



# Interactive Multimedia on Learning Achievement of the Digestive System in Elementary School

Yanti Fitria<sup>1\*</sup>, Lili Iswari<sup>2</sup>, Risa Amini<sup>3</sup>, Muhammad Kristiawan<sup>4</sup>, Ari Kiswanto<sup>5</sup> 

<sup>1,2,3</sup> Universitas Negeri Padang, Padang, Indonesia

<sup>4</sup> Universitas Bengkulu, Bengkulu, Indonesia

<sup>5</sup> Universitas Samudera, Langsa, Indonesia

## ARTICLE INFO

### Article history:

Received September 02, 2022

Accepted October 14, 2022

Available online November 25, 2022

### Kata Kunci:

Multimedia, Interaktif, Sains, Sistem Pencernaan, Sekolah Dasar

### Keywords:

Multimedia, Interactive, Science, Digestive System, Elementary Schools



This is an open access article under the [CC BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license.

Copyright © 2022 by Author. Published by Universitas Pendidikan Ganesha.

## ABSTRAK

Kurangnya pemilihan media pembelajaran IPA yang cermat untuk kelas V SD mendorong dilakukannya penelitian ini. Tujuan dari proyek ini adalah untuk menciptakan produk multimedia interaktif (MI) yang sah, berguna dan efisien untuk kelas IPA kelas 5 di sekolah dasar. Penelitian pengembangan merupakan metodologi yang digunakan. Model pengembangan ADDIE digunakan dalam penelitian ini. Jenis data yang diambil dalam penelitian ini adalah data primer. Subyek penelitian ini adalah 21 siswa dan guru kelas V di sebuah sekolah dasar. Bagan validasi instrumen, instrumen bahasa, instrumen materi, lembar kepraktisan, dan lembar soal tes adalah di antara alat pengumpulan data. Teknik analisis data disesuaikan dengan peralatan pengumpulan data. Lembar validasi digunakan untuk melakukan analisis validasi yang dilakukan dengan menggunakan skala Likert. Hasil penelitian menunjukkan hasil positif dari segi validitas, kepraktisan, dan keefektifan multimedia interaktif yang dikembangkan. Penelitian ini menghasilkan tiga temuan yaitu: (1) MI valid dengan nilai rata-rata 4,7 dengan kualifikasi sangat valid (2) praktis dengan nilai rata-rata 89,03 kualifikasi sangat praktis dan (3) efektif dalam meningkatkan keberhasilan belajar siswa pada kelas rata-rata 94,8 (95% berhasil). Kesimpulan dari penelitian ini adalah MI Sistem Pencernaan efektif dalam meningkatkan prestasi belajar siswa.

## ABSTRACT

The lack of careful selection of science learning media for fifth grade elementary school encourages this research. The aim of this project is to create a legitimate, useful and efficient interactive multimedia (MI) product for 5th grade science classes in elementary schools. Development research is the methodology used. The ADDIE development model is used in this study. The type of data taken in this study is primary data. The subjects of this study were 21 students and teachers of class V in an elementary school. Instrument validation charts, language instruments, material instruments, practicality sheets, and test question sheets are among the data collection tools. The data analysis technique is adapted to the data collection equipment. The validation sheet was used to perform the validation analysis, which was carried out using a Likert scale. The research findings show positive results in terms of validity, practicality, and effectiveness of the developed interactive multimedia. This study resulted in three findings, namely: (1) MI is valid at an average value of 4.7 with very valid qualifications (2) practical at an average value of 89.03 very practical qualifications and (3) effective in increasing student learning success at grades an average of 94.8 (95% success). The conclusion of this study is that the MI Digestive System is effective in increasing student achievement.

## 1. INTRODUCTION

The 4.0 industry has accessed all aspects of life, including education. The 4.0 industry era changes the educational aspect (Eliyasni et al., 2019; Rahmatina et al., 2019). It changes the education system, especially the learning process. The 4.0 industry era changes the traditional learning system into the modern learning system. This means that it is the era of using technology into all aspects of human life, thus the use of technology in the learning process is very necessary. In this 4.0 era, learning is no longer carried out as conventional learning. Learning must be carried out by combining the technology usage. It aims to make students comprehend the technology greatly (Baquier Orozco et al., 2020; Eliyasni et al., 2019). The 4.0 industry era impacts and challenges the learning process. The impact of the 4.0 industry era is the objective of the learning process changes. This era demands educational institutions to produce graduates with technological skills. This technological skill aims to enable students to compete globally and solve problems that occur in the present and the future and that will be related to technology (Helsa et al., 2021; Nurtanto et al., 2019). To respond to these impacts, the education system must be able to

\*Corresponding author.

E-mail addresses: [Yantifitria@fip.unp.ac.id](mailto:Yantifitria@fip.unp.ac.id) (Yanti Fitria)

answer the challenges. The 4.0 industry era opposes educational institutions to innovate in attempting the learning goals (Kalkan et al., 2020; Mutohhari et al., 2021). The innovations developed are related to the learning process to facilitate the education system to achieve these goals. This innovation is directed in the learning process because it is the closest environment to change the students, especially elementary school students. Elementary school is the first formal educational institution. Therefore elementary schools have an important role in teaching the concepts of science (Anif et al., 2020; Mtsi, 2021).

Elementary school learning is very different from advanced school learning. Elementary school learning is adjusted to the development of elementary school-age children. Elementary school students are in a concrete operational period (Indriani, 2016; Kiswanto, 2017). Students with this period are interested in real objects related to their direct experience. Thus learning in elementary schools must deliver material and information by bringing real objects that can be visualized by students directly. However, in its implementation, not all material and information can be presented directly in the learning process. Interactive multimedia that has been developed so far has only been limited to physical science material. The topic material of the human body system is content that has a high level of abstraction. Therefore, it is necessary to have an intermediary media to manipulate the material/information. This intermediary media is also called learning media. It is possible to state that the activity of interest completely (Al Sultan et al., 2021; Fawley et al., 2020).

Students need engaging learning materials that can effectively convey messages, and computers and related software have not been used as a learning medium to their full potential. The problem in this study is the low learning outcomes of science students, which are caused by the learning process's continued use of simple learning materials that lead to low student understanding of science material (Magdalena et al., 2021; Siang et al., 2020; Sudana & Wesnawa, 2017). Similar to the preceding observation, picture media were utilized to teach about the human digestive system. Using the two-dimensional illustrations in the book as a medium, students are given an explanation of the digestive system. In general, learning went well, but the teacher primarily used the lecture technique to describe how the human digestive system functions, leaving pupils without a clear understanding of how food can be digested and how it moves through the organ system (Purwani et al., 2021; Rachmadtullah et al., 2020; Sendurur, 2018). It is well recognized that students need a realistic illustration of how the human digestive system functions because it cannot be directly witnessed in action. Since fifth graders at SD Negeri 28 Ganting Selatan are on average 11 years old and the school is currently in its concrete operating phase, the presence of media is crucial to fostering learning.

Numerous factors, including a lack of preparation time for teaching and trouble locating the appropriate media, contribute to the neglect of the use of media. Another cause for the underutilization of media, according to the principal of SDN 28 Ganting Selatan, is the underutilization of computers and related software as a learning tool. Even though we can utilize computers and accompanying software as a fun learning medium and can use them to convey abstract concepts into more concrete things so that they are more easily comprehended by students, existing computers are only used as a tool for learning computer programs. Conditions like these can lead to a lot of students who don't enjoy learning spending hours paying attention to and thinking about a subject, both what the teacher is saying and what they are doing at the study table.

Work activities that the person performs with an unusually serious involvement of cognitive and emotional functioning. Learning media plays an important role in the learning process in elementary schools (Wiryanto, 2020; Yalvema Miaz et al., 2019). This will facilitate the teacher in teaching the concepts directly to students. The learning media needs to be developed in every elementary school learning, including science learning. Science learning relates to facts, concepts, principles and natural laws as well as a method for knowing and understanding natural phenomena and fostering scientific attitudes (Fitria et al., 2018; Zuryanty et al., 2019). One of the natural science learning materials in schools is the basic human digestive system. The digestive system material in humans is a compulsory subject taught by elementary school students. However, this type of learning cannot be presented directly in the classroom because the digestive system is inside the human body. That is why this material needs to be developed by media capable of manipulating the actual digestive process (Rosalina & Suhardi, 2020; Yeo, 2021).

The researchers took the initiative to develop a learning medium in the form of an interactive learning CD that can aid teachers in delivering content, delivery of learning messages that will have an impact on student learning outcomes, based on the findings in the field regarding low student learning outcomes and the not yet optimal use of media, especially computer media, by teachers as learning media as well as the demands of the curriculum. Additionally, interactive learning CD encourages participation and interaction from students throughout the learning process. With the use of this media, it is hoped that children will be able to study efficiently and give them a variety of experiences, particularly when learning science. Therefore innovation can overcome these problems. One of the ways is the development of

interactive multimedia in the human digestive system. Therefore the aim of this research is the development of interactive multimedia in a valid, practical and effective human digestive system.

## 2. METHOD

The study activity was carried out to gather information on the validity, practicability, and efficacy of generating interactive multimedia of the human digestive system on student learning outcomes. The ADDIE model is used in the research and development design, which consists of five phases: (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (Aldoobie, 2015; Branch, 2010). This research will be conducted in a public elementary school in the city of Padang, with the number of fifth grade students as many as 80 people. The city of Padang is the capital of the province of West Sumatra Indonesia, which can be used as a general example in the application of interactive learning media throughout the region West Sumatra Province. Next The main factors of the author in choosing the subjects of this school include: (1) the condition of students in relation to the demands of researchers, especially schools with the ability level of students who can represent groups in the field of study. (2) The school environment encourages research; (3) there is no interactive multimedia in fifth grade elementary school; and (4) the school is open to adopting changes, especially in an effort to improve the quality of the learning process in the classroom (Sinyanyuri et al., 2022).

In research, validation sheets, student and instructor response questionnaires, and learning outcomes exam questions were used as data collection tools. The results were examined subjectively and quantitatively according to the features of the instrument. Media validation sheet data, lesson plans, and questionnaire sheets were evaluated descriptively and determined by the criteria for evaluating the validity, practicality, and effectiveness of the media on the achievement of student learning skills. Based on comments from instructors and students, the implementation data was assessed qualitatively. Revisions are made based on the observations of observers on the implementation of learning and the opinions of colleagues and practitioners.

There are two data analysis stages based on the outcomes of expert reviews and field trials during the implementation phase, namely qualitative and quantitative data analysis. To handle data in the form of expert advice, criticism, and ideas, qualitative data analysis is employed. While quantitative data analysis was gathered from the questionnaire's responses in the form of numbers. All steps of this evaluation are aimed at determining the viability of the final product. It must be appropriate in terms of content, design, and users, specifically students and instructors. The data analysis technique is adapted to the data collection equipment. The validation sheet was used to perform the validation analysis, which was carried out using a Likert scale. By using a formula to determine the average rating of an expert or practitioner. while for the practicality sheet, the data analysis uses a questionnaire that will be given to teachers and students, while for its effectiveness it will be analyzed based on the learning outcomes obtained by the students themselves.

## 3. RESULT AND DISCUSSION

### Result

Analysis phase consists of 3 activities, namely requirements analysis, student characteristics analysis and curriculum analysis. First, *Requirement Analysis*. The development of interactive multimedia is based on the results of unstructured observations and interviews of the fifth-grade teachers at Elementary Schools in Padang City. There is an obstacle in the the human digestive system material, namely the image usage in the media is less effective to make students understand properly. The methods used by the teachers are they present a picture in front of the class, then ask students to pay attention to the picture. For detail information regarding the pictures, the teachers ask students to find them on the student's handbook. This causes students to not fully understand how the human digestive system works. From the observations, students are less enthusiastic to pay attention to the pictures provided. While the material of the human digestive system is abstract. They need media to deliver the abstract processes to concrete and clear understandings. Students need a real picture of how the digestive system's organs work. Besides, the development of the 4.0 industry era demands a change in learning systems that lead to the technology usage. Based on this analysis, it appears that technology-based learning media is needed to make students active. The learning media should be adjusted to the level of student development thus students do not get bored quickly during learning.

*Second, Characteristics Analysis*. This stage is carried out on the fifth-grade students of Elementary Schools in Padang City. In general, students in this class have a fairly active nature. However, this activity has not been well directed to positive things. This can be seen when the teacher starts the lesson by

displaying pictures, many students make comments. However, the teacher has not directed properly to make students less orderly. Besides, students get bored quickly and find it difficult to stay focused for a long time. It is seen when the teacher explains the lesson, only a small number of students pay attention. The rest are busy with their respective activities, some are talking with friends, asking permission to go out, glancing at the window, and so forth. Likewise, when teachers ask students to pay attention to the book, only a few are serious about reading the book. It seems like learning activities seem boring to them. This is different when teachers introduce interactive multimedia media. They looked enthusiastic watching the display on a computer screen. Especially in the current technological advancements, computers are familiar to them, but they have not been guided properly in operating them.

*Third, Curriculum Analysis.* Based on observation and information, student learning outcomes on midterm exams for 3 consecutive years are classical completeness <75%. Especially in Competency Standard 1, namely Identifying the function of human and animal organs. In this Competency Standard, there are still students who cannot identify the function of human organs. From the lesson plan, indicators of basic competency 1.3 not only ask students to know the digestive apparatus but also identify the function of the human digestive system. From this information, the researcher tries to modify the media used by the teacher in the form of text sheets into interactive multimedia. In several previous studies concluded that the use of interactive multimedia can improve student understanding. Analysis phase consists of 3 activities, namely requirements analysis, student characteristics analysis and curriculum analysis. The explanation is as follows: Based on the analysis results, it can be concluded that the technology-based learning media is needed on the digestive system material for elementary school students. To fulfil this need, interactive multimedia is developed on the human digestive system material for elementary school students.

In planning the product to be developed, the researchers had consulted with the fifth-grade teachers and other research teams. The result is the material to be delivered through interactive multimedia was related to identifying human and animal organs. Based on these competency standards, one basic competence is developed, which is identifying the function of the human digestive organ and its relationship with food and health, as in BC 1.3 of CS 1. Based on the basic competencies above, the researcher looks for relevant material related to the human digestive system. After determining the material, the researcher prepares the material thus the learning objectives are adjusted. Then the researcher makes a storyboard for material to support the media to be developed. At this planning stage, the researcher also made a grid of research instruments in the form of instrument validation, practicality.

The material used in creating this learning media is adapted to existing competencies, packaged using several applications before it becomes interactive multimedia. For learning materials, researchers chose digestive material in humans because the digestive system in humans cannot be observed directly. In this development, the researchers used the Macromedia Flash v.8 application. By using this application, the researcher packs all the material collected, in making this learning media the researcher combines images and the material meets the students' needs. In making this media, researchers pay attention to several aspects, namely graphic aspects (graphic design, sound effects), language aspects (use of EYD), material aspects (human digestive system, sub-materials identify the functions of the human digestive organs and their relationship with food and health. This will be validated by experts, while the validation results can be seen in [Table 1](#).

**Table 1.** Score of Validation

No	Validation	Graphic Aspect			Material Aspect			Language Aspect		
		Score	Results	Criteria	Score	Results	Criteria	Score	Results	Criteria
1	First Validation	54	2.7	Invalid	37	2.4	Invalid	26		Invalid
2	Second Validation	89	4.4	Valid	73	4.8	Very Valid	47	4.7	Very Valid

Base on [Table 1](#) shows that the first validation activity in the graphic aspect was categorized as invalid and after being revised, the second validation was categorized as valid. Furthermore, the results of the validation of the material aspects. The first validation in the material aspect was categorized as invalid and after being revised the second validation was categorized as very valid. Moreover, the results of the validation of linguistic aspects. The first activity in language aspects is categorized as invalid and after being revised the second validation was categorized as very valid. Therefore it can be concluded that the expert stated that interactive multimedia on the digestive system material for elementary school students

was valid in terms of graphic, material and linguistic aspects and suitable to use. The form of multimedia developed is show in [Figure 1](#).



**Figure 1.** The interactive Multimedia system of human digestion for elementary school students

Once declared valid, multimedia is implemented on a limited basis to predetermined elementary schools. This aims to determine the practicality and effectiveness of the media developed. The practicality test aims to determine the practicality of the media that has been developed. The practicality test consists of teacher aspects and student aspects. As for the results is show in [Table 2](#).

**Table 2.** Practicality Test

No	Aspect	Teacher Aspect			Student Aspect		
		Score	Value	Criteria	Score	Value	Criteria
1	Ease of use	445	91.67	Very Practical	450	89.28	Very Practical
2	Effectiveness of learning time	143	81.73	Practical	146	86.60	Very Practical
3	Benefits and attractiveness	450	93.75	Very practical	451	83.58	Practical
<b>Average</b>		-	<b>91.96</b>	<b>Very practical</b>	-	<b>89.03</b>	<b>Practical</b>

From the [Table 2](#), it can be seen that the developed media is stated to be very practical from the teacher aspect and practical from the student aspect. Then the effectiveness test is carried out. This effectiveness test aims to determine the effect of media usage on the learning objectives. This interactive multimedia is designed to increase students' understanding of the material of the human digestive system. The effectiveness of this test is carried out by using the instrument regarding the learning outcomes. The learning outcomes test is designed and adjusted to the competencies you want to improve. From the 21 students, only 1 student who has not met the minimum completeness criteria (KKM). This means that 95% of students have reached the KKM. This figure is greater when compared to the percentage of KKM achievement for mid-semester exams in the previous years which is around 48-68%. The evaluation stage is carried out along with the validity process and effectiveness test. When the validity of the product is evaluated by experts, revisions are made to be re-validated. Also, the effectiveness of the developed media is evaluated through tests given to students.

## Discussion

Based on the results of this development, it is stated that the interactive multimedia developed was declared valid, practical and effective. This research is supported by previous research. Research conducted by Reza who developed an interactive multimedia learning media on learning citizenship education for elementary school students ([Rachmadtullah, Zulela M, Sumantri, 2018](#)). The developed media was declared effective in improving the learning outcomes of elementary school student citizenship education. His study also supports this research. The results prove that interactive multimedia developed is effective in helping elementary school students learn to read. Previous study also support this research, the results prove that interactive multimedia to improve social studies learning outcomes of elementary school students ([Suwarti et al., 2019](#)). Other research also stated that AME-based interactive multimedia can improve student learning activities ([Saputri et al., 2018](#)).

This research is different from previous studies. This research develops interactive multimedia on science learning regarding digestive system material. This study visualizes the abstract digestion of the digestive system as concrete thus elementary school students understand more about the digestive system material. Therefore, in this study, the media is declared valid, practical and effective.

The validity of the media is due to several factors. The development of this media conducted by paying attention to aspects of graphics, material, and language. Good interactive multimedia is a media that pays attention to graphic, material, and language (Sherlyane Hendri et al., 2019; Yeo, 2021). This media was developed by paying attention to graphic design and sound effects suitable to the characteristics of elementary school students. Elementary school students like the striking color hence it can attract their attention (Suwarti et al., 2019; Wahyuni et al., 2020).

Then, in this development, the multimedia display is strengthened with attractive colors and added with simple images following the visualization of elementary school students. Besides graphically the developed media combines dancing sound effects. This sound effect aims to attract the attention of students (Sharon & Baram-Tsabari, 2020; Suryanti et al., 2018). Sound effects also aim to make students feel comfortable with simple music and become relaxed. Appropriate music will lead to enthusiasm and motivation in the learning process (García et al., 2020; Virkkula, 2020). Interactive CDs educate students comprehensively to understand the content swiftly and interestingly. With interactive CDs (compact disks), children can study independently and without the need for an instructor. In contrast to conventional storage media like placent discs or hard discs, students can start learning whenever they want and can make their own choices. Additionally, the package shows graphics that students can view in-person. With the help of this medium, it is hoped that students will be able to learn efficiently and give grade 5 children at SDN 28 Ganting Selatan a variety of experiences, particularly when learning science.

This media is also presented practically by teachers and students. Practical learning media will support the achievement of learning objectives. And than This media is also able to make students able to easily adapt themselves in the learning process that includes knowledge transfer activities for the better (El Islami & Nuangchalerm, 2020; Gustinasari et al., 2017). This media was developed based on an easy use process, the effectiveness of learning time as well as the benefits and attractiveness of this media which is able to support the learning process in order to increase the level of understanding of students (Sartono et al., 2022; Zulkifli, 2018). This media was developed by paying attention to the teacher and student characteristics thus they can easily use this media. The multimedia used must be made to be able to imitate the use of the teacher in the learning process so that the media is able to achieve the expected learning objectives (Ghofur & Youhanita, 2020; Susanto et al., 2021). This media was developed by paying attention to the characteristics of students consequently students can reach their learning goals to the maximum without any tedious learning process. This media was developed by utilizing technology, because combining technology in classroom learning will be able to make achieving educational goals easily within the limitations of policy and pedagogical support (Abbasi et al., 2018; Qurat-ul-Ain et al., 2019).

Implication of this study was to developed media is facilitated with instructions for use hence teachers and students easily understand material. Also, the material presented is simple and deep therefore students easily understand learning leading to the effectiveness of time. Besides, the picture presented also makes it easier for students and teachers to understand learning, as a result, students quickly understand the material. The limitation of this research lies in the limited time for product implementation, and the material integrated is still very limited. Therefore, it is hoped that future research will be able to deepen and broaden the scope of research related to interactive multimedia on learning achievement.

#### 4. CONCLUSION

The study's findings demonstrate the validity, applicability, and efficiency of the interactive multimedia that was created. In grade V elementary school, the study of the digestive system can benefit from the use of interactive multimedia. In this study, it was proven by almost 95% of students getting scores above the minimum completeness limit that had been determined in the previous year's midterm exam which was in the range of 48-68%. So that by applying this interactive learning media, the level of student understanding increases as evidenced by the mid-semester test scores obtained.

#### 5. REFERENCES

- Abbasi, S., Moeini, M., Shahriari, M., Ebrahimi, M., & Khoozani, E. K. (2018). Designing and manufacturing of educational multimedia software for preventing coronary artery disease and its effects on

- modifying the risk factors in patients with coronary artery disease. *Electronic Journal of General Medicine*, 15(3), 1–6. <https://doi.org/10.29333/ejgm/85942>.
- Al Sultan, A., Henson, H., & Lickteig, D. (2021). Assessing preservice elementary teachers' conceptual understanding of scientific literacy. *Teaching and Teacher Education*, 102, 103327. <https://doi.org/10.1016/j.tate.2021.103327>.
- Aldoobie, N. (2015). ADDIE Model. *American International Journal of Contemporary Research*, 5(6). [www.aijcrnet.com/journals/Vol\\_5\\_No\\_6\\_December\\_2015/10.pdf](http://www.aijcrnet.com/journals/Vol_5_No_6_December_2015/10.pdf).
- Anif, S., Sutopo, A., & Prayitno, H. J. (2020). Lesson study validation: Model for social and natural sciences teacher development in the implementation of national curriculum in Muhammadiyah schools, Indonesia. *Universal Journal of Educational Research*, 8(1), 253–259. <https://doi.org/10.13189/ujer.2020.080132>.
- Baquier Orozco, R., Barraza Castillo, R. I., & Husted Ramos, S. (2020). Neoaltar: An interactive multimedia day of the dead experience. *Heliyon*. <https://doi.org/10.1016/j.heliyon.2020.e03339>.
- Branch, R. M. (2010). Instructional design: The ADDIE approach. In *Instructional Design: The ADDIE Approach*. <https://doi.org/10.1007/978-0-387-09506-6>.
- El Islami, R. A. Z., & Nuangchalerm, P. (2020). Comparative study of scientific literacy: Indonesian and thai pre-service science teachers report. *International Journal of Evaluation and Research in Education*, 9(2), 261–268. <https://doi.org/10.11591/ijere.v9i2.20355>.
- Eliyasni, R., Kenedi, A. K., & Sayer, I. M. (2019). Blended Learning and Project Based Learning: The Method to Improve Students' Higher Order Thinking Skill (HOTS). *Jurnal Iqra': Kajian Ilmu Pendidikan*, 4(2), 231–248. <https://doi.org/10.25217/ji.v4i2.549>.
- Fawley, K. D., Stokes, T. F., Rainear, C. A., Rossi, J. L., & Budd, K. S. (2020). Universal TCIT Improves Teacher–Child Interactions and Management of Child Behavior. *Journal of Behavioral Education*, 29(4), 635–656. <https://doi.org/10.1007/s10864-019-09337-6>.
- Fitria, Y., Helsa, Y., Nirwana, H., & Zulkarnaini, A. P. (2018). The integration of science and math. *Journal of Physics: Conference Series*, 1088. <https://doi.org/10.1088/1742-6596/1088/1/012041>.
- García, E. G., Magaña, E. C., & Ariza, A. C. (2020). Quality education as a sustainable development goal in the context of 2030 agenda: Bibliometric approach. *Sustainability (Switzerland)*, 12(15), 1–18. <https://doi.org/10.3390/SU12155884>.
- Ghofur, A., & Youhanita, E. (2020). Interactive Media Development to Improve Student Motivation. *IJECA (International Journal of Education and Curriculum Application)*, 3(1), 1–11. <https://doi.org/10.31764/ijeca.v3i1.2026>.
- Gustinasari, M., Lufri, & Ardi. (2017). Pengembangan Modul Pembelajaran Berbasis Konsep Disertai Contoh pada Materi Sel untuk Siswa SMA. *Bioeducation Journal*, 1(1), 2354–8363. <http://ejournal.unp.ac.id/index.php/bioeducation/article/view/7154>.
- Helsa, Y., Ariani, Y., & Kenedi, A. (2021). Digital Class Model in Mathematics Learning in Elementary School Using Social Learning Network Schoology. *Advances in Social Science, Education and Humanities Research*, 382(Icet 2019), 2016–2019. <https://doi.org/10.4108/eai.4-11-2020.2304599>.
- Indriani, A. (2016). Pengaruh Motivasi Belajar Siswa Kelas V Terhadap Prestasi Belajar Matematika Di Sd Negeri Bejirejo Kecamatan Kunduran Kabupaten Bloro. *JIPM (Jurnal Ilmiah Pendidikan Matematika)*, 4(2), 134. <https://doi.org/10.25273/jipm.v4i2.848>.
- Kalkan, Ö. K., Altun, A., & Atar, B. (2020). Role of teacher-related factors and educational resources in science literacy: An international perspective. *Studies in Educational Evaluation*, 67(August). <https://doi.org/10.1016/j.stueduc.2020.100935>.
- Kiswanto, A. (2017). The Effect Of Learning Methods And The Ability Of Students Think Logically To The Learning Outcomes On Natural Sciences Of Grade Iv'S Student. *Advances in Social Science, Education and Humanities Research*, 118, 1040–1046. <https://doi.org/10.2991/icset-17.2017.168>.
- Magdalena, I., Hidayah, A., & Safitri, T. (2021). Analisis Kemampuan Peserta Didik pada Ranah Kognitif, Afektif, Psikomotorik Siswa Kelas II B SDN Kunciran 5 Tangerang. *Jurnal Pendidikan Dan Ilmu Sosial*, 3(1), 48–62. <https://doi.org/10.36088/nusantara.v3i1.1167>.
- Mtsi, N. (2021). Examining The Support Given To Teachers To Promote Science Learning And Science Literacy In Selected South African Schools. *PONTE*, 77(4), 56–75. <https://doi.org/10.21506/j.ponte.2021.4.4>.
- Mutohhari, F., Sofyan, H., & Nurtanto, M. (2021). Technological Competencies: A Study on the Acceptance of Digital Technology on Vocational Teachers in Indonesia. *Proceedings of the 1st International Conference on Law, Social Science, Economics, and Education, ICLSSEE 2021*, 1–11. <https://doi.org/10.4108/eai.6-3-2021.2305971>.
- Nurtanto, M., Sofyan, H., Fawaid, M., & Rabiman, R. (2019). Problem-based learning (PBL) in industry 4.0: Improving learning quality through character-based literacy learning and life career skill (LL-

- LCS). *Universal Journal of Educational Research*, 7(11), 2487–2494. <https://doi.org/10.13189/ujer.2019.071128>.
- Purwani, E., Hasan, K., & Alamsyah, H. (2021). *Peningkatan Hasil Belajar dengan Menggunakan Model Problem Based Learning Pendekatan SSTEAM Pada Siswa*. 3(3), 296–302. <https://doi.org/10.26858/tj.v2i3.26764>.
- Qurat-ul-Ain, quratulain raja15@gmail.com, Shahid, F., Aleem, M., Islam, M. A., Iqbal, M. A., & Yousaf, M. M. (2019). A review of technological tools in teaching and learning computer science. *Eurasia Journal of Mathematics, Science and Technology Education*, 15(11). <https://doi.org/10.29333/ejmste/109611>.
- Rachmadtullah, Zulela M, Sumantri, M. S. (2018). Interactive Multimedia Development Based on Scientific Approach to Civic Education Subjects in Elementary School. *Interciencia Journal*, 43, 13–21. [https://www.researchgate.net/profile/Reza-Rachmadtullah/publication/326570674\\_Interactive\\_Multimedia\\_Development\\_Based\\_on\\_Scientific\\_Approach\\_to\\_Civic\\_Education\\_Subjects\\_in\\_Elementary\\_School/links/5b5697dca6fdcc8dae3fcf08/Interactive-Multimedia-Development-Based-on-Scientific-Approach-to-Civic-Education-Subjects-in-Elementary-School.pdf](https://www.researchgate.net/profile/Reza-Rachmadtullah/publication/326570674_Interactive_Multimedia_Development_Based_on_Scientific_Approach_to_Civic_Education_Subjects_in_Elementary_School/links/5b5697dca6fdcc8dae3fcf08/Interactive-Multimedia-Development-Based-on-Scientific-Approach-to-Civic-Education-Subjects-in-Elementary-School.pdf).
- Rachmadtullah, R., Yustitia, V., Setiawan, B., Fanny, A. M., Pramulia, P., Susiloningsih, W., Rosidah, C. T., Prastyo, D., & Ardhian, T. (2020). The Challenge of Elementary School Teachers to Encounter Superior Generation in the 4.0 Industrial Revolution: Study Literature. *International Journal of Scientific and Technology Research*, 9(4), 1879–1882. [https://www.researchgate.net/profile/Reza-Rachmadtullah/publication/340886839\\_The\\_Challenge\\_Of\\_Elementary\\_School\\_Teachers\\_To\\_Encounter\\_Superior\\_Generation\\_In\\_The\\_4\\_0\\_Industrial\\_Revolution\\_Study\\_Literature/links/5ea2b9a492851c87d1b1066f/The-Challenge-Of-Ele](https://www.researchgate.net/profile/Reza-Rachmadtullah/publication/340886839_The_Challenge_Of_Elementary_School_Teachers_To_Encounter_Superior_Generation_In_The_4_0_Industrial_Revolution_Study_Literature/links/5ea2b9a492851c87d1b1066f/The-Challenge-Of-Ele).
- Rahmatina, Kenedi, A. K., Eliyasni, R., & Fransyaigu, R. (2019). Jigsaw using animation media for elementary school. *Journal of Physics: Conference Series*, 1424(1). <https://doi.org/10.1088/1742-6596/1424/1/012027>.
- Rosalina, S. S., & Suhardi, A. (2020). Need Analysis of Interactive Multimedia Development With Contextual Approach on Pollution Material. *INSECTA: Integrative Science Education and Teaching Activity Journal*, 1(1), 93. <https://doi.org/10.21154/insecta.v1i1.2107>.
- Saputri, D. Y., Rukayah, R. R., & Indriayu, M. I. (2018). Integrating Game-based Interactive Media as Instructional Media: Students' Response. *Journal of Education and Learning (EduLearn)*, 12(4), 638–643. <https://doi.org/10.11591/edulearn.v12i4.8290>.
- Sartono, E. K. E., Ambarsari, R., & Herwin, H. (2022). Interactive multimedia based on Indonesian cultural diversity in Civics learning in elementary schools. *Cypriot Journal of Educational Sciences*, 17(4), 1192–1203. <https://doi.org/10.18844/cjes.v17i4.7136>.
- Sendurur, E. (2018). The Pedagogical Beliefs and Instructional Design Practices: Pre-Service IT Teachers' Case. *Egitim Arastirmalari - Eurasian Journal of Educational Research*, 2018(75), 59–80. <https://doi.org/10.14689/ejer.2018.75.4>.
- Sharon, A. J., & Baram-Tsabari, A. (2020). Can science literacy help individuals identify misinformation in everyday life? *Science Education*, 104(5), 873–894. <https://doi.org/10.1002/sc.21581>.
- Sherlyane Hendri, S., Hendri, S., Kiswanto Kenedi, A., Helsa, Y., & Anita, Y. (2019). Elementary School Teacher Ability in Using Application Technology for Mathematics Learning Assessment in the 2013 Curriculum. *Advances in Social Science, Education and Humanities Research*, 382(Icet), 446–449. <https://doi.org/10.2991/icet-19.2019.112>.
- Siang, J. L., Sukardjo, M., Salenussa, B. J. M., Sudrajat, Y., & Khasanah, U. (2020). Pengaruh Model Pembelajaran dan Kemampuan Berpikir Kreatif Terhadap Hasil Belajar IPA Siswa SMP. *JTP - Jurnal Teknologi Pendidikan*, 22(1), 40–52. <https://doi.org/10.21009/jtp.v22i1.15329>.
- Sinyanyuri, S., Utomo, E., Sumantri, M. S., & Iasha, V. (2022). Literasi Sains dan Asesmen Kompetensi Minimum (AKM): Integrasi Bahasa dalam Pendidikan Sains. *Jurnal Basicedu*, 6(1), 1331–1340. <https://doi.org/10.31004/basicedu.v6i1.2286>.
- Sudana, I. P. A., & Wesnawa, I. G. A. (2017). Penerapan Model Pembelajaran Kooperatif Tipe Stad Untuk Meningkatkan Hasil Belajar Ipa Siswa Kelas Ii Sekolah Dasar. *Jurnal Ilmiah Sekolah Dasar*, 1(1), 1–8. <https://doi.org/10.33578/jpkip.v7i1.5359>.
- Suryanti, Ibrahim, M., & Ledo, N. S. (2018). Process skills approach to develop primary students' scientific literacy: A case study with low achieving students on water cycle. *IOP Conference Series: Materials Science and Engineering*, 296(1). <https://doi.org/10.1088/1757-899X/296/1/012030>.
- Susanto, H. A., Hobri, & Nugrahaningsih, T. K. (2021). Developing a handbook on multimedia integration in mathematics teaching for Indonesian primary school students. *International Journal of Education*

- in *Mathematics, Science and Technology*, 9(2), 236–251. <https://doi.org/10.46328/IJEMST.1550>.
- Suwarti, S., Restu, R., & Hidayat, H. (2019). Interactive Multimedia Development in Social Sciences Subject of Disaster Material at Grade IV SDN. (Public Elementary School) No.024183 East Binjai on 2017/2018. *Budapest International Research and Critics in Linguistics and Education (BirLE) Journal*, 2(1), 216–232. <https://doi.org/10.33258/birle.v2i1.211>.
- Virkkula, E. (2020). Evaluating motivational characteristics in vocational music education within the perspective of self-determination theory. *Empirical Research in Vocational Education and Training*, 12(1), 1. <https://doi.org/10.1186/s40461-020-00098-5>.
- Wahyuni, L. T. S., Japa, I. G. N., & Rati, N. W. (2020). Correlation of Reading Interests and Learning Motivation Toward Science Learning Outcomes. *Jurnal Ilmiah Sekolah Dasar*, 4(3), 484. <https://doi.org/10.23887/jisd.v4i3.25376>.
- Wiryanto, W. (2020). Proses Pembelajaran Matematika Di Sekolah Dasar Di Tengah Pandemi Covid-19. *Jurnal Review Pendidikan Dasar: Jurnal Kajian Pendidikan Dan Hasil Penelitian*, 6(2), 125–132. <https://doi.org/10.26740/jrpd.v6n2.p125-132>.
- Yalvema Miaz, Y., Miaz, Y., Kiswanto Kenedi, A., Wachyunaldi Monfajri, S., & Helsa, Y. (2019). Educative Learning Media for Elementary School Students. *Advances in Social Science, Education and Humanities Research*, 382(Icet), 722–727. <https://doi.org/10.2991/icet-19.2019.173>.
- Yeo, M. M. L. (2021). Social media and social networking applications for teaching and learning. *European Journal of Science and Mathematics Education*, 2(1), 53–62. <https://doi.org/10.30935/scimath/9400>.
- Zulkifli, Z. (2018). Upaya Guru Mengembangkan Media Visual dalam Proses Pembelajaran Fiqih di MAN Kuok Bangkinang Kabupaten Kampar. *Al-Hikmah: Jurnal Agama Dan Ilmu Pengetahuan*, 14(1), 18–37. [https://doi.org/10.25299/al-hikmah:jaip.2017.vol14\(1\).1170](https://doi.org/10.25299/al-hikmah:jaip.2017.vol14(1).1170).
- Zuryanty, Kenedi, A. K., Chandra, R., Hamimah, & Fitria, Y. (2019). Problem based learning: A way to improve critical thinking ability of elementary school students on science learning. *Journal of Physics: Conference Series*, 1424(1). <https://doi.org/10.1088/1742-6596/1424/1/012037>.