Education and Sociedad Journal
Vol. 4 No. 1 (2026) : 222-232
Available online at https://serambi.org/index.php/esj

Assessing the Need for Google Sites-Based Learning Media to Enhance Elementary Students' Conceptual Understanding in Science Learning

Indra Budiman[1], Ayu Puji Rahayu[2]✉, Suyato Kusumaryono[3], Fitri Eka Silviani[4], Mukhtiar Hussain Ibupoto[5]
[1,2,3,4]Institut Pendidikan Indonesia Garut, Indonesia
[5]Fujian Normal University, China

Abstract
This study aims to analyze the need for developing Google Sites-based learning media integrated with the Discovery Learning approach to improve elementary school students' problem-solving skills in science learning. This paper is important because science learning practices in elementary schools are still dominated by teachers and rely on limited interactive learning media, resulting in low conceptual understanding and limited opportunities for students to develop higher-order thinking and problem-solving skills. This study uses a descriptive mixed-methods approach by combining qualitative and quantitative data. Data were collected through classroom observations, interviews with teachers and students, student needs questionnaires, and analysis of learning documents and analyzed using a thematic approach. The research findings revealed that students experience difficulties in understanding abstract science concepts, especially photosynthesis, and tend to rely on memorization rather than conceptual understanding. Existing learning media are still limited, less interactive, and do not optimally facilitate student-centered learning. Quantitative results indicate that most students need digital learning media that are interactive, visual, easily accessible, and able to support the process of independent exploration and discovery. This study provides an empirical basis for designing innovative digital learning media using Google Sites to support the implementation of the Independent Curriculum and improve the quality of elementary science education.

Keywords: Google Sites, Discovery Learning, Science Learning, Problem-Solving Skills, Interactive Learning Media

Article History:
Received: May 2026; Revised: May 2026; Accepted: June 2026
✉**Correspondence Author:** ayupujirahayu14@gmail.com
DOI: https://doi.org/10.61987/edsojou.v4i1.2270
How to Cite:
Budiman, I., Rahayu, A. P., Kusumaryono, S., Silviani, F. E., & Ibupoto, M. H. (2026). Assessing the Need for Google Sites-Based Learning Media to Enhance Elementary Students' Conceptual Understanding in Science Learning. *Education and Sociedad Journal, 4*(1), 222-232.

INTRODUCTION

Learning Natural and Social Sciences (IPAS) in elementary schools needs experiences that focus on mastering concepts and developing critical thinking and problem-solving skills. However, teaching science often faces obstacles, especially with abstract topics such as photosynthesis. Students tend to understand concepts partially. Often, they only memorise terms without relating them to a bigger process. This shows that current learning does not fully support in-depth knowledge. Research shows that elementary students' understanding of science concepts remains variable and is often accompanied by misconceptions. This

situation needs a more context- and experience-based learning approach (Kamarudin & Mat Noor, 2024; Mahdiyah et al., 2021).

These limitations impact the suboptimal development of students' higher-order thinking skills, particularly problem-solving skills. In the context of science learning, problem-solving skills are a crucial competency that must be developed early on, as they relate to students' ability to identify problems, analyse information, formulate solutions, and draw logical conclusions. However, when learning is more memorisation-oriented, students tend to struggle with new situations that require the flexible application of concepts.

On the other hand, the Merdeka Curriculum policy currently implemented across various educational units emphasises student-centred learning, encourages exploration, and develops critical thinking and problem-solving skills (Arafat et al., 2025; Kemendikbudristek, 2022). This curriculum requires teachers to design lessons that provide meaningful and contextual learning experiences that enable students to actively construct knowledge. However, previous studies indicate that the implementation of such learning practices still faces various challenges, particularly due to the limited use of interactive learning media and the continued dominance of conventional teaching methods (Lestari & Prasetyo, 2021; Wulandari & Suryani, 2021). Although several studies have explored the development and effectiveness of digital learning media, most of them primarily focused on product implementation and learning outcomes, while limited attention has been given to the empirical needs analysis stage prior to media development. As a result, the actual learning needs, classroom constraints, student characteristics, and pedagogical challenges experienced by teachers and students have not been comprehensively identified. This condition indicates a gap between curriculum expectations, classroom realities, and the preliminary analysis required to design learning media that are contextually relevant and pedagogically appropriate.

To address these issues, the use of digital technology in learning has become an increasingly relevant alternative. Web-based learning media, such as Google Sites, offer flexibility in presenting learning materials by integrating various content formats, including text, images, videos, and interactive activities, into a single platform that is easily accessible to teachers and student (Rahadian et al., 2024). The use of such digital media not only facilitates content delivery but also has the potential to increase student engagement and support independent learning, particularly when integrated with an appropriate pedagogical approach such as Discovery Learning. Therefore, conducting a comprehensive needs analysis becomes essential to ensure that the developed learning media align with students' learning characteristics, classroom conditions, and the objectives of meaningful science learning.

One approach considered relevant to supporting active and meaningful learning is Discovery Learning. This approach emphasises direct student involvement in the process of discovering concepts through exploration, observation, information processing, and independent conclusion-making. Research shows that implementing Discovery Learning can encourage more meaningful learning activities and improve students' critical thinking and problem-solving skills (Nisa et al., 2024). This aligns with Nababan et al. (2023), who explain that Discovery Learning encourages students to be active and think critically through problem-solving and drawing conclusions. Furthermore, this approach aligns with the cognitive developmental characteristics of elementary school students, who are at the concrete operational stage and thus require real-world and contextual learning experiences.

The use of interactive multimedia has been reported to increase student motivation in science (Maritza Agustin et al., 2025). Furthermore, web-based learning environments have also been shown to increase student engagement and support independent learning (Durak, 2020). However, most previous studies have primarily focused on the implementation and effectiveness of digital learning media, while limited attention has been given to the

preliminary needs analysis stage prior to media development, particularly in the context of elementary science learning. In actual classroom practice, science learning is still dominated by teacher-centred instruction, passive use of learning videos, and memorisation-oriented activities, which limit students' opportunities to explore concepts independently and develop problem-solving skills.

These field conditions indicate that the challenges in science learning are not merely related to learning outcomes, but also to the absence of learning media designed based on students' actual needs, classroom characteristics, and pedagogical demands. Therefore, a comprehensive needs assessment becomes a crucial initial stage in ensuring that the developed learning media are contextually relevant, pedagogically appropriate, and aligned with the objectives of the Merdeka Curriculum. Through needs analysis, researchers can identify the gap between ideal learning expectations and actual classroom realities, thereby providing a stronger empirical foundation for media development.

Although several studies have examined Google Sites as a digital learning platform, studies specifically investigating the need for developing Google Sites-based learning media integrated with the Discovery Learning approach in elementary science learning remain relatively limited. This indicates both a research gap and an opportunity to contribute to the development of more meaningful and problem-solving-oriented learning media. Therefore, this study aims to analyse the need for developing Google Sites-based learning media integrated with Discovery Learning on photosynthesis materials to support the improvement of elementary school students' problem-solving skills. The findings of this study are expected to provide an empirical and pedagogical basis for designing innovative digital learning media that are relevant to classroom conditions, support meaningful learning, and align with the demands of the Merdeka Curriculum.

RESEARCH METHOD

This study employed a mixed-methods approach by integrating qualitative and quantitative data to obtain a comprehensive understanding of the need for developing Google Sites-based learning media integrated with the Discovery Learning approach in elementary science learning. The mixed-methods design was selected because the qualitative approach enabled an in-depth exploration of actual classroom conditions, learning challenges, and pedagogical needs, while the quantitative approach provided measurable data to strengthen and validate the qualitative findings. The integration of both types of data allowed the researchers to develop a more comprehensive and contextual needs analysis as the basis for media development. This study was conducted at SDN 1 Cintarasa involving 41 fourth-grade students and one classroom teacher. The research subjects were selected purposively because the school had implemented the Independent Curriculum, yet science learning practices were still dominated by conventional instruction and limited use of interactive digital learning media.

Data collection was conducted systematically in several stages. The first stage involved classroom observations to identify learning patterns, student participation, classroom interactions, and the use of learning media during science instruction. The observations revealed limited use of interactive learning media and low student engagement in conceptual exploration activities. The second stage consisted of in-depth interviews with the classroom teacher and several students to explore learning difficulties, media needs, learning experiences, and expectations regarding digital learning media. The interview process also aimed to identify pedagogical constraints faced by teachers in implementing student-centred and problem-solving-oriented learning. The third stage involved distributing questionnaires to all students to identify their learning needs, preferences, and experiences related to digital learning media. The questionnaire employed a four-point Likert scale and

consisted of indicators related to conceptual understanding, learning engagement, technology use, and students' interest in interactive learning media. Before implementation, the questionnaire instrument was reviewed through expert judgment to ensure content validity and clarity of language appropriate for elementary school students. In addition, instrument reliability was tested using internal consistency analysis to ensure the stability and consistency of the questionnaire items. The fourth stage involved document analysis, including students' learning outcomes, teaching modules, lesson plans, and documentation of learning activities. These documents were analysed to strengthen the findings obtained from observations, interviews, and questionnaires, thereby supporting data triangulation.

Qualitative data were analysed using thematic analysis procedures, including data reduction, data categorisation, data presentation, and conclusion drawing. Meanwhile, quantitative data were analysed using descriptive statistics to identify trends and patterns related to students' learning media needs. The integration of qualitative and quantitative findings was conducted during the interpretation stage to produce a comprehensive needs analysis regarding the development of Google Sites-based learning media integrated with Discovery Learning in elementary science learning.

FINDINGS AND DISCUSSION

Science Learning Observations

Observations conducted at SDN 1 Cintarasa, Garut, on January 28th indicated that the science learning process for photosynthesis utilised learning media, but their use remained limited to conveying basic concepts. According to the two observers, the media used helped students understand the concept of photosynthesis in general, but were not yet designed to develop problem-solving skills.

Learning activities began with a stimulus in the form of a YouTube video as an initial exploration. While the video provided a visual representation of the photosynthesis process, this activity was not followed by follow-up activities that encouraged students to engage in deeper analysis or reflection. Students tended to act as recipients of information without sufficient opportunities to construct knowledge independently. Furthermore, learning did not incorporate problem-based activities or case studies to develop students' higher-order thinking skills. The teacher did not provide contextual problems that required students to identify problems, analyse information, or formulate solutions related to photosynthesis. This indicates that learning was still focused on mastering concepts, rather than on applying concepts in real-life situations. The classroom observation process is presented Figure 1.

Figure 1. Observation of Classroom Learning Activities

The observations show that learning activities were still predominantly teacher-centred, where students mainly focused on watching instructional content displayed through a projector while the teacher explained the material verbally. Although visual media were used during the lesson, the learning process remained relatively passive because students were not actively engaged in exploration, investigation, experimentation, or collaborative problem-solving activities. The figure also demonstrates that the learning media functioned primarily as a tool for information delivery rather than as an interactive learning environment that facilitates conceptual discovery. Students tended to receive explanations directly from the teacher without being encouraged to independently investigate scientific phenomena or construct understanding through inquiry processes. As a result, learning activities focused more on memorising concepts than developing higher-order thinking and problem-solving skills.

Analytically, these findings indicate a gap between the student-centred learning principles promoted by the Merdeka Curriculum and the actual classroom practices observed in the field. The limited interactivity of the learning media reduced opportunities for students to participate actively in discovery-oriented learning activities. Therefore, the observation results strengthen the need to develop interactive web-based learning media integrated with the Discovery Learning approach to support exploration, conceptual understanding, and problem-solving skills in elementary science learning.

Teacher and Student Interview Results

The interview data were analysed through data reduction, data presentation, and conclusion drawing to identify the need for developing web-based learning media on photosynthesis. The findings revealed four main themes related to students' conceptual understanding, classroom learning limitations, learning media needs, and students' technological readiness.

Students generally possessed a basic understanding of photosynthesis concepts at the factual and conceptual levels (C1–C2), particularly in identifying the materials and products involved in photosynthesis. However, both teachers reported that students experienced considerable difficulty in explaining the photosynthesis process, understanding the influence of environmental factors, and applying these concepts to real-life situations. As one teacher explained, "They already know the materials and products of photosynthesis, but understanding the application in daily life still needs improvement" (Teacher Interview/INT-G1). Similarly, another teacher noted, "The most difficult part is understanding the process of photosynthesis and the effects of water and sunlight on plants" (Teacher Interview/INT-G2). These findings suggest that classroom learning has predominantly supported lower-order cognitive skills, while opportunities to develop conceptual understanding and analytical thinking remain limited.

The interviews also revealed several challenges in implementing inquiry-oriented learning activities. Teachers explained that the extensive science curriculum, limited instructional time, and large class sizes restricted opportunities for exploration and practical investigation. One teacher stated, "Science material is very broad, while the available learning time is limited" (Teacher Interview/INT-G3), while another admitted, "I have never taken students outside for direct observation because of time limitations and the large number of students" (Teacher Interview/INT-G4). Students confirmed these conditions by describing learning experiences that were largely passive, with one student explaining, "Usually, we only watch videos without practising directly" (Student Interview/INT-S1). These responses indicate that classroom instruction remains dominated by teacher-directed activities, providing limited opportunities for observation, experimentation, and scientific problem solving.

Another important finding concerns the limitations of the learning media currently used in science classes. Teachers reported relying mainly on instructional videos obtained from online platforms because of limited preparation time and teaching resources, even though these materials did not always align with the intended learning objectives. One teacher commented, "Sometimes the videos do not match the learning goals, but I still use them because of limited time and resources" (Teacher Interview/INT-G5). The teacher further acknowledged that the available media were insufficient to facilitate higher-order thinking skills, stating, "The media are still not enough to support problem-solving activities" (Teacher Interview/INT-G6). Nevertheless, students responded positively to visual learning materials, with one student expressing, "Learning with videos is interesting and makes us more enthusiastic" (Student Interview/INT-S2). Although videos increased students' motivation, the learning process remained largely one-way and provided few opportunities for active interaction or independent exploration.

The interviews further demonstrated that students were generally familiar with digital technology and routinely used smartphones and applications such as YouTube and TikTok. However, teachers observed that students still had limited experience in using educational web-based learning platforms. As one teacher explained, "Students can use smartphones, but they still do not understand how to navigate websites properly" (Teacher Interview/INT-G7). Both teachers and students expressed the need for learning media that are more interactive, flexible, and accessible beyond classroom hours. One teacher stated, "I need learning media that students can access at home first so classroom learning becomes more effective" (Teacher Interview/INT-G8). Students also expressed positive expectations toward interactive digital learning, with one student commenting, "I am more excited when learning uses pictures, videos, and interactive activities" (Student Interview/INT-S3), while another added, "I want to try learning using web-based media" (Student Interview/INT-S4).

The interview findings indicate that students require learning experiences that extend beyond memorising scientific concepts and provide greater opportunities for conceptual understanding, inquiry, and problem solving. At the same time, teachers require learning media that can overcome classroom constraints while supporting independent learning outside school. These findings collectively provide a strong empirical foundation for developing Google Sites-based learning media integrated with the Discovery Learning approach, which is expected to facilitate exploration-oriented learning, improve students' conceptual understanding, and promote higher-order thinking skills in science learning.

Student Needs Questionnaire Results

The results of the student needs questionnaire were obtained from 41 respondents using a 1–4 rating scale. The analysis was conducted descriptively by examining the average value for each indicator to identify trends in student perceptions and needs in science learning, particularly regarding photosynthesis.

Table 1. Science Learning Needs Analysis Questionnaire for Photosynthesis

No	Question	Average
1.	I find photosynthesis difficult to understand if it is only explained by the teacher.	2,46
2.	I'm still confused about how photosynthesis occurs in plants.	2,56
3.	The teacher's learning media make me interested in learning.	3,49
4.	I understand the lesson better with pictures or videos.	3,32
5.	I'm often asked to observe or try something when learning about photosynthesis.	2,54
6.	I like it when learning gives me the opportunity to find answers on my own.	3,12
7.	I have difficulty answering questions related to photosynthesis.	2,27
8.	I want to learn photosynthesis through activities that train my thinking and problem-solving skills.	2,83
9.	I'm interested in learning to use internet-based media like Google Sites.	3,12

10.	I want learning media that can be accessed on my phone or laptop at any time.	3,61
11.	I learn more easily if lessons are presented with pictures, videos, and engaging activities.	3,41
12.	I'm used to using my phone or laptop to study or search for information.	2,85

The questionnaire results indicate that students still experience difficulties in understanding photosynthesis concepts, particularly when learning relies only on teacher explanations. This finding is reflected in the moderate average scores related to conceptual understanding and confusion about the photosynthesis process. In addition, students were not yet actively involved in observation or experimental activities, indicating that learning practices still provide limited opportunities for exploration and inquiry-based learning. On the other hand, students demonstrated strong interest in visual, interactive, and technology-based learning media. High average scores were found on indicators related to the use of pictures, videos, engaging activities, and flexible access through smartphones or laptops. Students also expressed positive attitudes toward learning activities that encourage independent exploration and problem-solving. These findings suggest that students require learning media that are not only visually attractive but also capable of facilitating active participation, conceptual exploration, and independent learning.

Furthermore, students showed interest in using internet-based learning media such as Google Sites, indicating their readiness to engage with digital learning environments. However, the moderate score related to the use of technology for learning purposes suggests that students still require structured guidance in using digital media effectively. The questionnaire findings strengthen the results of observations and interviews, confirming the need to develop interactive web-based learning media integrated with Discovery Learning to support meaningful and problem-solving-oriented science learning.

Learning Document Analysis

Student Learning Outcome Analysis

Based on learning outcome data from 41 students who met the minimum passing grade (KKM) of 75, it was clear that student learning outcomes remained suboptimal. The average quiz score of 68.65 and the evaluation score of 60 indicated that students generally had not achieved the established passing grade. The learning completion percentage on the quiz was 48.8%, while on the evaluation, it decreased to 41.8%. Thus, more than half of the students did not achieve the KKM, with 51.2% on the quiz and increasing to 58.2% on the evaluation. These findings indicate that classical learning completion remains in the low category. Furthermore, performance declined from the quiz to the evaluation. This indicates that students are relatively capable of answering simple or memory-based questions but experience difficulties with questions that require deeper conceptual understanding and higher-order thinking skills.

This finding is consistent with interview results, which indicated that students remain at the lower cognitive level (C1–C2) and are not yet optimal at the application and analysis levels (C3–C4). The very wide range of scores, from 0 to 100, also indicates high heterogeneity in student abilities. This condition reinforces previous findings that students' independent learning abilities are not evenly distributed, necessitating learning media that accommodate these differences through flexible, iterative access. Furthermore, the low achievement in the evaluation indicates that students still view photosynthesis as abstract. Without the support of media that can visualise the process concretely, students tend to simply memorise concepts without understanding cause-and-effect relationships, resulting in a low ability to solve problem-based questions.

Analysis of Lesson Plan

Analysis of the lesson plan shows that, in general, the lesson plan contains basic learning components, such as objectives, materials, and activity steps. However, there are several gaps between the lesson plans and actual needs in the field. First, from a learning-strategy perspective, the activities in the lesson plan do not fully accommodate a student-centred learning approach, particularly in terms of independent exploration and discovery of concepts. This is evident in the limited activities that involve students in direct observation, experimentation, or problem-solving. Second, from a learning media perspective, the tools used have not systematically integrated technology-based interactive media. The use of media is still supplementary and has not been designed as an integral part of the learning process that supports the achievement of learning objectives. Third, from the perspective of developing higher-order thinking skills, the learning activities in the lesson plan do not explicitly direct students toward analysis, evaluation, and problem-solving. This aligns with findings on student learning outcomes, which indicate low achievement in these aspects.

The analysis of learning documents indicates a gap between the demands of science learning, which emphasises conceptual understanding and higher-order thinking skills, and learning conditions still dominated by conventional approaches. Learning outcome data show that the majority of students have not achieved mastery, particularly in in-depth understanding and problem-solving. Meanwhile, the analysis of lesson plan indicates that there is insufficient media support and learning strategies to address these issues. These findings reinforce the results of previous interviews and questionnaires, thus demonstrating the urgency of developing more interactive, flexible, and student-oriented learning media. In this regard, utilising web-based platforms such as Google Sites with an integrated Discovery Learning approach is relevant to addressing this need. The developed media is expected to function not only as a supplement but also as a primary tool in facilitating independent learning, visualising abstract concepts, and developing students' higher-order thinking skills.

Discussion

Elementary students' understanding of photosynthesis remains limited to basic conceptual recognition rather than deeper conceptual reasoning and problem-solving. Although students were able to identify the materials and products of photosynthesis, they experienced difficulties in explaining causal relationships, environmental influences, and contextual applications of the concepts. This finding suggests that science learning has not yet optimally facilitated knowledge construction processes that support higher-order thinking skills. This condition aligns with the revised Bloom's Taxonomy proposed by Anderson & Krathwohl (2001), which emphasises that higher-order thinking skills require learning experiences involving analysis, evaluation, and knowledge construction rather than memorisation alone. This condition reflects a mismatch between the objectives of the Independent Curriculum, which emphasises meaningful and student-centred learning, and the actual classroom practices that still rely heavily on memorisation-oriented instruction (Arafat et al., 2025; Kemendikbudristek, 2022). Students require learning environments that support exploration, conceptual interaction, and inquiry-based activities rather than passive reception of information. This finding is also consistent with Hattie (2009), who argued that knowledge-construction-oriented learning has a stronger impact on learning outcomes than information-transmission approaches.

Ramadhani & Ratnawulan (2022) demonstrated that Discovery Learning positively influences students' higher-order thinking skills. Unlike previous studies that mainly focused on measuring the effectiveness of digital media after implementation, this study specifically highlights the importance of empirical needs analysis prior to media development. The findings confirm that understanding students' conceptual difficulties, learning characteristics,

and classroom constraints is essential for designing learning media that are pedagogically relevant and capable of supporting higher-order thinking development in elementary science learning.

The findings revealed that limited instructional time, large class sizes, and the dominance of teacher-centred learning significantly hindered the implementation of exploratory and discovery-oriented learning activities. As a result, students rarely engaged in direct observation, experimentation, or inquiry processes that could support meaningful conceptual understanding. Learning activities were primarily focused on content delivery, while opportunities for investigation and collaborative problem-solving remained limited. From a constructivist perspective, this situation indicates that the learning process has not yet provided sufficient scaffolding for students to actively construct knowledge through interaction and exploration. This finding is closely related to the theory of Bruner (1961), which emphasises that meaningful learning occurs when students are actively involved in the process of discovery.

Similarly, Vygotsky (1978) highlighted the importance of social interaction and guided learning experiences in supporting cognitive development. The study demonstrates that the challenge in elementary science learning is not solely related to students' cognitive ability, but also to the lack of instructional environments that facilitate active engagement and inquiry-based experiences. Research conducted by Alfieri et al (2011) further supports this finding by showing that discovery-based learning becomes more effective when accompanied by appropriate scaffolding. Therefore, this study contributes to constructivist digital learning research by emphasising that technology integration should not merely function as content delivery media, but as a learning environment that supports exploration, interaction, and guided discovery.

Another important finding of this study is that students demonstrated strong interest in flexible and interactive digital learning media, particularly media accessible through smartphones and capable of integrating visual and exploratory learning activities. However, the study also found that students' technological familiarity does not automatically indicate readiness for structured digital learning. Students still require simple navigation, guided activities, and contextual learning support to effectively use web-based learning platforms. This finding differentiates the present study from previous needs-analysis research that generally focused only on technological availability or media preferences. The current study contributes by identifying the relationship between students' technological readiness, conceptual learning difficulties, and the pedagogical characteristics required for effective media development. Consequently, the findings suggest that developing web-based learning media should consider not only technical accessibility but also constructivist learning principles, cognitive scaffolding, and contextual learning needs.

Google Sites has the potential to function not merely as a digital platform, but as a constructivist learning environment that integrates visual content, inquiry activities, contextual problems, and independent exploration into a flexible learning system. This finding is supported by Mayer (2020), who emphasised that interactive integration of verbal and visual information can improve conceptual understanding, and by Moreno (2006), who identified interactivity as an important factor in increasing cognitive engagement. In addition, research by Hermawati & Yulianto (2025) and Marhaini et al. (2025) showed that Google Sites-based learning media can improve student engagement, participation, and learning outcomes due to their accessibility and flexibility. Therefore, the contribution of this study lies not only in identifying the need for digital learning media, but also in providing an empirical and pedagogical foundation for designing needs-based digital learning environments in elementary science education.

CONCLUSION

Elementary science learning on photosynthesis has not yet optimally developed students' conceptual understanding and higher-order thinking skills. Students still tend to rely on memorisation and experience difficulties in understanding conceptual relationships and solving contextual problems. In addition, limited instructional time, large class sizes, and the use of less interactive learning media have hindered the implementation of exploratory and student-centred learning. The findings indicate the need to develop web-based learning media integrated with the Discovery Learning approach to support more interactive, flexible, and meaningful science learning. In this context, Google Sites has the potential to function as a constructivist digital learning environment that facilitates inquiry, independent exploration, and problem-solving activities. This study contributes by providing an empirical and pedagogical foundation for designing needs-based digital learning media aligned with students' characteristics and the demands of 21st-century elementary education. However, this study was limited to the needs-analysis stage within a single elementary school context and did not yet include the development and implementation of the proposed media. Therefore, future research is recommended to continue into the stages of media development, implementation, and effectiveness testing in broader educational contexts.

ACKNOWLEDGMENT

The authors would like to express sincere gratitude to the Graduate School of Institut Pendidikan Indonesia (IPI) Garut for the support and guidance provided throughout the Master's program in Educational Technology, which enabled the completion of this study.

REFERENCES

Alfieri, L., Brooks, P. J., Aldrich, N. J., & Tenenbaum, H. R. (2011). Does Discovery-Based Instruction Enhance Learning? *Journal of Educational Psychology, 103*(1), 1–18. https://doi.org/10.1037/a0021017

Anderson, L. W., & Krathwohl, D. R. (2001). *A Taxonomy for Learning, Teaching, and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives*. Longman.

Arafat, L. Z., Rahayu, A. P., Amalia, A., Asiah, S., Latifah, S., & Yulia, R. (2025). Analysis of the Implementation of the Independent Curriculum in Elementary School Driving Schools. *PANDU: Jurnal Pendidikan Anak dan Pendidikan Umum, 3*(1), 36–44. https://doi.org/10.59966/pandu.v3i1.1600

Bergmann, J., & Sams, A. (2012). *Flip Your Classroom: Reach Every Student in Every Class Every Day*. International Society for Technology in Education.

Bruner, J. S. (1961). The Act of Discovery. *Harvard Educational Review, 31*(1), 21–32.

Hattie, J. (2009). *Visible Learning: A Synthesis of Over 800 Meta-Analyses Relating to Achievement*. Routledge.

Hermawati, V., & Yulianto, S. (2025). Development of Google Sites Website Based Learning Media to Improve IPAS Learning Outcomes on the Material of Sound and Its Propertie. *Jurnal Penelitian Pendidikan IPA, 11*(2), 654–662. https://doi.org/10.29303/jppipa.v11i2.10277

Jonassen, D. H. (1999). Designing Constructivist Learning Environments. In C. M. Reigeluth (Ed.), *Instructional-Design Theories and Models: A New Paradigm of Instructional Theory* (Vol. 2). Lawrence Erlbaum Associates.

Kamarudin, M. Z., & Mat Noor, M. S. A. (2024). To What Extent Do Primary School Children Understand Photosynthesis?: A Study of Children's Drawings with Follow-Up Interviews. *Education 3–13*, 1–16. https://doi.org/10.1080/03004279.2024.2385434

Kazu, İ. Y., & Yalçın, C. K. (2022). A Meta-Analysis Study on the Effectiveness of Flipped Classroom Learning on Students' Academic Achievement. *E-International Journal of Educational Research, 13*(1), 85–102. https://doi.org/10.19160/e-ijer.1033589

Kemendikbudristek. (2022). *Kurikulum Merdeka: Capaian Pembelajaran*.

Lestari, N., & Prasetyo, A. (2021). Analysis of Elementary Learning Media Needs in Science Subjects. *Journal of Educational Research, 5*(3), 245–253.

Mahdiyah, L., Wahyuning S, N., & Marzuki, I. (2021). Identification of Science Subject Misconception in Elementary Schools. *Journal Universitas Muhammadiyah Gresik Engineering, Social Science, and Health International Conference (UMGESHIC), 1*(2), 27. https://doi.org/10.30587/umgeshic.v1i2.3364

Marhaini, H., Rokhmaniyah, & Chamdani, M. (2025). Analisis Kebutuhan Media Pembelajaran Interaktif Berbasis Google Sites. *Social, Humanities, and Education Studies (SHEs): Conference Series, 8*(3), 824–831.

Maritza Agustin, I., Made Citra Wibawa, I., & Wayan Eka Paramartha, W. (2025). Interactive Learning Multimedia to Increase Student Motivation in Science Learning on the Photosynthesis Topic for Grade IV Elementary School. *Jurnal Media dan Teknologi Pendidikan, 5*(2), 351–362. https://doi.org/10.23887/jmt.v5i2.99685

Mayer, R. E. (2020). *Multimedia Learning* (3rd ed.). Cambridge University Press. https://doi.org/10.1017/9781316941355

Moreno, R. (2006). Learning in High-Tech and Multimedia Environments. *Current Directions in Psychological Science, 15*(2), 63–67. https://doi.org/10.1111/j.0963-7214.2006.00408.x

Nababan, D., Bakara, A., & Sihite, C. E. H. (2023). Penerapan Strategi Pembelajaran Discovery Learning dalam Meningkatkan Keaktifan Belajar Peserta Didik. *Pediaqu: Jurnal Pendidikan Sosial dan Humaniora, 2*(2).

Nisa, S. D., Febrianti, F. A., Asyari, L., Mutaqin, E. J., & Adiredja, R. K. (2024). Pengaruh Model Pembelajaran Discovery Learning Berbantu Media Pop Up Book terhadap Pemecahan Masalah Matematika. *CaXra: Jurnal Pendidikan Sekolah Dasar, 4*(2), 124–132. https://doi.org/10.31980/caxra.v4i2.1928

Rahadian, D., Ilham, S., An, K., Imania, N., & Nasrulloh, I. (2024). Development of Google Sites-Based E-Learning with TIME Learning Model. In *4th International Conference on Education and Technology (ICETECH 2023)* (pp. 657–678). Atlantis Press. https://doi.org/10.2991/978-94-6463-554-6

Ramadhani, D. P., & Ratnawulan, R. (2022). The Effect of Using Discovery Learning Model in High School Physics Learning: A Meta-Analysis. *Jurnal Pendidikan Fisika, 10*(2), 93–106. https://doi.org/10.26618/jpf.v10i2.6545

Vygotsky, L. S. (1978). *Mind in Society: The Development of Higher Psychological Processes*. Harvard University Press.

Wulandari, R., & Suryani, L. (2021). Analysis of Learning Media Use in Elementary Science Learning. *Journal of Primary Education, 11*(3).