JPPIPA 12(1) (2026)

Jurnal Penelitian Pendidikan IPA

http://jppipa.unram.ac.id/index.php/jppipa/index

Development of an Integrated "Vein" Pop-Up Book Media for Science Number Patterns in Increasing Interest and Critical Thinking

Ria Budi Astuti[1*], Helti Lygia Mampouw[1], Ferdy Semuel Rondonuwu[1]

[1] Faculty of Teacher Training and Education, Satya Wacana Christian University, Salatiga, Indonesia.

Received: November 01, 2025
Revised: December 21, 2025
Accepted: January 25, 2026
Published: January 31, 2026

Corresponding Author:
Ria Budi Astuti
riabudi596@gmail.com

DOI: 10.29303/jppipa.v12i1.14191

Abstract: Science learning in elementary school plays an important role in developing students' learning interest and critical thinking skills. However, students often experience difficulties in understanding abstract concepts such as vertebrate and invertebrate classification due to limited interactive learning media. This study aimed to develop and evaluate the feasibility and effectiveness of an integrated learning medium called the "VEIN" (Vertebrate–Invertebrate) flashcards and 3D pop-up book to increase students' learning interest and critical thinking skills. This research employed a Research and Development (R&D) design conducted in two elementary schools in Jambi City involving 16 third-grade students. Data were collected through observation, interviews, questionnaires, documentation, and critical thinking tests, and analyzed quantitatively using percentage analysis. The results showed that 62.5% of students were categorized as having high learning interest, 25% medium, and 12.5% low. Critical thinking skills improved particularly in interpretation (68.75%) and analysis (62.5%) indicators, while inference reached 43.75% in the medium category. These findings indicate that the VEIN media effectively promotes active engagement, facilitates concrete conceptual understanding, and supports the gradual development of critical thinking skills. In conclusion, the VEIN flashcards and pop-up book are feasible, practical, and effective as innovative media to enhance learning interest and critical thinking in integrated elementary science learning.

Keywords: Critical thinking; Flashcard; Integrated science learning; Learning interest; Pop-up book media

Introduction

Science learning in elementary schools is grounded in constructivist learning theory, which emphasizes that students actively construct knowledge through meaningful experiences (Utami et al., 2025; Dharma, 2025; Oktaviani & Isdaryanti, 2024; Sukmawati et al., 2023a). According to Bruner's discovery learning theory, students understand concepts more effectively when they are directly involved in manipulating learning objects and discovering relationships independently. Furthermore, Dale's Cone of Experience explains that students retain learning better when they engage in visual and hands-on activities compared to passive listening (Nu'man, 2020; Sarini et al., 2024; Unaenah et al., 2020; Zhao, 2021). Therefore, learning media that integrate visual, manipulative, and cooperative elements are theoretically appropriate for elementary school students who are in the concrete operational stage of cognitive development. Natural science (IPA) learning in elementary schools plays a crucial role in fostering students' scientific thinking and equipping them with essential 21st-century competencies (Darsana, 2025; Daryanto & Karim, 2017; Hicks et al., 2025; Ingebrigtsen et al., 2025; Oktaviani & Isdaryanti, 2024). At this stage, the introduction to the basic concepts of science not only aims to make students know natural and environmental phenomena, but also to

How to Cite:
Astuti, R. B., Mampouw, H. L., & Rondonuwu, F. S. (2026). Development of an Integrated "Vein" Pop-Up Book Media for Science Number Patterns in Increasing Interest and Critical Thinking. *Jurnal Penelitian Pendidikan IPA*, *12*(1), 991–998. https://doi.org/10.29303/jppipa.v12i1.14191

develop curiosity, observation skills, logical thinking, and problem-solving skills from an early age. These abilities are Foundation It is important to understand the world rationally and systematically as the level of education increases (Hicks et al., 2025; Hotimah, 2024; Rosnaeni, 2021). In addition, science learning also plays a role in instilling the value of concern for the environment and an attitude of responsibility in daily decision-making (Haryono et al., 2024; Matruty & Que, 2021). Therefore, the science learning process needs to be designed to be more contextual, attractive, and actively involve students in order to achieve the expected goals. In order for the objectives of science learning to be achieved optimally, it is necessary to select a suitable learning model. The learning model should be able to create a conducive learning atmosphere, encourage interaction between students, and accommodate the learning needs of elementary school students who tend to be active and collaborative (Hidayat et al., 2022).

One of the approaches that is suitable to be applied in elementary schools is the cooperative learning approach. In this approach, students are invited to conduct student-centered learning (student center learning), which means that students will be more actively involved in the learning process (Mawaddah et al., 2024). Through these social activities, students not only master the material, but also develop critical thinking skills, communication skills, and a responsible attitude towards their group (Fauzi et al., 2025). Therefore, cooperative learning is an effective alternative solution in bridging the needs of science learning with the characteristics of elementary school students (Fajrianti et al., 2024; Fujiandri et al., 2025).

In addition to choosing the right approach, learning media also plays a significant role in supporting the quality of the learning process. Media that is creatively designed and appropriate to the student's level of development will make learning more interesting and easier to understand. The existence of interactive, visual, and contextual media can help students understand abstract science concepts to be more concrete and easy to understand. Saleh et al. (2023) mentioned that media involving physical activity and visualization can increase learning motivation and strengthen students' memory. In addition, fun learning media can reduce boredom and make students more enthusiastic about participating in lessons (Palyanti, 2023). Therefore, the development of innovative and relevant learning media is needed to increase the effectiveness of science learning in elementary schools (Ery et al., 2024; Ritonga et al., 2023).

However, the reality in the field shows that students' interest in science lessons is still relatively low. This also has an impact on students' understanding of students' critical thinking skills, especially in animal classification materials Vertebrate and invertebrates. This material is considered difficult by most students because it is abstract and poorly provided in visual or concrete form, thus having an impact on the low learning outcomes of students in the topic. This is in line with the results of the research by Sumampouw et al. (2023) which one The result It is known that students' understanding of the classification material of living things is still relatively low, with the highest achievement in the indicator explaining the difference between monocot and dicot plants of 66.67% (medium category), while the lowest achievement is found in the indicator explaining the characteristics of the animal group (kingdom Animalia) which only reaches 9.38% (very low category).

One of the causes of students' low interest and critical thinking skills is because the learning model used in the classroom is still dominated by lecture methods. Teachers convey more material in one direction, while students only receive information without being actively involved in the learning process. Such an approach is less able to stimulate students' curiosity and thinking ability. In addition, the learning media used is also still limited to textbooks, static images, or simple aids that do not attract students' attention. These media are not sufficiently able to describe the material visually and interactively, especially in materials that require classification or grouping such as vertebrates and invertebrates.

One of the learning approaches that can be used as a solution is learning media as visual learning and pop-up book media as the presentation of learning materials in an interactive 3D form, where students have their own role to learn certain parts of the material, then share their understanding with each other in their groups. This model not only enhances social interaction, but also spurs an individual's sense of responsibility for the group's overall understanding. This is in accordance with the opinion of Harefa (2022) who demonstrate the experience of providing participation of learners working in groups to develop plans and address the problems presented through the use of cases.

On the other hand, the use of card media flashcard and pop-up books As a means of learning, it can be an interesting innovation that combines visual, motor, and educational game elements (Neteria et al., 2020). These two media can assist students in identifying and classifying objects directly through the activity of compiling images or information. In the context of science learning that integrates mathematics lessons, Cards flashcard and pop-up This book About Animals Vertebrate and Invertebrates It is very relevant to support students' understanding of the classification of living things in a more fun and easy-to-understand way.

Seeing the potential of media flashcard card and Pop-up book This can help in a fun and meaningful learning process, so the media is developed flashcard card and Pop-up book "VEIN" (Vertebrate–Invertebrate) which is specifically designed to support the learning of animal classification in Primary School. This medium combines visual and manipulative elements in the form of images of animals representing groups Vertebrate and Invertebrates, complete with its name and characteristics (Wibowo & Mufidah, 2022). Flashcard and Pop-up book are systematically arranged so that students can recognize, group, and understand the differences between the two types of animals through compilation and discussion activities. The synergy between play-while learning activities and group cooperation is expected to create a more active, collaborative, and meaningful learning experience. However, in many elementary classrooms, science learning remains dominated by teacher-centered instruction and limited visual-interactive media, resulting in low student engagement and inadequate opportunities to train higher-order thinking skills. This issue becomes more urgent when students learn abstract topics such as vertebrate and invertebrate classification, which require concrete visualization and structured reasoning to support conceptual understanding. Without attractive and interactive learning experiences, students tend to lose interest and struggle to develop critical thinking, especially in interpreting and analyzing scientific information.

To address this challenge, innovative and developmentally appropriate learning media are urgently needed to transform abstract science concepts into more concrete and meaningful experiences for young learners. In response to this need, the present study offers a novelty by developing an integrated learning medium called “VEIN” (Vertebrate–Invertebrate) flashcards and a 3D pop-up book, which combines interactive visualization, manipulative learning, and cooperative learning activities. Unlike conventional media that rely mainly on static images or textbooks, VEIN media is designed to actively involve students through hands-on classification tasks, group discussion, and contextual integration with number patterns. Therefore, this study contributes a new alternative learning innovation that is expected to improve students’ learning interest and critical thinking skills in integrated elementary science learning. Therefore, the development of flashcard media and pop-up book "VEIN" (Vertebrate-Invertebrate) is expected to be an innovative solution that combines the power of cooperative approaches and visual manipulative media.

Despite various studies on pop-up books and cooperative learning, limited research integrates science concepts with number patterns using interactive 3D media specifically designed to improve both learning interest and critical thinking skills simultaneously. Therefore, this study is necessary to provide an innovative and integrative solution aligned with 21st-century learning demands.

Method

This research is a type of Research and Development (R&D) that aims to develop learning media in the form of flashcards and 3D pop-books on number pattern and vertebrate-invertebrate material for integrated subjects in grade III elementary school. The researcher uses treated data collection techniques, such as questionnaires, tests, structured interviews, and so on (different methods from experiments). The learning media designed is a flashcard and 3D pop-book related to number pattern material that integrates vertebrates and invertebrates in integrated lessons for grade III elementary school. To ensure that the research and development process runs regularly from the planning stage to implementation, a number of steps are needed. This research and development site are in 2 elementary schools in Jambi City. Vein flashcard and 3D pop-book teaching media focusing on vertebrate and invertebrate topics in integrated learning for grade III elementary school students is the focus of this research and development. The research instrument was selected and used to facilitate the data collection process, namely through observation, interviews, questionnaires and documentation. The development procedure followed a systematic R&D cycle adapted from Borg & Gall, consisting of needs analysis, product design, validation, limited trials, revision, and final product development.

Result and Discussion

The subjects in this study are grade III elementary school students totaling 16 students. The number of subjects in this study was adjusted to the number of subjects in the comparative data from the first study, which was 16 students, so that the results of data comparison can be carried out proportionally and balanced. The questionnaire scores obtained were then analyzed quantitatively and classified into three categories, namely high, medium, and low, to find out the level of student interest in learning as a whole.

Table 1. Distribution of student learning interest categories (n = 16)

Categories of Learning Interests	Number of Students	Percentage (%)
Height	10	62.50
Medium	4	25
Low	2	12.50
Total	16	100

Based on the data in Table 1, it is known that most students are in the category of high learning interest, which is as many as 10 students (62.5%). These results show that the majority of students show a sense of enjoyment of learning, have a high interest in vertebrate and invertebrate material, and are actively involved in the learning process.

During the learning, students looked enthusiastic in observing the pop-up book media, actively answering teachers' questions, and participating in group discussions. Visual media that is concrete and interesting helps students understand the material more easily, thus encouraging the emergence of a high interest in learning. A total of 4 students (25%) were in the category of medium learning interest. Students in this category show interest in learning, but their active involvement is not consistent at every stage of the activity. Meanwhile, as many as 2 students (12.5%) were in the category of low learning interest, which was characterized by limited involvement and lack of focus on some learning activities.

When compared to the data of the first study, the students' learning interest in this study showed a larger percentage of the high category. This indicates that the use of pop-up book media and VEIN flashcards is able to increase students' interest in learning more optimally than learning using conventional media.

Table 2. Distribution of students' critical thinking test results

Critical Thinking Indicators	Dominant Categories	Number of Students	Percentage (%)
Interpretation	Medium-High	11	68.75
Analysis	Medium-High	10	62.50
Inference	Medium	7	43.75

Based on Table 2 the interpretation indicator shows the highest achievement, namely 11 students (68.75%) are in the medium to high category. This shows that students are able to understand the information presented through the media of pop-up books and VIN flashcards, and are able to identify the characteristics of vertebrates and invertebrates well.

In the analysis indicators, as many as 10 students (62.5%) were in the medium to high category. Students are able to compare and group animals based on specific characteristics. However, there are still some students who need guidance in stating reasons more systematically. The inference indicator showed a relatively lower achievement, namely 7 students (43.75%) were in the medium category. This shows that students' ability to draw conclusions still needs to be improved through continuous practice and the habit of reflective thinking. However, this achievement still shows a positive development when compared to the first research data, which shows that students' inference ability tends to be in the low category.

The results of the comparison quantitatively showed that the data of the second researcher (16 students) had a higher percentage of the category of learning interest and critical thinking skills compared to the data of the first researcher (16 students). This shows that the use of pop-up book media and VEIN flashcards provides more optimal results in improving the quality of learning. This difference in results is influenced by the characteristics of VEIN media which are interactive, concrete, and involve students directly in the learning process, so as to increase learning interest as well as train students' critical thinking skills.

Discussion

The results showed that most of the students were in the category of high learning interest after using the VIN 3D flashcard and pop-book media. These findings were obtained through a quantitative analysis of the learning interest questionnaire which was compiled based on indicators of student satisfaction, interest, acceptance, and involvement, and analyzed using percentage calculation as explained in Chapter III.

Methodologically, the use of questionnaires with the Likert and Guttman scales in R&D research aims to describe students' responses and attitudes towards the developed media. The high percentage of learning interest shows that VEIN media meets the aspects of attractiveness, ease of use, and suitability of the material with the characteristics of grade III elementary school students. Based on the results of the research that has been presented in Chapter IV, especially in Table 4.1, it is known that most students are in the category of high learning interest, which is 62.5%. The high percentage of student interest in learning shows that the use of pop-up book media and VEIN flashcards is able to create an interesting, fun, and meaningful learning process for grade III elementary school students.

The increased interest in learning is inseparable from the characteristics of 3D pop-book media which are concrete and visual (Hasanah et al., 2024; Sunarti et al., 2023). This media allows students to directly observe the shapes and characteristics of vertebrate and invertebrate animals, so that learning becomes more meaningful. In addition, flashcards help reinforce the understanding of concepts through systematic visual repetition (Anindita & Wardani, 2025; Inayah et al., 2024). High interest in learning is reflected in several main indicators, namely students' feelings of happiness during learning, increased interest in vertebrate and invertebrate materials, and active involvement of students in learning activities. Students look enthusiastic when observing the media, participating in group discussions, and answering questions asked by teachers. This

condition shows that VEIN media is able to attract students' attention and encourage active involvement in the learning process.

VEIN pop-up books and flashcards are visual and concrete, helping students understand concepts that were previously abstract. The visualization of animal shapes and their characteristics makes the material easier to understand and less boring. This is in line with the learning theory that states that elementary school students understand material more easily if it is presented through concrete media and involves the sense of sight. This finding is in line with Slameto's opinion that learning interest is influenced by students' feelings of pleasure, interest, and active involvement in the learning process. If students feel happy and interested, then their motivation to learn will increase, which ultimately has a positive impact on learning outcomes.

When compared to the first research data that showed that students' learning interests tended to be in the medium category, the results of this study showed that VEIN media was more effective in fostering students' learning interests. This reinforces that the use of interactive learning media in accordance with the characteristics of elementary school students has an important role in improving the quality of learning.

Discussion of Students' Critical Thinking Skills

The results of the critical thinking ability test presented in Table 4.2 show that the interpretation and analysis indicators are in the medium to high category. This shows that students are able to understand the information presented, identify animal characteristics, and distinguish between vertebrate and invertebrate animals after participating in learning using pop-up book media and VIN flashcards. Relatively high interpretation ability shows that students are able to capture the meaning of information presented through visual media. Pop-up book media helps students understand concepts through three-dimensional images, while flashcards help reinforce students' memories of animal traits. Thus, students not only memorize, but also understand the information obtained.

In the analysis indicators, most students were able to group animals based on certain characteristics and explain the differences. However, there are still some students who need guidance in conveying reasons more systematically. This is natural considering that the ability to think analytically in elementary school students is still in the early stages of development and requires continuous practice. Concrete visual media plays an important role in helping students connect abstract concepts with real representations (Sukmawati et al., 2022).

The inference indicator shows lower achievement than the other two indicators. This shows that students' ability to draw conclusions still needs to be improved. Students still need direction and examples in drawing conclusions based on the information that has been analyzed (Fujiandri et al., 2025). Nevertheless, this achievement still shows a positive development when compared to the first research data which shows that students' inference abilities tend to be in the low category. In the context of R&D research, these findings form the basis for further improvement and development of media to place greater emphasis on reflective and reasoning activities (Fajrianti et al., 2024).These findings support Facione's opinion that critical thinking skills develop gradually through a learning process that involves interpretation, analysis, and reflection activities. Thus, the use of pop-up book media and VEIN flashcards has made a positive contribution to training students' critical thinking skills, although special reinforcement is still needed in the aspect of inference.

Learning Implications

Based on the results of quantitative and qualitative analysis, VEIN 3D flashcard and pop-book media have positive implications in integrated science learning in elementary school.

The use of pop-up books and VEIN flashcards has been proven to increase students' interest and motivation to learn, so that the learning process becomes more active and fun, This media helps students understand the concept of animal classification in a more concrete way, thereby reducing students' difficulties in understanding abstract material, VEIN media also plays a role in developing students' critical thinking skills from an early age, especially in interpretation and analysis indicators. Therefore, teachers are advised to use interactive and contextual learning media so that learning not only focuses on memorization, but also on the development of high-level thinking skills, this media not only increases interest in learning, but also supports the development of students' critical thinking skills. These findings show that the developed product has met the R&D research goal, which is to produce a valid, practical, and effective media. These findings are consistent with previous studies showing that pop-up book media significantly improve students' motivation and conceptual understanding (Sukmawati et al., 2023b). Similarly, Ery et al. (2024) reported that interactive pop-up book media enhanced students' science literacy skills in elementary schools. Demonstrated that cooperative learning strategies positively influence students' conceptual understanding and engagement (Kurniati et al., 2023; Kurniawati, 2023; Pimada et al., 2020; Sukmawati et al., 2023a).

Furthermore, visual-manipulative media such as flashcards and puzzles have been proven effective in strengthening memory retention and classification skills. Therefore, the present study supports and extends previous findings by integrating visual 3D media with cooperative and number-pattern-based activities to simultaneously improve learning interest and critical thinking skills.

Conclusion

This study concludes that the development of VEIN flashcards and 3D pop-up book media effectively enhances third-grade students' learning interest and critical thinking skills in integrated science learning. Quantitative findings indicate that 62.5% of students achieved high learning interest, while critical thinking skills showed positive development particularly in interpretation (68.75%) and analysis (62.5%), with inference (43.75%) demonstrating gradual improvement compared to previous data. The visual, concrete, and interactive characteristics of VEIN media successfully transformed abstract vertebrate and invertebrate concepts into meaningful learning experiences aligned with students' cognitive development stages. Supported by cooperative learning activities, this media fosters active participation, conceptual understanding, and higher-order thinking skills. Therefore, VEIN media is feasible, practical, and effective as an innovative alternative for improving the quality of integrated science learning in elementary schools.

Acknowledgments
The authors would like to express their gratitude to the principals, teachers, and third-grade students of the participating elementary schools in Jambi City for their cooperation and support during the implementation of this research.

Author Contributions
Conceptualization, methodology, software, validation, formal analysis, investigation, resources, data curation, writing—original draft preparation, writing—review and editing, visualization, supervision, project administration, funding acquisition, R.B.A., H.L.M., and F.S.R.

Funding
This research received no external funding.

Conflicts of Interest
The authors declare no conflict of interest.

References

Anindita, D., & Wardani, N. S. (2025). Pengembangan Media Pop-Up Book untuk Meningkatkan Hasil Belajar Tematik. *Scholaria: Jurnal Pendidikan dan Kebudayaan*, *15*(1), 76-83. https://doi.org/10.24246/j.js.2025.v15.i1.p76-83

Darsana, K. I. P. D. (2025). The Use of Bilingual Flashcards as Learning Media to Teach English Vocabulary for Young Learners. *The Art of Teaching English as a Foreign Language (TATEFL)*, *6*(1). https://doi.org/10.36663/tatefl.v6i1.954

Daryanto, D., & Karim, S. (2017). *Pembelajaran Abad 21*. Yogyakarta: Gava Media.

Dharma, I. D. A. E. P. (2025). Behavioral Changes in Education Triggered by AI Use: A Perspective Based on Human-Computer Interaction (HCI) Theory. Advances in Psychological Sciences and Applications,. *Advances in Psychological Sciences and Applications*, *1*(01), 32-39. https://doi.org/10.56741/apsa.v1i01.990

Ery, N. K. D., Rati, N. W., & Agustiana, I. G. A. T. (2024). Improving the Quality of the Learning Process Through Fun Thinkers Learning Media in Elementary Schools. *Jurnal Pedagogi dan Pembelajaran*, *7*(2). https://doi.org/10.23887/jp2.v7i2.71456

Fajrianti, F., Ridzal, D. A., & Kaif, S. H. (2024). Peningkatan Kemampuan Literasi Sains Siswa SDN 111 Buton melalui Penggunaan Media Pop Up Book. *Jurnal Pengabdian Masyarakat Bangsa*, *1*(12). https://doi.org/10.59837/jpmba.v1i12.760

Fauzi, A., Rahmawati, R., Agustyarini, Y., & Nurhayati, U. (2025). Pengaruh Model Pembelajaran Guide Inquiry Terhadap Hasil Belajar Matematika Materi Bangun Ruang di Kelas V MI. *Pendidikan dan Pembelajaran*, *5*(1), 31–43. https://doi.org/10.31538/adrg.v5i1.1305

Fujiandri, Z., Delrefi, D., & Sari, D. L. (2025). Enhancing Cognitive Skills in Early Childhood Through Science-Literacy-Based Pop-Up Books: A Development Study. *International Journal of Contemporary Studies in Education (IJ-CSE)*, *4*(2). https://doi.org/10.56855/ijcse.v4i2.1481

Harefa, D. (2022). Penggunaan Model Pembelajaran Kooperatif Tipe Jigsaw Terhadap Kemampuan Pemahaman Konsep Belajar Siswa. *Aksara: Jurnal Ilmu Pendidikan Nonformal*, *8*(1), 325. https://doi.org/10.37905/aksara.8.1.325-332.2022

Haryono, A. N., Djufri, E., Nizhomi, B., Utaminingsih, R., Murniningsih, M., Zuhdi, R., & Qamariah, Q. (2024). Peran Pembelajaran IPA dalam Membentuk Karakter Peduli Lingkungan pada Siswa Kelas III . *Research in Science and Mathematics Education*, *1*(02), 43–50. https://doi.org/10.62385/riseme.v1i02.113

Hasanah, M., Rokhman, F., & Pramono, S. E. (2024). Pengebangan Media Pembelajaran Pop Up Book Berbasis Graphic Organizer guna Meningkatkan Kemampuan Literasi Sains Siswa pada Materi IPAS

Kelas IV. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *9*(03). https://doi.org/10.23969/jp.v9i03.16121

Hicks, J., Marnita, R., & Oktavianus, O. (2025). Comparing the Effectiveness of Multimodal vs Monomodal Digital Flashcards for L2 Vocabulary Learning. *Studies in English Language and Education*, *12*(3). https://doi.org/10.24815/siele.v12i3.39630

Hidayat, D., Tanjung, S., & Sutopo, A. (2022). Pengaruh Model Pembelajaran Kooperatif dan Kreativitas Terhadap Hasil Belajar IPS di Sekolah Dasar. *Jurnal Basicedu*, *6*(5), 7735–7742. https://doi.org/10.31004/basicedu.v6i5.3587

Hotimah, H. (2024). Flash Card Media Development in Grade 1 Indonesian Language Learning at Madrasah Ibtidaiyah Negeri 2 Jember. *Engineering: Journal of Mechatronics and Education*, *1*(2). https://doi.org/10.59923/mechatronics.v1i2.197

Inayah, A., Harahap, F. K. S., Widia, F., Purba, H. M., Handini, N., & Yusnaldi, E. (2024). Pengembangan Media Pop Up Book untuk Meningkatan Minat Belajar Siswa pada Mata Pembelajaran IPS di MI/SD. *Jurnal Pendidikan Tambusai*, *8*(1), 674–681. Retrieved from https://jptam.org/index.php/jptam/article/view/12446%0Ahttps://jptam.org/index.php/jptam/article/download/12446/9577

Ingebrigtsen, M., Miland, Å. O., Bastesen, J., & Sæle, R. G. (2025). Effective, Scalable, and Low Cost: The Use of Teacher-Made Digital Flashcards Improves Student Learning. *Applied Cognitive Psychology*, *39*(4). https://doi.org/10.1002/acp.70086

Mawaddah, D., Rarasafitri, T., Widia, W., & Anggraini, W. (2024). Konsep Dasar Strategi Pembelajaran Kooperatif (SPK) Perspektif Pendidikan Formal. *Jurnal Ilmu Pendidikan dan Pembelajaran*, *6*(3), 1–10. Retrieved from https://journalversa.com/s/index.php/jipp/article/view/2486

Kurniati, E., Fitri, N., Jufrizal, J., & Fauzan, A. (2023). Use of Flash Card Media to Improve English Vocabulary Memory for Class V Students at SDN 205/IV Jambi. *Electronic Journal of Education, Social Economics and Technology*, *4*(2). https://doi.org/10.33122/ejeset.v4i2.52

Kurniawati, L. W. (2023). Effect of Flash Card Media Effectiveness on Beginning Reading Ability and Symbolic Thinking in Early Childhood 5-6 Years: Case Study in Kindergarten. Imam Syafi'I Jember Odd Semester 2022-2023 Academic Year. *Journal of Education Technology and Inovation*, *6*(1). https://doi.org/10.31537/jeti.v6i1.1328

Matruty, E., & Que, S. R. (2021). Using Flashcard as A Media In Teaching Vocabulary for the Eighth Grade Students of Junior High School. *MATAI: International Journal of Language Education*, *2*(1). https://doi.org/10.30598/matail.v2i1.5490

Neteria, F., Mulyadiprana, A., & Respati, R. (2020). Puzzle sebagai Media Pembelajaran Inovatif dalam Mata Pelajaran IPS bagi Guru di Sekolah Dasar. *PEDADIDAKTIKA: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *7*(4), 82–90. https://doi.org/10.17509/pedadidaktika.v7i4.25809

Nu'man, M. (2020). Eksplorasi Berpikir Kreatif Melalui Discovery Learning Bruner. *Humanika*, *20*(1). https://doi.org/10.21831/hum.v20i1.29265

Oktaviani, P., & Isdaryanti, B. (2024). Learning Media for Sound Picture Cards Based on E-Flashcard Quizlet Content for Elementary School IPAS Lessons. *Journal of Education Technology*, *7*(4). https://doi.org/10.23887/jet.v7i4.69680

Palyanti, M. (2023). Media Pembelajaran Asik dan Menyenangkan untuk Meningkatkan Motivasi Belajar Mahasiswa dalam Mata Kuliah Bahasa Indonesia. *Attractive: Innovative Education Journal*, *5*(2), 1–12. https://doi.org/10.51278/aj.v5i2.859

Pimada, L. H., Toba, R., & Rasyidi, A. W. (2020). Learning of Imla' Using Flashcards on Writing Skill at Islamic Elementary School Level in Samarinda. *Izdihar: Journal of Arabic Language Teaching, Linguistics, and Literature*, *3*(1). https://doi.org/10.22219/jiz.v3i1.11682

Ritonga, S. A., Ritonga, S., Tangse, U. H. M., Putri, D., Ritonga, A., & Ritonga, W. A. (2023). The Effect of ClassPoint Learning Media as Interactive and Fun Learning. *International Journal of Humanities Education and Social Sciences (IJHESS)*, *2*(6). https://doi.org/10.55227/ijhess.v2i6.554

Rosnaeni, R. (2021). Karakteristik dan Asesmen Pembelajaran Abad 21. *Jurnal Basicedu*, *5*(5), 4341–4350. https://doi.org/10.31004/basicedu.v5i5.1548

Saleh, M. S., Syahruddin, S., Saleh, M. S., Azis, I., & Sahabuddin, S. (2023). *Media Pembelajaran*. Purbalingga: Eureka Media Aksara.

Sarini, P., Widodo, W., Sutoyo, S., & Suardana, I. N. (2024). The Hypothetic OMIRE Learning Model to Improve The Scientific Literacy of Prospective Science Teachers. *International Journal of Current Educational Research*, *3*(1). https://doi.org/10.53621/ijocer.v3i1.328

Sukmawati, E., Fitriadi, H., Pradana, Y., Saleh, M. S., Trustisari, H., Wijayanto, P. A., & Rinaldi, K. (2022). *Digitalisasi sebagai Pengembangan Model Pembelajaran*. Batam: Cendikia Mulia Mandiri. Retrieved from http://repository.binawan.ac.id/1802/1/BUKU_%20%20Digitalisasi%20sebagai%20Pengembangan%20Model%20Pembelajaran_compressed.pdf

Sukmawati, E., Imanah, N. D. N., & Rantauni, D. A. (2023a). Implementation and Challenges of Project-

Based Learning of STEAM in the University During the Pandemic: A Systematic Literature Review. *JINoP (Jurnal Inovasi Pembelajaran)*, *9*(1). https://doi.org/10.22219/jinop.v9i1.25177

Sukmawati, E., Marzuki, K., Batubara, A., Harahap, N. A., Efendi, E., & Weraman, P. (2023b). The Effectiveness of Early Childhood Nutrition Health Education on Reducing the Incidence of Stunting. *Jurnal Obsesi: Jurnal Pendidikan Anak Usia Dini*, *7*(4). https://doi.org/10.31004/obsesi.v7i4.4846

Sumampouw, Z., Najoan, R., Bella, M., & Kolomban, D. (2023). Analisis Pemahaman Konsep Klasifikasi Makhluk Hidup Peserta Didik Kelas VI SD Negeri 14 Manado. *Jurnal Ilmiah Wahana Pendidikan*, *9*(22), 1224–1233. https://doi.org/10.5281/zenodo.10393348

Sunarti, S., Anggraini, D., Sarie, D. P., & Jana, P. (2023). The Effectiveness of Pop-Up Book Media in Learning Reading Skills of Grade II Elementary School. *Cakrawala Pendidikan*, *42*(2). https://doi.org/10.21831/cp.v42i2.50381

Unaenah, E., Hidyah, A., Aditya, A. M., Yolawati, N. N., Maghfiroh, N., Dewanti, R. R., & Safitri, T. (2020). Teori Bruner pada Konsep Bangun Datar Sekolah Dasar. *Jurnal Pendidikan dan Ilmu Sosial*, *2*(2), 327-349. Retrieved from https://ejournal.stitpn.ac.id/index.php/nusantara/article/download/840/577/

Utami, A. N., Aisyah, A., Syarifuddin, F., Humairoh, S. A. F., Sahidi, S. N., Nafiah, T., & Nurrohim, A. (2025). The Effectiveness of Flashcard Media as a Hijaiyah Script Learning Media at TPQ Shaqul Al Husna in Indonesia. *Solo Universal Journal of Islamic Education and Multiculturalism*, *3*(01). https://doi.org/10.61455/sujiem.v3i01.249

Wibowo, A., & Mufidah, I. (2022). Media Puzzle Daur Hidup Hewan untuk Menstimulasi Peningkatan Hasil Belajar Kognitif Siswa Sekolah Dasar. *Jurnal Educatio FKIP UNMA*, *8*(2), 661–669. https://doi.org/10.31949/educatio.v8i2.1848

Zhao, Z. (2021). Virtual Reality Language Lab of Second Language Learning Based on J Bruner's Discovery Learning and Self-Efficacy Theory—Literature Review and Solution Improvement. *Journal of Innovation and Social Science Research*, *8*(7). https://doi.org/10.53469/jissr.2021.08(07).30