

Analysis of the Suitability of Science Content in YouTube Learning Videos for Elementary School Students

Firayani

Universitas Islam Negeri Sultan Thaha Saifuddin Jambi

E-mail: firayani60@gmail.com

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ABSTRACT

This study aims to analyze the alignment between Natural Science (IPA) learning video content available on the YouTube platform and the Indonesian elementary school (SD) curriculum. Employing a descriptive qualitative method with a content analysis approach, the study examined a selection of science learning videos chosen based on specific criteria, including thematic relevance, view count, and age-appropriate targeting. The analysis instrument was developed using core competency indicators outlined in both the 2013 Curriculum (Kurikulum 2013) and the Merdeka Curriculum (Kurikulum Merdeka). Findings indicate that while the majority of videos are thematically aligned with curriculum standards, several issues persist, such as the presence of scientifically inaccurate concepts, use of language that does not match students' cognitive development stages, and limited connection to real-life contexts. Content produced by official or verified channels tended to demonstrate higher quality and better adherence to pedagogical principles. Based on these findings, the study recommends the development of clear evaluative guidelines for educators and parents in selecting appropriate digital learning materials, as well as the need to enhance the overall quality and instructional design of YouTube-based educational content to foster more effective and meaningful science learning experiences at the elementary level.

Keywords: YouTube Education, Elementary Science, Curriculum Suitability, Content Analysis

INTRODUCTION

The development of digital technology has revolutionized the teaching and learning process, including at the elementary school level. Today, students no longer rely solely on textbooks or teacher lectures, but are beginning to explore a variety of digital learning resources. One example of this transformation is the increasing use of video-based media, which offers a more interactive, visual, and easy-to-understand learning experience. (Filho et al., 2023).

YouTube has become a popular platform and is widely used as an alternative learning resource by teachers, students, and parents. Its high accessibility and diverse content make it a primary choice for supporting learning, including in science lessons. Many teachers also use YouTube videos to enrich teaching materials or provide additional explanations outside of class hours. (Mady & Baadel, 2020).

In science learning, visualization plays a crucial role because it helps students understand scientific concepts that are often abstract or inaccessible to direct observation. Learning videos can facilitate demonstrations of experiments, simulations of scientific processes, and illustrations of natural phenomena in a more engaging and



understandable way for elementary school students who are still in the concrete-operational stage of cognitive development.(Hayat et al., 2024).

While YouTube offers a wide selection of educational videos, not all of the available content aligns with the national curriculum or has sufficient scientific validity. Much of the material is not aligned with learning outcomes, uses inappropriate terminology, or conveys information that is too shallow or too complex for elementary school students.

Educational Content from Non-Education Creators

Most educational video content is created by creators without an academic background in education or science. This raises concerns about the pedagogical quality and scientific accuracy of the material presented. Without academic guidance or verification, the content produced has the potential to contain conceptual errors that can confuse or mislead students.

Lack of Quality Control of Open Content

Platforms like YouTube are open and freely available, so quality control mechanisms for educational content are very limited. Unlike textbooks, which undergo academic review and editing, videos on YouTube are directly accessible without any filtering. As a result, students are vulnerable to receiving invalid information, which can lead to the formation of misconceptions about science.

Based on these conditions, a comprehensive and systematic analysis is needed to determine the suitability of science learning video content on YouTube with the elementary school curriculum. This analysis aims to assess whether the content used truly supports meaningful learning, is scientifically accurate, aligns with students' cognitive developmental stages, and is relevant to the core competencies established in the curriculum.

Although numerous studies have been conducted on the effectiveness of digital learning media, most of these studies are general in nature and have not specifically addressed the content of instructional videos on YouTube, particularly in the Natural Sciences (IPA) subject at the elementary school level. Studies that systematically analyze the suitability of video content to core competency indicators and learning outcomes in the national curriculum are still very limited. This is despite the fact that YouTube is one of the most widely accessed platforms by students and teachers as a supplementary learning resource. The lack of scientific evaluation of the quality of video content widely consumed on this public platform represents a critical gap that requires investigation, particularly to ensure that the material presented is scientifically sound, appropriate to students' cognitive developmental levels, and supports the achievement of formal learning objectives in schools.

This research offers novelty by presenting a systematic approach in assessing the suitability of learning video content on YouTube with the Elementary School Natural Science (IPA) curriculum, through an analysis based on Basic Competency (KD) indicators and relevant pedagogical aspects. Not only assessing the effectiveness of digital media in general, this research also designs a video content evaluation framework that can be used as a practical guide for teachers, content developers, and policy makers in selecting, recommending, or even producing educational materials that are appropriate to learning needs. Thus, this research is one of the initial significant contributions in bridging open digital media such as YouTube with the formal curriculum at the elementary education level in a critical and in-depth manner, as well as opening up space for strengthening digital literacy and contemporary pedagogy based on the national curriculum.

This study aims to analyze the suitability of the content of science learning videos available on the YouTube platform with the Elementary School Science curriculum, both the 2013 Curriculum and the Independent Curriculum, to ensure that the content consumed by students is in accordance with national education standards. In addition, this study also aims to identify the extent to which these videos are able to convey science concepts scientifically and pedagogically, so that they truly support a meaningful learning process. From the results of this analysis, this study is expected to provide recommendations regarding the quality and use of YouTube learning videos in the context of formal learning in Elementary Schools, while also providing practical evaluative tools for teachers in selecting and filtering digital content that is appropriate, relevant, and safe for use by students.

METHOD

This study used a descriptive qualitative method with a content analysis approach to assess the suitability of science learning video content on YouTube with the elementary school curriculum. Primary data were obtained from Indonesian-language science learning videos aimed at elementary school students and met criteria such as a minimum number of views, published by educational channels, and covering themes in science subjects. Secondary data consisted of curriculum documents (the 2013 Curriculum and/or the Independent Curriculum), elementary science textbooks, and other relevant literature. Data collection techniques were carried out through non-participatory observation and documentation of video content, while the research instrument used a content analysis sheet based on basic competency indicators and an assessment rubric covering aspects of suitability with the curriculum, accuracy of scientific concepts, language use, visualization, and potential to foster student learning interest. Data analysis was conducted qualitatively by comparing video content to curriculum standards and scientific literature, then categorizing the results into high, medium, and low levels of suitability. Data validity was strengthened through source triangulation and consultation with science education experts.

RESULTS AND DISCUSSION

Evaluation of Content Quality and Scientific Accuracy in Elementary Science Learning Videos on YouTube

This study found that of the 10 science learning videos analyzed for elementary school students, 70% of the videos were thematically aligned with the curriculum, but only 40% fully included learning indicators aligned with the core competencies in the 2013 Curriculum and the Independent Curriculum. The accuracy of the scientific concepts in the videos varied widely; 4 out of 10 videos presented accurate information, while the rest contained oversimplifications, and 2 videos contained misconceptions that could impact student understanding. In terms of visualization, 60% of the videos used engaging animation or illustrations, but only 30% provided narrative explanations that were scientifically correct and educational (Helming et al., 2021).

The language used in the videos was generally communicative, but not entirely tailored to the cognitive development of elementary school students; three videos used overly technical terms without simple explanations. Videos from official channels or educational institutions showed better content quality than videos from personal channels. Furthermore, only two of the ten videos linked science material to students' daily lives, despite the importance of local context in improving scientific literacy. These findings suggest a gap between video popularity and content quality, with many visually appealing videos being less pedagogically and scientifically appropriate (Sütcüoğlu).

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The accuracy of scientific concepts presented in science learning videos on YouTube shows significant variation. On the one hand, some videos present information accurately and in accordance with scientific principles and applicable curricula, even delivered in a way that is engaging and easy for elementary school students to understand. These videos are generally produced by official institutions, verified educational channels, or professional educators who understand the importance of material accuracy. However, on the other hand, many videos oversimplify scientific concepts to the point of obscuring their true meaning and even containing misconceptions that have the potential to confuse students. An example is the oversimplification of the concepts of force or changes in state of matter without in-depth explanations of the mechanisms or scientific requirements. These errors, if widely consumed without teacher guidance, can form erroneous understandings that are difficult to correct later. Therefore, critical evaluation of the accuracy of scientific concepts in video content is crucial to ensure that the material students absorb truly supports the achievement of valid scientific literacy from an early age (Anggraini & Putra, 2021).

This study found that out of the 10 science learning videos analyzed for elementary school students, 70% were thematically aligned with the curriculum, indicating that most content creators are aware of the essential scope of science topics within both the 2013 Curriculum and the *Independent Curriculum*. However, only 40% of the videos explicitly included learning indicators aligned with the core competencies, meaning that the majority of videos did not present clear instructional goals, structured learning sequences, or competency-based outcomes. This gap suggests that even when topics are aligned with the curriculum, many videos are not intentionally designed as pedagogical tools for learning, but instead as informational or entertainment-oriented content.

In terms of scientific accuracy, substantial variation was detected across the videos. Only 4 out of 10 videos presented fully accurate scientific information, while the remaining 6 videos showed signs of oversimplification that risked obscuring the actual scientific mechanisms. More critically, two videos contained explicit misconceptions that could mislead student understanding, particularly regarding concepts such as force, phases of matter, and light reflection. Misconceptions at the elementary level are highly problematic because once learned, they tend to persist and become increasingly difficult

to correct in later stages of education. Thus, the presence of scientifically inaccurate content highlights the importance of teacher supervision and critical media selection when using YouTube as a learning resource. (Azak et al., 2023).

With regard to visualization quality, 60% of the videos incorporated engaging animations or illustrations, allowing students to visualize phenomena that are otherwise abstract in real-life settings. Nevertheless, only 30% of the videos accompanied visuals with scientifically sound and structured narrative explanations. Several videos relied heavily on visual appeal without providing sufficient conceptual reasoning or the scientific "why" behind the phenomenon. This imbalance shows that attractive visuals do not guarantee meaningful learning, especially when narration does not reinforce scientific concepts.

The language used in the videos was generally communicative and appealing, yet not always developmentally appropriate for elementary school students. Three videos introduced highly technical terminology without simplified explanations or analogies, such as "kinetic energy," "gravitational force," or "molecular movement," which risk creating confusion and cognitive overload. Videos from official educational institutions consistently demonstrated clearer language organization and age-appropriate terminology, while independently produced videos tended to prioritize narration style over linguistic suitability for young learners. (Putri & Putri, 2025).

Furthermore, only two of the ten videos connected the scientific material with students' everyday lives, despite the well-established importance of contextual learning in the development of scientific literacy. The absence of real-world examples limits opportunities for students to understand the relevance of science in daily situations, reducing curiosity, motivation, and knowledge retention. When contextual learning is missing, science becomes a collection of abstract facts rather than a meaningful tool for understanding the world.

Another notable finding is the difference in quality between official and personal YouTube channels. Videos uploaded by educational institutions or verified academic channels had stronger alignment with curriculum competencies, clearer learning objectives, more accurate information, and more pedagogically structured delivery. In contrast, personal channels (despite often being visually appealing and gaining large numbers of viewers) did not consistently prioritize scientific accuracy or instructional design. This exposes a clear gap between popularity and educational quality, suggesting that high view counts cannot be used as an indicator of learning worthiness. (Setiana et al., 2021).

Taken together, these findings reveal that science learning videos on YouTube offer both opportunities and risks. While many provide visually engaging content, only a limited number fully meet the criteria of scientific validity, age-appropriate communication, and competency-oriented learning. Therefore, teachers must act as critical evaluators and curators of digital instructional media, selecting videos not only based on visual appeal but also on pedagogical and scientific quality. Strengthening media literacy among educators is crucial to ensure that YouTube functions as a reliable learning resource rather than a source of inaccurate scientific knowledge.

Pedagogical Alignment of Science Learning Videos: Language Appropriateness, Educational Focus, and Contextual Relevance

The visualization aspect of science learning videos on YouTube has proven quite helpful in improving student understanding, especially when the videos use interactive animations, engaging illustrations, or simple experimental demonstrations appropriate to the context of elementary school learning. These types of visuals can bridge abstract

concepts, making them easier to understand for students who are still at the concrete thinking stage. However, the effectiveness of these visuals depends heavily on the accompanying narrative. Unfortunately, not all videos include adequate verbal explanations or use scientific terminology appropriately to explain what is being visualized. Some videos tend to only show images or animations without strong explanatory context, or use overly simplistic narratives that fail to fully explain scientific processes. This can lead to students being merely entertained by the visuals without truly understanding the scientific principles behind them. Therefore, it is crucial for content creators to integrate visuals with educational narratives that are appropriate to students' cognitive levels and aligned with science learning objectives. (Lin & Wu, 2021).

The visualization aspect of science learning videos on YouTube has demonstrated considerable potential in supporting conceptual understanding among elementary school students, particularly when the videos incorporate interactive animations, engaging illustrations, and context-appropriate experimental demonstrations. Such visuals act as cognitive scaffolding that helps young learners transition from concrete thinking to more abstract scientific reasoning by representing phenomena that would otherwise be difficult to observe directly. However, the effectiveness of visualization is not determined by imagery alone. It relies substantially on the quality of the accompanying narration, specifically, the extent to which verbal explanations clarify what is being visualized and provide accurate scientific frameworks for interpretation.

The findings indicate that this synergy between visual and verbal elements is not consistently present across the analyzed videos. Some videos display high-quality animations but lack adequate explanatory narration, resulting in students watching eye-catching phenomena without understanding the underlying mechanisms. Others employ narration that is overly simplistic or overgeneralized, which prevents learners from fully grasping the scientific processes involved and increases the risk of misconceptions. In such cases, visuals serve more as entertainment than as learning tools, causing students to retain superficial impressions rather than meaningful scientific concepts. (Jelatu & Ardana, 2018).

Therefore, effective visual media in science learning requires more than appealing imagery; it demands intentional instructional design, in which visuals and spoken explanations work together to guide learners through the reasoning process step by step. For maximum pedagogical impact, content creators should integrate visuals with developmentally appropriate scientific narratives that explicitly articulate cause-and-effect relationships, highlight key terminology, and connect visualized phenomena to students' existing knowledge. By aligning visualization with clear learning goals and cognitive characteristics of elementary students, YouTube-based science videos can transition from merely engaging media to powerful tools for building robust scientific understanding. (Monch & Markic, 2022).

The language used tends to be communicative

The language used in science learning videos on YouTube is generally communicative and attempts to explain concepts in an engaging manner, but it is not fully adapted to the cognitive developmental level of elementary school students. Some videos use technical terms or long sentences that are too complex for children to understand, making it difficult for them to grasp the core meaning of the material being presented. Conversely, some videos present information in overly simplified language that loses its scientific essence, leaving students with only a general overview without

understanding the fundamental principles they should master. This mismatch has the potential to hinder the learning process, particularly in developing scientific thinking skills that are developed gradually according to age. Ideally, the language used in learning videos should consider the cognitive developmental characteristics of elementary school students namely, the concrete-operational stage according to Piaget's theory, by presenting concepts simply but not deviating from scientific truth. This is crucial so that videos are not only visually appealing but also effective in conveying knowledge in a meaningful and sustainable manner.

Some science learning videos on YouTube contain a significant entertainment element, such as the use of striking sound effects, cute animated characters, or engaging storylines. These elements are indeed effective in capturing and increasing student interest, especially in elementary school, where learning requires visual and emotional stimulation. However, this dominance of entertainment often distracts from the primary learning objective, which is to thoroughly understand scientific concepts.

As a result, the content becomes unclear or only conveyed in passing, without the in-depth scientific meaning that students should gain. Some videos even overemphasize humor or drama, making the scientific message invisible or obscured. This imbalance between educational and entertainment elements is a crucial concern in evaluating digital learning media. While videos can create a fun learning environment, clarity, accuracy, and depth of content are still essential for optimal achievement of science learning objectives.

Only a small percentage of science learning videos on YouTube explicitly link science concepts to students' everyday life contexts, such as activities at home, their surroundings, or their direct experiences. Yet, this connection is crucial for fostering early scientific literacy, as it allows students to understand that science is not merely abstract theory, but something close and relevant to their lives. When science material is presented without real-world context, students tend to memorize concepts mechanically without truly understanding their meaning or recognizing their application in everyday life. (Bidarra & Rusman, 2017)

Videos that successfully connect material to real-life experiences can increase learning interest, build critical thinking skills, and strengthen conceptual understanding through concrete examples. Unfortunately, most of the videos observed in this study focused more on delivering content textually or visually without bridging the material with students' real-life experiences. Consequently, video's potential as a tool for building applied scientific awareness has not been optimally utilized.

A systematic and structured content evaluation guide or standard is needed to assist teachers in screening and selecting appropriate YouTube learning videos for use in the classroom. This guide should include indicators assessing curriculum alignment, scientific conceptual accuracy, visual and narrative quality, language appropriateness to students' cognitive levels, and the relevance of the material's context to everyday life. (Pelález et al., 2024)

With this evaluative tool, teachers no longer rely solely on intuition or content popularity, but instead have an objective benchmark for ensuring the quality and usefulness of the learning videos they use. This study also found that videos from official channels such as the Ministry of Education and Culture, Rumah Belajar, or channels managed by educational institutions tend to better meet these criteria, both in terms of material accuracy, presentation structure, and alignment with the national curriculum. Conversely, videos from private or unverified channels often present less standardized content, both in terms of content and pedagogical approach, thus risking misconceptions or misunderstandings. Therefore, content validation and curation are

crucial steps in optimizing the use of YouTube as an effective learning medium in elementary schools.

CONCLUSION

This study concluded that while most science learning videos on YouTube for elementary school students are aligned with the curriculum, they do not fully meet the established learning outcome indicators. There is variation in the accuracy of the scientific concepts presented; some videos convey accurate information, while others contain conceptual errors or oversimplifications that could potentially lead to misconceptions. Visuals and animation are considered quite effective in capturing students' attention, but they need to be accompanied by appropriate scientific narratives to avoid misinterpretation. Another challenge is the use of language that is not appropriate for elementary school students' cognitive developmental level. In general, videos from official and verified channels more consistently convey curriculum-aligned material compared to non-educational channels. Therefore, a guide or evaluative framework is needed that teachers and parents can use to assess the appropriateness of learning videos in terms of content, methodological approach, and educational value. This study emphasizes the urgency of quality control of digital educational content so that video-based learning can support the achievement of correct and sustainable scientific literacy from an early age.

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