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Exploration of the Utilization of Lumio as Interactive Media in Science Learning in Elementary Schools

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Abstract
This study aims to explore the use of Lumio as an interactive learning medium in Integrated Natural and Social Sciences (IPAS) subjects in elementary schools. This study uses a qualitative approach with an exploratory descriptive method which was carried out at SD Negeri 1 Suru, Nganjuk Regency, East Java. The research involved one science teacher and 28 grade V students, with data collection techniques through observation, semi-structured interviews, and documentation. The data collection process was conducted over a period of two weeks during the even semester of the 2024/2025 academic year. Data analysis was carried out using the Miles and Huberman model which includes data reduction, data presentation, and conclusion drawing. The results showed that the use of Lumio increased students' active participation, strengthened the understanding of abstract IPAS concepts, and created a more collaborative learning atmosphere. Interactive features such as digital quizzes, concept mapping, and collaborative whiteboards have proven effective in facilitating meaningful learning. The teacher stated that Lumio helps the formative assessment process and speeds up the giving of feedback. The main obstacle faced is the limitation of devices and internet connections, but it can be overcome through teachers' adaptive strategies. This study recommends strengthening teacher capacity through educational technology training and the provision of adequate digital infrastructure. The findings support the implementation of the Independent Curriculum that encourages technology-based active learning. In conclusion, Lumio has great potential as an innovative medium that strengthens the integration of technology in science learning at the elementary school level.

INTRODUCTION

The development of digital technology has brought significant changes in the world of education, especially in the approach to learning at the elementary level. The learning process now does not only rely on conventional methods, but also begins to shift to the use of interactive media based on digital technology (Fitri & Hadi, 2024). This is in line with the demands of the Independent Curriculum which encourages the strengthening of digital literacy and 21st century skills in students from an early age (Wulansari et al., 2023). In this context, Integrated Natural and Social Sciences (IPAS) learning in elementary schools needs to be packaged attractively so that students are more actively involved and have a better understanding of concepts. Interactive media can be a bridge between abstract material and a concrete and fun learning experience (Solihin & Rahmawati, 2024). The use of interactive digital media has also been proven to be able to significantly increase student motivation and engagement (Lestyono et al., 2024). Therefore, it is important to explore the different platforms that support the interactive learning process in elementary schools. One of the platforms

that is starting to be widely used is Lumio, an interactive learning application designed to support visual-based and participatory teaching.

Lumio is a digital learning medium that allows teachers to design interactive learning through various features, such as quizzes, collaborative activities, and visual concept mapping. The platform is integrated with digital devices commonly used in schools, such as Chromebooks, tablets, and computers, making it flexible to be implemented in various classroom conditions (Wardana & Winarti, 2025). One of the advantages of Lumio is its ability to facilitate active and experiential learning, which is in accordance with the characteristics of elementary school-age learners (Riski & Jasiah, 2025). In the midst of massive digital transformation in the education sector, Lumio is an attractive alternative to support an adaptive learning process that is responsive to the needs of students. In addition, Lumio provides real-time learning analytics that can help teachers conduct formative evaluations effectively (Andayani & Fatayati, 2024). These features encourage students' active participation in constructing their own understanding rather than passively receiving information. However, despite its potential, studies exploring the pedagogical use of Lumio in the context of science learning at the elementary level remain limited.

Science learning (IPAS) in elementary schools integrates natural and social science concepts that emphasize conceptual understanding, critical thinking, and problem-solving related to students' daily lives (Taufik & Prasetyaningtyas, 2024). However, in practice, social studies learning often takes place theoretically and minimally involves exploratory activities, especially at the elementary school level. Many students have difficulty understanding abstract IPAS concepts if they are not supported by the right media (Saukani, 2024). The use of interactive media such as Lumio is believed to bridge this problem by presenting materials in the form of visuals, simulations, and collaborative activities. Research shows that learning involving interaction and visualization enhances conceptual understanding more effectively than traditional lecture-based methods (Saputra et al., 2024).

Theoretically, this study is grounded in constructivist learning theory, which emphasizes that learners actively construct knowledge through experience and social interaction. Lumio supports this constructivist approach by enabling students to explore, discuss, and present their ideas interactively. Through digital tools such as shared whiteboards and collaborative quizzes, Lumio facilitates peer learning and scaffolding, allowing teachers to guide students in forming their understanding. This aligns with the characteristics of elementary students who learn best through active, visual, and enjoyable experiences (Putra & Hadi, 2024). Although various studies have demonstrated the positive impact of interactive media on learning, further research is still needed to examine their contextual effectiveness and alignment with specific educational levels and subjects (Kaltsum et al., 2024). Not all digital media are suitable for every learning environment; therefore, exploratory research is essential before large-scale implementation. This exploratory study aims to identify the potential, challenges, and opportunities of using Lumio in science learning at the elementary level. The focus is not only on the technology but also on its pedagogical relevance and students' responses. Hence, this study seeks to describe how Lumio is implemented by teachers in IPAS learning and how students respond to its use. Additionally, it aims to identify the challenges encountered and the prospects for future development of Lumio-based interactive learning. The findings are expected to provide preliminary insights into schools' readiness to adopt digital learning technology and serve as a foundation for subsequent quantitative research. Through this, the study contributes to the ongoing effort to enhance technology-based science education at the primary level.

METHODS

This study uses a qualitative approach with a descriptive exploratory study type that aims to describe the use of Lumio as an interactive medium in science learning in elementary schools. This approach was chosen because it allows researchers to deeply understand the practice of using technology in the context of real learning as well as the perception of teachers and students towards the media used. The focus of this research does not lie in statistical measurement, but on the

exploration of learning processes, interactions, and responses that occur during the application of Lumio in IPAS learning activities. This research was carried out at SD Negeri 1 Suru, which is located in Oro-Oro Ombo Village, Ngetos District, Nganjuk Regency, East Java Province. The selection of this location is based on the consideration that the school already has adequate basic information technology support tools and is open to digital learning innovation. Grade V was specifically selected because students at this level have entered a transitional stage from concrete to abstract thinking, making them suitable for exploring interactive technology-based learning media in IPAS subjects. The research subjects are 28 grade V students and one science teacher who are directly involved in the learning process using Lumio media. The student sample was selected using a purposive sampling technique, considering their active participation in previous IPAS learning and the teacher's recommendation to ensure data relevance. Data collection activities are carried out in an authentic classroom atmosphere to obtain a natural and representative picture of learning practices.

The data collection techniques in this study include observation, interviews, and documentation. Observations are carried out directly during the learning process, to record student involvement, teacher-student interaction, and the use of features in the Lumio platform. The observation instruments are arranged in the form of observation sheets based on indicators of interactive learning activities that have been developed previously. The observation sheet consists of four main aspects: (1) student participation, (2) interactivity and collaboration, (3) utilization of Lumio features, and (4) teacher facilitation strategies. Each aspect is assessed using a descriptive rubric with qualitative notes. Interviews were conducted in a semi-structured manner with class V science teachers as the main informants to explore their experiences, perceptions, and obstacles faced while using Lumio. An interview guide was prepared consisting of 10 open-ended questions covering three dimensions: (1) teachers' experience using Lumio, (2) student responses and engagement, and (3) perceived challenges and benefits. In addition, some students were also interviewed in small groups to get feedback on their experiences in participating in the interactive learning. Documentation in the form of screenshots, teacher notes, and student work was also collected as supporting data to strengthen the findings from observations and interviews. The entire data collection process was carried out for two weeks in the learning span of the even semester of the current school year.

The data obtained was analyzed using the Miles and Huberman model qualitative analysis techniques, which included three main stages: data reduction, data presentation, and conclusion drawn. Data reduction is carried out by sorting and simplifying data from observations, interviews, and documentation that are relevant to the focus of the research. Furthermore, the data is presented in the form of narratives, tables, and direct quotes to facilitate understanding and interpretation of the findings. The analysis process is carried out simultaneously with data collection activities to ensure that dynamics in the field are monitored and interpreted appropriately. The validity of the data is strengthened through triangulation of sources and techniques, namely by comparing the results of observations, interviews, and documentation to ensure the consistency of information. In addition, member checking was carried out on informants to ensure that the researcher's interpretation was in accordance with the meaning intended by the participants. Thus, the reliability of the data can be maintained and the research findings can provide an accurate picture of the use of Lumio in science science learning at SD Negeri 1 Suru.

RESULTS AND DISCUSSION

Results

This study aimed to explore the utilization of Lumio as an interactive media tool in Integrated Natural and Social Sciences (IPAS) learning in elementary school settings. Data were collected through classroom observations, teacher and student interviews, and documentation analysis. The research was conducted in Class V of SD Negeri 1 Suru, located in Oro-Oro Ombo Village, Ngetos Subdistrict, Nganjuk Regency, East Java Province. The findings are presented in narrative form,

supported by descriptive tables to capture classroom dynamics, interaction patterns, and user perceptions.

Teacher's Implementation of Lumio in IPAS Learning

Compared to traditional methods previously used by the same teacher—dominated by textbook explanations and question-answer sessions—Lumio enabled students to participate actively in constructing their own understanding through digital activities. This aligns with the constructivist view that knowledge is built through interaction and experience rather than passive reception. For example, during the concept mapping activity, students collaboratively linked key ideas about natural resources, reflecting Vygotsky's (1978) social constructivism, where peer dialogue serves as a scaffold for learning.

The platform's visual and interactive nature appeared to stimulate student curiosity and made abstract topics more accessible. The teacher commented: *"With Lumio, students can see and manipulate what we're learning. They are not just listening—they are doing."*

Student Engagement and Response

Observations and interviews indicated a high level of student engagement when Lumio was used. Most students appeared enthusiastic, actively responding to prompts and collaborating with peers during group tasks. According to the teacher, the use of interactive tools encouraged more students to participate, including those who were typically passive in traditional learning settings. Students stated that the images, games, and drag-and-drop tasks helped them "*understand better*" and "*feel like playing while learning*."

Extended Observation Summary and Quotes: During the second session, students showed excitement during the interactive quiz, shouting answers together and showing competitive enthusiasm. One student shared: "*It feels like a game show, and I want to get the answers right*!"

Meanwhile, during the collaborative whiteboard activity, groups discussed the structure of the Earth, using drawings and digital sticky notes to represent their ideas. This activity fostered peer learning and negotiation of meaning—key processes emphasized in constructivist learning theory.

Table 1. Summary of Classroom Observations: Lumio Features and Student Responses

Lumio Feature Used	Observed Student Behavior	Student Feedback (Interview Excerpts)	Constructivist Interpretation
Concept Mapping Tool	Students collaboratively connected key ideas on ecosystems	"It helped me see how ideas are related."	Active knowledge construction through conceptual linking.
Interactive Quiz	All students responded enthusiastically; competitive atmosphere emerged	"It was fun like a game show!"	Learning through play enhances engagement and motivation.
Image Sorting Activity	Active participation; students discussed and corrected each other's answers	"Now I remember where the layers of the Earth are."	Social interaction reinforces cognitive restructuring.
Collaborative Whiteboard	Group discussions and shared visual creation	"We made it together, so it was easier."	Collaborative meaning-making reflects social constructivism.

Challenges and Teacher Reflections

Despite the overall positive outcome, several challenges were also noted. The teacher highlighted technical issues such as unstable internet connectivity and limited access to devices for all students, especially in group settings. Furthermore, some students initially required guidance to navigate the platform effectively. The teacher also emphasized the need for professional training in

using digital tools to optimize learning. However, she expressed strong interest in continuing to use Lumio and integrating it into other subjects beyond IPAS.

Analysis and Interpretation

Based on the Miles and Huberman qualitative analysis model, three key themes emerged from the data: (1) Increased student engagement, (2) Improved conceptual understanding, and (3) Need for infrastructure and teacher support. The use of Lumio created a learning atmosphere that was visually rich, interactive, and collaborative, supporting the constructivist learning approach. Student responses aligned with the goal of enhancing conceptual understanding of IPAS content through digital interactivity. Although limitations in digital infrastructure were present, the potential of Lumio to transform static content into meaningful experiences was clearly evident. The findings suggest that interactive digital media not only enhance engagement but also serve as a pedagogical bridge between abstract scientific concepts and real-world understanding.

In summary, the results support the theoretical foundation of constructivist learning, showing that Lumio encourages active, experiential, and collaborative learning experiences. Future research should compare learning outcomes between Lumio-based and traditional instruction to quantitatively measure its impact on conceptual mastery and motivation.

Discussion

The results of the study show that the use of Lumio in social studies learning in grade V of elementary school is able to significantly increase student involvement. This is shown by increased active participation during the learning process, both in the form of group discussions and responses to interactive quizzes. This finding is in line with the opinion of Wirda (2024) who states that interactive learning media can significantly increase student participation in the classroom. IPAS learning, which was previously conventional, has become more dynamic and fun through the integration of Lumio-based technology. In this context, Lumio functions not only as a visual aid, but also as a medium for the construction of students' knowledge. The teacher plays the role of a facilitator who directs students' exploration in understanding concepts, no longer just as the main source of information. This transformation is particularly relevant to 21st-century learning approaches that emphasize active and collaborative learning (Solihin et al., 2024). Therefore, the use of Lumio can be categorized as a pedagogical innovation that is adaptive to the needs of the times.

In addition to increasing participation, the use of Lumio also has a positive impact on the understanding of abstract IPAS concepts, such as the structure of the earth's layers, environmental changes, and ecosystem relationships. Students demonstrate a deeper understanding through the digital visualization and manipulation activities provided by the features in the Lumio platform. According to Relawati et al. (2024), interactive media can help represent complex scientific concepts to be simpler and easier to understand by elementary school-age children. In the observed learning activities, students seem to have an easier time remembering the material presented in the form of pictures, short videos, and drag-and-drop activities. Anggraini & Sari (2024) that elementary school children are in the concrete operational stage and are easier to learn through real objects or experiences. The visualizations provided by Lumio bridge the gap between conceptual abstraction and the concrete learning experience that students need. Thus, Lumio integration becomes an effective means of addressing the gap between complex IPAS content and the cognitive capacity of elementary school students. These findings provide support for the importance of differentiating learning media based on children's developmental needs.

Another important finding is the emergence of a more collaborative and dialogical learning atmosphere during the use of Lumio. Activities such as collaborative whiteboards and group quizzes not only enhance interaction between students, but also strengthen social and communication skills. The teacher said that students who are usually passive become more confident to express their opinions in digital discussions (Widyaningrum & Hasanah, 2021). This shows that interactive technologies such as Lumio can encourage the achievement of affective and social aspects of

learning, not just cognitive aspects. According to Ramadhan & Santosa (2023), IPAS learning should ideally not only transfer knowledge, but also foster the value of cooperation and social concern. Lumio allows for intensive two-way interaction, both between students and teachers and between students themselves. In the context of science learning that emphasizes integration and interconnectedness between concepts, a collaborative atmosphere is essential to develop a holistic understanding. Therefore, the role of interactive digital media is very strategic in forming a constructive and participatory learning climate.

Although it generally shows positive results, the study also found some obstacles in the application of Lumio in the classroom. One of the main obstacles is the limited digital devices owned by students, so learning activities often have to be carried out in groups. The teacher stated that this limitation slightly hindered the equal distribution of student participation, especially for those who were less dominant in the group. According to Irawan & Zuhdi (2025), one of the main challenges in the application of learning technology in elementary schools is the gap in access to digital devices and infrastructure. In addition, unstable internet connections in rural areas such as Oro-Oro Ombo Village are also an obstacle in the maximum use of online platforms. However, teachers are looking for alternatives such as downloading materials first and using the offline mode of Lumio to overcome these technical obstacles. Teachers' willingness to adapt to conditions is the key to the success of technology implementation in schools (Tarofil et al., 2024). Thus, despite facing limitations, the use of Lumio can still be done optimally with the right strategy and technical readiness.

In terms of teacher readiness, this study found that the role of teachers is crucial in determining the success of interactive media integration. Teachers at SD Negeri 1 Suru showed high enthusiasm in exploring the features of Lumio even though they had never received formal training before. Teachers make independent efforts through video tutorials and hands-on practice to master the use of the platform. This is in accordance with the opinion of Andayani & Fatayati (2024) that teachers' readiness in technology-based learning is influenced by internal motivation and external support such as training or learning communities. The teacher's activeness in evaluating and adjusting Lumio content to the needs of students shows that there is a good reflective process. Teachers also stated that the use of Lumio helps in regulating the learning flow as well as measuring students' understanding directly through the quiz analysis feature (Riski & Jasiah, 2025). Therefore, support for teacher capacity development is one of the aspects that need to be considered in a wider implementation scale. Teachers are not only users of technology, but also agents of change in digital learning in elementary schools.

Furthermore, the integration of Lumio in social studies learning also has an impact on the formative assessment process. Teachers can monitor student work directly and provide quick feedback through the systems available within the platform. According to Solihin et al. (2024), learning technology equipped with evaluative features allows teachers to identify students' difficulties in real-time. In this study, the teacher said that he could adjust the advanced material based on the results of the quiz displayed by the Lumio system. This allows the application of the principle of assessment as learning, where the assessment process becomes an integral part of learning itself (Agustianti et al., 2022). Students also responded positively because they found it easier to understand the location of the error and correct it. Thus, Lumio not only serves as a presentation medium, but also as a responsive and contextual evaluation tool. The use of technology in this formative evaluation is one of the indicators that learning has moved towards a more modern and based on the real needs of students.

When viewed from a constructivist approach, the use of Lumio is very relevant to the principle that students build their own knowledge through interaction and exploration. Lumio-based activities such as concept mapping, interactive quizzes, and simulations encourage students to actively connect new information with previous knowledge. According to Jamiruddin & Ilyas Thamrin (2023), social interaction in the learning process plays an important role in children's cognitive development. In an observed classroom, students not only receive information, but also process, discuss, and reflect on

their understanding. Thus, the role of media such as Lumio is a learning facilitation tool that is in line with a constructivistic approach (Wardana & Winarti, 2025). The teacher also acts as a companion who directs students to find concepts independently. Therefore, the integration of Lumio not only meets the demands of technology, but also the fundamental pedagogical principles of meaningful learning. This strengthens Lumio's position as a learning medium that has a strong theoretical foundation.

From the perspective of education policy, the results of this research are in line with the direction of the Independent Curriculum which encourages project-based learning, exploration, and technology utilization. This curriculum emphasizes the importance of active student involvement and teachers' flexibility in developing learning strategies (Putro et al., 2023). In this context, Lumio can be one of the tools that support the practical achievement of curriculum principles. This research proves that the application of technology does not have to wait for the infrastructure to be perfect, but can be done gradually with an adaptive strategy. This opens up opportunities for elementary schools in the region to continue to innovate without having to wait for major programs from the center. Alignment between policies and field practices is the key to the success of digital transformation in primary education (Ilham, 2021). Therefore, the results of this study are important to be considered for policy makers at the local and national levels. Support in the form of training, infrastructure, and incentive policies will strengthen the usefulness of digital media in basic learning.

Overall, this study provides a complete picture that Lumio as an interactive media has great potential in improving the quality of science learning in elementary schools. Interactivity, flexibility, and evaluative feature support make Lumio a medium that can accommodate modern learning needs. Increased student engagement, better understanding of concepts, and a more collaborative classroom atmosphere are all indicators of success that cannot be ignored. However, behind these successes, there are still challenges that need to be anticipated, such as the availability of devices, internet stability, and teacher training. Further research needs to be conducted quantitatively to test the effectiveness of using Lumio more systematically in various school contexts. In addition, it is also necessary to study the implementation of Lumio in other subjects to see flexibility across curricula. With these findings, it is hoped that Lumio can become an innovative alternative that supports technology-based learning at the elementary level. This research is the initial foundation for the development of more contextual, inclusive, and future-oriented educational practices.

CONCLUSION

Based on the results of the research, it can be concluded that the use of Lumio as an interactive media has a positive impact on the learning process of IPAS in elementary schools. The use of Lumio not only increases student engagement, but also deepens the understanding of abstract concepts through visual and interactive media. Teachers play the role of facilitators who are able to direct students' exploration more actively and constructively. Lumio's features support collaborative, fun, and constructivist learning. In addition, Lumio's ability to provide real-time formative evaluations strengthens the teacher's function in conducting continuous assessments. Despite technical constraints, teachers are able to implement this media effectively through adaptive strategies. This research also shows that the integration of technology in science learning supports the practical implementation of the Independent Curriculum. Therefore, Lumio can be used as a model for the application of interactive media in contextual and transformative elementary education.

Based on these conclusions, it is recommended that the government and education policy makers provide intensive training for teachers in the use of interactive digital media, including Lumio. Schools also need to strengthen technology infrastructure, especially access to devices and internet connectivity, to support the equitable implementation of digital-based learning media. Further research can be carried out with a quantitative approach to measure the effectiveness of Lumio in statistically improving learning outcomes. In addition, exploring the use of Lumio in other subjects is also important to know the flexibility and usefulness of cross-curricula. Longitudinal studies are also

needed to see the long-term impact of this technology integration on the digital literacy and 21st century skills of primary school students. Collaboration between schools in the development of Lumio content can also be a strategy to enrich community-based learning resources. Overall, the adoption of Lumio needs to be part of a broader primary education digital transformation strategy.

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