challenges. In this research, interviews were used to find out teachers' perspectives on the challenges and use of educational video in third cycle science instruction to understand how teachers use educational video in science instruction, why they use video, the benefits they see and the challenges they face. Interviews also allow the researcher to obtain information about aspects that cannot be observed directly in the classroom.

The interview was established in the form of group interviews for students, where students were divided into 2 groups with codes GK1 and GK2. But for the teacher (MVM) and the director (DrAV), use individual interviews. The interview was conducted in a direct manner by asking questions to the informants directly. Interviews were conducted in a semi-structured manner. Semi-structured interviews are qualitative data collection techniques that use a question guide prepared before the interview but maintain flexibility for the researcher to adapt questions according to the participant's responses and experiences. This technique allows the researcher to explore participant perspectives, experiences and interpretations in depth, while follow-up questions can be used to clarify or deepen relevant information. In the interview process, the researcher used open-ended questions to give the informant the opportunity to explain their experiences in their own words and used probing questions when additional clarification was needed. The semi-structured interview practice also involved recording and transcribing the interview to preserve information from the participant and facilitate the data analysis process. Qualitative studies using this approach show that interview guides can be prepared in advance, but questions can be adjusted according to participant responses, and interviews can be recorded and transcribed to support data analysis (Vibeke Eriksen, 2025).

3.3.2. Observation

Observation is a data collection technique that allows the researcher to directly observe phenomena in a natural context. In this research, observation is used to see how teachers and students engage in learning activities when educational videos are used in science classes. Observation is important because it allows the researcher to compare the information given by the teacher during the interview with the practice that occurs directly in the classroom.

The researcher used direct observation, where the researcher observed the learning process without directly intervening in the teaching activity. The focus of observation included teacher preparation before video use, teacher presentation and operation of video, video relationship to learning content, time management, teacher-student interaction, student participation during and after video, activities or discussions accompanying video, technology use, and technical and pedagogical challenges. Student participation, understanding, motivation, and interest appeared during class.

To organize the data, the researcher used observation protocol. The protocol records the date, time, place, class, and activity observed, as well as descriptive notes on the observation items. Ryker, Teasdale, and Bitting (2025) showed that observation protocols can be used as a systematic tool to record activities, behaviors, and teacher-student interactions in the classroom. The observation protocol allows the researcher to determine important aspects that need to be observed and organize the data obtained during the observation process. In this way, observation can provide data on real practice that occurs in the classroom and help the researcher analyze how teaching and learning activities are implemented in natural situations.

3.3.3. Documentation

Documentation is a data collection technique used to collect and analyze documents relevant to the research topic. The document can provide information about the planning, content, and implementation of learning activities. In this research, documentation was used to supplement the information obtained from interviews and observations so the researcher could obtain additional evidence of the use of educational video (Chand, 2025).

Documents collected in this research include lesson plans, educational videos used by teachers, science books or manuals, photographs, and attendance lists. The lesson plan was analyzed to see how the teacher planned the use of the video and how the video related to the learning objectives. Educational videos were collected to analyze their content, relevance to the subject, duration, language, and way of presenting science concepts. The book or science manual will be compared to the video content to see if there is a correspondence with the subject matter. The list was used to track student participation in class, and the photograph was used to show evidence of the implementation of educational videos and activities established in science class. He also saw challenges in the use of technology. Thus, documentation can help see the connection between the planning and implementation of science instruction. These documentations help the researcher verify information from interviews and observations.

3.4. Data Analysis Techniques

The data analysis techniques in this research are thematic analysis and content analysis. These techniques are adapted to the nature of data collected through interviews, observations and documentation. Thematic analysis was primarily used to identify emerging themes and patterns in the interview data, while content analysis was used to organise and interpret data from observations and documentation. After separate analyses, data from these sources will be compared and triangulated to gain a completed understanding of the phenomenon under study.

3.4.1. Thematic analysis

Thematic analysis is a data analysis technique used to identify, organise and interpret themes and patterns that emerge in qualitative data. DeJonckheere et al. (2024) explained that qualitative thematic analysis is an analysis method that can be applied across different areas and types of research, aiming to identify, organise, and interpret emerging themes or patterns in the data. This process allowed the researcher to analyse participant responses and look for important themes related to the research question. This technique is appropriate for qualitative research because it allows the researcher to organise large amounts of complex interview data into clear themes related to the research objectives.

In this research, thematic analysis is used mainly to analyse data from interviews, because interview data contains information about participant experiences, perspectives and opinions. The researcher did repeated readings of the interview transcripts, identified relevant information, assigned codes to important parts, grouped related codes and developed themes that represented the main patterns in the data. This process helped the researcher deeply understand the participant's perspective on the use of educational video in science learning. DeJonckheere et al. (2024) emphasise that thematic analysis needs to be clearly described because the method is implemented in various ways depending on the purpose and nature of the research.

3.4.2. Content analysis

Content analysis is a systematic technique to analyze and interpret the content of observation notes and documents, which are relevant to the research problem. This technique allows the researcher to organize information according to categories or indicators related to the research objective (Nicmanis, 2024). In this research, content analysis was used for data from observation and documentation. Observation data were analyzed based on what the researcher saw directly in the classroom, such as teacher preparation before video use, teacher presentation and operation of video, video relationship with learning content, teacher interaction with students, discussion activities, student participation, interest, motivation, understanding, and problems that arose during class.

For documentation, the researcher analyzed documents such as lesson plans, educational videos, science books or manuals, photographs of teachers and students in the use of educational videos, and attendance lists. In this research, the content analysis process is carried out through data selection, content review, category determination, coding of relevant information, grouping by category, and interpretation of results. Data from observation and documentation are organized according to indicators related to the research objective. Then, the results were compared with the interview data to see the consistency between the information provided by the informants, the practices observed, and the documentary evidence found.

3.5. Data Analysis Process

The data analysis process in this research was conducted in a systematic manner to ensure that the data collected could respond to the research objectives. First, the researcher organized and prepared data from interviews, observations, and documentation. Interview data were transcribed, while observation notes and relevant documents were organized by source and date of collection.

Second, the researcher read and understood the entire data to become familiar with the information collected. In this step, the researcher identifies important information that is directly related to the research objective. Third, the researcher coded the interview data. Relevant information was coded and grouped according to similarity, and then these codes were organized into categories and main themes. Themes were reviewed to ensure they represented the data and related to the research objectives.

Fourth, data from observations and documentation were analyzed through content analysis. The researcher identifies relevant information, organizes it by category, and interprets the content based on the research indicator. Finally, the researcher compared and triangulated the interview, observation, and documentation data. Triangulation is used to compare information from different sources and techniques so that the researcher can see the consistency between what the informants say, what the researcher observes in the classroom, and what the documents show. Through this process, the researcher was able to obtain a complete interpretation of the teacher's perspective, ways of using, benefits, and challenges of educational video in third-cycle science instruction.

3.6. Data Validation

In qualitative research, data quality can be viewed through credibility, which refers to the level of confidence about the data collected from the participants and the research context. Afiyanti (2008) explains that credibility is important to ensure that the data obtained represent the reality, experience and perspective of the participant on the phenomenon being studied. Therefore, the researcher needs to conduct a verification process to ensure that the information obtained is relevant, clear and corresponds to the research objectives.

To increase the credibility of the data in this research, the researcher used member checking. Member checking is the process of validation in qualitative research in which the researcher represents information from the interview to the participant to verify accuracy and correspondence with their experience. Through this process, the participant can see, confirm, clarify or correct the information that the researcher transcribes and interprets. Member checking also allows the participant to add or add information deemed important, thus helping to ensure that the researcher's interpretation does not deviate from the meaning the participant intended to convey (Sahakyan, 2023; Erdmann & Potthoff, 2023).

In this research, member checking was conducted with teachers, students and principals as participants to confirm the information from the interview to know the information corresponds to their answers and experiences. When the researcher finds some information is unclear, incorrect, or needs

to be added, the researcher confirms to obtain justification and detailed and clear information before making a final interpretation.

The researcher also compared data from interviews, observations and documentation as a form of data triangulation. This combination of sources and techniques allows the researcher to see the phenomenon from a different perspective. Interviews provide information about informant perspectives and experiences, and observations provide evidence of real classroom practice, while documentation provides evidence of planning and materials used. Information from these sources supported each other and helped the researcher produce evidence-based results and participant perspectives on the use and challenges of educational video in third-cycle science instruction.

3.7. Research Ethics

In conducting this research, the researcher respects and applies the principles of research ethics to ensure that the process of collection, analysis, and presentation of data is carried out with responsibility, respect, and integrity. Ethics in research is important because the researcher must protect the rights, dignity, privacy, and safety of the participants during the research process (Creswell & Poth, 2018). Therefore, before conducting the research, the researcher obtained a research license letter from the institute and prepared a letter of knowledge or authorization to the school to submit to the director or school leadership. This letter serves as an official authorization of the objectives and research activities carried out at the school.

After obtaining permission from the school, the researcher communicated with the school principal and teachers who participated in the research. The researcher clearly explained the title of the research, the objective, the activity to be carried out, the time of data collection, and the contribution of the participant. This information is important so that participants understand the research process before they give their consent to participate. This principle is important to ensure that participation is based on clear information and voluntary decisions (Creswell & Poth, 2018).

The researcher ensured that participation in the research was based on voluntary consent. Participants were given the opportunity to ask questions and receive explanations about aspects that were not understood. They have the right to accept or refuse participation and can end their participation at any time if they do not feel comfortable. The researcher will not force or pressure the participant to respond or continue to participate in the research process. In qualitative research, informed consent and voluntary participation are important aspects of respecting the autonomy of the participant (Orb, Eisenhauer, & Wynaden, 2001).

In the interview process, the researcher respected the opinions, experiences, and perspectives of the participants. The researcher gave the participant the opportunity to speak freely and express their ideas based on their own experiences about the use of educational video in science instruction. The researcher avoided making judgments on participant responses and asked clarifying questions when necessary to fully understand the information.

In the observation process, the researcher first informed the school and participants about the objective of observation and the aspects observed. Observation was conducted in a manner that did not disturb the teaching and learning process in the classroom. The researcher will avoid making judgments of teachers or students and use the information obtained only for the academic purpose of the research.

The researcher also ensured confidentiality and anonymity of the identity of the participants. The full names of teachers, students, and principals are not shown in the research report. Where participant responses or opinions are reported, the researcher uses codes or initials, such as ST (SCIENCE TEACHER), which refers to the natural science teacher for the seventh grade; the director uses the code DS (DIRECTOR OF SCHOOL); and students with the codes GS1 (GROUP STUDENT 1) and GS2 (GROUP STUDENT 2). The principles of confidentiality and identity protection are important to avoid risk or harm to participants (Orb et al., 2001).

Data collected through interviews, observations, and documentation are treated with confidentiality and responsibility. Data were used only for research purposes and were not shared with others unrelated to the research. Documents, interview transcripts, observation notes, and other evidence were kept securely during the research process, and access to data was limited to the academic needs of the researcher.

This research involves students in the observation process, so the researcher pays special attention to the protection of students. Students received a simple and understandable explanation of the research activity. Their safety, comfort, dignity, and privacy were prioritized during the data collection process.

Finally, the researcher presents the research results with honesty and academic integrity. The data was not falsified, manipulated, or changed according to the expectations of the researcher. The results will be presented based on evidence obtained from interviews, observations, and documentation. Thus, the application of these ethical principles helps ensure that the research on "Teacher Perspectives on the Challenges and Use of Educational Video in Third Cycle Science Instruction in Timor-Leste" is conducted with respect, responsibility, and academic integrity.

4. Research Results

4.1. Teacher Interview Results

4.1.1. Teacher perspectives on the use of educational video

The teacher's perspective is important to understand how teachers see the usefulness of educational video and its contribution to student understanding, especially in understanding scientific content that is difficult to explain through verbal explanation alone. Based on the results of the interview with the natural science teacher, ST, she showed a positive perspective on the use of educational video in the natural science classroom. ST 2026) said that educational video is a medium that can help students understand content in depth and allow students to see concepts that are difficult to see through teacher explanation alone. From this data, it shows that teachers see educational videos not only as a tool to show information but also as a visual support that can facilitate students' understanding of the concept. Thus, it is concluded that teachers have a good perspective on the use of video in helping students understand content in depth and visualise concepts that are difficult to understand through verbal explanation only.

4.1.2. Benefits of using educational video in natural science learning

Using educational videos has benefits for student learning. These benefits can be seen through changes in understanding, willingness to learn, participation and student interaction during class. Based on the interview, natural science teacher ST showed that educational videos benefit the student learning process. According to ST (2026), using educational videos facilitates the learning process, makes students want to know the content learned, and maximises student participation in science classes, enthusiasm, and the number of questions asked, and students understand the content better. This data demonstrates that educational video contributes to the cognitive aspect, where video helps students understand the content better, and in the affective aspect, student participation arouses interest and willingness to learn, so students become more active during class. From this result, it is concluded that the use of educational video can support the learning process of natural sciences by facilitating understanding and increasing the willingness to learn, participation and enthusiasm of students in the classroom. In addition, teachers at ST (2026) further stressed that there is a difference between classes that teachers explain only and classes that integrate educational video. When explained, students are not enthusiastic, noisy, and difficult to understand the concept. However, when the educational video was shown, the class became quiet, and the students focused more on the material. The student can discover the concept of the video, understand the content better, and get to know the figure relevant to the subject. Students also became active in asking questions during class. The data showed changes in student behaviour, understanding, and participation when video was used as part of the instruction. Therefore, it can be concluded that the use of educational video has a positive effect, especially on increasing attention, focus, understanding, and student participation. Video can also stimulate students to ask questions and discover concepts from the material they see.

4.1.3. The manner of using educational video in science learning

The implementation of video education is an important part in the learning process. There are many ways to implement video education to facilitate student learning and achieve learning outcomes. Based on the results of the interview, ST (2026) said that first, explain the content; then give the opportunity for students to ask questions and the teacher to answer the questions; present a video; give clear explanations; give questions to students to discuss in groups; give opportunities to present the results of discussion; ask for answers among students; and close with clarification and demonstration of figures. This process shows that teachers use educational video as part of a pedagogical strategy. Video integrates with other activities such as questioning, discussing, and presenting. Thus, it can be concluded that teachers use educational videos in an interactive manner to engage and stimulate students to actively involve themselves in the learning process.

4.1.4. Natural science content and educational video

In science learning, some content requires visual observation because it involves structures, processes, habitats, and phenomena that are difficult to demonstrate directly in the classroom. Based on the interview, teacher ST (2026) said that there are many natural science contents that are appropriate to use video. Among them are the stage of pregnancy, animal and bone structure, animal habitat, aquatic ecosystems, and other content. These contents require visual representation for students to understand better. Through video, students can see images or processes that are not easy to demonstrate directly by the teacher. However, teachers also point out that the use of video faces facility problems. The teacher also stressed that the laptop available is in poor condition, so at times the teacher prepares videos but fails to show them to students. In other situations, the teacher must use someone else's laptop. From this data, it can be concluded that educational video is considered especially appropriate for natural science content that requires visualization. However, the effectiveness of video use also depends on the availability and condition of technology equipment.

4.1.5. Challenges in using educational video

Implementation of video education also has its own challenges. Challenges are barriers that hinder the realization of an activity. This theme thus identifies the challenges that teachers face when integrating educational video into natural science classrooms. Based on the interview, ST teachers identified two main challenges, such as student behavior and technical equipment limitations. The teacher (2026) said that some students sometimes make noise, and the laptop used is also in poor condition. From the interview data, it can be concluded that the main challenges in using educational video are student behavior management and technological limitations. Bad behavior can affect attention, and poor laptop condition becomes an obstacle because it can make the video that has been prepared not be used in class.

4.1.6. Teacher strategies for solving challenges in the use of educational video

Teacher capacity to adapt and find alternatives is important to ensure the learning process continues despite technical limitations or classroom management problems. Based on the interview data, teacher ST (2026) presented that when students make noise, teacher ST approaches students, asks them to be quiet, and gives them the opportunity to ask questions. This strategy helps the teacher direct student attention back to the subject and learning activity. Regarding technical problems, teacher ST (2026) said that the technical problem encountered was a bad laptop and was looking for alternatives by asking a colleague's laptop to use. This shows that teachers do not rely solely on their own equipment but seek support and alternatives from the school environment. Thus, it can be concluded that teachers use pedagogical and practical strategies to overcome challenges in the use of educational video. For behavioral problems, the teacher uses approach and interaction, and for technical problems, the teacher uses alternatives through peer support. These strategies allow the learning process to continue despite limitations.

4.2. Student Interview Results

4.2.1. Student perspectives on educational video use

Student perspective in the use of educational video is an important part of knowing students' thoughts and views about educational video's use, challenges and benefits. The interview results showed that students had a positive perspective on the use of educational videos in science classes. The GS1 student (2026) said that the use of educational video helps students to see directly the content taught, sit quietly, increase interest in learning, and understand the subject better. While GS2 students (2026) said that educational videos can stimulate students to participate actively, increase enthusiasm, focus concentration on

the lesson, and understand the content taught. This result shows that students consider educational video as a means that can facilitate the learning process. The visual element in the video allows students to see and follow the content in a concrete way, thus supporting understanding and interest in learning science.

4.2.2. Benefits of using educational video

The use of video education has its own benefit for student learning. Thus, from the interviews, students identified various benefits of using educational videos. GS1 (2026) demonstrates that educational videos can attract students to attend the lesson, increase participation, and help them understand the content better. GS2 (2026) also said that video helps teachers to explain content clearly, especially when the subject involves processes that need to be seen directly. Students can see the process, understand information, and know aspects that were not previously understood. Therefore, it can be concluded that the benefits of using educational video can be seen through four aspects: increased understanding, increased participation, increased interest, and facilitated explanation of science content. This shows that educational videos are not only used to present information but also can be a tool to support the student learning process.

4.2.3. Frequency of educational video usage

The use of video depends on the content and teacher creativity. However, the interview results also showed that the use of educational videos in science classes has not become a frequent activity. Related to the interview data from GS1 (2026), it said that the video was only used once in science class, especially in content about the pregnancy process. The student also reported that in other subjects, such as religion, educational videos have been used. Thus, GS2 (2026) states that video is only used once in science class, and before that, teachers use more figures in books to demonstrate content. This result shows that, although students view the use of video with a positive perspective, the practice has not been regularly used in science classrooms. Thus, the use of educational video in the content the research focused on, especially the pregnancy process, would represent a relatively new learning experience for students.

4.2.4. The Manner of using video education in natural science classrooms

In the implementation of video education, it needs to be combined with some strategies to make it more effective. Based on the interview, the teacher did not use the educational video as an isolated activity but integrated it with other learning strategies. GS1 (2026) explained that the teacher starts the class with an introduction to the subject, explains the content, uses pictures, asks and answers questions, and then presents the video. After watching the video, students were given the opportunity to ask questions and express their ideas. The teacher also organizes students to discuss in groups and presents the results of the discussion in front of the class after the teacher gives the correct answer and also shows it with pictures. In addition, GS1 & GS2 (2026) add that the teacher first explained about the pregnancy process, then presented the video, and explained clearly the content shown in the video. After that, students had the opportunity to express ideas, ask questions, and do group exercises before making a presentation in front of the class. The results of this interview showed that the use of educational video is accompanied by interactive activities, such as question-and-answer, group discussion, expression of ideas, and presentation. This approach is part of the learning process that involves students actively developing their understanding of the content.

4.2.5. Science content using educational videos

In science there are various learning contents that teachers present to develop students' scientific knowledge. According to students, in the GS1 and GS2 (2026), there is much content that needs visualisation, but only the pregnancy process that uses video. The teacher uses it to show us the concrete process of pregnancy. The use of video can provide us with the opportunity to see processes that are not easily understood through verbal explanations or figures alone. Interview results showed that video was purposefully used to support students' understanding of specific content in science class.

4.2.6. Effect of using educational videos on students

The use of educational video has an effect on students' behavior and participation during class. Based on the data presented by GS1 (2026), when the teacher shows the video, students sit quietly, do not make noise, participate well, become curious, like to learn, and most can understand the lesson. The student also said that students who normally do not like to learn can also show interest when watching videos. GS2 (2026) also stressed that when the teacher shows the video, many students focus more on the class. Students who are normally noisy can become quiet, increase concentration, understand and know the content, participate actively, and ask many questions. Based on these responses, the use of educational video showed a positive contribution to student learning in which students were more focused, actively participated, understood, and demonstrated interest.

4.2.7. Challenges in using educational video

Although students provided positive perspectives, the interview also identified some challenges in using educational video. GS1 (2026) said that there are some students who will make noise during class. GS2 (2026) also reported that some students will provoke each other and talk when the teacher explains, although this behavior is not like the situation normally makes noise. This indicates that one of the challenges in the use of educational video is the control of student behavior. Although video can increase attention and concentration, there will be some students who need guidance from the teacher to continue focusing on learning activities.

4.2.8. Teacher strategies to address challenges

Strategy is a way to look for a solution for a problem. Regarding the way the teacher solved the challenges, student GS1 (2026) said that when students made noise, the strategy that the teacher used was to approach the student and speak softly after telling them to be quiet to listen to the explanation. GS2 (2026) also adds that the teacher approaches the students and guides them to be quiet, listen, and follow the lesson. From the students' responses, it can be seen that the teacher uses direct communication strategies and approaches students to solve behavior problems in class. This strategy includes calming students, speaking in an appropriate manner, approaching students, and providing guidance to continue participating in the learning process.

4.3. Principal Interview Results

4.3.1. Principal's perspective on the importance of educational video

The use of educational video is considered an important pedagogical strategy in the teaching and learning process of natural sciences. It contributes to students' presentation and understanding of scientific content. Based on the interview, DS (2026) considered the use of educational video as an important strategy in natural science pedagogy. Educational video can help teachers present scientific content visually, dynamically, and contextually. This perspective shows that video is not just for viewing but can be a means to facilitate students' understanding of scientific concepts that are difficult to explain. DS (2026) also emphasized that using video can grab students' attention, increase motivation, and stimulate their curiosity. From the interview data, it can be concluded that educational videos play an important role in teaching natural sciences because they can help teachers present content in a visual, dynamic, and contextual way and facilitate students' understanding of scientific concepts that are difficult to explain in conventional ways.

4.3.2. Benefits of educational video for teachers and students

This theme presents benefits that students and teachers can get through the use of educational video in the natural science classroom. Interview data from DS (2026) shows that educational videos not only provide support to students but can also be a support resource for teachers in the teaching process. Thus, from the interview data, it can be concluded that the use of educational video benefits both parties, such as teachers and students. For students, video can help understanding and increase interest in learning, while for teachers, video can support the process of presenting content in the classroom.

4.3.3. Frequency and conditions of educational video use

This theme describes the frequency of use of educational video by teachers in natural science classes and the conditions that determine when using video. According to information from DS (2026), the use of video does not occur in all classes but depends on the topic and the need to display the content visually. From this data, it can be concluded that teachers use educational videos with limited and selective frequency, especially when a topic requires visual support to facilitate students' understanding.

4.3.4. Strategies for using educational videos in the science classroom

The implementation of any activity requires strategies that can facilitate effective implementation. This theme explores the strategies teachers use when integrating educational video into natural science classrooms. Thus, according to the observation of DS (2026), teachers in Central Basic School Mary Wilson use educational videos according to the topic that needs to show the content in a visual form. The process begins with a presentation of the topic before the video is shown. After students watch the video, the teacher gives students the opportunity to express their ideas about what they have seen. The activity continues with group work, practice, and debate through questions prepared by the teacher. From the interview data, it can be concluded that the use of educational video in the classroom is not limited to video viewing activities but integrates with interactive activities such as discussion, group work, practice, and debate. This strategy gives students the opportunity to express their understanding and actively engage in the learning process.

4.3.5. Effect of video use on student

This theme focuses on the changes in learning conditions that the director observes when teachers use educational video in the classroom. According to the results of the direct interview, DS (2026) presented that the use of video in the learning process makes students participate well, pay attention to the lesson, show interest in learning, and make the classroom dynamic and interactive. From the interview data, it can be concluded that the use of educational video can contribute to increasing students' attention, interest, and participation. In addition, video helps make the classroom environment more dynamic and interactive.

4.3.6. Challenges in using educational video

Although educational video is beneficial, the interview revealed that there are some challenges in implementing this technology in the classroom. Challenges faced by teachers include lack or limitation of computers/laptops, electricity problems, and space limitations. Based on live interview data, DS (2026) shows that from the school side, problems of electricity, technology equipment, and internet access are also obstacles to the use of educational video. This situation shows that the effectiveness of the use of educational video not only depends on the will of the teacher but also depends on the availability of facilities and technology resources in the school. From these data, it can be concluded that the main challenge in the use of educational video is the limitation of infrastructure and technology resources, especially electricity, laptops or computers, and the internet. These limitations may affect the continuity and frequency of video use in the natural science teaching process.

4.3.7. School Efforts to overcome challenges

This final theme deals with the efforts and measures taken by the school to respond to technical and infrastructure challenges in the use of educational video. According to information, the school is looking for alternatives so that teachers can continue to use technology resources in the teaching process. DS (2026) stated that the school often uses generators when teachers need electricity to use video. A laptop or computer is also used when needed. These efforts show that the school is looking for practical alternatives to allow the use of educational video to continue despite facing infrastructure constraints. Based on the interview data, it can be concluded that the school makes efforts to overcome infrastructure limitations, especially by using generators when electricity is not available and using laptops or computers that are available. These efforts show that the school is looking for practical solutions to support the integration of educational video in natural science classrooms.

4.4. Results of Observation Data for Teachers and Students

4.4.1. Teacher observation data results

Based on the results of teacher observation, the indicators that received the answer "Yes" consist of teacher preparation for the use of educational video, the use of educational video in the science instruction process, instructional methods, time management, and technology use. This shows that the items of these indicators received a "yes" sign, which presents that the use of educational video in the science learning process is carried out with good preparation and integration. In terms of preparation, teachers prepare educational videos and necessary equipment such as laptops and projectors before starting class. The video used is of good quality because it has clear and appropriate images, sound, and content, and the video content is also relevant to the science topic taught. During the instructional

process, the teacher introduces the topic before opening the video, explains the content of the lesson, presents the video clearly and understandably to the student, and uses the video to explain science concepts clearly. The teacher does not pause but continues to explain important scientific concepts, asks questions related to the video, and encourages students to discuss, connecting the video content with the explanation of the lesson before and after the video while encouraging students to ask questions. Teachers use video as support in learning, not as a single teaching method, and the duration of video is considered appropriate for students in third cycle or third cycle schools, especially 7th grade. After the video presentation, the teacher summarizes the lesson and uses the video to help students understand the concept of science better. In terms of instructional methods, the teacher gives clear instructions for activities during learning with educational videos and integrates other methods such as discussion and demonstration based on video content. In terms of time management, teachers use time correctly and efficiently without harming other classes. In terms of technology, teachers can operate equipment such as computers, projectors, or mobile phones.

On the other hand, the observation results also identified some items that received a "No" answer in the indicator of the use of educational video in science instruction. One item, "no," talks about the teacher presenting the learning objective. In addition, there are two indicators, such as technical challenges and pedagogical challenges. In technical challenges, its item talks about problems in electricity, the internet, computers, projectors, or mobile phones. In the pedagogical challenge, its item presents the teacher's difficulty integrating video with the subject and learning objectives.

The observation indicated that the teacher did not convey the learning objectives to the students before starting the video presentation. This shows that in terms of learning orientation, it is not complete and does not lead children to the initial thought that makes them concentrate on the video and know the purpose of what they are going to see. Therefore, the objective needs to be clearly communicated so that students know the purpose of the video activity. However, regarding technical challenges, the observation was answered "No," which means that during the video presentation there were no significant problems with electricity, internet, projector, computer, sound, or other equipment. However, the observation notes showed that the computer used was borrowed from a colleague and was in good condition. In the aspect of pedagogical challenges, I also received the answer "No," because the teacher did not encounter difficulties integrating the video with the subject and learning objectives. Observation notes showed no difficulties during the video presentation.

4.4.2. Learner Observation Data Results

Related to the observation of students, the indicators that received the "yes" sign were described as student participation, motivation, and understanding. The observation showed that the items for these indicators are "yes" because students pay attention when watching educational videos, participate in answering questions, and discuss and ask questions after watching videos. The students also asked questions based on the video content and showed interest, willingness, motivation, and enthusiasm in the learning process. In time management, the use of video does not detract from class time for other learning activities. Finally, in the aspect of understanding, observation showed that students understand the learning content better when using educational video. These results show that in many respects, the use of educational video integrates with the instructional process and engages students in learning activities.

In the category of student challenges, the item regarding students' difficulty in understanding the language, content, or message of the video also received a "No" response. This shows that students do not encounter significant difficulties in understanding the language or video content. However, the observation notes showed that the challenge was that some students made noise, which could disturb other students during the video. Thus, the "No" items in the table do not mean that there is no problem in all situations but indicate that there is no problem in the specific aspect to which the observation item refers.

Overall, the content analysis of the observation data showed that the use of educational video in third-cycle science instruction was mostly with a "yes" sign. The teacher prepares, selects relevant videos, explains during the video, asks questions, discusses, summarizes, and integrates with other instructional methods. Students show attention, participation, interest, and motivation during the learning process and understanding of the lesson. On the other hand, the challenges identified were not major problems in the use of video but included noise from some students and dependence on borrowed equipment. The point that needs to be considered in the instruction process is that the teacher has not conveyed the learning objectives to the students before presenting the video.

Based on the results of observations conducted through observation grids for teachers and students, the use of educational video in the learning process of the third cycle of science showed positive results. Thus, it can be said that the implementation of educational video has a positive effect on students' active participation, increasing their willingness to learn and understand scientific concepts.

4.5. Documentation data results

Documentation data in this research were obtained from documents related to the learning process of natural sciences in the 7th grade. This documentation includes photographs of teachers implementing educational videos in the instructional process, student attendance lists, lesson plans, natural science textbooks for 7th grade, and educational videos. These documents are used to support and complement the data obtained from interviews and observations. In addition, it shows evidence of the implementation of educational videos in the process of teaching natural sciences in the 7th grade.

4.5.1. Educational video implementation photography

The photographs documented when the teacher prepared and presented the educational video to the students during the instructional process. The results of photographic documentation showed that teachers use educational video as one of the learning media in the natural science classroom. The photograph also indicates that teachers establish interaction between themselves and students and the way video is used to support the explanation of natural science material.

This photograph is visual evidence that the implementation of educational video is indeed carried out in the learning process. Using educational video helps teachers present content through images and movement, so students can see and understand scientific concepts that are difficult to explain through words alone.

4.5.2. Student attendance list

The attendance list is used to identify students who participate in classes and receive learning using educational videos. The documentation of the attendance list showed that the presence of educational videos made students' participation in the learning process of natural sciences maximum. The data from the attendance list also supported the observation of student participation in the classroom process. With documented attendance, the researcher can also compare the student attendance situation with the instructional implementation process used by the teacher. Thus, it can be said that the presence and use of educational video makes student participation become maximum compared to explanation only.

4.5.3. Lesson plan

The lesson plan is an important document to show the teacher's preparation before the instructional process. From the lesson plan you can see the learning objectives, materials to be taught, instructional methods, student activities, and learning media used. In the context of this research, lesson plans help to know how teachers plan the use of educational videos in natural science classes for 7th grade students. The documentation results showed that in the teacher's teaching, the teacher used the use of educational video with dynamic instruction. The use of educational video is not only a spontaneous activity, but is integrated into the process of planning and implementing instruction according to learning objectives.

4.5.4. Natural science textbook 7th year

The 7th grade natural science textbook is used as a reference source for learning materials used by teachers and students in the classroom. Textbook documentation helped the researcher identify natural science content related to the use of educational videos. The textbook also serves as a reference to see the relationship between the material in the book and the video content presented by the teacher. The book shows evidence that the content presented is relevant to the educational video presented by the teacher. Thus, educational video is used as support material to facilitate students' understanding of scientific concepts learned in 7th grade.

4.5.5. Educational video

Educational video is an instrument that shows that teachers use video in learning science content, especially about the pregnancy process. Through this video, we can also indicate evidence that the content presented in the video is appropriate with the content of science in the third cycle of grade 7. This evidence also further strengthens the data from interviews and observations on the use of educational video in third-cycle science instruction.

5. Discussion

Teacher perspectives on the use of educational video in the learning process are important in understanding how technology is integrated into pedagogical practices in the classroom. The teacher is not only a media user but also has the responsibility to determine the purpose, content, duration, moment, and pedagogical activity that accompanies the use of video. Therefore, the effectiveness of educational videos depends not only on the quality of the video but also on the way the teacher plans and integrates the video with the learning strategy.

The interview results in this research showed that ST have a positive perspective on the use of educational videos in natural science classes. From the teacher's perspective, video is a supportive means that helps students understand science concepts, especially content that is difficult to explain through words alone. Video allows students to see images, movements, and processes in a more concrete way, thus supporting the process of understanding. Higgins, Moeed & Eden (2018) explore how video can be a mediating tool in science learning. Video can represent processes and phenomena that are difficult to see directly, thus helping students construct understanding.

In Perspective Brame (2016), it was explained that the effectiveness of educational video depends on three important aspects, namely cognitive load management, student engagement, and active learning. In Brame's perspective, the use of video is not only about presenting information through audiovisual media but also requires planning and strategies that allow students to actively process the information. Thus, educational video will have pedagogical value when it is integrated with activities that stimulate students to think, respond, discuss, and apply the information they learn. In the context of this research, this principle can be seen in the practice of science teacher. The teacher did not use the video as an independent activity but began the lesson with an explanation, presented a question, used the video to support the content, and then gave students the opportunity to ask questions, discuss in groups, and present the results. This practice shows that the teacher's perspective on educational video is not limited to video as a means of viewing but considers video as part of an instructional strategy that complements other pedagogical activities to build a better understanding in students.

Educational video is of specific value in natural science learning because this subject involves concepts, processes, phenomena, structures, and interactions that are often difficult to observe directly in the classroom. Content such as pregnancy processes, bone structure, animal habitats, and ecosystems, for example, requires representations that can help students visualize relationships and processes that are not easily understood through verbal explanations or static figures alone. The results of this research show that teachers and students consider video especially useful for content that requires visualization. Through video, students can observe processes or phenomena in a dynamic way so that content that is abstract or difficult to see directly can become easier to understand. This result relates to a systematic review of the use of video in science learning conducted by Naimah, which reported that video has the potential to facilitate the science learning process and support understanding and learning outcomes.

The relationship between the empirical results and this literature shows that video plays an important role, especially when learning content involves visual representations and processes that are difficult to demonstrate directly. Thus, the value of video in the natural science classroom is not only because of its audiovisual form but also because of its ability to represent information that students will find difficult to imagine through verbal explanation alone. In this regard, Fiorella and Mayer (2018) also emphasize the principle of multimedia learning, which considers that designing and organizing video content is important to support learning. Content organization, segmentation, and the way students engage with the material can influence cognitive processing. Students learn better when video not only presents information but also helps them do cognitive activities such as remembering, explaining, making connections, and making sense of the information they observe.

Therefore, educational videos in natural science classrooms are not considered merely as a substitute for teachers or textbooks. instead, the video can be a supporting material that complements the teacher's explanation and the content in the textbook. This is consistent with the results of this research, as teachers continue to use the textbook as a reference source, while video is used as a visual means to reinforce and clarify content.

Another important aspect of the research results is the contribution of video to student engagement in the learning process. Interview results showed that students perceived video benefits through increased understanding, attention, interest, motivation, participation, and willingness to ask questions. Classroom observations also showed that students paid attention to the video, participated in question-and-answer activities, asked questions, and discussed with classmates. Interviews with GS1 and GS2 students also revealed that the use of video made them more interested and focused on the lesson. This result can be understood through the concept of active learning. Brame (2016) emphasized that student engagement and active learning are important elements in making educational video effective. Students do not need to be passive spectators but need to engage with the content through questions, discussion, reflection, or other activities. In this context, video can be the stimulus that initiates the process of student interaction and cognitive processing. The practice of ST teachers in this research demonstrates the application of this principle. After students watch the video, the teacher asks questions, organizes group discussions, gives students the opportunity to express ideas and make presentations. These strategies help transform the video viewing activity from a passive activity to a learning activity that engages the student directly. This result is also supported by the meta-analysis of Zhang, Li, Pi and Yang (2025), which analyzed 54 studies on active learning strategies in video-based learning. The results show that active learning strategies in the video context can support knowledge retention, comprehension, and transfer, although the effect may vary according to student characteristics and video properties. Thus, the use of video with active learning strategies can be considered as an approach that gives students the opportunity to not only receive information, but also process and use the information they receive.

An important aspect of the research results is the contribution of video to the understanding of natural science content. Teachers report that video helps students understand concepts that are difficult to explain through verbal words alone. Students also reported that the video helped them see the process and understand the information more clearly. This result shows that the benefits of video are not limited to increased attention or interest but also related to the content comprehension process. This thought can be explained through the multimedia learning theory of Fiorella and Mayer (2018), which emphasises the way students process information from visual and verbal representations. When audiovisual content is well organised and students engage with the information, video can support the cognitive processing needed to understand and make connections between ideas.

In natural science learning, this mechanism is particularly relevant because much of the content involves processes and phenomena that change over time. The process of pregnancy, for example, may be easier to understand when students can observe dynamic representations of the process, rather than relying solely on verbal descriptions or static figures. Therefore, the research results that identify the pregnancy process as appropriate content to use video reinforce the argument that the nature of the content should be considered when teachers choose and plan the use of video.

Although the research results showed a positive perspective on the use of educational video in 7th grade natural science and the benefits of using video, the data also showed that video itself does not guarantee learning outcomes. The effectiveness of video depends on how the teacher plans, selects and integrates the video with the learning objectives and pedagogical activity. In this research, video is used along with explanations, questions, discussions and presentations. This structure is important because students have the opportunity to process the information they see and transform this information into knowledge through interaction and activity.

The planning aspect is also important in content selection. Teachers need to consider whether the video is relevant to the learning objective, appropriate to the student's level, and can clarify content that is difficult to explain in traditional ways. In addition, the availability of equipment and classroom conditions can also influence implementation. Thus, the use of educational video needs to be seen as part of the whole instructional system, not as a technology that can be used independently of pedagogical planning. In this sense, the research results reinforce the views of Brame (2016) and Fiorella and Mayer (2018), all of whom emphasize that video design, cognitive processing, student engagement, and instructional strategies should be considered together. Video will have pedagogical value when used with a clear purpose and integrated with activities that allow students to do cognitive processing and actively engage in learning.

The challenge in using educational video is the student's attitude, which is a little noisy to disturb the class, but the teacher has already taken positive measures to prevent it. Another limitation is the lack of facilities or equipment such as computers and laptops. Thus, Breslyn and Green (2022), in their study of science learning through YouTube videos, showed that student access to technology is unequal, and students who do not have access to technology may not have the same opportunities to participate. They also reported that some accessed the video through a laptop/Chromebook, desktop, mobile phone, or tablet. Therefore, in schools with limited laptops, teachers may face difficulties in ensuring that all students have equal opportunities to watch and learn from educational videos.

6. Conclusion

Teacher perspective" refers to the teacher's understanding, thinking, and evaluation of a phenomenon that occurs in the teaching and learning process. In the context of this research, the teacher perspective focuses on how teachers see and understand the use of educational video in third-cycle natural science instruction. Based on the results of interviews with teachers, students, and the principal, and also supported by the results of observation and documentation, the research showed that the participants had a positive perspective on the use of educational video in natural science instruction. Teachers consider educational videos as pedagogical resources that can facilitate the process of explanation and help students understand scientific concepts, especially content or processes that are difficult to explain through words or figures alone. Students also see educational videos as a learning medium that can help them see the content directly, increase interest, and facilitate

understanding. The director also considers educational videos important because they can help teachers present content in a visual, dynamic, and interactive way.

In terms of use, the research results showed that teachers do not use educational videos as an isolated activity but integrate videos with other instructional strategies and methods. The use of video begins with an introduction and explanation of the topic, followed by a video presentation, questions and answers, expression of ideas, group discussion, and presentation and clarification by the teacher. Teachers also use video as a support medium to connect visual content with explanations and other learning activities. This shows that educational video does not replace the role of the teacher but becomes a support resource that integrates with pedagogical practice to make the learning process interactive and involve students more actively.

Linked to the effect of using educational video, the interview and observation results show that video makes a positive contribution to students' learning process. When video is used in the classroom, students show better attention and concentration, demonstrate interest, motivation, and enthusiasm, and actively participate by answering and asking questions and discussing and expressing their ideas. Video also helps students understand scientific concepts better because it allows them to see images, movements, and processes that are not easily understood through verbal explanations alone. Thus, the effect of using educational video can be seen through the increased attention, interest, motivation, participation, and understanding of students in the learning process of natural science.

Despite these benefits, research also identifies challenges in integrating educational video into the instructional process. These challenges include limited equipment and technology infrastructure, such as laptops or computers, electricity, and internet access. However, teachers and schools make efforts to overcome these challenges, such as using borrowed laptops and generators when electricity is not available. On the other hand, there are some students who sometimes make noise, talk, or disturb other students during class, so teachers need to manage behavior and direct student attention. The observation results also showed that teachers can integrate videos with learning materials and activities, but there is one aspect that needs to be improved, which is to present the learning objectives clearly before presenting the video.

This research shows that the use of educational video can be a pedagogical resource to support the quality of the teaching and learning process, especially in the area of the third cycle of natural sciences. This research provides information to teachers on how to integrate educational video with other instructional strategies, such as questions and answers, group discussions, demonstrations, and presentations, to promote interactive learning and provide opportunities for students to be actively involved. For students, the use of video contributes to facilitating understanding, increasing attention, interest, motivation, and participation, especially in learning scientific concepts that require visualization.

Thus, this research contribution is not limited to the benefits of students in the classroom but also contributes to the development of teacher pedagogical practices, the integration of technology in education, and the improvement of conditions that support the teaching and learning process. This research can also be a reference for teachers, schools, and other researchers to continue developing and exploring the use of educational video in the teaching of natural sciences and other learning areas.

7. Recommendations

7.1. To the Ministry of Education

It is recommended to continue to support the integration of technology in the teaching and learning process, especially through the availability of technology infrastructure and equipment, and also promote training for teachers on the use of educational video in the instruction process.

7.2. School

It is recommended to ensure the availability and maintenance of technology facilities, such as laptops or computers, projectors, audio equipment and power sources. Schools also need to support teachers and promote the sharing of experiences among teachers about the use of educational video in the learning process.

7.3. For teachers

It is recommended to continue integrating educational video with other instructional strategies, especially for content that requires visualization. Teachers need to state the learning objectives before presenting the video, choose videos that are relevant to the content and student level, and use questions and answers, discussion, presentation and clarification to stimulate student participation and understanding.

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Competing Interests

The authors declare that no competing interests exist.

Authors' Contributions

Edviges Maria Sidalia de Oliveira was responsible for the conceptualization, methodology, data collection, data analysis, interpretation of the findings, and writing, reviewing, and editing of the manuscript. The author has read and agreed to the published version of the manuscript.

Informed Consent

Informed consent was obtained from all participants before their participation in the study. Participants were informed about the purpose of the research, the voluntary nature of their participation, and the confidentiality of the information provided.

Ethics Approval

This study received ethical approval from the Instituto Católico para a Formação de Professores (ICFP), Baucau, Timor-Leste. The study was conducted in accordance with the approved research protocol and applicable ethical guidelines and regulations.

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