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# Development of Interactive Media Using Macromedia Flash 8 Software in Natural Sciences Subjects in Elementary Schools

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**ABSTRACT**

This research aims to develop interactive media using Macromedia Flash 8 software in science and technology subjects in elementary schools. This research uses a Research and Development (R&D) approach with the Analysis, Design, Develop, Implement, Evaluate (ADDIE) model. It was conducted at three elementary schools in West Sumatra with fourth-grade students as research subjects. Qualitative and quantitative data were obtained from teacher and student practicality questionnaires, as well as evaluation tests in the form of pretest and posttest. Data collection utilized validation sheets, questionnaires, and evaluation tests. The results of the interactive multimedia validity test based on Macromedia Flash 8 were found to be in a very valid category (scoring 81-100% based on expert assessments) with an average percentage of 90%. The practicality assessment yielded an average percentage of 88.5% in the highly practical category (scoring 85.01-100%). The effectiveness evaluation resulted in an N-Gain Score (a metric measuring the increase between pre and post-test scores) of 0.77, indicating a high level of gain, and a percentage of 77.87 in the effective category.The evaluations affirm that Macromedia Flash 8-based interactive media is valid, practical, effective, and suitable for educational use in enhancing science learning for elementary students. The findings have implications for integrating such multimedia tools in science curriculum design and teacher training to facilitate more engaging and effective delivery of abstract scientific concepts. Future research could explore wider implementation and long-term impacts on student learning outcomes.



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## 1. INTRODUCTION

The science subject is the result of integration between two subjects, namely natural sciences (natural sciences) and social sciences (social sciences), to enable students to understand the environment around them, which includes natural phenomena and social phenomena. Science subjects are a field of science that includes learning about various types of living creatures and non-living objects that exist in the universe, as well as how interactions between them occur. Apart from that, this subject also examines human life both as individuals and as part of a society that interacts with its environment (Nur et al., 2023).

Given the widespread use of Macromedia Flash in education, the innovative approach in this research lies in the specific application of this software for science subjects in elementary schools. The interactive multimedia content to be developed will be tailored to the characteristics of elementary school students and relevant science concepts, with interactive methods that actively involve students through animations, practice questions, and feedback. The integration with science education is done by presenting abstract theories and explanations in a more concrete and engaging visual form for elementary school students.

The problem that often arises in the field is that many students have difficulty recognizing and solving problems related to science subjects (Nur et al., 2023). In learning Natural Sciences (IPA), it is hoped that students will have many opportunities to develop skills by participating in various activities, including studying natural science events that are relevant to everyday life, observing natural objects or events, and practicing applying concepts. Science is used in everyday life situations, and various science experiments are carried out. However, in reality, science learning at the elementary school level faces challenges in becoming a subject that can provide students with a conceptual understanding of the environment around them while still offering an active and interesting learning experience. Elementary students often have difficulty understanding abstract science concepts, especially when these concepts are explained by the teacher (Wulandari, 2015).

In this situation, students need other alternatives in the learning process in class, such as learning media. The use of this learning media is expected to trigger students' interest and curiosity in learning (Damara et al., 2021). Based on field observations, it appears that learning media that can be found on the market or downloaded from the internet still does not meet the needs of teachers and students well. This is because the available learning media is less interactive, the material explained is incomplete, and students are not encouraged to participate actively. As a result, students who have critical and creative thinking abilities do not feel motivated to explore deeper knowledge and skills according to their level of learning independence (Sutiyanto et al., 2018).

One solution to overcome this problem is the use of interactive learning media. In the realm of interactive media, the imparting of educational content relies not solely on the teacher's involvement but also affords students the chance to actively participate in the learning experience (Damara et al., 2021). Interactive multimedia is a type of multimedia that allows users to interact with the content and have control over the next process that will be executed (Gunawan et al., 2017). Interactive multimedia can function as a tool in the learning process. Educational media serves as a tool for transmitting information or content, aiming to captivate the attention, interest, and emotions of students while also engaging their minds throughout the learning journey (Istiningsih et al., 2021).

The utilization of interactive educational media offers various advantages, including presenting concepts in a manner that is easily comprehensible, graspable, and well-organized. Interactive learning media also provides opportunities for students to learn according to their learning tempo, allowing them to learn more efficiently without feeling bored because it is supported by pictures, animations, and various types of practice questions. Repetition of material when the answer is wrong also helps students to better understand the lesson content. Apart from that, this interactive learning media can be used as an alternative to learning, both in groups and individually (Daniar & Sari, 2022).

Moreover, research by Rohmanurmeta (2018) indicates that the use of interactive multimedia significantly enhances students' listening skills, making the learning process more enjoyable, engaging, and meaningful. Interactive multimedia integrates text, sound, images, and video simultaneously, aiming to create a more captivating, effective, and efficient learning experience, thereby facilitating easier comprehension for students (Egok & Hajani, 2018). The application of multimedia in science education plays a crucial role, as it provides students with tangible examples and processes, reducing the need for abstract conceptualization (Syaflin, 2022). Macromedia Flash 8.0 has been identified as an effective tool for creating interactive media (Gift, 2017).

Macromedia Flash 8.0 is computer software used to create animations for learning media (Pratiwi & Jasril, 2019). This application has the advantage of being able to create animations and present them

interactively, which can stimulate students' interest in learning (Yuniasti & Wulandari, 2015). Macromedia Flash is very easy to learn and can be used to create various types of interactive multimedia, including presentations, games, film production, and website development. The resulting flash file is a movie file (Daniar & Sari, 2022).

The use of multimedia in learning provides students with the opportunity to explore the new knowledge they encounter more freely (Sylvia Lara Syaflin, 2022). Flash-based interactive multimedia was declared valid by experts and supported by a completion percentage of the mathematical communication skills test of 85.59% so that the learning multimedia developed was suitable for use and met the criteria of being valid, practical, and effective (Gute, 2017). The same results were also found in research (Hodiyanto et al., 2020) which states that the use of Macromedia Flash in developing interactive multimedia has been proven valid and effective in overcoming challenges in the learning process.

Additionally, research (Simbolon et al., 2017) stated that the use of learning applications based on Macromedia Flash increases students' ability to think critically through the application of problem-solving methods. Compared to not using Adobe Flash-based multimedia learning applications, using Macromedia Flash has also been proven to improve student learning outcomes. Correspondingly, (Istiqlal, 2017) Interactive learning multimedia has great potential to motivate students to respond positively to learning material.

According to research (Wardani & Setyadi, 2020), Macromedia Flash-based interactive media can activate and stimulate students' thinking, allowing them to manipulate concepts and turn abstract things into real ones. This has the potential to encourage the development of higher-order thinking Skills (HOTS) in students. Apart from simply displaying learning material, interactive media based on Macromedia Flash also actively involves students, such as in answering practice questions presented through this media. In his research, (Arisanti & Adnan, 2021) media development with Macromedia Flash has been proven to be effective in the learning process and can increase student motivation, encouraging student enthusiasm for learning

The latest in this research is developing interactive media using Macromedia Media Flash 8 software in elementary school science and science learning. The results of this development can later be used as a reference in alternative teaching materials to improve student learning outcomes. Illustrations that can be displayed in teaching materials can help students imagine science theory, which is generally abstract. Apart from that, with the help of this media application feature, it can be designed with an appearance that is as attractive as possible according to the needs and characteristics of children at elementary school age. This will certainly increase students' interest and enthusiasm for learning in learning.

Based on the information contained in this background, it appears that there is a need for research to develop teaching materials in the form of learning multimedia. This is considered a relevant option for overcoming challenges and problems that arise in the learning process for science subjects, with the title "Development of Interactive Media Using Macromedia Flash 8 Software in Natural Sciences Subjects in Elementary Schools". The main objective of this research is to develop an attractive, effective and appropriate Macromedia Flash 8-based interactive learning media for science learning in elementary schools. Specifically, this research will design interactive multimedia content that visualizes science concepts in a more concrete way and actively involves students through animations, exercises, and feedback. This approach has not been widely applied previously in the context of science in elementary schools. The potential impact of this research is to create an innovative and engaging teaching material alternative for elementary school students, thereby increasing their interest, understanding, and learning outcomes in science subjects. For teachers, the findings of this research will provide new media to enrich science teaching. As for curriculum developers, this research can provide insights into the use of interactive multimedia in future elementary school science curricula.

## 2. METHODS

The research and development (R&D) research method was used in this research. Development model (ADDIE) Analysis, Design, Development, Implementation, Evaluate (Suryani, 2018). At the analysis stage, curriculum evaluation is carried out and student needs are identified. In the design stage, flowcharts and interactive multimedia storyboards are prepared. At the development stage, a product feasibility test is carried out by validating the developed teaching materials with validators, media experts, and material experts. During the implementation phase, trials of interactive multimedia were conducted to assess the feasibility and efficiency of the multimedia. At the evaluation stage, improvements are made based on the evaluation results that have been found (Damara et al., 2021).

This research was carried out in elementary schools located in Gugus IV 3 Koto Silungkang, Palembayan District, Agam Regency, namely SDN 09 Gumarang, SDN 20 Gumarang, and SDN 35 Gumarang. The subjects in this development media research were fourth-grade elementary school students. These schools were selected through convenience sampling based on their proximity and accessibility to the researcher. The selection of fourth-grade students was random to provide more context regarding the representativeness of the sample. This research incorporates both qualitative and quantitative data, with qualitative information derived from questionnaires administered to teachers and students. Quantitative data, on the other hand, involves computing the average values obtained from assessments and evaluating validity, practicality, and effectiveness through the N-Gain Score method. These values will then be compared with the ideal score standard to assess the feasibility level of the product that has been developed (Bella Amanda et al., 2023).

The data collection technique used in this research uses data collection instruments, namely, validity instruments, teacher and student validity instruments, and evaluation tests in the form of pretests and posttests. Validity instruments are used to determine the validity of interactive multimedia in the form of media aspects and material aspects. The practicality instrument is used to determine the practicality of interactive multimedia, and the N-gain test is used to determine the effectiveness of interactive multimedia (Bella Amanda et al., 2023).

The data obtained is then assessed. The first step is to test the validity of the product design to assess whether the resulting product is valid or not. The results of the validity instrument assessment are presented in the form of a Likert scale, which functions to measure individual or group opinions, attitudes, and responses to social situations(Sugiyono, 2016).

**Table 1.** Likert Scale Table

| Rating | Score |
|---|---|
| Very good | 5 |
| Good | 4 |
| Currently | 3 |
| Bad | 2 |
| Very bad | 1 |

The validity of media and material can be calculated using the following method (Faizah, N. et al., 2017):

$$\text{Vah} = \frac{Tah}{Tsh} \text{x } 100\%$$

The assessment results obtained will then be interpreted according to the table below:

**Table 2.** Validity Criteria

| Achievement Rate (%) | Validity Category |
|---|---|
| 81-100% | Very valid, very effective, very complete, and can be used without correction |
| 61-80% | Valid enough, effective enough, complete enough, can be used but needs minor improvements |
| 41-60% | Invalid, less effective, less complete, needs major improvement, it is recommended not to use it. |
| 21-40% | Invalid, ineffective, incomplete, cannot be used |
| 0-20% | Very invalid, very ineffective, very incomplete, not usable |

Next is the assessment of the practicality instrument for teachers and students. The practicality of teachers and students can be calculated using the following formula (Winarti, 2013):

$$P = \frac{TSe}{TSh} x\ 100\%$$

**Table 3.** Practicality Criteria

| Percentage (%) | Qualification | Follow-up |
|---|---|---|
| 85.01-100% | Very Practical | Implementation |
| 70.01-85% | Quite Practical | Revision, Implementation |
| 50.01-70% | Less Practical | Major Revision |
| 1-50% | Impractical | Major Revision |

Subsequently, an efficacy assessment of interactive media was conducted to ascertain variations in student learning outcomes both before and following the utilization of the media, utilizing the N-Gain score test. In analyzing the effectiveness of the pretest and posttest results using the N-Gain Score with the following formula:

$$N - Gain = \frac{Spost - Spre}{Smaks - Spre} \times 100$$

Information :

Spost = Posttest score

Spre = Pretest score

Smax = Ideal maximum score (100)

The calculation results using the formula are then interpreted into the N-Gain value criteria categories shown in the following table:

**Table 4**. N-Gain Score Assessment Criteria

| N-Gain Value | Category |
|---|---|
| n-gain ≥ 0.7 | Tall |
| 0.7 > n-gain ≥ 0.3 | Currently |
| n-gain < 0.3 | Low |

The findings from this study are expected to provide valuable insights into the design, development and implementation of interactive multimedia specifically for science learning in primary schools. As such, this research contributes to a more comprehensive understanding of the role and potential of interactive media in enhancing students' learning experiences and their learning outcomes.

## 3. FINDINGS AND DISCUSSION

The creation of interactive media is geared towards aiding students in comprehending educational content and fostering enthusiasm for learning. Additionally, interactive media serves as a source of inspiration for teachers, encouraging them to devise more innovative learning materials. In this study, the ADDIE development model was employed to craft interactive multimedia centered on science lessons for elementary school, utilizing Macromedia Flash 8. This development consists of five stages.

The first stage namely the problem analysis and needs analysis stages. The problem analysis stage is carried out using interviews and observations. From the results of the analysis, the problem was that the learning media used by teachers was less interesting and still only used visual media and there was still a lack of IT media used by teachers in Cluster IV 3 Koto Silungkang, Palembayan District, Agam Regency. Science learning presented to students is still carried out using minimal media. This will certainly make things difficult for students because science has an abstract learning context and is difficult to imagine if it is not taught well. Based on these problems, researchers concluded that it is necessary to develop interactive media in the learning process to be able to clearly describe the abstract context of science and science learning in elementary schools. The use of interactive media can make it easier for students to understand and receive material because it is presented in the form of images, animation, audio, and video. Based on this analysis of problems and needs, researchers feel it is necessary to develop interactive media based on Macromedia Flash 8 for natural and social science learning for fourth-grade elementary school.

Second is the planning stage (Design), which is carried out by developing a framework for the Macromedia Flash 8-based interactive media that will be developed. This includes: 1) Cover page, 2) Menu page, 3) Core Competencies, 4) Basic Competencies, 5) Indicators, 6) Learning Objectives, 7) Materials, 8) Quizzes. After the interactive multimedia framework has been prepared, the next step is to prepare a validity instrument to be used as a test instrument for the level of media validity before the media is used in the learning process.

The third phase namely the development stage, In this stage the researcher develops learning media, namely Interactive Multimedia based on Macromedia Flash 8 in elementary school science and science subjects. The following is a display of interactive multimedia based on Macromedia Flash 8.

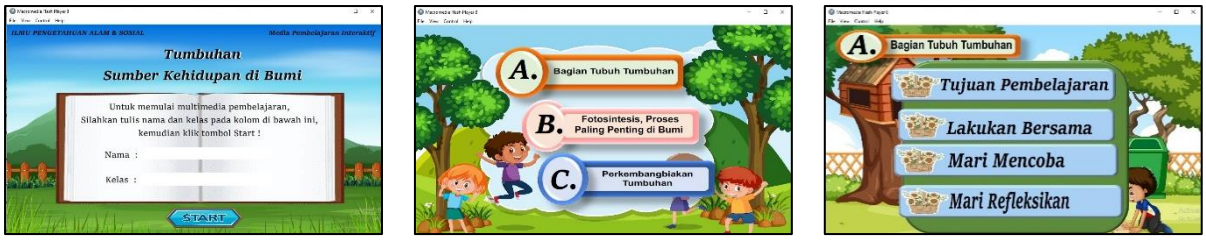


**Figure 1.** Media Display

After the developed media is ready, it will then be validated by media expert validators and material experts. Apart from validating, validators also provide suggestions and comments to improve the media. The following is a table of expert validation results:

**Table 5.** The Results of Expert Validation

| No | Validator | Average Percentage Score | Category |
|---|---|---|---|
| 1 | Media Expert | 92% | Very Valid (81-100%) |
| 2 | Materials Expert | 88% | Very Valid (81-100%) |
| Average | | 90% | Very Valid (81-100%) |

The average validation of interactive media by media experts obtained a validity score percentage of 92% in the very valid category. The average validation of interactive media by material experts obtained a validity score percentage of 88% in the very valid category. On average, the validation results for interactive media based on Macromedia Flash 8 obtained a validity score percentage of 90% in the very valid category. After all suggestions, input, and improvements by experts are added to interactive media, this media is valid to be implemented in elementary schools.

In the fourth stage namely the implementation stage, at this stage the media developed has been declared valid by expert validators and will then be implemented in class IV elementary schools located in Cluster IV 3 Koto Silungkang, Palembayan District, Agam Regency, namely SDN 09 Gumarang, SDN 20 Gumarang, and SD 35 Gumarang. The assessment of the feasibility of interactive multimedia based on Macromedia Flash is derived from practical instruments administered to both teachers and students following the integration of interactive media into the learning process. The outcomes of the practicality questionnaire for both teachers and students are presented in the following table.

**Table 6**. The Results of the Teacher and Student Practicality Questionnaire

| No | Respondent | Average Percentage Score | Category |
|---|---|---|---|
| 1 | Teacher Practicality Questionnaire | 91% | Very Practical (85.01-100%) |
| 2 | Student Practicality Questionnaire | 86% | Very Practical (85.01-100%) |
| | Average | 88.5% | Very Practical (85.01-100%) |

The analysis of the teacher practicality questionnaire yielded an average percentage of 91%, categorizing it as highly practical. The student practicality questionnaire analysis resulted in an average percentage of 86%, also falling within the highly practical category. The combined analysis of teacher and student responses indicated an average practicality result categorized as highly practical, with a score percentage of 88.5%.

Testing the effectiveness of interactive media based on Macromedia Flash 8 was obtained from student learning results using evaluation questions in the form of pretest and posttest. The evaluation questions were tested on class IV students at SDN 09 Gumarang, SDN 20 Gumarang, and SDN 35 Gumarang. The maximum completeness criteria (KKM) in these three schools apply the number 75, meaning that if students get a score ≥75 then they can be declared successful on that topic.

**Table 7.** The Results of The Effectiveness Test Using the N-Gain

| No | School name | Pre-Test | Post-Test | N-Gain Score | Category | N-Gain Score (%) | Category |
|---|---|---|---|---|---|---|---|
| 1 | SDN 09 Gumarang | 63.25 | 92.25 | 0.78 | Tall | 78.91 | Effective |
| 2 | SDN 20 Gumarang | 61.75 | 90.65 | 0.75 | Tall | 75.56 | Effective |
| 3 | SDN 35 Gumarang | 60.45 | 91.75 | 0.79 | Tall | 79.14 | Effective |
| Amount | | 185.45 | 274.65 | 2.32 | | 233.61 | |
| Average | | 61.81 | 91.55 | 0.77 | Tall | 77.87 | Effective |

The table demonstrates a significant enhancement in student learning outcomes, transitioning from the period prior to the implementation of Macromedia Flash 8-based interactive media to the

subsequent phase. Pre-test scores averaged 61.81 across the three schools, whereas post-test scores averaged 91.75. Analysis using the N-Gain test showed an average score of 0.77, categorized as high, with a percentage of 77.87 falling within the effective range across all three schools. These findings underscore the effectiveness of Macromedia Flash 8-based interactive media in improving student learning outcomes in science subjects.

Fifth is the evaluation stage; at this evaluation stage, the four previous stages are carried out. Evaluations involve media specialists, content experts, teachers, and students. This process aims to identify weaknesses in the developed learning media, specifically interactive multimedia utilizing Macromedia Flash 8. Any shortcomings discovered prompt researchers to promptly address them based on feedback and suggestions from experts. The ultimate goal is to ensure that the developed media is deemed appropriate for educational use.

***Discussion***

The findings of this research demonstrate the effectiveness of interactive media based on Macromedia Flash 8 in enhancing student understanding and engagement with abstract science concepts in elementary schools. Based on feedback from students and teachers, the multimedia tools facilitated learning by presenting theoretical explanations in a more concrete and visually engaging manner. Students expressed increased interest and motivation when using animations, interactive exercises, and immediate feedback features provided by the media. Teachers also noted that the interactive nature of the media helped students grasp complex concepts more easily by allowing them to actively manipulate and explore the material.

Notably, some unexpected findings emerged during the research process. Contrary to initial expectations, the interactive media appeared to benefit not only lower-performing students but also those with higher academic abilities. High-achieving students reported that the multimedia tools helped them reinforce their understanding and provided additional opportunities for self-paced learning (Swasti et al., 2022). This unanticipated outcome suggests that interactive media can cater to diverse learning needs and potentially enhance learning outcomes across various student profiles.

Another surprising result was the positive impact on student engagement and classroom dynamics. Teachers observed that the interactive media fostered more collaborative learning experiences, as students frequently shared their insights and assisted one another during multimedia activities (Cholila et al., 2019). This collaborative dynamic contrasted with the traditional teacher-centered approach, indicating the potential of interactive media to promote more student-centered and participatory learning environments.

While the overall findings were positive, it is important to acknowledge the limitations of this study. One constraint was the relatively small sample size, limited to three elementary schools in a specific geographic region. Consequently, the generalizability of the findings to other educational contexts or grade levels may be limited. Additionally, the research focused primarily on science subjects, and the effectiveness of the interactive media in other subject areas remains unexplored.

Furthermore, the study did not extensively examine potential biases or confounding factors that could have influenced the results. For instance, the novelty effect of introducing new technology or the influence of teacher characteristics on student engagement were not thoroughly investigated. Future research could address these limitations by incorporating larger and more diverse samples, exploring the applicability of interactive media across different subjects, and controlling for potential confounding variables.

Despite these limitations, the findings of this research have broader implications for the field of educational technology, curriculum development, and pedagogical practices in science education. The positive outcomes suggest that interactive multimedia tools like Macromedia Flash 8 can address emerging challenges in science education, such as fostering student engagement and catering to diverse learning styles (Tri Wulandari & Adam Mudinillah, 2022). Curriculum developers and policymakers

could consider integrating such tools into future science curricula, particularly for presenting abstract concepts or facilitating hands-on, interactive learning experiences.

Additionally, this research contributes to the ongoing discourse on effective pedagogical practices in the digital age. The success of the interactive media aligns with constructivist learning theories, which emphasize active learning, discovery, and student-centered approaches (Nurrita, 2018). Educators and teacher training programs could benefit from incorporating strategies for effectively utilizing interactive multimedia in their instructional practices.

Moving forward, continued research and development in interactive learning media are crucial to keep pace with technological advancements and evolving educational needs. Future studies could explore the potential of integrating emerging technologies, such as virtual reality or gamification, into interactive multimedia for science education. Additionally, investigating the long-term effects of interactive media on student achievement, critical thinking, and scientific literacy would provide valuable insights for educators and policymakers.

## 4. CONCLUSION

Using interactive multimedia, particularly Macromedia Flash 8, is highly effective for teaching elementary school science. This tool has been validated as practical and effective, significantly boosting students' understanding of science. Validation tests show a very high score of 90% for validity and 88.5% for practicality. Effectiveness tests yield an N-Gain Score of 0.77 and 77.87%, placing it in the high and effective categories. These findings suggest that integrating such multimedia tools into science curricula can enhance learning by making abstract concepts more tangible and engaging. Teachers should be trained to use these tools effectively, with programs focusing on selecting suitable multimedia, creating engaging content, and promoting interactive learning. The adoption of technologies like Macromedia Flash 8 supports current educational trends, emphasizing student engagement and the use of digital tools. Interactive multimedia addresses engagement issues by presenting content interactively, catering to different learning styles, and allowing for self-paced learning. Although the research has limitations due to its specific geographic focus and small sample size, future studies with larger, more diverse samples could offer broader insights. It is recommended that educators and policymakers integrate interactive multimedia in science education, allocate resources for teacher training, encourage collaboration in content development, support ongoing research, and establish best practices for its use. This approach can enhance science education, foster student engagement, and prepare students for the digital age.

## REFERENCES

Arisanti, Y., & Adnan, M. F. (2021). Pengembangan Multimedia Interaktif Berbasis Software Macromedia Flash 8 Untuk Meningkatkan Motivasi Dan Hasil Belajar Peserta Didik Sekolah Dasar. *Jurnal Basicedu*.

Bella Amanda, A., Amirul Mukmin, B., Eka Putri, K., & Artikel, I. (2023). *DIAJAR: Jurnal Pendidikan dan Pembelajaran Pengembangan Multimedia Interaktif Berbasis Macromedia Flash 8 pada Pembelajaran Ilmu Pengetahuan Alam Kelas V Sekolah Dasar*. *2*(1), 40–48. https://doi.org/10.54259/diajar.v2i1.1348

Cholila, A., Purwanto, P., & Hidayanto, E. (2019). Media Pembelajaran Matematika Materi Kombinatorika Berbasis Media Interaktif pada Siswa SMK. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *4*(4), 548. https://doi.org/10.17977/jptpp.v4i4.12379

Damara, A. D., Junaidi, I. A., & Rachmawati, P. A. (2021). Pengembangan Media Pembelajaran Interaktif Plant Flash Pada Materi Bagian-bagian Tumbuhan Untuk Siswa Kelas IV Sekolah Dasar. *Jurnal Inovasi Pendidikan Dan Pembelajaran Sekolah Dasar*, *5*(2), 160. https://doi.org/10.24036/jippsd.v5i2.114585

Daniar, F., & Sari, P. M. (2022). Pengembangan Multimedia Interaktif Macromedia Flash Berbasis Keterampilan Berfikir Kritis pada Pembelajaran IPA di Sekolah Dasar. *Jurnal Paedagogy*, *9*(4), 646. https://doi.org/10.33394/jp.v9i4.5463

Egok, A. S., & Hajani, T. J. (2018). Pengembangan Multimedia Interaktif pada Pembelajaran IPA bagi Siswa Sekolah Dasar Kota Lubuklinggau. *Journal of Elementary School (JOES)*, *1*(2), 141–157. https://doi.org/10.31539/joes.v1i2.446

Faizah, N., Roza, Y., & Kartini. (2017). Development Of Mathematics Learning Instrument Based On Discovery Learning To Social Arithmetic Matematika Berbasis Discovery Learning Untuk Materi Aritmatika Sosial SMP / Mts. *Jurnal Online Mahasiswa Fakultas Keguruan Dan Ilmu Pengetahuan*, *4*(2), 1–13.

Falahudin, I. (2014.). Pemanfaatan media dalam pembelajaran, *1*(4), 104–117.

Gunawan, G., Harjono, A., & Sutrio, S. G., & G., Harjono, A., & Sutrio, S. (2017). Multimedia Interaktif dalam Pembelajaran Konsep Listrik bagi Calon Guru. *Jurnal Pendidikan Fisika Dan Teknologi*, *1*(1), 9–14.

Gute, A. (2017). *Pengembangan Media Pembelajaran Berbasis Multimedia Interaktif Menggunakan Adobe Flash CS3 dengan Pendekatan Matematika Realistik untuk Meningkatkan Komunikasi Matematis Siswa pada Pokok Bahasan Lingkaran*. Mercu Buana University.

Hodiyanto, H., Darma, Y., & Putra, S. R. S. (2020). Pengembangan Media Pembelajaran Berbasis Macromedia Flash Bermuatan Problem Posing Terhadap Kemampuan Pemecahan Masalah Matematis. Musharraf. *Jurnal Pendidikan Matematika*, *9*(2).

Inkiriwang, R. R., Singal, R., & Roeroe, J. V. (2020). Kewajiban Negara Dalam Penyediaan Fasilitas Pendidikan Kepada Masyarakat Menurut Undang-Undang Nomor 20 Tahun 2003 Tentang Sistem Pendidkan Nasional. *Quarterly Journal of Health Psychology*, *8*(32), 73–92.

Istiningsih, S., Darmiany, Puji, F., & Muhammad, E. (2021). *Pengembangan media pembelajaran berbasis permainan monopoli di era new normal*. *4*(6), 911–920.

Istiqlal, M. (2017). Pengembangan Multimedia Interaktif Dalam Pembelajaran Matematika. *JIPMat*, *2*(1).

Karunia, F. S. (2017). *Pengembangan Media Pembelajaran Berbasis Macromedia Flash 8 Pelajaran IPA Materi Energi Listrik Kelas VI Di SD*.

Mukmin, B. A., & Primasatya, N. (2020). Pengembangan Multimedia Interaktif Macromedia Flash Berbasis K-13 Sebagai Inovasi Pembelajaran Tematik Untuk Siswa Sekolah Dasar. *Jurnal Pendidikan Dasar Nusantara*, *5*(2), 211–226.

Nur, H., Abidah, L., Agama, I., & Negeri, I. (2023). *Efektivitas Model Pembelajaran Make a Match terhadap Kemampuan Penyelesaian Masalah Siswa pada Mata Pelajaran Ilmu Pengetahuan Alam dan Sosial ( IPAS )*. *4*, 251–263.

Nurrita, T. (2018). Pengembangan media pembelajaran untuk meningkatkan hasil belajar siswa. *MISYKAT: Jurnal Ilmu-Ilmu Al-Quran, Hadist, Syari'ah Dan Tarbiyah*, *3*(1), 171.

Pratiwi, M. A., & Jasril, I. R. (2019). Pengaruh Penggunaan Macromedia Flash 8.0 Terhadap Hasil Belajar Dasar Listrik Dan Elektronika. *Jurnal Vokasional Teknik Elektronika Dan Informatika*, *7*.

Rohmanurmeta, F. M. R. (2018). Peningkatan Prestasi Belajar Menyimak Pada Pembelajaran Tematik Integratif Melalui Multimedia Interaktif Pada Siswa Sekolah Dasar. *Jurnal Bahasntra*, *38*(1), 29–33.

Simbolon, M., M., Surya, E., & Syahputra, E. (2017). The Efforts to Improving the Mathematical Critical Thinking Student's Ability through Problem-Solving Learning Strategy by Using Macromedia Flash. America Journal of Educational Research. *America Journal of Educational Research*, *5*(7), 725–731.

Sugiyono. (2016). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

Suryani, S. P. (2018). *Media Pembelajaran Inovatif dan Pengembangannya*. PT.Remaja Rosdakarya Offset.

Sutiyanto, Marzuki, & Sulistyarini. (2018). Pengembangan Media Pembelajaran Ilmu Pengetahuan Alam Berbasis Komputer Menggunakan Macromedia Flash 8 Di Sekolah Dasar. *Jurnal Pendidikan Dan Pembelajaran Khatulistiwa*, *6*(7), 10–27. https://medium.com/@arifwicaksanaa/pengertian-use-case-a7e576e1b6bf

Swasti, M., Hutapea, N. M., & Suanto, E. (2022). Pengembangan Media Pembelajaran Interaktif Berbasis Discovery Learning. *Jurnal Cendekia : Jurnal Pendidikan Matematika*, *6*(3), 2428–2441. https://doi.org/10.31004/cendekia.v6i3.1561

Sylvia Lara Syaflin. (2022). Pengembangan Multimedia Interaktif Berbasis Macromedia Flash Pada Materi Ipa Sekolah Dasar. *Jurnal Cakrawala Pendas*, *8*(4), 1516–1525. https://doi.org/10.31949/jcp.v8i4.3003

Tri Wulandari, & Adam Mudinillah. (2022). Efektivitas Penggunaan Aplikasi CANVA sebagai Media Pembelajaran IPA MI/SD. *Jurnal Riset Madrasah Ibtidaiyah (JURMIA)*, *2*(1), 102–118. https://doi.org/10.32665/jurmia.v2i1.245

Wahyugi, R., & Fatmariza, F. (2021). Pengembangan Multimedia Interaktif Menggunakan Software Macromedia Flash 8 Sebagai Upaya Meningkatkan Motivasi Belajar Siswa Sekolah Dasar. *Edukatif : Jurnal Ilmu Pendidikan*, *3*(3), 785–793. https://edukatif.org/index.php/edukatif/article/view/439

Wardani, K. W., & Setyadi, D. (2020). Pengembangan Media Pembelajaran Matematika Berbasis Macromedia Flash Materi Luas dan Keliling untuk Meningkatkan Motivasi Belajar Siswa. *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, *10*(1), 73–84. https://doi.org/10.24246/j.js.2020.v10.i1.p73-84

Winarti. (2013). Peningkatan Keaktifan Dan Hasil Belajar Siswa Pokok Bahasan Penyusutan Aktiva Tetap Dengan Metode Menjodohkan Kotak. *Dinamika Pendidikan*, *8*(2), 123–132.

Wulandari, A. Y. R. (2015). Pengembangan Media Pembelajaran IPA Berbasis Animasi Komputer Menggunakan Programmacromedia Flash 8. *Jurnal Pena Sains*, *2*(1), 35–43.

Yuniasti, A., & Wulandari, R. (2015). Pengembangan Media Pembelajaran Ipa Berbasis Animasi Komputer Menggunakan Program Macromedia Flash 8. *Jurnal Pena Sains*.

Yusra, M., Yunita, N. A., Nurhasanah, & Arliansyah. (2021). Efektivitas Pengelolaan Dana Bantuan Operasional Sekolah ( BOS ) pada SD di Kecamatan Jambo Aye , Aceh Utara : Partisipasi Stakeholder Sebagai Variabel Moderasi. *Visioner Dan Strategis*, *10*(3), 79–86.