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The Development of *Adobe Flash CS6*-Based Interactive Media to Improve Numerical Literacy Skills for *Madrasah Ibtidaiyah* Students

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Abstract

It is essential to improve students' numeracy literacy skills to apply concepts in everyday life and interpret information correctly, so interactive learning media is needed to support this. However, teachers need to be more optimal in using interactive learning media so that numeracy literacy skills are low. This study aimed to develop interactive media based on Adobe Flash Media CS6, the development used as ADDIE. The stages of this research model include Analysis, Design, Development, Implementation, and Evaluation. The results of this study indicate that the development of interactive learning media based on Adobe Flash CS6 can improve numeracy literacy skills. This can be seen from the average percentage of validity of 87% with very valid criteria, media expert validation of 78.3% with valid criteria, and practitioner validation of 94.2% with very valid criteria, besides that the average percentage of practicality obtained from the results of the black box testing questionnaire on five different types of android devices and types, 100% was successfully used. The percentage of effectiveness was 0.49, and the criteria were moderate. For this reason, interactive learning media based on Adobe Flash CS6 can be used as alternative learning at Madrasah Ibtidaiyah to improve numeracy literacy skills.

Keywords: Adobe Flash CS6; Numerical Literacy; Interactive Media; Improve; Madrasah Ibtidaiyah

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Abstrak

Kemampuan literasi numerasi siswa penting untuk ditingkatkan agar siswa dapat mengaplikasikan konsep dalam kehidupan sehari-hari serta menginterpretasi informasi dengan baik, sehingga diperlukan media pembelajaran interaktif untuk mendukung hal tersebut. Namun guru belum maksimal dalam menggunakan media pembelajaran interaktif sehingga kemampuan literasi numerasi rendah. Tujuan penelitian ini adalah untuk mengembangkan media interaktif berbasis adobe media flash cs6, pengembangan yang digunakan adalah ADDIE. Adapun tahapan dari model penelitian ini meliputi: Analysis, Design, Development, Implementation, dan Evaluation. hasil dari penelitian ini menunjukkan bahwa pengembangan media pembelajaran interaktif berbasis adobe flash cs6 dapat meningkatkan kemampuan literasi numerasi. Hal ini dapat dilihat dari rata-rata persentase kevalidan sebesar 87% kriteria sangat valid, validasi ahli media sebesar 78,3% kriteria valid, dan validasi praktisi sebesar 94,2% dengan kriteria sangat valid, selain itu rata-rata persentase kepraktisan yang diperoleh dari hasil angket uji coba blackbox testing pada 5 perangkat android yang berbeda jenis dan tipe sebesar 100% berhasil digunakan dan persentase keefektivan sebesar 0,49 kriteria sedang. Untuk itu media pembelajaran interaktif berbasis adobe flash cs6 bisa digunakan alternatif pembelajaran di Madrasah Ibtidaiyah untuk meningkatkan kemampuan literasi numerasi.

INTRODUCTION

The development of Information Technology (ICT)-based learning media, in general, has contributed to numerical literacy skills. Interactive media is very well used to improve the quality of students' numeracy (Miller, 2018). This is in line with the opinion put forward by Letwinsky (2017), which stated that when access to technology becomes more abundant, educators must realize the potential expansion of the benefits of using ICT to foster numerical literacy. Therefore ICT-based learning media plays an essential role because it can be used to make learning exciting and positively impact academic performance (Chuang, 2014, p.1969), in this case, numerical literacy skills.

However, based on the results of observations and interviews with several fifth-grade teachers, it was found that teachers only used *WhatsApp* media as an intermediary for delivering matters. *WhatsApp* was not only an intermediary for providing matters but also a means of communication between teachers and students.

MI Darussalam Brengkolo uses WhatsApp media to make learning videos that contain the flow of learning activities, namely opening activities (orientation), core activities (explanation of material), and closing activities (evaluation or assignment). Then they upload the video to *youtube* and will send the link via *WhatsApp*. The problem is that when online learning was carried out, students were less motivated if the learning activities were only limited to providing matters through learning videos.

This happens because teachers only used monotonous learning methods with closed questions, which impacted students' numerical literacy skills. Closed questions here defined as routine questions that are closed and can be directly solved by using a formula (Kartikasari, Kusmayadi, & Usodo, 2016). Even though on the other hand, students ideally need questions with mathematical reasoning, such as PISA (Putri, 2017).

To overcome the problems stated above, researchers offer interactive learning media to help students learn independently and with guidance. The media developed is a *Flash*-based application media which is also expected to help teachers deliver learning matters. The advantages of *Flash* media are not only used for web applications (Fanani, 2006) but can be developed to build desktop applications. The learning media developed by researchers can be used by students offline on their *Android* devices

without using the internet after installing it. Apart from being used on *Android*, this media can also be used on a PC.

This interactive learning media was developed using computer software, namely *Adobe Flash CS6*. *Adobe Flash* is a computer software specifically designed by *Adobe* and is a standard professional authoring tool application program used to create animations, webs, and interactive and dynamic applications. *Flash* is designed to create reliable and lightweight 2-dimensional animations, so *Flash* is widely used to build and provide animation effects on websites, interactive multimedia, animated films, games, and others (Atiaturrahmaniah & Ibrahim, 2017). *Flash*-based interactive media was developed containing learning objectives, matter summaries, exercises, and discussions, and supporting interactive learning multimedia packaged as innovative, effective, and practical. With this *Flash*-based interactive media, student learning activities are hoped to become more active, fun, and motivated.

Rahmaibu has carried out some previous research on learning media using similar software (2016) and stated that students had good conceptual understanding and completeness criteria above 86%. In addition, *Adobe Flash* media also received positive responses from students, and the media is effectively used in learning. Umbara and Nuraeni (2019), in their research results, explained that learning media using *Adobe Flash CS6* were considered suitable for use and succeeded in adding value to learning outcomes and students' literacy interests. In addition, Krismadinata (2019) research obtained results that the content contained in interactive media proved valid, practical, effective in improving learning outcomes, and valuable when used in learning activities. This is reinforced by research conducted by Mustarin *et al* (2019), which stated that learning activities became alive with the application of interactive learning media with *Adobe Flash CS6* in class. The use of these media also affects students' metacognition skills (Madinda, 2022).

Based on the results of research on *Adobe Flash* media, there has yet to research on numerical literacy skills, so in this study, it is necessary to develop media to improve numerical literacy skills. Numerical literacy skills are essential to give to students because, in the current era of globalization, people with the skills to discover new concepts, open networks, and the competence to meet high work standards are needed (Yusuf & Hayat, 2010). When a person has numerical literacy skills, that person can apply concepts in everyday life and interpret information well (Pangesti, 2018). The literacy skills in question are (1) mathematical communication skills, (2) mathematization skills, (3) representation skills, (4) reasoning and argumentation skills, (5) skills in devising problem-solving strategies, (5) skills to use symbolic, formal, and technical language, and (7) skills to use mathematical tools (OECD PISA; 2012). In addition, numerical literacy also involves mathematical reasoning (Purwasih, 2018), which gives students the power to use mathematical thinking in solving everyday problems to be better prepared to face life's challenges (Stecey & Tuner, 2007). Thus, this study focuses on developing *Adobe Flash* Media to improve numerical literacy skills in the mathematics subject of fractions.

METHODS

This research used the research and development type. This research was conducted in the fifth grade of MI Darussalam Brenggolo Kediri. In learning in fifth grade, most of the teachers used

WhatsApp as a learning medium, so learning is less interactive. This research was conducted to produce a product and test its feasibility. The product being developed was interactive learning media using *Adobe Flash CS6* software in the fifth grade of MI mathematics subject on addition and subtraction of fractions subject matter. The development model used is the Lee and Owens development model. The primary reason for this interactive learning media development model is using the Lee and Owens development model because this model is devoted to developing multimedia (Lee & Owens, 20004).

The development steps, according to Lee and Owens are: (1) Assessment/Analysis, which is divided into two parts, namely needs assessment and front-end analysis; (2) Design; (3) Development; (4) Implementation; (5) Evaluation. The development procedure is shown in Figure 1 as follows.

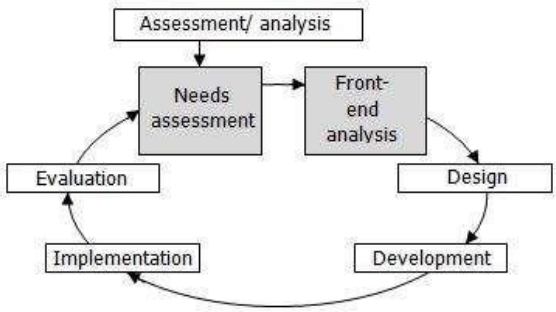

Figure 1. The Development Procedure (William W. Lee & Diana L. Owens, 2004)

Following the type of research, the type of data used in media development research is in the form of quantitative and qualitative data types. Quantitative data were obtained from validation questionnaire scores from experts and field practitioners (teachers), student response questionnaires, Black Box testing questionnaires, and the results of pre-test and post-test assessments. Meanwhile, qualitative data were obtained from interviews, criticisms, and media validators' suggestions. In this research, three types of data analysis techniques were used: **(1)** the validity analysis was obtained from validation questionnaire scores of matter experts, media experts, and field practitioners (homeroom teachers) with a questionnaire rating score ranging from 1 to 5. These scores were analyzed using a Likert scale in Table 1 and then managed with the validity formula.

Table 1. Likert Scale

No	Score	Description
1	Score 1	Very imprecise, inappropriate, unclear, unattractive, and not easy.
2	Score 2	Imprecise, inappropriate, unclear, unattractive, not easy.
3	Score 3	Sufficiently precise, appropriate, clear, attractive, and straightforward.
4	Score 4	Precise, appropriate, clear, attractive, and straightforward.
5	Score 5	Very precise, appropriate, clear, attractive, and straightforward.

(Source: Sugandi & Rasyid, 2019)

Validity Percentage Formula:

$$p = \frac{\sum X}{\sum X_1} \times 100\%$$

Description: p= percentage of validity score, $\sum X$= sum of experts' answers in one aspect, $\sum X_1$= maximum sum of answers in one aspect, 100%= constant (Sugandi & Abdur Rasyid, 2019).

Once the validation score was known, the results were described by looking at the validation criteria in table 2 below.

Table 2. Validation Criteria

No	Achievement Level	Qualification	Description
1	81% - 100%	Very Good	Very Valid
2	61% - 80%	Good	Valid
3	41% - 60%	Sufficient	Quite Valid
4	21% - 40%	Less Good	Less Valid
5	0% - 20%	Very Poor	Invalid

(Source: Damayanti, et al., 2018)

(2) the practicality analysis was obtained from the Black Box testing results in data which were carried out in small group tri-

als of 5 *Android* users. The data obtained were then analyzed using the Guttman scale in table 3. The variables in the questionnaire were measured from two categories: a checklist with a score of 1 for the answer "Yes" and a score of 0 for the answer "No".

Table 3. Guttman Scale

No	Score	Description
1	Score 1	Agree / Yes
2	Score 0	Disagree / No

(Source: Sugiyono, 2018)

Practicality Percentage Formula:

$$p = \frac{\sum X}{\sum X_1} \times 100\%$$

Description: p = percentage of practicality score, $\sum X$ = sum of experts' answers in one aspect, $\sum X_1$ = maximum sum of answers in one aspect, 100% = constant (Sugandi & Abdur Rasyid, 2019).

Once the practicality score was known, the results were described by looking at the practicality criteria in table 4 below.

Table 4 Practicality Criteria

No	Achievement Level	Qualification	Description
1	81% - 100%	Very Strong	Very Practical
2	61% - 80%	Strong	Practical
3	41% - 60%	Quite Strong	Quite Practical
4	21% - 40%	Weak	Less Practical
5	0% - 20%	Very Weak	Impractical

(Source: Damayanti *et al*, 2018)

(3) the effectiveness analysis was obtained from students' numerical literacy data by conducting a pre-test and post-test on large group trial activities conducted on 42 fifth-grade students of MI Darussalam Brenggolo. The formula for calculating numerical literacy skills is as follows.

$$S = \frac{T}{T_t} \times 100\%$$

Description: S = numerical literacy score for each student, T = total score obtained, T_t = maximum total score, 100% = constant (Ariska, Darmadi, & Murtafi'ah, 2018).

Afterward, to calculate the difference in the significance level between the pre-test and post-test evaluation results, researchers used the N-Gain Score test to measure students' numerical literacy skills before and after using interactive learning media with the following formula.

$$N - Gain = \frac{Post - test\ Score - Pretest\ Score}{Maximum\ Score - Pretest\ Score}$$

Based on the formula, the criteria for increasing numerical literacy can be seen in table 5 as follows.

Table 5 N-Gain Score Criteria

N- Gain Score	Criteria
N-Gain > 0,7	High
0,3 ≤ N-Gain ≤ 0,7	Moderate
N-Gain < 0,3	Low

(Source: Majdi, Subali, & Sugianto, 2018)

RESULTS AND DISCUSSIONS

This research and development results were in the form of *Adobe Flash*-based interactive mathematics learning media on addition and subtraction of fractions matter for fifth graders of Elementary School/MI. The results of media development products that researchers have developed are presented in the following figure.

Figure 2. Start Page

Figure 3. First Login Page

Figure 4. Second Login Page

Figure 5. Main Page

Figure 6. Exercise Menu Page

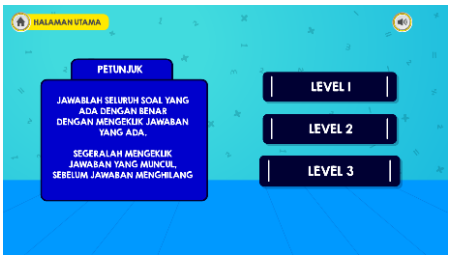

Figure 7. Game Menu Page

The steps conducted by researchers in developing *Adobe Flash*-based interactive mathematics learning media are as follows.

Analysis

There are two parts to the analysis stage needs assessment and front-end analysis. Needs assessment is an activity carried out to analyze field conditions and students and analyze the subject matter that will be used as a source in product development. The problems found by researchers in field studies include: (1) students needed supporting media that can assist in learning both with guidance and independently; (2) students needed learning media that can be accessed offline so that it can help reduce the level of data purchases they complain about; (3) students did not understand fractions subject matter because there are too many sub-matter so they needed media that can summarize the subject matter practically; (4) the unavailability of interactive learning media in mathematics, especially for addition and subtraction of fractions subject matter; (5) students needed more fun learning variations. From the results of these data, researchers developed interactive mathematics learning media using *Adobe Flash CS6* software as a learning tool for fifth graders of MI Darussalam Brenggolo.

Design

The design stage is the initial planning stage for making interactive learning media products. This includes activities to determine the specifications of the developed media, the structure of the developed media subject matter, making explanations of the subject matter and designing questions about addition and subtraction, fractions for fifth grade SD/MI students, creating flowcharts and media storyboards developed with the *Balsamiq Mockup* application, as well as the preparation of the assessment instrument used to obtain the developed media validity score.

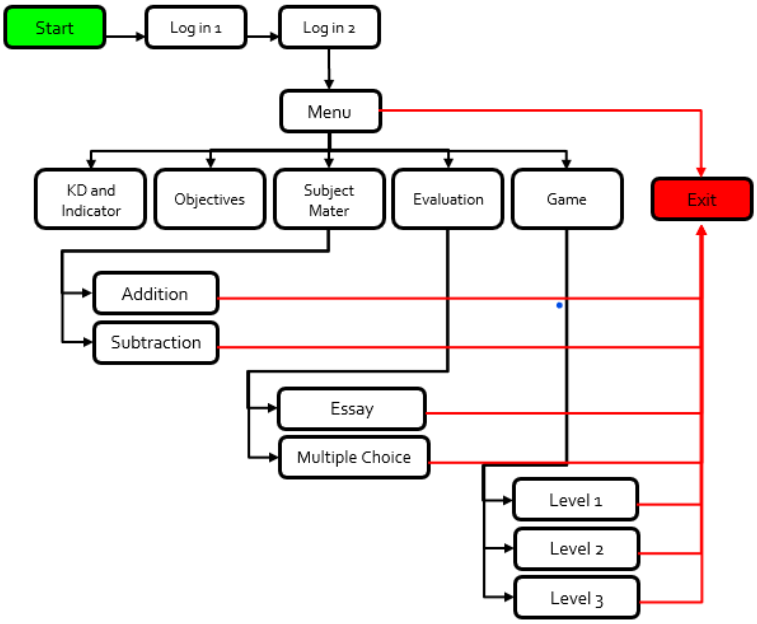

Figure 8. Flowchart for the Media Development

Development

Researchers carry out the media development stage to assemble all components, such as material, images, animation, music, and others, into an interactive learning media product. To make it happen, researchers need the following things: (1) Laptop/Computer with minimum specifications as follows: Processor = 133 Mhz Intel Pentium; OS =Windows 95/98/NTA/2000 *Professional;* RAM = 32 MB, and HDD = 40 MB; (2) *Adobe Flash CS6 application to make a media program*; and (3) *Audacity* application to create sound effects.

Then, the media was designed and developed according to the flowchart and storyboard designs. The following is a flowchart for the development of media design used in this research (see Figure 8).

After making a flowchart design, researchers made storyboard designs for the display designs of interactive learning media using *Balsamiq Mockup* application which is shown as follows.

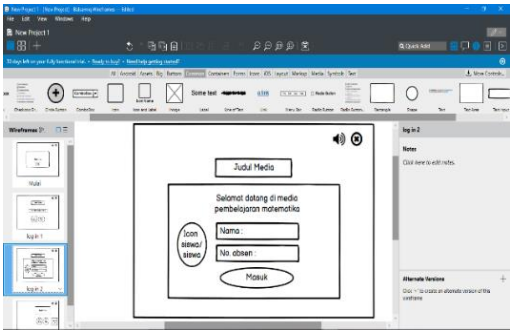

Figure 9. Storyboard Making

After making the storyboard (see Figure 9), the researchers looked for the necessary pictures and animations. They then designed them as an interactive learning media interface design that included button designs, writing designs, background designs, and others. In this stage, researchers used *Adobe Illustrator CC2018* application.

The steps for media development, namely (1) create a media interface design with *Adobe Illustrator CC2018* application; (2) create a learning media with *Adobe Flash CS6* application; (3) arrangement of Black Box testing; (4) Black Box testing; (5) publishing interactive learning media; (6) and lastly, validating media products.

Implementation

The implementation stage is the stage of testing learning media products developed to know whether the media is appropriate or not to be used. A team of experts determined at the design stage carry out this stage, namely matter experts, media experts, and field practitioners, to carry out media validation. After the expert team tried out the media, the trial result was revised to perfect the product before being implemented to students. Next, researchers continued with small-group trials and large-group trials. The results of the data analysis on the product's validity, practicality, and effectiveness are described as follows.

Media Validity Analysis

Validation by Matter Experts

There were two validations by matter experts used in this research. The researchers used a questionnaire sheet containing 15 questions by matter experts. First, matter experts validated on May 1^{oth}, 2022, and the second was on May 15th, 2022. The validation results were obtained with an average percentage of 87% with very good/very valid validity criteria. This follows the results of research conducted by Krismadinata (2019) that the results obtained are that the content contained in interactive media is proven valid, practical, and effective. Thus, the numerical literacy matter in the media was feasible to use. This follows the research results by Krismadinata (2019) that interactive media was proven valid and practical in improving students' learning skills and valuable when used in learning activities. In addition, the matter expert validators also conveyed several things that needed to improve in the media: (1) the need to improve learning indicators, (2) the need to adjust students' and teachers' animations according to the characters of MI students, (3) the need for variations in numerical literacy questions to suit everyday life, and (4) the need for sound recordings of subject matter explanations as a facility for all types of student learning.

Validation by Media Experts

Two validators also carried out validation by media experts. This media validation assessment was seen from the appearance and programming aspects of learning media using a validation questionnaire sheet containing 24 questions. Based on these two aspects, an average percentage of validity of 78.3% was obtained with the Good/Valid validation criteria. The conclusion obtained was that this interactive learning media is feasible to use. The media expert validators also conveyed several things in the media that needed to improve, including making the background color different in each section, adding animated images, placing exit buttons, shortening learning objectives, and increasing the font size.

Validation by Field Practitioners

Validation by valid practitioners was carried out by field expert validators, namely homeroom teachers of the fifth grade of MI Darussalam Brenggolo. The field practitioners' assessment combines validation from matter experts and media experts, including appearance, ease of use, matter presentation, and media benefits. This validation activity used a validation questionnaire sheet that contained 15 questions. It was obtained that the average percentage of interactive mathematics learning media validity was 94.2% with very good/very valid validity criteria. Thus, this interactive learning media is

feasible to use. Field practitioners also conveyed several things to improve the media, namely the need for other matters and the addition of matters other than writing.

Media Practicality Analysis

Practicality analysis was obtained from Black Box testing activities in small group trials by 5 *Android* users with different brands and types. This test was carried out after researchers improved the media according to the expert validators' criticisms and suggestions. This test was used to determine the functionality of the learning media software and whether it was functioning correctly or not. The results of the Black Box testing that was carried out proved that the percentage of media functionality has a perfect result, namely 100%. Therefore, the developed media can run and function properly without any errors.

Media Effectiveness Analysis

Effectiveness analysis was obtained from large group trials and post-test evaluation activities. This test was carried out by 42 fifth-grade students of MI Darussalam Brenggolo, Kediri Regency, using their respective *Android*(s). Based on the results of the analysis of the pre-test and post-test evaluations, it was found that in the pre-test results, three students scored ≥ 75 with a maximum score of 75. Meanwhile, in the post-test results, of students who scored ≥ 75, 31 students with a maximum score of 100. It was necessary to do a classical calculation between the pre-test and post-test to calculate the completeness score of numerical literacy.

The classical percentage of the completeness score of numerical literacy before using interactive learning media (pre-test) was 7.14%. The classical percentage of the completeness score of numerical literacy after using interactive learning media (post-test) was 73.8%. Based on the calculations, the students' classical numerical literacy results were 7.14% on the pre-test and 73.8% on the post-test. Afterward, the calculation of the significance level using the N-Gain Score test was carried out. From the calculation results, the N-Gain Score obtained was 0.49. This score is $0.3 \leq$ n-gain ≤ 0.7, which surpassed the medium criteria. This showed an increased in the medium category in students' numerical literacy after using developed interactive learning media. This follows the results of Umbara and Nuraeni (2019) research that learning media using *Adobe Flash CS6* is considered appropriate and has increased student literacy. From the detailed description, it can be concluded that this *Adobe Flash*-based interactive learning media was quite effective in increasing students' numerical literacy, and the class atmosphere was more interactive than before. This follows the results of research conducted by Mustarin *et al* (2019), which stated that learning activities become livelier with the application of interactive learning media with *Adobe Flash CS6* in class. The use of these media also affected students' metacognition skills (Madinda, 2022).

Evaluation

The evaluation stage was carried out by collecting data from the trials, namely validation by matter experts, validation by media experts, and validation by field practitioners to make improvements and follow up as suggested. Apart from experts and field practitioners, product evaluations were also obtained from small and large-group trials. The results of the evaluation data were used to de-

termine which learning media is appropriate to be used as supporting media in learning mathematics on addition and subtraction of fractions subject matter.

Limitation

This study has limitations, including the number of students for product trials which causes various response results, and the number of validators for the product to see the accuracy and validity of the media used. In addition, this study was not conducted longitudinally to determine whether the effectiveness or influence of the media on students' numeracy literacy skills changed or remained over time. Nevertheless, the results of this study can be used as evidence that interactive learning media based on adobe flash cs6 can improve students' Numeracy literacy skills will not change.

Implication

The results of this study are expected to provide information to educators to develop learning media on other materials, to provide an alternative selection of learning methods in elementary schools to improve students' numeracy literacy skills. In addition, it can also be applied in schools at other high levels on other mathematical concepts.

CONCLUSIONS

The *Adobe Flash*-based developed interactive mathematics learning media was feasible to be used in learning activities, especially in mathematics subjects on addition and subtraction of fractions subject matter because it met the feasibility criteria. Based on the results of media feasibility in terms of media validity, the percentage of validation results obtained by matter experts was 87% in very valid criteria. The percentage of validation results by media experts was 78.3% in the valid criteria, and the percentage of validation results from field practitioners was 94.2% in very valid criteria. Furthermore, regarding practicality, the media obtained a 100% percentage result from the Black Box testing results. Afterward, regarding the effectiveness of the media in improving students' numerical literacy skills, the significance of the N-Gain Score obtained was 0.49 in the medium category. This proved that the learning media developed met the feasibility criteria of the media.

REFERENCES

Ariska, M. D., Darmadi, & Murtafi'ah, W. (2018). Pengembangan Media Pembelajaran Menggunakan Adobe Flash Berbasis Metakognisi untuk Meningkatkan Motivasi Belajar Matematika. *Edumatica: Jurnal Pendidikan Matematika*, *8*(01), 83-97.

Atiaturrahmaniah, & Ibrahim, D. S. (2017). Pengembangan Media Pembelajaran Berbasis Adobe Flash dengan Penerapan Teori Van Hiele. *Jurnal DIDIKA: Wahana Ilmiah Pendidikan Dasar*, *3*(1), 1-13.

Damayanti, A. E., Syafei, I., Komikesari, H., & Rahayu, R. (2018). Kelayakan Media Pembelajaran Fisika Berupa Buku Saku Berbasis Android Pada Materi Fluida Statis. *Indonesian Journal of Science and Mathematics Education*, *1*(1), 63-70.

Fanani, Z. (2006). *Tip dan Trik Animasi Makromedia Flash.* Yogyakarta. Graha Ilmu

Hayat & Yusuf (2010) *Mutu Pendidikan*. Jakarta: Bumi Aksara.

Jarmita, N., & Hazami. (2013). Ketuntasan Belajar Siswa Melalui Pendekatan Realistic Mathematics Education (RME) pada Materi Perkalian. *Jurnal Ilmiah Didaktika, 13*(2), 212-222.

Kartikasari, M., Kusmayadi, T. A., & Usodo, B. (2016). Kreativitas Guru SMA dalam Menyusun Soal Renah Kognitif Ditinjau Dari Pengalaman Kerja. In *Prosiding Seminar Nasional Matematika dan Pendidikan Matematika UNS*, (November), 431–442.

Krismadinata, K., Elfizon, E., & Santika, T. (2019). Developing Interactive Learning Multimedia on Basic Electrical Measurement Course. in *Advances in Social Science, Education and Humanities Research, 299.* 305–308.

https://doi.org/10.2991/ictvet-18.2019.69

Lee, W. W., & Owens, D. L. (2004). *Multimedia Based Instructional Design: Compute Based Training, Web Based Training, Distance Broadcast, Second Edition.* San Fransisco: Pfeiffer.

Letwinsky, K. M. (2017). Examining the relationship between secondary mathematics teachers' self-efficacy, attitudes, and use of technology to supportcommunication and mathematics literacy. *International Journal of Research inbEducation and Science, 3*(1), 56–66. https://doi.org/10.21890/ijres.267371

Madinda, D. P., Hobri, H., Hadi, A. F., & Fauziyah, M. E. (2022). Designing Hybrid Learning Tools Based on Lesson Study for Learning Community against Metacognition Ability. *Kreano, Jurnal Matematika Kreatif-Inovatif, 13*(1), 174-185

Majdi, M. K., Subali, B., & Sugianto. (2018). Peningkatan Komunikasi Ilmiah Siswa SMA melalui Model Quantum Learning One Day One Qustion berbasis Daily Life Science Question. *Unnes Physics Educational Journal. 7*(1), 81-90.

Miller, T. (2018). Developing Numeracy Skills Using Interactive Technology in a Play-Based Learning Environment. *International Journal of STEM Education, 5*(1), 1-11. https://doi.org/10.1186/s40594-018-0135-2

Mustarin, A; Arifyansah, R.; Rais, M. (2019). Penerapan Media Pembelajaran Adobe Flash CS6 Dalam Meningkatkan Hasil Belajar Siswa Kelas X ATPH Pada Mata Pelajaran Alat Dan Mesin Pertanian di SMK N 4 Jeneponto. *Jurnal Pendidikan Teknologi Pertanian, 5*(1), 1-8

OECD (2013) PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy, Paris: OECD Publisher.

Pangesti, FTP. (2018). Menumbuhkembangkan Literasi Numerasi Pada Pembelajaran Matematika Dengan Soal HOTS. *Indonesian Digital Journal of Mathematics and Education, 5*(09), 566 –575

Purwasih, R., Sari, N. R., & Agustina, S. (2018). Analisis Kemampuan Literasi Matematik Dan Mathematical Habits of Mind Siswa SMP Pada Materi Bangun Ruang Sisi Datar. *Numeracy*, *5*(1), 67-76.

Putri, J.A. (2017). Kemampuan Penalaran Matematis Siswa SMP Kelas VIII dalam Menyelesaikan Soal PISA Matematika di Kota Kediri. *Simki-Techsain, 01*(02), 1-8.

Rahmaibu, F. H., Ahmadi, F., & Prasetyaningsih, F. D. (2016). Pengembangan Media Pembelajaran Menggunakan Adobe Flash untuk Meningkatkan Hasil Belajar PKn. *Jurnal Kreatif: Jurnal Kependidikan Dasar*, *7*(1), 1-10.

Stecey, K & Tuner, R. (2015) *Assessing Mathematical Literacy: The PISA experience.* Australia: Springer.

Sugandi, M. K., & Rasyid, A. (2019). Developing of Adobe Flash Multimedia Learning Biology Through Project Based Learning to Increase Student Creativity in Ecosystem Concepts Pengembangan Multimedia Adobe Flash Pembelajaran Biologi Melalui Project Based Learning Untuk Meningkatkan Kreativitas. Biodik: *Jurnal Ilmiah Pendidikan Biologi, 5*(3), 181–196.

Sugiyono (2018). *Metode Peneltian Pendidikan; Pendekatan Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.

Umbara, U., & Nuraeni, Z. (2019). Implementation of Realistic Mathematics Education Based on Adobe Flash Professional CS6 to Improve Mathematical Literacy. *Infinity Journal*, *8*(2), 167-178.