



# Development of iSpring Suite-Based Mobile Learning on Human Mobility for Grade XI Science

Muhammad Arham Firmansyah<sup>1\*</sup>, Anisa<sup>1</sup>, Hilmi Hambali<sup>1</sup>

<sup>1</sup>Biology Education Study Program, Universitas Muhammadiyah Makassar, Makassar, Indonesia.

Received: February 25, 2026

Revised: March 24, 2026

Accepted: April 25, 2026

Published: April 30, 2026

Corresponding Author:

Muhammad Arham Firmansyah  
[arham2404firmansyah@gmail.com](mailto:arham2404firmansyah@gmail.com)

DOI: [10.29303/jppipa.v12i4.14682](https://doi.org/10.29303/jppipa.v12i4.14682)

 Open Access

© 2026 The Authors. This article is distributed under a (CC-BY License)



**Abstract:** This study aims to develop and evaluate the validity, practicality, and effectiveness of iSpring Suite-based mobile learning media integrated with gamification and Artificial Intelligence (AI) assistants for human mobility topics. This research employs the Research and Development (R&D) method using the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). The research subjects involved 35 students from Class XI Biology 3 at SMAN 5 Makassar. Data collection was conducted through expert validation sheets, practicality questionnaires, cognitive learning outcome tests, and motivation questionnaires. The results showed that the developed media obtained an Aiken Index of 0.96, placing it in the very valid category. The practicality level reached 100% based on teacher responses and 85.64% from student responses, classifying it as very practical. N-Gain analysis proved an improvement in cognitive learning outcomes by 0.71 (high category) and an increase in learning motivation by 0.79 (high category). In conclusion, this iSpring Suite-based mobile learning application is highly valid, practical, and effective for enhancing high school students' motivation and cognitive learning outcomes.

**Keywords:** Gamification; iSpring suite; Learning motivation; Learning outcomes; Mobile learning

## Introduction

Biology education often faces challenges in visualizing abstract concepts, such as organ structural illustrations that are difficult for students to comprehend (Adillah et al., 2025). Furthermore, the extensive and complex nature of biological material is frequently considered difficult as it demands a high level of cognitive effort for memorization (Sari et al., 2024; Nuraini et al., 2026). Consequently, the inability to accurately visualize material can trigger misconceptions and result in sub-optimal conceptual understanding (Yatri, 2025). Therefore, innovative interactive learning media are required to bridge these comprehension gaps, one of which is by utilizing smartphones. Smartphones are beneficial for delivering material interactively, which can improve students' conceptual mastery (Pratidina et al., 2024; Raudah et al., 2024).

Based on preliminary observations at SMA Negeri 5 Makassar, the school possesses excellent potential for

supporting learning. There is a moving class system specialized for subject interests, meaning that fundamentally, students already have a high level of interest in biology. Additionally, teachers indicated that students are permitted to use smartphones for learning. This represents significant potential, considering that digital proficiency makes students better prepared to optimally integrate technological developments into their academic activities (Ervianti et al., 2023). Despite having interest and supporting facilities, the majority of students, based on an initial needs analysis, stated that the topic of human mobility – particularly the nervous system – is difficult to grasp because it explains internal bodily processes that are not directly visible. The nervous system is recognized as one of the most complex topics for high school students (Laelasari & Wakhidah, 2023). This condition sometimes leads to boredom during lessons, as evidenced by a lack of student concentration during the teaching and learning process. This also impacts psychological aspects; students feel

## How to Cite:

Firmansyah, M. A., Anisa, & Hambali, H. Development of iSpring Suite-Based Mobile Learning on Human Mobility for Grade XI Science. *Jurnal Penelitian Pendidikan IPA*, 12(4), 64-72. <https://doi.org/10.29303/jppipa.v12i4.14682>

less confident, which ultimately affects their levels of learning motivation. On the other hand, the use of smartphones in learning remains limited to quiz applications used only as evaluation tools, rather than as interactive media for in-depth exploration of the material. Therefore, the results of the initial needs analysis indicate that to overcome these issues, almost all students expressed a strong need for the development of mobile learning-based instructional media. Specifically, the features most desired by students in the application are interactive images and animations, educational videos, and quizzes to help them master complex material independently and flexibly.

To address these needs, an innovation in the form of mobile learning is required to allow for flexible access to learning (Abdulah, 2022). By presenting material that integrates visual, auditory, and kinesthetic aspects into a single platform (Faqih, 2021), mobile learning is capable of simplifying the student learning experience. This is highly recommended, especially for complex science topics, as it significantly impacts the improvement of student understanding and retention (Karatay et al., 2024). One of the most relevant application builders for this solution is iSpring Suite, due to its ability to convert presentations into applications or HTML5 without requiring complex programming languages (Sulistiyorini & Listiadi, 2022). In line with this, research by Rahmah et al. (2025) and Syarif et al. (2024) has proven that the use of iSpring Suite significantly improves learning outcomes and student motivation. While widely used, current biology media development is generally still limited to one-way material presentation. It is still very rare to find research that packages complex material, such as human mobility (the nervous and musculoskeletal systems), into in-depth mobile learning for high school students.

Responding to the limitations of previous media, this study seeks to develop a more interactive mobile learning experience. The designed application does not merely present material in multimedia format but also integrates gamification elements such as drag-and-drop features, feedback-based quizzes, leaderboards, and Artificial Intelligence (AI) virtual assistants as independent study companions. Through these features, this research aims to produce an iSpring Suite-based learning tool while evaluating its level of validity, practicality, and effectiveness regarding the motivation and cognitive learning outcomes of Grade XI students.

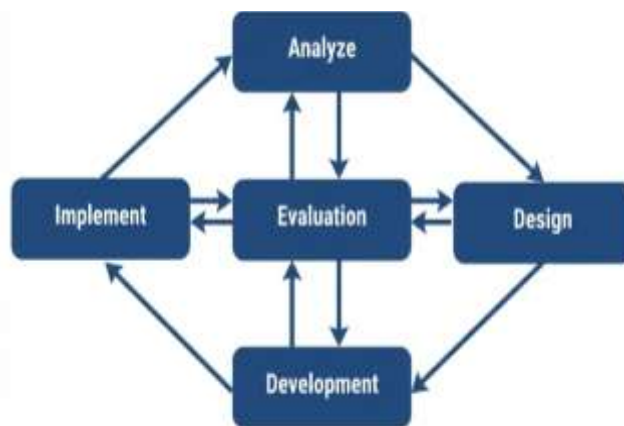
**Method**

This study is a Research and Development (R&D) project based on the ADDIE model (Analysis, Design, Development, Implementation, Evaluation). According

to Waruwu (2024), the ADDIE model is the framework most frequently utilized in research and development (R&D) studies.

The development procedure begins with the Analysis phase to identify the curriculum and the needs of teachers and students, distributed via preliminary needs analysis questionnaires. The results of this analysis established that human mobility material has a high level of conceptual difficulty. In the Design phase, learning indicators were formulated in accordance with the *Kurikulum Merdeka* (Independent Curriculum), and the application interface was designed using iSpring Suite, which was then validated by two experts.

The Development phase focused on creating multimedia features, including videos, animations, and interactive quizzes optimized for smartphone use. The Implementation phase was conducted through limited trials to assess the technical quality and practicality of the media in the classroom. Finally, the Evaluation phase was carried out to observe the improvement in students' motivation and cognitive learning outcomes after using the application, as well as to review the final product evaluation results.



**Figure 1.** ADDIE framework (Herawati et al., 2024)

The research was conducted from January 29 to February 12, 2025, at SMAN 5 Makassar. The subjects of this study consisted of 35 students from Class XI Biology Specialization 3, serving as the field trial subjects. The data collection instruments included validity and practicality sheets, motivation questionnaires, and cognitive learning outcome tests administered before and after the implementation of the media.

The product's validity assessment was performed by two expert validators: a material expert and a media expert. Data analysis for media validity utilized the Aiken's V method with a scale of 1-4 to measure the degree of agreement among validators regarding the instrument items. As explained by Hafild et al. (2025), Aiken's V is an analytical technique frequently used to determine content validity in research instrument

development, such as questionnaires or tests. Following the guidelines of Kurnawati et al. (2023), the calculation formula and validity category criteria used are as follows:

$$V = \frac{\sum(r-l_0)}{n(C-1)} \tag{1}$$

Notes: r = score assigned by the validator; l<sub>0</sub> = lowest possible score; C = highest possible score; N = number of validators.

**Table 1.** Media Practicality Criteria

Score Range	Category
81% - 100%	Very practical
61% - 80%	Practical
41% - 60%	Moderate
21% - 40%	Less practical
0% - 20%	Not practical

The practicality of the learning media was determined through response questionnaires completed by both teachers and students. The assessment instrument utilized a four-point Likert scale consisting of positive and negative statements. The obtained score data were subsequently analyzed using percentage techniques to determine the level of media practicality. Following Milala et al. (2022), the percentage calculation formula and the criteria for interpreting practicality are as follows:

$$P = \frac{TSe}{TSh} \times 100\% \tag{2}$$

Notes: P = Percentage; Tse = Total empirical score (actual score obtained); TSh = Total expected score (maximum possible score)

**Table 2.** Media Validity Criteria

Index Range	Category
V > 0.8	Very valid
0.4 ≤ V ≤ 0.8	valid
V < 0.4	Less valid

The effectiveness of the learning media was tested to observe improvements in students' cognitive competence and learning motivation. Data were gathered through test instruments (pre-test and post-test) structured according to Bloom's Taxonomy, as well as motivation questionnaires administered before and after the implementation of the learning media. The score increase between pre- and post-treatment was analyzed using the Normalized Gain (N-Gain) score test, referring to Hamida et al. (2025). The N-Gain calculation formula and its classification are as follows:

$$g = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}} \tag{3}$$

Notes: g = Normalized gain; S<sub>pre</sub> = Total pre-test score (before the trial); S<sub>post</sub> = Total post-test score (after the trial); S<sub>max</sub> = Maximum possible score.

**Table 3.** N-Gain Value Classification

Range Score N-Gain (g)	Interpretation
0.70 ≤ g ≤ 1.00	High
0.30 ≤ g < 0.70	Moderate
0.00 < g < 0.30	Less
g = 0.00	No Improve
-1.00 ≤ g < 0.00	Decrease

## Result and Discussion

### Product Description

The final product of this development is a learning application designed to help students understand human mobility material independently. This application packages the material on the nervous and musculoskeletal systems in straightforward and concise language, ensuring that the main learning points are easier to comprehend without the need to read excessively long texts. Educational videos from YouTube are also provided to support visualization, alongside animations depicting body structures and mechanisms—such as reflex actions or detailed brain structures—which students can explore interactively. This aligns with the benefits of multimedia learning as explained by Siregar et al. (2024) and Laselvy et al. (2025), who state that the utilization of multimedia is vital because its interactive aspects allow the learning process to become more adaptive. This condition is also consistent with the findings of Ljubojević et al. (2025), which emphasize that well-structured and interactive multimedia design can significantly enhance learning efficiency.



**Figure 2.** Application Homepage



Figure 3. Material content in application



Figure 4. Instructional video feature

The learning process within the application is also made more active through a drag-and-drop game feature. This feature trains students' precision and independence in identifying the names and locations of brain or musculoskeletal structures in a more engaging manner. Tavares et al. (2021), state that applications combining animations and games effectively visualize abstract concepts and encourage students' self-regulated learning.

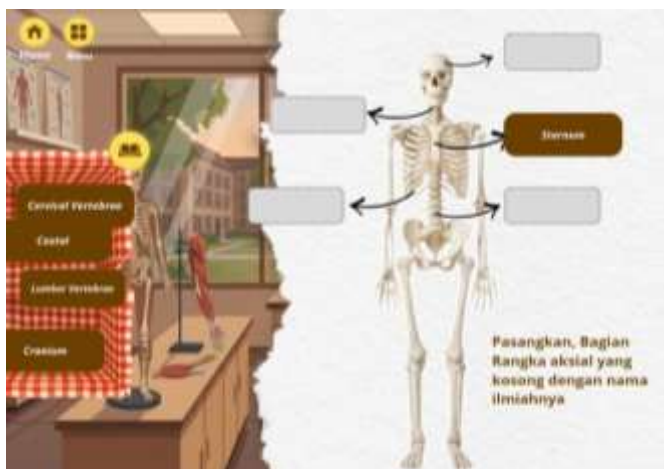


Figure 5. Drag and drop game feature

Additionally, an interactive quiz menu is provided, featuring automatic feedback and a leaderboard system. Consequently, each selected answer immediately displays a correct or incorrect explanation, enabling students to learn from their mistakes in real-time. The leaderboard feature in the interactive quiz has also proven effective in sparking positive competition within the classroom. This aligns with the research of Ramadhan et al. (2025) and Chastnyk et al. (2024), which demonstrates that interactive quizzes are effective tools for reinforcing student understanding of learning materials and increasing focus. This quiz feature functions not only as an evaluation tool but also fosters a more engaging learning environment, ensuring students do not lose interest when studying complex topics.

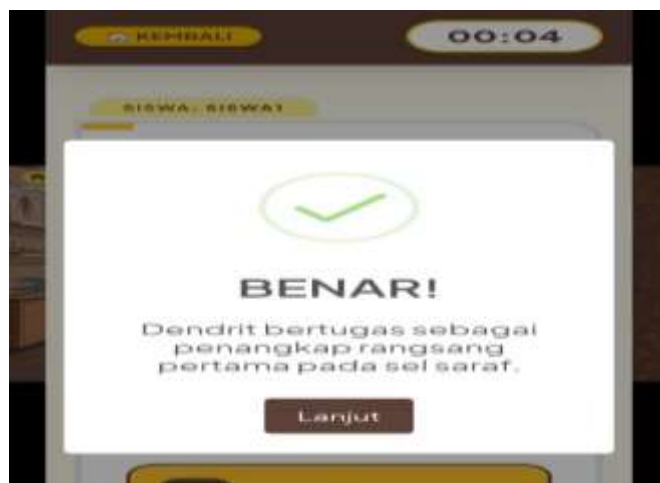


Figure 6. Quiz feature equipped with feedback and leaderboard



Figure 7. Virtual Assistant Feature

As a distinguishing feature that sets it apart from similar applications, an AI-based smart assistant is embedded to serve as a companion tutor for students.

This feature ensures that students continue to receive guidance even while studying independently at home. Through the AI assistant, students can pose questions regarding challenging topics within the human mobility material and receive responses as if they were engaging in a discussion with a personal instructor. The presence of this feature aligns with the framework of modern digital education. Research by Yanto et al. (2025) and Yaseen et al. (2025) demonstrates that AI is capable of analyzing student interactions in real-time to provide feedback tailored to the student’s characteristics, thereby significantly increasing student engagement and learning motivation. This capability effectively assists students in evaluating their learning strategies, which ultimately leads to enhanced academic performance.

*Media Validity*

Media validity testing was conducted to ensure that the application is materially and technically feasible prior to implementation. Two experts evaluated the feasibility of the media and the material, and their assessments were subsequently calculated using the Aiken’s V formula. The expert validation results are presented in the table below:

**Table 4.** Expert Validation Results

Validator	Total Score	Aiken Indeks (V)	Criteria
Media Expert	55	V = 0.96	Very Valid
Material Expert	54	V= 0.96	Very Valid

Based on Table 4, it is evident that the application has undergone feasibility testing by two experts. The Media Expert assigned a total score of 55, while the Material Expert provided a score of 54. The calculation results yielded an Aiken Index of 0.96. Referring to these criteria, the application falls into the "highly valid" category and is thus declared feasible for implementation. This high score is consistent with previous research indicating that iSpring Suite-based media is highly valid and suitable for use (Fikrotin & Sulaikho, 2021; Samudro et al., 2022). These findings prove that learning media developed with the aid of iSpring Suite is highly reliable for use in self-directed learning.

*Media Practicality*

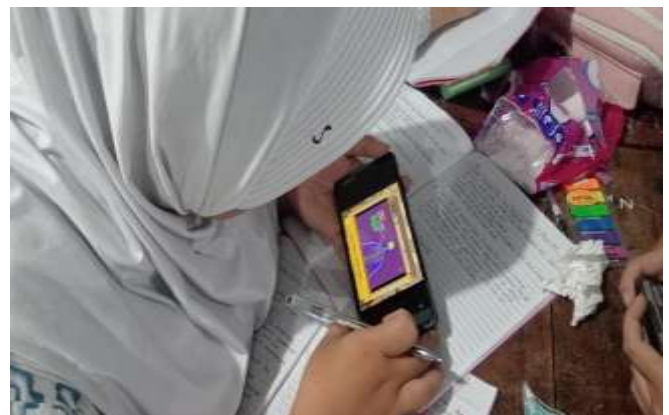
Media practicality testing was conducted to determine the feasibility and ease of use of the application within the learning process. Both teachers and students provided assessments through questionnaires regarding the application's practicality. The collected data were then analyzed using the media practicality percentage formula. The results are presented in the table 5.

**Table 5.** Media Practicality Results

Respondent	Media Practicality	Criteria
Students	85.64%	Very Practical
Teacher	100%	Very Practical

Based on Table 5, the overall level of media practicality falls within the "very practical" category. This is evidenced by the teacher's evaluation, which achieved the maximum score, and the high percentage of positive student responses. These results indicate that the developed application is highly user-friendly within the learning process. This high practicality rating aligns with previous research stating that iSpring Suite-based media is practical and easy to use (Widyatama & Pratama, 2022; Susilo et al., 2023). The clear interface and navigation ensure that students do not require significant time to understand how to operate the application, thereby enhancing the efficiency of learning time.

*Effectiveness Testing*



**Figure 8.** Students accessing the video feature



**Figure 9.** Students accessing the quiz feature

*Improvement of Learning Outcomes*

To determine the magnitude of the improvement in student learning outcomes before and after the implementation of the application, a descriptive

statistical analysis was conducted using the N-Gain test. A summary of these calculation results is presented in the table 6.

Based on the table 6, the average N-gain score for students is 0.71 (71.47%) with a standard deviation of

24.93. The lowest N-gain score obtained by a student is 0.14 (14.29%) and the highest is 1.00 (100%). An average value of 0.71 falls into the high category, which signifies that the use of this application is proven effective in improving student learning outcomes.

**Table 6.** N-Gain Test Results for Learning Outcomes Improvement

	No	Minimum	Maximum	Mean	STD Deviation
N-Gain Score	35	0.14	1.00	0.7147	0.24930
N-Gain Persen	35	14.29	100.00	71.4701	24.92979
Valid N (listwise)	35				

The high learning outcomes achieved by several students are also significantly influenced by the visual design and features integrated into the application. As stated by Melati et al. (2025), when learning through multimedia, students do not only read text but also view images and hear sounds simultaneously. This significantly assists in reducing the students' cognitive load (working memory). Consequently, the instructional material becomes easier to absorb and retain in long-term memory (Mayer, 2024; Asaadi et al., 2024; Ariyatun et al., 2026). This process ultimately allows students to

grasp difficult concepts more rapidly. This improvement in learning outcomes proves the effectiveness of iSpring Suite-assisted media, aligning with the research results of Syarif et al. (2024) and Maurisa et al. (2021).

*Improvement of Learning Motivation*

In addition to measuring learning outcomes, an N-gain analysis was also conducted to assess the improvement in students' learning motivation. Descriptive statistical data regarding the increase in learning motivation can be observed in the table 7.

**Table 7.** N-Gain Test Results for Learning Motivation Improvement

	No	Minimum	Maximum	Mean	STD Deviation
N-Gain Score	35	0.19	1.00	0.7962	0.18950
N-Gain Persen	35	18.64	100.00	79.6184	18.94960
Valid N (listwise)	35				

The data in the table above indicates that the mean N-gain score for the learning motivation variable is 0.7962 or 79.62%. Based on N-gain classification, a score of 0.79 falls within the High category. This result proves a significant increase in student learning motivation following the use of the developed application. This high value underscores the role of technology in encouraging students to be more proactive and increasing their interest in the subject matter. As explained by Asna et al. (2025) and Sabri et al. (2024), technology plays an essential role in fostering active student engagement through the presentation of visual and interactive concepts. This is further supported by the findings of Al-Mughrabi (2025), who asserts that the use of technology in education, particularly in science, has a direct positive impact on student engagement. The effectiveness of technology regarding motivation is also evidenced by the use of the iSpring Suite-based media developed in this research. These findings align with the studies of Firdha et al. (2022) and Nisa et al. (2025), which consistently found that learning media assisted by iSpring Suite can enhance student learning motivation. The presence of interactive features within this application serves as a primary factor in making

students more enthusiastic and preventing boredom when studying complex material.

**Conclusion**

The iSpring Suite-based mobile learning media for human mobility topics, developed using the ADDIE model, has met the validity standards for implementation and has been tested for its practicality and effectiveness in biology education. The validity test results from material and media experts yielded an Aiken Index of 0.96, categorized as very valid. The media's practicality level was also classified as very practical, based on a 100% teacher response rate and an 85.64% student response rate. Furthermore, the implementation of the media proved effective in improving students' cognitive learning outcomes and motivation, with N-Gain scores of 0.71 and 0.79, respectively, both falling into the high category. Consequently, this media is feasible for use in Grade XI High School Biology learning.

**Acknowledgments**

The author would like to express their deepest gratitude to the Biology Education Study Program, Faculty of Teacher Training

and Education, Universitas Muhammadiyah Makassar. Sincere appreciation is also extended to the Principal and the biology teacher of SMA Negeri 5 Makassar (Class XI Biology 3), as well as the staff and faculty members for their cooperation and permission during the data collection process. Finally, the author wishes to thank the Grade XI students for their active participation in this research.

#### Author Contributions

Conceptualization, M.A.F., A., and H.H.; methodology, M.A.F.; software, M.A.F.; validation, A. and H.H.; formal analysis, M.A.F.; investigation, M.A.F.; resources, M.A.F.; data curation, M.A.F.; writing—original draft preparation, M.A.F.; writing—review and editing, A. and H.H.; visualization, M.A.F.; supervision, A. and H.H.; project administration, M.A.F. All authors have read and agreed to the published version of the manuscript.

#### Funding

This research received no external funding.

#### Conflicts of Interest

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript; or in the decision to publish the results.

#### References

- Abdulah. (2022). Pembelajaran Interaktif Mobile Learning pada Mata Kuliah Pendidikan Kewarganegaraan. *Jurnal Tunas Pendidikan*, 5(1), 127–136. <https://doi.org/10.52060/pgsd.v5i1.821>
- Al-Mughrabi, A. M. (2025). The Impact of Digital Teaching Materials on Educational Engagement and Outcomes in Science Education: the Mediating Role of Technology Integration an Empirical Analysis of Private Universities in Jordan. *International Journal of Data and Network Science*, 9(3), 461–474. <https://doi.org/10.5267/j.ijdns.2024.8.020>
- Ariyatun, S., Sagita, D. M., & Venessa, D. M. (2026). Exploratory Study of Student Needs in the Development of Technology-Based Chemical Computing Software. *Journal of Science Education Research*, 10(11), 38–48. <https://doi.org/10.21831/jsr.v10i11.90331>
- Asaadi, A. H., Amiri, S. H., Bosaghzadeh, A., & Ebrahimpour, R. (2024). Effects and Prediction of Brain Cognitive Load on Encoding Model of Brain Response to Auditory and Linguistic Stimuli in Educational Multimedia. *Scientific Reports*, 14(1), 9133. <https://doi.org/10.1038/s41598-024-59411-x>
- Chastnyk, O., Zoria, M., Poletay, O., Shumskyi, O., & Klochkova, Y. (2024). *Exploring the Influence of Interactive Education on Academic Progress: Evaluating Effectiveness and Implementation Approaches*. Retrieved from <https://epub.chnpu.edu.ua/jspui/handle/123456789/10834>
- Ervianti, E., Sampelolo, R., & Pratama, M. P. (2023). The influence of digital literacy on student learning. *Klasikal: Journal of Education, Language Teaching and Science*, 5(2), 358–365. <https://doi.org/10.52208/klasikal.v5i2.878>
- Faqih, M. (2021). Efektivitas Penggunaan Media Pembelajaran Mobile Learning Berbasis Android dalam Pembelajaran Puisi. *Konfiks Jurnal Bahasa dan Sastra Indonesia*, 7(2), 27–34. <https://doi.org/10.26618/konfiks.v7i2.4556>
- Fikrotin, V., & Sulaikho, S. (2021). Kebutuhan Pengembangan Media Pembelajaran iSpring Suite Berbasis Android pada Mata Pelajaran Morfologi Bahasa Arab. *Ta'lim al-'Arabiyyah: Jurnal Pendidikan Bahasa Arab & Kebahasaaraban*, 5(2). <https://doi.org/10.15575/jpba.v5i2.13587>
- Firdha, N., & Zulyusri, Z. (2022). Penggunaan iSpring dalam Pengembangan Media Pembelajaran Interaktif. *Diklabio: Jurnal Pendidikan Dan Pembelajaran Biologi*, 6(1), 101–106. <https://doi.org/10.33369/diklabio.6.1.101-106>
- Hafild, M. N. R., Abdurahman, & Yulianti, D. (2025). Meningkatkan Kemampuan Komputasi Siswa dengan Model Pembelajaran Berbasis STEAM-PJBL. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 10(1), 422. <https://doi.org/10.23969/jp.v10i01.20525>
- Hamida, R. N., Khotimah, H., Nurhalisa, Nuurmahiroh, R. L., Sifalin, J., Umam, Z., & Rahmawati, I. D. (2025). Efektivitas Penggunaan Media Assembler Edu dan ZEP Metaverse dengan Model TGT terhadap Hasil Belajar IPAS. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, 10(2), 386. Retrieved from <https://journal.unpas.ac.id/index.php/pendas/article/view/27112>
- Herawati, S. S., Kurniawan, D., & Rahmanita, U. (2024). Pengembangan Video Animasi Berbasis Animaker Menggunakan Model ADDIE pada Topik Karakteristik Materi dan Perubahannya. *Jurnal PIPA: Pendidikan Ilmu Pengetahuan Alam*, 5(2), 141–150. <https://doi.org/10.56842/jp-ipa>
- Karatay, S. K., Bakirci, H., & Bülbül, S. (2024). Mobile Learning Supported Science Teaching Application: Electric Charges and Electric Energy. *Education and Information Technologies*, 29(15), 19783–19811. <https://doi.org/10.1007/s10639-024-12631-0>
- Kumawati, S., Rahmawati, F., & 'Adna, S. F. (2023). Pengembangan Media Pembelajaran Interaktif Android “Si-Inka” Berbasis Etnomatematika untuk Meningkatkan Kemampuan Pemahaman Matematis Materi Bangun Ruang Sisi Datar. *Math Locus: Jurnal Riset Dan Inovasi Pendidikan*

- Matematika*, 4(2), 110-124.  
<https://doi.org/10.31002/mathlocus.v4i2.4225>
- Laelasari, I., & Wakhidah, N. (2023). Conceptual Understanding and Analysis Conceptual Difficulties of Nervous System: From the Perspective of Pre-Service Biology Teachers. *Thabiea: Journal of Natural Science Teaching*, 6(2), 182. <https://doi.org/10.21043/thabiea.v6i2.16690>
- Laselvy, K., & Rahmawati D. (2025). Pengaruh Penggunaan Media Animasi Berbasis YouTube Terhadap Hasil Belajar Kognitif Peserta Didik pada Materi Virus Kelas X SMA. *MASALIQ*, 5(6), 2759-2772.  
<https://doi.org/10.58578/masaliq.v5i6.7612>
- Ljubojević, M., Savić, M., Mijić, D., & Vico, G. (2025). Improving the Efficiency of Multimedia Learning and the Quality of Experience by Reducing Cognitive Load. *Applied Sciences*, 15(3), 1054. <https://doi.org/10.3390/app15031054>
- Maurisa, K. Z. A., & Rahayu, W. P. (2021). Meningkatkan kemandirian dan hasil belajar siswa melalui pengembangan Mobile Learning berbasis Android berbantuan Ispring Suite 9. *Jurnal Ekonomi, Bisnis Dan Pendidikan*, 1(6), 546-558. <https://doi.org/10.17977/um066v1i62021p546-558>
- Mayer, R. E. (2024). The Past, Present, and Future of the cognitive Theory of Multimedia Learning. *Educational Psychology Review*, 36(1), 8. <https://doi.org/10.1007/s10648-023-09842-1>
- Melati, M. P. K., & Fadilah, M. (2025). Analisis Literatur : Pengaruh Multimedia Interaktif Terhadap Beban Kognitif dalam Pembelajaran. *Jurnal Biogenerasi*, 10(4), 2270-2273. <https://doi.org/10.30605/biogenerasi.v10i4.7434>
- Milala, H. F., Joko, Endryansyah, & Agung, A. I. (2022). Keefektifan dan Kepraktisan Media Pembelajaran Menggunakan Adobe Flash Player. *Jurnal Pendidikan Teknik Elektro*, 11(2), 195-202. <https://doi.org/10.26740/jpte.v11n02.p195-202>
- Nisa, R. A. C., & Asmarani, D. (2025). Pengembangan Media Pembelajaran Interaktif Berbasis Android Menggunakan iSpring Suite 11. *Jurnal Penelitian Pendidikan Indonesia*, 2(1), 11-23 Retrieved from. <https://ejournal.intelektualedu.com/index.php/JPPi/article/view/52>
- Nuraini, S., & Zulfiani, Z. (2026), Correlation of Teacher Interpersonal Interaction and Classroom Emotional Climate in Biology Learning, Merdeka Curriculum. *Quagga Jurnal Pendidikan dan Biologi*, 18(1), 21-31. <https://doi.org/10.25134/quagga.v18i1.418>
- Pratidina, N. A., Suriansyah, A., & Rafianti, W. R. (2024). Penggunaan Smartphone dalam Pembelajaran di Sekolah Dasar. *MARAS: Jurnal Penelitian Multidisiplin*, 2(4), 2138-2145. <https://doi.org/10.60126/maras.v2i4.575>
- Ramadhan, M. F., Arif, M. R., Nurjannah, Rahmayanti, N. S., & Khoerunnisa, P. (2025). Implementasi Metode Pembelajaran Kuis Interaktif untuk Meningkatkan Hasil Belajar Siswa di Kelas X-4 SMAN 2 Karawang. *Hikmah: Jurnal Studi Pendidikan Agama Islam*, 2(2), 73-87. <https://doi.org/10.61132/hikmah.v2i2.880>
- Raudah, S., Cinantya, C., & Suriansyah, A. (2024). Efektivitas Penggunaan Media Pembelajaran Interaktif dalam Meningkatkan Keaktifan dan Minat Belajar pada Siswa Sekolah Dasar. *Maras Jurnal Penilitaian Multidisiplin*, 2(4), 2092-2097. <https://doi.org/10.60126/maras.v2i4.559>
- Samudro, G. D., Shodikin, A., & Aini, K. N. (2022). Pengembangan Media Pembelajaran Berbasis Android Menggunakan Ispring Suite 10 pada Materi Turunan Fungsi Aljabar. *Jurnal Eksakta Pendidikan (JEP)*, 6(2), 161-169. <https://doi.org/10.24036/jep/vol6-iss2/692>
- Sari, I. P. N., & Ferry, D. (2024). Analisis Kesulitan Belajar Siswa pada Mata Pelajaran Biologi di SMA. *BIOSFER: Jurnal Biologi Dan Pendidikan Biologi*, 9(2), 172-181. <https://doi.org/10.23969/biosfer.v9i2.18613>
- Siregar, L. N. K., Bofferding, L., & Arfanuddin, I. (2024). Manfaat Multimedia Pembelajaran terhadap Kualitas Pemahaman Siswa Anak Usia Dasar. *Nizhamiyah*, 14(2), 148. Retrieved from <https://jurnaltarbiyah.uinsu.ac.id/index.php/nizhamiyah/article/view/3960>
- Sulistiyorini, S., & Listiadi, A. (2022). Pengembangan Media Pembelajaran Ispring Suite 10 Berbasis Android pada Materi Jurnal Penyesuaian di SMK. *Edukatif: Jurnal Ilmu Pendidikan*, 4(2), 2116-2126. <https://doi.org/10.31004/edukatif.v4i2.2288>
- Susilo, B. E., Kasdriyanto, D. Y., & Jannah, F. (2023). Pengembangan Media Pembelajaran Interaktif Berbasis Ispring Suite Pada Mata Pelajaran Matematika Materi Bangun Datar Kelas III di SDN Mangunharjo 1 Kota Probolinggo. *Jurnal Pendidikan, Sains Dan Teknologi (JPST)*, 2(3), 622-633. Retrieved from <http://jurnal.minartis.com/index.php/jpst/>
- Syarif, W., Akib, T., & Baso, B. S. (2024). Pengaruh Media iSpring Suite 11 Terhadap Hasil Belajar Membaca Bahasa Indonesia Kelas IV SD Inpres Kampung Parang Kab. Gowa. Gowa. *Pragmatik: Jurnal Rumpun Ilmu Bahasa dan Pendidikan*, 2(2), 118-125. <https://doi.org/10.61132/pragmatik.v2i2.468>
- Tavares, R., Marques Vieira, R., & Pedro, L. (2021). Mobile App for Science Education: Designing the Learning Approach. *Education Sciences*, 11(2), 79. <https://doi.org/10.3390/educsci11020079>

- Waruwu, M. (2024). Metode Penelitian dan Pengembangan (R&D): Konsep, Jenis, Tahapan dan Kelebihan. *Jurnal Ilmiah Profesi Pendidikan*, 9(2), 1220–1230.  
<https://doi.org/10.29303/jipp.v9i2.2141>
- Widyatama, A., & Pratama, F. W. (2022). Pengembangan Mobile Learning PINTHIR Berbasis Android sebagai Sumber Belajar dan Sarana Mengerjakan Soal Trigonometri SMA. *Mosharafa: Jurnal Pendidikan Matematika*, 11(1), 25–36.  
<https://doi.org/10.31980/mosharafa.v11i1.684>
- Yanto, M., Mad Sa'I, & Nailatur Rizqiyah. (2025). Personalisasi Pendidikan Berbasis AI dalam Meningkatkan Kualitas Belajar Siswa. *Entita: Jurnal Pendidikan Ilmu Pengetahuan Sosial dan Ilmu-Ilmu Sosial*, 507–522.  
<https://doi.org/10.19105/ejpis.v1i.19116>
- Yaseen, H., Mohammad, A. S., Ashal, N., Abusaimah, H., Ali, A., & Sharabati, A.-A. A. (2025). The Impact of Adaptive Learning Technologies, Personalized Feedback, and Interactive AI Tools on Student Engagement: the Moderating Role of Digital Literacy. *Sustainability*, 17(3), 1133.  
<https://doi.org/10.3390/su17031133>
- Yatri, A. E. (2025). Kajian Literatur: Faktor Penyebab Kesulitan dalam Pemahaman Konsep Matematis pada Siswa. *Lattice Journal: Journal of Mathematics Education and Applied*, 5(2), 146–159.  
<https://doi.org/10.30983/lattice.v5i2.10469>