JPI, Vol. 10 No. 4, December 2021
p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: http://dx.doi.org/10.23887/jpi-undiksha.v10i4.28611

Mobile-Based Interactive Multimedia Learning for Problem-Solving Skills in Vocational High School

Emma Valensia Aurum[1*], Herman Dwi Surjono[2]
[1,2] Educational of Electronics and Informatics Engineering, Yogyakarta State University, Yogyakarta, Indonesia
*e-mail: emmavalensiaaurum@gmail.com

Abstract

This research aims to solve some common problems faced by learners, namely difficulties in understanding materials with abstract ideas and the lack of problem-solving skills. Mobile-based interactive learning multimedia as an innovation in educational setting is a self-learning media that the learners can use both in school and at home to help them understand the materials easily, minimize learning difficulties, and increase their problem-solving skills. This is a Research and Development (R&D) with the APPED model. The subjects of this research were the 10th grade students of the Vocational Program of Computer and Network Technology at SMK Negeri 1 Tulung Klaten (State Vocational School 1 of Tulung, Klaten). The data analysis technique was done through the descriptive quantitative. The results showed that the mobile-based interactive multimedia learning was feasible with the Very Good category. The mobile-learning-based interactive multimedia learning was effectively used with a percentage of 77.85% and the difference in significance, based on the Wilcoxon Test on the pretest posttest of 0.000 it indicates that there is a difference in the increase in problem-solving skills while learning using the mobile-based interactive multimedia learning.

Keywords: Interactive Learning Multimedia, Mobile-Based, Problem-Solving Skills, Learning Facility

1. Introduction

This development has also penetrated the education world, one of which supports the learning process (Ardianti et al., 2017; S. Saputra et al., 2020). Responding to this development, teachers have to master technology to develop ICT-based learning materials as learning media (Ali & Maksum, 2020; Arfinanti, 2018). Technological development significantly influences the development of learning media (Anwariningsih & Ernawati, 2013; Gil-Flores et al., 2017; Ilmiani et al., 2020). Technological development has changed conventional learning into interactive learning, which means that current learning should use various media in learning activities (A. T. Y. R. Dewi & Negara, 2020; Masniladevi et al., 2017). Learning media can make the learning process more optimal. A good learning process is to use learning media; for without learning media, a learning process will be passive and boring (Anggraini & Sartono, 2019; Muliasari & Linda, 2020). ICT development has not yet been used optimally as a learning medium, even though learning media is an essential component that supports successful learning (Argarini & Sulistyorini, 2018). In addition to making the learning process optimal, learning media also aims for students to shape their own concepts and enable independent learning (Hanik et al., 2018; Owon, 2019).

Learning media is a solution for students to understand the explanation given and make learning quality (Krisnawati & Marahayu, 2020; Wahyu et al., 2020). As an educator, a teacher has to provide learning media that help students understand the material, and stick in their memory for a long time (Saputra et al., 2020; Suranti et al., 2017). However, the facts found is that teachers lack the will to learn and use technology as media that can support learning; they even are only fixated on textbooks as the only learning source. The learning media that is still limited to books will make the material presentation dense and produce unattractive appearance, thus will make students bored with learning (Handayani et al., 2018; Kimianti & Prasetyo, 2019; Priatna et al., 2017). The textbooks are tiresome since there is no exciting interaction and only listening. How important it is nowadays to use technology in learning activities (Banindro, 2019; Masnuna et al., 2020). One use of

*Corresponding author.

Received September 20, 2020; Accepted May 03, 2021; Available online December 25, 2021

p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: http://dx.doi.org/10.23887/jpi-undiksha.v10i4.28611

technology in learning is the use of interactive learning media. Interactive media is a medium that facilitates the delivery of information more innovatively and effectively (Rahmadianto & Melany, 2018; Suarsana et al., 2018). The use of technology through interactive media is one of the deliveries of information that easily attracts attention (Primamukti & Farozin, 2018; Putera et al., 2020). The learning process is more exciting and fun through interactive learning media (Hakim et al., 2018). Therefore, the development of technology and the great potential of students in using technology must be optimized by teachers, especially as interactive learning media, so that students are interested, motivated, and feel happy in learning.

The current learning at SMK Negeri 1 Tulung of Klaten, especially in the basic programming subject, has used media to support the learning process. The media or teaching materials used are still limited to job sheets developed by the teachers. In this case, the use of learning media has not been obtained optimally. Whereas in the 2013 curriculum, teachers are required to utilize technology and use various media. As a matter of fact, teachers have not been able to use various media in the learning process. Furthermore, an initial search conducted on the Computer and Network Engineering (TKJ) expertise program showed that all students owned smartphones; during the learning process, many students were busy with their smartphones. The data from observations and interviews showed that most of the students stated that basic programming was a complex subject to understand and required problem-solving skills. For example, when given a question, students found it difficult to relate it to the materials that had been taught. This indicates that the problem-solving skills of students was still low. The use of problem-solving-oriented interactive learning multimedia will lead students to find problem-solving independently and provide a substantial experience in problem-solving.

This situation shows that smartphones negatively influence students because they enjoy playing with their gadgets more than reading books (Synnott, 2018; Widjayanti et al., 2019). Adolescent learners lately tend to use electronic media more than printed media or books (Aeni & Yusupa, 2018; Fonda & Sumargiyani, 2018). According to such reality, researchers want to optimize the use of learning media under the needs and characteristics of students, that is, by utilizing mobile technology and developing it into interactive learning media, therefore students can feel the positive impact of using their smartphones. The mobile learning-based learning media can make students linger and comfortable studying the materials (Nuryadi et al., 2020; Purwanto et al., 2019).

Another problem that arises is that students are often difficult to remember and understand the materials and linking them with the questions given (Bahari et al., 2018; Dewi et al., 2014; Melinda et al., 2018; Prehanto et al., 2021). One of which is in the basic competence of applying the use of functions and creating program codes using functions. This is due to the lack of understanding of students applying the material into programming languages, the lack of teaching materials used, and the unavailskills of teaching materials that can be used independently to make it easier to remember and understand the materials that have been studied. These difficulties need to be minimized through mobile-based interactive learning multimedia that can be used independently, and to increase understanding related to basic programming subjects (Jabar & Ahmad, 2018; Molina et al., 2018; Umarella et al., 2019). The learning multimedia developed is feasible according to material and media experts, and the use of Android-based learning multimedia is effectively used as learning support for students that can be used anytime and everywhere (Hendriawan & Muhammad, 2018; Molina et al., 2018).

Several previous studies have enhanced this, learning media can improve student problem solving (Ambarwati, 2019; Safitri, 2019; Wigati, 2019). STEM-based multimedia being feasible in learning to grow students' skills to solve problems (Sari & Apriyantika, 2020). Based on the description above, the general purpose of this research is to produce mobile-based interactive multimedia learning to improve problem-solving skills, which is one of the supporters of independent learning. In particular, this research aims to determine the feasibility and effectiveness of mobile-based interactive multimedia learning to improve students' problem-solving skills.

p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: http://dx.doi.org/10.23887/jpi-undiksha.v10i4.28611

2. Method

This is development research using the APPED model, consisting of five stages: (1) analysis and initial research; (2) design; (3) production; (4) evaluation; (5) dissemination (Surjono, 2017). The feasibility analysis was obtained through the assessments of experts and practitioners using questionnaires covering aspects of learning design, material substance, software, visual communication, and benefits. The effectiveness analysis was obtained by analyzing student learning outcomes and whether or not there was an increase in problem-solving skills. Mobile-based interactive learning multimedia was said to be effective if the average score of all students reached the Minimum Completeness Criteria (KKM), which was ≥75, and the Wilcoxon test results showed a significant increase in problem-solving skills between before and after using mobile-based interactive learning multimedia. The test assessment referred to the scoring guidelines with a maximum score of 200 and a maximum value of 100. The formula below was to calculate the problem-solving skills test score (Rohani, 2010). The data analyzed were the results of the pretest and posttest. The improvement in problem-solving skills can be seen from the difference in pretest and posttest scores, which were calculated using this formula (Meltzer, 2002). The standard gain value obtained was then converted into standard gain, referring to David E. Meltzer's criteria as shown in Table 1.

Table 2. Standard Gain Criteria

Interval	Criteria
g>0,70	High
0,3<g>0,70	Medium
g<0,3	Low

(Meltzer, 2002)

3. Result and Discussion

Results

The resulting product was first tested for feasibility to determine the suitskills and quality of the material and appearance presented. The assessment was carried out by material and media experts and also practitioners. The assessment given by the learning material expert in terms of learning design got a value of 4.46, and from Substance Materials, it got a value of 4.50, so it got an excellent qualification. The assessment given by practitioners in terms of learning design got a value of 4.34, and from Substance Materials, it got a value of 4.50, so it got excellent qualifications. The scores were then converted into assessment categories, which are presented in Table 3.

Table 3. Assessment Category of Material Experts and Practitioners

	Aspect (Score)					
	Learning Design		**Material Substance**		**Benefit**	
Respondent	%	Category	%	Category	%	Category
Material Expert	93,91	Very Good	90	Very Good	96,66	Very Good
Practitioner	86,95	Very Good	90	Very Good	90	Very Good
Average	90,43	Very Good	90	Very Good	93,33	Very Good
$\overline{X}_{Total}$	**91,25**					
Category	**Very Good**					

The assessment given by the Material Expert, from Learning Design got a score of 93.91% (very good) and Material Substance 90% (very good). The assessment given by the Practitioner, from Learning Design got a score of 86.95% (very good) and Material Substance 90% (very good). The assessment given by media experts in terms of Software is 4.57 and Visual Communication is 4.87. The assessment given by the Practitioner in terms of

p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: http://dx.doi.org/10.23887/jpi-undiksha.v10i4.28611

Software is 3.42 and Visual Communication is 3.80. The scores were then converted into assessment categories, which are presented in Table 4.

Table 4. Assessment Category of Media Experts and Practitioners

	Aspect (Score)					
	Software		**Visual Communication**		**Benefit**	
Respondent	%	Category	%	Category	%	Category
Media Experts	91,4	Very Good	93,3	Very Good	97,5	Very Good
Practitioner	68,5	Good	76,0	Good	82,5	Good
Average	80,0	Good	84,6	Very Good	90,0	Very Good
$\overline{X}_{Total}$	**84,88**					
Category	**Very Good**					

The assessment given by Media Experts, in terms of software, is 91.4 (very good), and Visual Communication is 93.3% (very good). The assessment given by the Practitioner, in terms of software, is 68.5 (good), and Visual Communication is 80.0% (very good). The display of the resulting mobile-based interactive learning multimedia product can be seen in Figure 1.

Figure 1. Display of mobile-based interactive learning multimedia product

After the product was declared feasible based on the assessment of experts and practitioners, field trials were carried out to determine the effectiveness of mobile-based interactive multimedia learning to improve problem-solving skills. The results are based on the calculation of the posttest value, which is 77.85% (Completed) and the Pretest is 44.12% (Uncompleted). Meanwhile, the effect of mobile-based interactive learning multimedia for improving problem-solving skills was obtained from the pretest and posttest gain values, 17,1% (High), 82,9% (Medium), 0,0% (Low). Student responses were discovered based on the questionnaires given after the learning activities. Visual Communication (4,17), Software (4,10), and Benefit (4,11), so get very good category. The product's effectiveness was found based on the comparison of the pretest and posttest results. The average posttest result obtained was 77.85, which was above the KKM, so that the learning mastery results were achieved. The analysis of differences in problem-solving skills was carried out using the Wilcoxon (Related) test on the pretest-posttest value, and the *Asymp. Sig.* (2-tailed) value 0.000 was obtained. This value was smaller than the 0.05 significance level, which indicated a difference in learning problem-solving skills using mobile-based interactive multimedia learning.

p-ISSN: 2303-288X, e-ISSN: 2541-7207 DOI: http://dx.doi.org/10.23887/jpi-undiksha.v10i4.28611

Discussion

The development of this problem-solving-oriented mobile-based interactive learning multimedia used the APPED development model, which consisted of five stages of development: (1) initial analysis and research, (2) design, (3) production, (4) evaluation, and (5) dissemination. In the initial analysis and research, the main problems that needed to be considered and handled in learning were identified, including the use of technology-based learning media that was not optimal, and the common problem-solving skills of students. Based on the study conducted, a problem-solving step was designed to develop mobile-based interactive multimedia learning oriented to problem-solving skills. Furthermore, a mobile-based interactive learning multimedia design was carried out at the design stage, and research instruments such as product assessment sheets, problem-solving skill tests, and student response questionnaires. At the production stage, mobile-based interactive learning multimedia and research instruments are arranged based on the designs that have been made so that a product prototype is produced. First, the mobile-based interactive multimedia learning was structured using a problem-solving approach that directed students to solve problems. These results reaffirmed what had been obtained in previous research; research showed that the use of Android-based learning multimedia effectively supported student learning (Hendriawan & Muhammad, 2018; Ilmi et al., 2021). In line with this, research also showed that using STEM-based multimedia was feasible to be applied to grow students' problem-solving skills (Ngabekti et al., 2019; Roberts et al., 2018; Sari & Apriyantika, 2020). Problem-solving skills as part of the thinking process in the completion step, and providing solutions was one of the important aspects that had to be applied in learning activities to make students own problem-solving skills as needed in current and future conditions (Dooren et al., 2019; Jayanti et al., 2018; Öztürk et al., 2020).

Second, the learning environment using smartphones allowed students to explore material quickly and easily, and encouraged students to learn to be critical and selective in choosing existing information according to the problems given (Hendriawan & Muhammad, 2018; Nisa', 2020; Synnott, 2018). Mobile-based learning media that is packaged in an attractive and varied way can make students comfortable in learning the materials (Churchill et al., 2013; Purwanto et al., 2019). This confirms what has been expressed by Ambarwati (2019), which states that learning using technology can attract the interest and attention of students, and can improve problem-solving skills. The students responded very positively in learning the developed mobile-based interactive multimedia learning. This indicates that they could already enjoy the way of learning that was applied (Churchill et al., 2013; Darmaji et al., 2019; Majid et al., 2012). In the beginning, they found it a bit difficult to follow the lesson because they had never learned to use mobile-based interactive multimedia learning. However, after several meetings, the students began to enjoy and learn independently. Through mobile-based interactive learning multimedia, they became more interested in learning and doing the assigned tasks because the basic programming concepts presented could not be separated from their lives. Multimedia interactive learning increasingly has advantages compared to conventional learning media when combined with mobile technology (Gluzman et al., 2018; Mustaqim, 2016; Nopriyanti & Sudira, 2015). The collaboration between interactive multimedia learning and mobile technology makes students more interested in learning basic programming.

The advantages of mobile-based interactive multimedia learning compared to conventional learning media (Wigati, 2019). The results of this study indicate that the use of android-based learning media can improve students' problem-solving skills. Problem-solving skills are bits of intelligence of thinking (Dooren et al., 2019; Öztürk et al., 2020; Sumirattana et al., 2017). No wonder that the students who take the problem-solving-oriented mobile-based interactive multimedia learning are better than those who take lessons with common learning media, such as job sheets, because they are taught how to solve problems coherently, and understand each problem-solving flow. The learners finally understood and realized that basic programming played a very important role in life, especially in improving logical thinking skills, developing systematic thinking, practicing careful detail, and improving problem-solving skills (Effendi & Hendriyani, 2020; Misla & Mawardi, 2020; Parto, 2011).

When they were given a simple project related to the calculation process, they were excited and challenged to complete the project. They were taught to understand every program flow, from opening a new worksheet for the first time, writing program code, understanding every line of program code, until executing the program. If there were errors, the students were asked to find out the error, and presented the solution in class before their mates (Ikhsan et al., 2017; Mahardika et al., 2017; Suwatra et al., 2019).

Consequently, learning in the classroom is more interesting based on above description. The students will be more motivated to learn because they learn about basic programming material, and prepare and hone programming skills more deeply. They also produce a simple calculation product from the learning applied, which requires concepts in basic programming in the process. Learning will be more meaningful if students know the benefits of learning basic programming in real life. Thus, learning basic programming is studying for exams and learning to use it in everyday life. The last stage is the dissemination. However, this research did not reach the dissemination stage. As a consequence, the mobile-based interactive multimedia learning product had been submitted to the school.

4. Conclusions and Suggestions

Based on the data analysis above, it can be concluded that the developed mobile-based interactive multimedia learning has met the criteria of being feasible and effective. The feasibility is based on the assessments of experts and practitioners, covering aspects of learning design, material substance, visual communication, software, and benefits. In contrast, the effectiveness is seen from the results of student learning achievements, which result in differences in the improvement of learning problem solving abilities using mobile-based interactive multimedia learning.

5. References

Abdiyani, S. S., Khabibah, S., & Rahmawati, N. D. (2019). Profil Kemampuan Pemecahan Masalah Matematika Siswa SMP Berdasarkan Langkah-langkah Polya Ditinjau dari Adversity Quotient. *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *7*(2), 123–134. https://doi.org/10.24256/jpmipa.v7i2.774.

Aeni, W. A., & Yusupa, A. (2018). Model Media Pembelajaran E-Komik untuk SMA. *Jurnal Kwangsan: Jurnal Teknologi Pendidikan*, *6*(1), 43–59. https://doi.org/10.31800/jtp.kw.v6n1.p43-59.

Ambarwati, M. (2019). Efektivitas Media Pembelajaran Berbasis Web Game untuk Meningkatkan Kemampuan Pemecahan Masalah pada Pembelajaran Matematika SD. *Mimbar PSGD Undiksha*, *7*(2), 65–71.

Anggraini, M. S. A., & Sartono, E. K. E. (2019). Kelayakan Pengembangan Multimedia Interaktif Ramah Anak untuk Meningkatkan Kemampuan Pemahaman Konsep dan Karakter Cinta Tanah Air Siswa Kelas IV SD. *Kwangsan: Jurnal Teknologi Pendidikan*, *07*(01), 57–77. https://doi.org/10.31800/jtp.kw.v7n1.p57--77.

Arfinanti, N. (2018). Pengembangan Media Pembelajaran Matakuliah Metode Numerik dengan Implementasi Scilab Berbantuan Software Latex. *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *6*(2), 121–138. https://doi.org/10.24256/jpmipa.v6i2.370.

Argarini, D. F., & Sulistyorini, Y. (2018). Pengembangan Media Pembelajaran Berbasis Prezi pada Matakuliah Analisis Vektor. *Kalamatika: Jurnal Pendidikan Matematika*, *3*(2), 209–222. https://doi.org/10.24256/jpmipa.v1i2.95.

Banindro, B. S. (2019). Pengembangan Techno Virtual Berbasis Website sebagai Media Pembelajaran Rekayasa Visual Blender 3D bagi Mahasiswa Desain Produk. *ANDHARUPA: Jurnal Desain Komunikasi Visual & Multimedia*, *5*(01), 102–114. https://doi.org/10.33633/andharupa.v5i01.1965.

Chabibah, L. N., Siswanah, E., & Tsani, D. F. (2019). Analisis Kemampuan Pemecahan Masalah Siswa dalam Menyelesaikan Soal Cerita Barisan Ditinjau dari Adversity

Quotient. *Pythagoras: Jurnal Pendidikan Matematika*, *14*(2), 199–210. https://doi.org/10.21831/pg.v14i2.29024.

Darmawan, A., Asa, B. N., Kurniawan, F., Nukhba, R., Albab, U., & Parno. (2020). Pengembangan Instrumen Tes Pemecahan Masalah bagi Mahasiswa Jurusan Fisika pada Materi Dinamika Partikel. *Jurnal Pendidikan Fisika Dan Keilmuan (JPFK)*, *6*(1), 55–64. https://doi.org/10.25273/jpfk.v6i1.5579.

Dewi, A. T. Y. R., & Negara, I. G. A. O. (2020). Pengaruh Model Pembelajaran (SAVI) Berbantuan Multimedia terhadap Kompetensi Pengetahuan IPA. *Mimbar PSGD Undiksha*, *8*(1), 40–49. https://doi.org/10.23887/jppp.v4i2.27372.

Dwiningsih, K., Sukarmin, Muchlis, & Rahma, P. T. (2018). Pengembangan Media Pembelajaran Kimia Menggunakan Media Laboratorium Virtual Berdasarkan Paradigma Pembelajaran di Era Global. *Kwangsan: Jurnal Teknologi Pendidikan*, *6*(2), 156–176. https://doi.org/10.31800/jtp.kw.v6n2.p156--176.

Gunur, B., Makur, A. P., & Ramda, A. H. (2018). Hubungan Antara Kemampuan Numerik dengan Kemampuan Pemecahan Masalah Matematis Siswa di Pedesaan. *MaPan: Jurnal Matematika Dan Pembelajaran*, *6*(2), 148–160. https://doi.org/10.24252/mapan.2018v6n2a2.

Hakim, M. L., Asrowi, & Akhyar, M. (2018). Pengembangan Multimedia Interaktif Mata Pelajaran Bahasa Arab Materi Profesi bagi Siswa Kelas VIII SMP IT Al-Huda Wonogiri. *JTP - Jurnal Teknologi Pendidikan*, *20*(3), 249–263. https://doi.org/10.21009/jtp.v20i3.9537.

Handayani, H., Yetri, & Putra, F. G. (2018). Pengembangan Media Pembelajaran Berbasis Macromedia Flash. *JURNAL TATSQIF: Jurnal Pemikiran Dan Penelitian Pendidikan*, *16*(2), 186–203.

Hanik, N. R., Harsono, S., & Nugroho, A. A. (2018). Penerapan Pendekatan Contextual Teaching and Learning dengan Metode Observasi untuk Meningkatkan Hasil Belajar pada Matakuliah Ekologi Dasar. *Jurnal Pendidikan Matematika Dan IPA*, *9*(2), 127–138. https://doi.org/10.26418/jpmipa.v9i2.26772.

Hendriawan, M. A., & Muhammad, G. S. (2018). Pengembangan Jimath sebagai Multimedia Pembelajaran Matematika Berbasis Android untuk Siswa Sekolah Menengah Atas. *MaPan: Jurnal Matematika Da*, *6*(1), 274–288. https://doi.org/10.24252/mapan.2018v6n1a12.

Hidayat, W., & Ayudia, D. B. (2019). Kecemasan Matematik dan Kemampuan Pemecahan Masalah Matematis Siswa SMA. *Kalamatika: Jurnal Pendidikan Matematika*, *4*(2), 205–214. https://doi.org/10.22236/kalamatika.vol4no2.2019pp205-214.

Ilmiani, A. M., Ahmadi, A., Rahman, N. F., & Rahmah, Y. (2020). Multimedia Interaktif untuk Mengatasi Problematika Pembelajaran Bahasa Arab. *Al-Ta'rib : Jurnal Ilmiah Program Studi Pendidikan Bahasa Arab IAIN Palangka Raya*, *8*(1), 17–32. https://doi.org/10.23971/altarib.v8i1.1902.

Jayanti, M. D., Irawan, E. B., & Irawati, S. (2018). Kemampuan Pemecahan Masalah Kontekstual Siswa SMA pada Materi Barisan dan Deret. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *3*(5), 671–678.

Krisnawati, V., & Marahayu, N. M. (2020). Peningkatan Keterampilan Menulis Puisi Menggunakan Model Bengkel Sastra melalui Media Kotak Gambar Ajaib. *JINoP (Jurnal Inovasi Pembelajaran)*, *6*(1), 12–27. https://doi.org/10.22219/jinop.v6i1.10470.

Masnuna, Wardani, N. I. K., & Kadiasti, R. (2020). Desain Aplikasi Salim sebagai Media Pembelajaran untuk Menanggulangi Tindakan Kenakalan Remaja. *ANDHARUPA: Jurnal Desain Komunikasi Visual & Multimedia*, *6*(1), 100–114. https://doi.org/10.33633/andharupa.v6i1.3327.

Meltzer, D. E. (2002). The Relationship Between Mathematics Preparation and Conceptual Learning Gains In Physics: A Possible "Hidden Variable" In Diagnostic Pretest Scores. *American Journal of Physics*, *70*(12), 1259–1268. https://doi.org/10.1119/1.1514215.

Muliasari, A., & Linda. (2020). Sikap dan Respon Anak PAUD dalam Mengenal Metamorfosis Serangga melalui Media Animasi. *Jurnal Obsesi : Jurnal Pendidikan Anak Usia Dini*, *5*(2), 1083–1100. https://doi.org/10.31004/obsesi.v5i2.776.

Munir, N. P. (2018). Pengembangan Buku Ajar Trigonometri Berbasis Konstruktivisme dengan Media E-Learning pada Prodi Tadris Matematika IAIN Palopo. *Al-Khwarizmi: Jurnal Pendidikan Matematika Dan Ilmu Pengetahuan Alam*, *6*(2), 167–178. https://doi.org/10.24256/jpmipa.v6i2.454.

Owon, R. A. S. (2019). Penggunaan Media Plano Kalender Bekas Untuk Meningkatkan Prestasi Siswa pada Materi Pidato Persuasif. *JINoP (Jurnal Inovasi Pembelajaran)*, *5*(2), 198–213.

Pucangan, A. A. S. N. A., Handayanto, S. K., & Wisodo, H. (2018). Pengaruh Scaffolding Konseptual dalam Problem Based Learning terhadap Kemampuan Pemecahan Masalah. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *3*(10), 1314–1318.

Purwanto, A., Widaningrum, I., & Nurfitri, K. (2019). Aplikasi Musicroid sebagai Media Pembelajaran Seni Musik Berbasis Android. *Khazanah Informatika: Jurnal Ilmu Komputer Dan Informatika*, *5*(1), 78–87. https://doi.org/10.23917/khif.v5i1.7772.

Putera, I. K. A., Ardyanti, A. A. A. P., Fredlina, K. Q., Sujarwo, W., Satwika, I. P., & Pharmawati, M. (2020). Perancangan Aplikasi Media Interaktif Berbasis Mobile sebagai Pengenalan Artefak Museum. *ANDHARUPA: Jurnal Desain Komunikasi Visual & Multimedia*, *6*(1), 43–62. https://doi.org/10.33633/andharupa.v6i1.2794.

Rahmadianto, S. A., & Melany. (2018). Perancangan Multimedia Interaktif Pengenalan DKV Ma Chung sebagai Upaya Meningkatkan Brand Equity. *ANDHARUPA: Jurnal Desain Komunikasi Visual & Multimedia*, *4*(02), 130–142. https://doi.org/10.33633/andharupa.v4i02.1623.

Rahmani, W., & Widyasari, N. (2018). Meningkatkan Kemampuan Pemecahan Masalah Matematis Siswa melalui Media Tangram. *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika*, *4*(1), 17–24. https://doi.org/10.24853/fbc.4.1.17-23.

Rahmayanti, A., Wibawa, B., & Khaerudin. (2018). Peningkatkan Hasil Belajar Matematika dan Kemampuan Pemecahan Masalah Siswa SMA melalui Pendekatan Saintifik. *JTP - Jurnal Teknologi Pendidikan*, *20*(3), 181–198. https://doi.org/10.21009/jtp.v20i3.7790.

Safitri, W. C. D. (2019). Efektivitas Media Board Game terhadap Kemampuan Pemecahan Masalah pada Pembelajaran Tematik di SD. *Mimbar PSGD Undiksha*, *7*(2), 72–78. https://ejournal.undiksha.ac.id/index.php/JJPGSD/article/view/17477.

Saputra, R., Thalia, S., & Gustiningsi, T. (2020). Pengembangan Media Pembelajaran Berbasis Komputer dengan Adobe Flash Pro CS6 pada Materi Luas Bangun Datar. *Jurnal Pendidikan Matematika*, *14*(1), 67–80. https://doi.org/10.22342/jpm.14.1.6794.67-80.

Saputra, S., Rahmawati, T. D., & Safrudin, N. (2020). Pengembangan Puzzle Square sebagai Media Pembelajaran Interaktif Menggunakan Macromedia Flash 8. *JINoP (Jurnal Inovasi Pembelajaran)*, *6*(2), 124–135. https://doi.org/10.22219/jinop.v1i1.2441.

Sari, D. P., Putra, R. W. Y., & Syazali, M. (2018). Pengaruh Metode Kuis Interaktif terhadap Kemampuan Pemecahan Masalah Matematis Mata Kuliah Trigonometri. *Jurnal Pendidikan Matematika*, *12*(2), 63–72.

Sari, D. S., & Apriyantika, M. (2020). Multimedia Berbasis STEM untuk Menumbuhkan Kemampuan Siswa dalam Pemecahan Masalah pada Materi Mitigasi Bencana. *Jurnal Pendidikan IPA Veteran*, *4*(2), 132–146. https://doi.org/10.31331/jipva.v4i2.1291.

Sigit, D. V., Heryanti, E., Pangestika, D. A. W., & Ichsan, I. Z. (2019). Pembelajaran Lingkungan bagi Siswa : Hubungan Kemampuan Berpikir Kreatif dengan Kemampuan Pemecahan Masalah. *Jurnal Pendidikan: Teori, Penelitian, Dan Pengembangan*, *4*(1), 6–12.

Surjono, H. D. (2017). *Multimedia Pembelajaran Interaktif*.

Titin, & Yokhebed. (2018). Peningkatan Keterampilan Pemecahan Masalah (Problem Solving) Calon Guru Biologi melalui Pembelajaran Berbasis Kearifan Lokal. *Jurnal Pendidikan Matematika Dan IPA*, *9*(1), 77–86. https://doi.org/10.26418/jpmipa.v9i1.23701.

Wahyu, Y., Edu, A. L., & Nardi, M. (2020). Problematika Pemanfaatan Media Pembelajaran IPA di Sekolah Dasar. *Jurnal Penelitian Pendidikan IPA*, *6*(1), 107–112. https://doi.org/10.29303/jppipa.v6i1.344.

Wardani, N. M. ., Suniasih, N. ., & Sujana, I. . (2018). Korelasi Antara Konsep Diri dengan Kemampuan Pemecahan Masalah IPS. *Jurnal Ilmiah Sekolah Dasar*, *2*(2), 209–216. https://doi.org/10.23887/jisd.v2i2.15498.

Widjayanti, W. R., Masfingatin, T., & Setyansah, R. K. (2019). Media Pembelajaran Interaktif Berbasis Animasi pada Materi Statistika untuk Siswa Kelas 7 SMP. *Jurnal Pendidikan Matematika*, *13*(1), 101–112. https://doi.org/10.22342/jpm.13.1.6294.101-112.

Wigati, S. (2019). Penerapan Geogebra Handphone Android untuk Meningkatkan Kemampuan Pemecahan Masalah, Keaktifan, dan Motivasi Belajar Siswa. *Jurnal Inovasi Pembelajaran Karakter (JIPK)*, *4*(4), 1–7.

Winata, R., & Friantini, R. N. (2018). Proses Pemecahan Masalah Mahasiswa Pendidikan Matematika STKIP Pamane Talino. *FIBONACCI: Jurnal Pendidikan Matematika Dan Matematika*, *4*(1), 87–96. https://doi.org/10.24853/fbc.4.1.87-96.

Zuhaida, A. (2018). Program Sciences Kids Community Berbasis Group Investigation untuk Meningkatkan Kemampuan Pemecahan Masalah Madrasah Ibtidaiyah. *Jurnal Pendidikan Sains (JPS)*, *6*(2), 13–20. https://doi.org/10.26714/jps.6.2.2018.13-20.