Available online at: http://journal.uny.ac.id/index.php/jpe

Jurnal Prima Edukasia, 10 (2), 114-122

The Use of Macromedia Flash Application in Improving the Mathematical Understanding of Elementary School Students

Fery Muhamad Firdaus *, Dika Afianti, Rizki Cahya, Arina Septianingtias
Universitas Negeri Yogyakarta. Jl. Colombo No. 1, Karangmalang, Yogyakarta 55281, Indonesia
*Corresponding Author. E-mail: fery.firdaus@uny.ac.id

Received: 17 January 2022; Revised: 9 June 2022; Accepted: 9 June 2022

Abstract: Mathematics learning will run optimally if it is supported by the use of learning media commensurate with learning objectives and student needs. One of them is the application of learning media through Macromedia Flash to improve students' mathematical understanding. This type of research is classroom action research (Classroom Action Research). This research was conducted in class V. The subjects of this study were students of class V with a total of 16 children. The object of this research is the learning process by applying learning media based on Macromedia Flash. The results of this study indicate that the application of learning media based on Macromedia Flash 8 in building materials could improve students' mathematical understanding with a percentage of 94% of 16 students, which can be categorized in the "Very Strong" category. His learning outcomes also increased from the average value of 80.4 in cycle 1 to 87,625 in cycle 2 and were declared "Completed".
Keywords: mathematical understanding, macromedia flash

How to Cite: Firdaus, F. M., Afianti, D., Cahaya, R., & Septianingtias, A. (2022). The use of macromedia flash application in improving the mathematical understanding of elementary school students. *Jurnal Prima Edukasia, 10* (2), 114-122. doi: https://doi.org/10.21831/jpe.v10i2.47427

Introduction

Mathematics is one of the basic science branches at the formal school level, which has a vital role in developing science and technology. Suherman (2003) states that one of the goals of learning mathematics is for students to be able to face changing conditions in a world that continues to develop based on logical, rational, critical, careful, honest, and practical thinking. In studying mathematics, students need mathematical understanding. Santoso (2017) mentions that students' mathematical understanding is one of the goals in learning mathematics, so it can be interpreted that the material taught to students is not just memorizing but requires students to understand the concepts of the material being taught. Furthermore. Knowledge learned with understanding will provide the basis for forming new knowledge to be used to solve problems. After understanding is developed from a concept, students can give an opinion or idea and explain a concept (Nurapriani, 2020). Understanding concepts or ideas not only by memorizing but by studying concrete examples so that students can define the information themselves. The students must build concepts from a mathematical understanding of symbols and their theory before practicing the symbol model (Lie, 2006).

Mathematical understanding includes two things, namely instrumental understanding and relational understanding (Sumarmo & Utari, 2010). In instrumental understanding, students can use concepts directly by knowing or memorizing formulas or working sequences to solve mathematical problems (Samudro, 2017). NCTM (Hikmah 2017) states that indicators of students' mathematical understanding include: (1) defining concepts verbally and in writing, (2) identifying and creating examples and counter-examples, (3) using models, diagrams, and symbols to represent a concept, (4) changing a concept. Representations to other forms, (5) recognize the various meanings and interpretations of concepts, (6) identify the properties of a concept and recognize the conditions that define a concept, and (7) compare and distinguish a concept. An excellent mathematical understanding of students can be seen from the achievement of some of these indicators, so teachers always try to help students improve their mathematical understanding.

Mathematical understanding can be achieved optimally if teachers create fun and meaningful learning using technological advances. In addition, the use of technology can support government programs in education to break the chain of the spread of Covid-19. Although the school is closed, learning must continue with a *blended learning* system. Hidayat et al. (2020) state that learning with *a blended learning* model combines *online* and *offline* learning to achieve graduate learning achievements. Next is Rachman et al. (2019) define *blended learning* as a combination of face-to-face learning systems with *e-learning* that can be used by anyone *(everyone)*, where only *(everywhere)*, and anytime *(anytime)*. The term *blended learning* means a mix or combination of learning or elements of face-to-face learning (*offline)* and in the network (*online*).

Based on the results of interviews with mathematics teachers at MI Al Washliyah Jangkungan, Bandongan, Magelang, information was obtained that class V students have mathematical comprehension skills that are still relatively low, especially in space building materials. This is evidenced by student learning outcomes, namely, 9 out of 16 students scored under the established mastery learning, which is 70 in the Building Space material. In learning such materials, students tend to be passive and teacher-centered learning. This is in line with Hadi's opinion (2007), which states that a one-way learning system, namely the provision of materials from educators, will result in students being passive in learning. Furthermore, the results of observations in the field and low mathematical understanding can be seen in the number of students who have not been able to distinguish the nature of space building. In addition, some other students still have difficulty determining the formula of the volume of building space. The problem arises from several factors: *blended learning* is still monotonous and has not used innovative learning devices. This is in line with the opinion of Van De Walle (Nuryadi & Khuzaini, 2016); in general, mathematics learning still uses traditional teaching, which is dominant using lecture methods. Mathematics learning contains complex concepts to understand, consisting of many formulas that need to be memorized, calculations, and complicated problem-solving. Mathematics learning in *blended learning* is done only using WAG *(Whatsapp Group)* in the form of writing, pictures, and voice messages. The explanation of material about building space can only be received through visual and auditory on a limited basis. Fowler (Yuhasriati, 2012) states, *"Mathematics is an abstract subject, so teachers are required to be able to strive* for appropriate *methods under the level of mental development of students"*. Elementary school children (7-11 years old) enter a concrete operational stage, where they still think and understand something from tangible things. The learning device used must provide an overview. *Real* concepts that are still abstract (Ibda, 2015).

In mathematics learning on the *blended learning* model, students have not been involved in constructing their knowledge and only receive information conveyed in the direction of the teacher in this learning. Murizal et al. (2012) state that many students have difficulty understanding mathematical concepts because they cannot redefine mathematics subject matter in their language. In addition, according to Tambunan. T. (2014) *"Difficulties in learning mathematics in students are caused because they simply memorize concepts instead of understanding them."* Based on some of these opinions, it can be concluded that the low mathematical understanding of students is due to the unavailability of interactive learning devices that help students understand mathematical concepts. So, mathematics learning is still in the form of memorization.

Low mathematical understanding can make it difficult for students to learn mathematics and result in low learning outcomes. Ruseffendi (2006) revealed that there are many students who, after studying mathematics, are not able to understand even the most superficial parts; many concepts are misunderstood, so mathematics is considered a difficult, complicated, and difficult science. However, understanding concepts are the most crucial part of mathematics learning. Based on the problems described above, there needs to be a problem-solving action. Improving students' mathematical understanding of space-building materials can be done by using innovative and creative learning devices. One of the learning tools that can be created is the learning media. According to Tafonao (2018), learning media is everything that can be used to channel the sender's message to the recipient to stimulate students' thoughts, feelings, attention, and interest in learning. Learning media can motivate students to learn, encouraging students to be active so that learning is student-centered.

Computers as multimedia can be used in the creation of interactive learning media. Technological advances present convenience for teachers in making learning media, one of which is through Macromedia Flash. Macromedia Flash is a multimedia and software application used to design animations, games, and internet enrichment applications that can be viewed, played, and run in Adobe

Flash Player (Masykur, Nofrizal, & Syazali, 2017). Macromedia Flash displays information in writing, drawings, and animations so that students can be more interested in participating in mathematics learning. This application has various advantages: easily accessible and applied, can produce small files, can be used on all types of computers, and can produce varying outputs (Fitri et al., 2019).

Kania & Arifin (2020) have conducted a study entitled "Macromedia Flash Application to improve students' understanding of mathematical concepts." This research focuses on increasing students' conceptual understanding skills in learning mathematics and student responses to the use of Macromedia Flash in learning. The study used a quasi-experimental by forming groups on the use of Macromedia Flash. The difference from previous research lies in the type of research that uses classroom action research (Classroom Action Research). With the subject of class V, MI Al Washliyah Jangungan, while in the study by (Kania & Arifin, 2020), the research subjects were class IX students of Majalengka State Junior High School.

In addition, Mardhatillah & Trisdania (2018) also conducted research that focused on developing Macromedia Flash-based interactive media learning on Three-Dimensional material to improve the mathematical spatial abilities of XI grade students of SMK PAB 2 Helvetia. The difference with this research lies in the type of research that uses classroom action research (Classroom Action Research). With the subject of class V MI Al Washliyah Jangkungan. This study has a drawback; namely, the use of Macromedia Flash is not optimal because, in this study, the subjects were students of class V MI, so in the use of Macromedia Flash, the teacher had to be accompanied by the teacher because of the students' lack of ability to use interactive media.

Based on the results of previous studies, this research has advantages that focus on the application of learning media through Macromedia Flash to improve students' mathematical understanding. Learning by utilizing Macromedia Flash application media in class V on the concept of building space that shows more effective learning outcomes.

The use of Macromedia Flash as a learning medium benefits teachers in preparing interactive teaching materials to implement learning. This medium can also spur student stimulus to understand concepts and know the real/concrete form of abstract mathematical concepts. Students will be easier to understand the material of building space, and student mathematics learning results will increase. Therefore, the author offers interactive media based on Macromedia Flash to improve students' mathematical understanding of space-building materials.

Methods

The method used in this study is the class action research method. The subject of this study was the students of class V MI Al Washliyah Jangkungan, which is 16 students consisting of 10 female students and six male students.

The data collection techniques used in this study are tests, observations, and interviews. The test is used to determine the successful use of *Macromedia Flash-based* learning media. In this study, observation guidelines were used to observe the mathematical learning process with the help of interactive learning media based on *Macromedia Flash*. Furthermore, data collection techniques in interviews with teachers and students. Interviews with teachers are conducted to find out the problems experienced by teachers in mathematics learning and interviews with students are conducted to find out the student's experience in learning mathematics with Macromedia Flash-based learning media.

Results and Discussion

Results

This classroom action research was carried out through two cycles which resulted in several findings. The research results for each cycle are as follows.

Cycle I

Stage of Action Planning,

The action planning stage begins with the approval of lecturers, principals, and class V teachers. In addition, researchers also prepare research instruments that include evaluation questions, observation sheets, and interview questions.

Stage of Action Implementation,

The first action was carried out on Friday, April 16, 2021, learning lasted for 180 minutes followed by 16 students. Teaching and learning activities refer to learning scenarios, which consist of an initial, core, and final activities. The acquisition of student proficiency test results in cycle I with the application of Macromedia Flash-based media, on average can be seen in the table below:

Table 1. Distribution of Cycle I Test Results

Score	Grade	Freq	Percentage
91-100	A	4	25%
81-90	B	5	31%
70-80	C	2	13%
0-69	D	5	31 %

In cycle 1, students' grades are very varied. This was shown by 16 students, as many as 11 students (69%) achieved completeness in the learning of mathematics material properties of cubes and blocks, and 5 students were not complete (31%). When presented in detail as follows: students who get grades under mastery learning, as many as 5 students or 31% with a score of 60 as many as 1 child, 65 as many as 3 children, 67 as many as 1 child. Students who obtained the above mastery learning as many as 11 people. The distribution of grades is as follows: 4 students obtained grades in the range of 91-100 with predicate A, 5 students obtained grades in the range of 81-90 with predicate B, and 2 students obtained grades in the range of 70-80 with predicate C. While 5 students have not been completed.

Observation Stage

The observation stage of cycle 1 is carried out during the learning process. This stage is carried out directly by researchers by observing the learning activities of students and teachers during the learning process. The reference used is to use an observation sheet. From the results of observations during the learning process, overall learning activities ranging from opening, and core activities, to closing have been carried out completely by the teacher. But learning is still teacher-centered, students still tend to be passive in learning activities, especially when responding to questions asked by teachers. In addition, 5 students do not understand the material, and must be explained repeatedly. Although overall the learning process of the first cycle is still not running optimally. The learning process in cycle 1 must be further improved to increase students' understanding by looking at the above. So that the learning results obtained are also more maximal.

Based on the results of observations and interviews with students in cycle 1, it was found that students felt happy learning to use macromedia flash, in learning mathematics in elementary schools. However, they are still not used to using new media, so they have to be more intensive in studying the material using macromedia flash. Students feel interested and motivated to repeat learning using macromedia flash because they say that learning mathematics is easier to understand and more fun.

Analysis and Reflection

The results obtained at the observation stage are collected and the results of the evaluation question test that has been done by students. The data is then analyzed and reflected. The reflection aims to see if the plan has been optimally or needs improvements. The results of the analysis of cycle I am used as a reference for the author to design cycle II. The reference is to maintain things that are considered good and revise activities that have not been optimal. Based on the acquisition of grades and observation results, it can be known that the learning process in cycle I have not achieved optimal results.

Many things still need improvement, especially during the learning process. From the observations, it can be known that students still tend to be passive and still confused in doing problems.

Cycle II

Stage of Action Planning,

The planning stage is carried out by making learning devices that include RPP, LKS, teaching materials, and test questions. In addition, researchers also prepare research instruments that include evaluation questions, and observation sheets. This stage also pays attention to the data obtained from cycle I.

Stage of Action Implementation,

Teaching and learning activities refer to learning scenarios, which consist of an initial, core, and final activities. At this stage, students listen to the teacher's explanation of the cube and beam volume material with Macromedia Flash-based media. Then the students do the evaluation questions.

The acquisition of student proficiency test results in cycle II with the application of Macromedia Flash-based media, on average can be seen in the table below:

Table 2. Distribution of Cycle II Test Results

Score	Grade	Freq	Percentage
91-100	A	7	44%
81-90	B	6	37%
70-80	C	2	13%
0-69	D	1	6%

The second cycle showed a significant increase in math learning outcomes from the previous cycle. Sixteen students took the cycle 2 test, with almost all results getting scores above the predetermined mastery learning. The highest score on this cycle is 96 earned by one student. In addition, there is 1 student who gets the lowest score of 68 and has not reached the mastery learning score. Here is a breakdown of the test results in cycle 2: as many as seven students obtained grades in the range of 91-100 with predicate A, 6 students obtained grades in the range of 81-90 with predicate B, students with C predicates as many as 2 students with a range of 70-80, and students with D predicate as many as 1 student.

Observation Stage

The observation was carried out on 16 students directly in the learning process. From the results of observations during the learning process, student learning activities and teaching activities at the time of learning showed an increase in the second meeting compared to the first meeting. In this cycle, students are more active and easily understand the material delivered by the teacher. In addition, the learning results obtained are also higher than in the previous cycle. The results of interviews with students show that students are very happy to learn mathematics using macromedia flash because they find it easier to understand and not boring, so they want that every concept can be presented using macromedia flash as well.

Analysis and Reflection

The results obtained at the observation stage and the evaluation test results are collected. Then analysis and reflection on the data obtained. Based on the observation and analysis of data in cycle II, it can be concluded that the learning of cube and beam volume materials with Macromedia Flash-based media has achieved maximum results. The shortcomings in cycle I have been corrected in cycle II. From the observations, it is known that students more easily understand the material so their learning results increase.

Discussion

The results showed that there was an increase in students' learning activities and mathematical understanding of the concept of building space using the macromedia flash application. The use of Macromedia flash applications in elementary schools is an appropriate step in maximizing the use of technology in mathematics learning. Macromedia Flash can help explain that mathematical concept to students with a variety of interesting looks. This is in line with the opinion (Kania & Arifin, 2020) that Macromedia Flash in mathematics learning can simulate a mathematical concept in real terms. Macromedia Flash is software (software) utilized by its development with simulation methods that can help students learn. (Liberna, H., & Nusantari, 2018) using the Macromedia flash application, students can directly see simulations and demonstrations that resemble an actual event. Students can capture the concept properly and correctly so that it can be applied to everyday life.

This Macromedia Flash application is designed using contextual problems so that students can easily understand mathematical concepts. This is in line with the results of research (Widyastuti & Pujiastuti, 2014), which shows that by using contextual problems in realistic mathematics learning, elementary students' understanding of mathematics is better than using direct learning. In addition, the study results (Arifin et al., 2020) also show that the contextual group-guided discovery (CGGD) learning

approach affects mathematical understanding and reasoning. So, it is very suitable when Macromedia flash applications collaborate with a contextual approach in the development process.

Learning by utilizing Macromedia Flash Application media in class V shows more effective learning outcomes with space-building learning materials. Departing from the development of student grades that have been described above, it can be said that there is a significant difference in students' learning achievements between learning activities carried out before, namely learning using lecture methods, with learning after using actions (utilization of media Macromedia Application of Mathematics learning in class V Tall) in cycles I and II. Based on the assessment results, this Learning application has fulfilled its characteristics as a viable learning medium, according to (Meilinda et al., 2019), which has more than one media that is converged, interactive, and independent. While reviewed in terms of the component of learning applications (Meilinda et al., 2019) has fulfilled the multimedia components, namely text, graphics, sound, video, and interactivity so that the use of media is following the needs of students and characteristics of students of class V. The use of technology in learning can certainly help understand mathematics in learning the basics of computing to improve students' competence (Allen, 2018), so that the use of this Macromedia Flash application is appropriate for the development of the student's competence.

Based on the assessment results of the Macromedia Flash Learning application, it has fulfilled its characteristics as a viable learning medium. According to Daryanto in (Meilinda et al., 2019), a viable learning medium with more than one converging interactive and independent media. While viewed in terms of learning application components in Macromedia Flash according to (Munir, 2012) has fulfilled a good multimedia component that is accompanied by text, graphics, sound, video, and interactivity so that this media is interactive. Nasution et al. (2019) stated that learning media developed by utilizing Macromedia Flash applications can improve students' conceptual understanding and self-regulated learning.

The research carried out on students in class V as a whole has completed learning but there are still students who have not completed their learning. In cycle 1, students' grades are very varied. This was shown by 16 students, as many as 11 students (69%) achieved completeness in the learning of mathematics material properties of cubes and blocks, and 5 students were not complete (31%). When presented in detail as follows: students who get grades under mastery learning, as many as 5 students or 31% with a score of 60 as many as 1 child, 65 as many as 3 children, 67 as many as 1 child. Students who obtained the above mastery learning as many as 11 people. With the distribution of the following values: The value of 77 as many as 2 children, 83 as many as 2 children, 89 as many as 2 children, 90 as many as 1 child, and 94 as many as 4 children.

Based on the predicate, as many as 4 children obtained the predicate A (25%), 5 children predicate B (31%), 2 children predicate C (13%), and 5 children predicate D (31%). In this cycle, the student's mathematical understanding ability of space building matter is introduced by presenting contextual problems related to the material properties of building cube and beam spaces. Students' mathematical understanding is still experiencing some difficulties. This relates to the way students understand the material and the learning outcomes obtained. Based on the results in cycle I, it can be known that students' mathematical understanding has not been optimal because there are still many students who have not completed their learning results. So that the next cycle is still needed so that students' mathematical understanding can improve and obtain optimal results.

The second cycle showed a significant increase in math learning outcomes from the previous cycle. 16 students took the cycle 2 test with almost all results getting scores above the predetermined mastery learning. The highest score on this cycle is 96 earned by one student. In addition, one student gets the lowest score of 68 and has not reached the mastery learning score. Here are the details of the test results in cycle 2: as many as 7 students have received A predicate (44%), students with B predicate as many as 6 students (37%), students with C predicate as many as 2 students (13%), and students with D predicate as many as 1 student (6%). This study was conducted in 2 cycles because in the 2nd cycle the completeness of student learning was already visible. In this cycle, the student's mathematical understanding has developed better than in the previous cycle. The student's mathematical understanding has been obtained optimally.

The discussion of the results of this study refers to the formulation of the problem, namely whether using the Macromedia Flash Application in space building materials can improve student learning outcomes. Learning by using the Macromedia Flash Application on space-building materials can

overcome students' learning difficulties. After implementing learning activities using the Macromedia Flash Application, there was an increase in learning outcomes ranging from cycle I to cycle II. The use of Macromedia Flash Application as a medium of learning mathematics learning carried out is seen in that students learn with enthusiasm and enthusiasm, so that the concept of building an implanted space reaches its goal. With the use of this media, it can attract the attention of students and attract students' interest and enthusiasm for learning. This is in line with the opinion of Nuriza, et al (2019) who explained that the use of the Macromedia Flash application as a learning medium can spur students to be active and responsive in learning activities because students can learn materials in more accurate terms. Students who usually lack attention, seem to be more enthusiastic about this learning. In addition, Muljo (2020) also revealed that this application can support the learning process because it is supported by *command action*, making it easier for teachers to explain materials to their students. Similarly, students who have begun to be saturated with monotonous and non-varied learning, return to concentrate more on learning through learning with Macromedia Flash application media. This is because there are audiovisual learning media so that teachers can display illustrations by using several animations that support students' learning interests (Hidayah, Syahputra, & Mulyono, 2019).

Another advantage obtained after treatment is that students' ability to think becomes more complex. This application can stimulate students' stimulus to manipulate concepts and know the real form of abstract mathematical concepts (Irvan, Mushlihuddin, & Suhartini, 2020). Students' activeness can be seen in their response to the material, their willingness to answer the teacher's questions, and their ability to solve problems given by the teacher. This is following Situmorang & Andayani's (2019) opinion that the use of Macromedia Flash can benefit the psychomotor aspects of students who support their learning outcomes in the form of ease of processing new information. Based on the explanation, the use of Macromedia Flash-based learning media is proven to improve student's learning achievements in learning Mathematics materials in the room building material in class V.

The use of macromedia flash applications is one of the teacher's efforts to improve students' mathematical understanding because, through macromedia flash, teachers can develop teaching materials with interactive audio-visual content (Bains & Jones, 2003) so that students are expected to be interested in learning, and more easily understand a mathematical concept. In addition, the application of Macromedia flash is also very suitable for elementary school students who incidentally have a passion for animation because the application of macromedia flash can be developed through animation that allows interactive observations to accelerate the student learning process (García et al., 2007). Therefore, macromedia flash applications can make learning interactive and improve the mathematical understanding of elementary school students' concepts.

Conclusion

The use of Macromedia Flash application media can improve students' mathematical understanding of class V. This is evidenced by the improvement of learning outcomes whose description is as follows: Learning outcomes 80.4 in cycle 1, and 87,625 in cycle 2. Macromedia Flash media is more effective in instilling the concept of building space in Mathematics learning in class V. Therefore, the application of macromedia flash can be used as an alternative in improving the mathematical understanding of elementary school students on building space. In developing this Macromedia flash application, teachers should be able to develop a variety of interactive and contextual visual, audio, and animation media so that elementary school students can be interested in learning and easily understand a mathematical concept.

References

Allen-Lyall, B. (2018). Helping students to automatize multiplication facts: a pilot study. *International Electronic Journal of Elementary Education*, *10*(4), 391–396. https://doi.org/10.26822/iejee.2018438128

Arifin, S., Wahyudin, W., & Herman, T. (2020). The effects of contextual group-guided discovery learning on students' mathematical understanding and reasoning. *Jurnal Prima Edukasia*, *8*(2), 106–114. https://doi.org/10.21831/jpe.v8i2.33059

Bains, S., & Jones, R. (2003). Using macromedia flash to create online information skills materials at Edinburgh University Library. *Program*, *37*(4), 242–250. https://doi.org/10.1108/00330330310500720

Fitri, J., Sarmidin, & Mailani, I. (2019). Pengembangan media pembelajaran macromedia flash 8 pada mata pelajaran pai kelas xi ips 1 sma negeri 1 gunung toar kabupaten kuantan singingi. *Jurnal Online Mahasiswa. 1 (1), 23-33.* https://core.ac.uk/download/pdf/270295338.pdf

García, R. et al. (2007). Interactive multimedia animation with macromedia flash in descriptive geometry teaching. *Computers and Education*, *49*(3), 615–639. https://doi.org/10.1016/j.compedu.2005.11.005

Hadi, R. (2007). Dari teacher-centered learning ke student-centered learning: perubahan metode pembelajaran di perguruan tinggi. Insania: *Jurnal Pemikiran Alternatif Pendidikan, 12(3), 408-419*. https://insaniaku.files.wordpress.com/2009/03/9-dari-teacher-centered-learning-student-centereded-learning-rahmini-hadi.pdf

Hikmah, R. (2017). Penerapan model advance organizer untuk meningkatkan kemampuan pemahaman siswa. *SAP (Susunan Artikel Pendidikan)*, *1*(3). https://doi.org/10.30998/sap.v1i3.1204

Hidayah Putri, J., Syahputra, E., & Mulyono, M. (2019). Developing mathematics learning media based on macromedia flash by using problem-based learning to improve students' mathematical spatial ability. *American Journal of Educational Research*, *7*(10), 708-712. https://doi.org/10.12691/education-7-10-6

Hidayat, M. T., Junaidi, T., & Yakob, M. (2020). pengembangan model pembelajaran blended learning dalam meningkatkan pemahaman siswa terhadap tradisi lisan aceh. *Jurnal Mimbar Ilmu, 25*(3), *401–410.* https://doi.org/10.23887/mi.v25i3.28913

Ibda, F. (2015). Perkembangan kognitif: teori jean piaget. *Jurnal Intelektualita, 3*(1), *27-38.* https://jurnal.ar-raniry.ac.id/index.php/intel/article/view/197

Irvan, Mushlihuddin, R., & Suhartini. (2020). Effectiveness of learning media using contextual based macromedia flash for junior school students al hikmah medan. *Journal of Physics: Conference Series*, *1429*(1), 3–8. https://doi.org/10.1088/1742-6596/1429/1/012002

Kania, N., & Arifin, Z. (2020). Aplikasi macromedia flash untuk meningkatkan pemahaman konsep matematika siswa. *JNPM: Jurnal Nasional Pendidikan Matematika*, *4*(1), 96. https://doi.org/10.33603/jnpm.v4i1.2872

Liberna, H., & Nusantari, D. (2018). The influence of macromedia flash learning on the students' mathematics concept understanding. *Journal of Mathematics Education*, *3*(1), 1–6. https://doi.org/10.31327/jomedu.v3i1.440

Lie, S. (2006) *Mathematics education in different cultural traditions: A comparative study of East Asia and the West*. New York: Springer.

Mardhatillah, & Trisdania, E. (2018). Pengembangan media pembelajaran berbasis macromedia flash untuk meningkatkan kemampuan. *Bina Gogik: Jurnal Ilmiah Pendidikan Guru Sekolah Dasar*, *5*(1), 91–102. https://ejournal.stkipbbm.ac.id/index.php/pgsd/article/view/19/18

Masykur, R., Nofrizal, N., & Syazali, M. (2017). Pengembangan media pembelajaran matematika dengan macromedia flash. *Al-Jabar: Jurnal Pendidikan Matematika*, *8*(2), 177. https://doi.org/10.24042/ajpm.v8i2.2014

Meilinda, N. V, Nuraisyah, L. F., & Senjayawati, E. (2019). Implementasi media pembelajaran menggunakan aplikasi macromedia flash 8 pada materi bangun ruang sisi datar. *Journal on Education*, *01*(03), 515–524. https://doi.org/10.31004/joe.v1i3.197

Muljo, A. (2020, November). The Development of Teaching Macromedia Flash for Plane Material in Class X SMKN 1 Langsa. In *Innovation and Technology for Mathematics and Mathematics Education*. 1st International Seminar on Innovation in Mathematics and Mathematics Education (pp. 326-334). Universitas Negeri Yogyakarta.

Munir. (2012). *Multimedia: Konsep dan Aplikasi dalam Pendidikan*. Alfabeta.

Murizal, A., Yarman, & Yerizon. (2012). Pemahaman konsep matematis dan model pembelajaran quantumteaching. *Jurnal Pendidikan Matematika, 1*(1), *19–23.* https://adoc.pub/pemahaman-konsep-matematis-dan-model-pembelajaran-quantum-te.html

Nasution, N., Sinaga, B., & Mukhtar, M. (2019). Developing learning media assisted-flash macromedia software by applying discovery model to improve students' concept and self-regulated learning in

senior high school. *American Journal of Educational Research*, *7*(2), 161–165. https://doi.org/10.12691/education-7-2-7

Nurapriani, F., Lestari, S. A. P., & Kusumaningrum, D. S. (2020). Mathematical understanding ability of information system students in discrete mathematics. *International Journal of Scientific & Technology Research, 9*(3). http://www.ijstr.org/paper-references.php?ref=IJSTR-0320-31568

Nuriza, U., Saminan, & Abidin, Z. (2019). Peningkatan kemampuan pemahaman matematis dan motivasi belajar matematika siswa melalui penerapan model discovery learning berbantuan macromedia flash 8. *Jurnal Peluang. 7*(1). http://www.jurnal.unsyiah.ac.id/peluang/article/view/13738

Nuryadi, & Khuzaini, N. (2016). Keefektifan teams games tournament ditinjau dari kemampuan komunikasi dan pemecahan masalah (studi eksperimen pada siswa kelas VIII SMP Negeri 1 Seyegan). *Jurnal Mercumatika, 1*(1), 80-91. https://doi.org/10.26486/mercumatika.v1i1.185

Rachman, A., Sukrawan, Y., & Rohendi, D. (2019). Penerapan model blended learning dalam peningkatan hasil belajar menggambar objek 2 dimensi. *Journal of Mechanical Engineering Education*, *6*(2), 145-152. https://ejournal.upi.edu/index.php/jmee/article/view/21784

Ruseffendi, E. T. (2006). *Pengantar kepada Membantu Guru Mengembangkan Kompetensinya dalam Meningkatkan Matematika dalam CBSA*. Bandung: Tarsito.

Samudro, Galuh Joko. (2017). *Pemahaman relasional dan instrumental matematik siswa pada model pembelajaran treffinger pada materi operasi hitung pada bentuk aljabar kelas VIII di SMPN 1 Munjungan*. Universitas Nusantara PGRI Kediri.

Santoso, E. (2017). Penggunaan model pembelajaran kontekstual untuk meningkatkan kemampuan pemahaman matematika siswa sekolah dasar. *Jurnal Cakrawala Pendas, 3*(1), 16-29. https://doi.org/10.31949/jcp.v3i1.407

Situmorang, R. P., & Andayani, E. P. (2019). Penggunaan media animasi berbasis macromedia flash untuk meningkatkan hasil belajar siswa pada konsep materi sistem peredaran darah manusia. *Assimilation: Indonesian Journal of Biology Education*, *2*(1), 35–41. https://doi.org/10.17509/aijbe.v2i1.14544

Suherman. (2003). *Strategi Pembelajaran* Matematika *Kontemporer*. Jurusan Pendidikan Matematika UPI.

Tafonao, T. (2018). Peranan media pembelajaran dalam meningkatkan minat belajar mahasiswa. *Jurnal Komunikasi Pendidikan, 2*(2), 103-114. https://doi.org/10.32585/jkp.v2i2.113

Tambunan. T. (2014). *Perekonomian Indonesia*. BPFE.

Widyastuti, N. S., & Pujiastuti, P. (2014). Pengaruh pendidikan matematika realistik indonesia (pmri) terhadap pemahaman konsep dan berpikir logis siswa. *Jurnal Prima Edukasia*, *2*(2), 183-193. https://doi.org/10.21831/jpe.v2i2.2718

Yuhasriati. (2012). Pendekatan realistik dalam pembelajaran matematika. *Jurnal Peluang, 1(1),* 81-87. http://jurnal.unsyiah.ac.id/peluang/article/view/1301