

Received : 8 January 2022
Revised : 11 March 2022
Accepted : 6 April 2022
Online : 30 June 2022
Published: 30 June 2022

DOI: doi.org/10.21009/1.08112

Development of Audio-Visual Physics Animation Media to Improve Students' Understanding of Concepts and Creativity

Fita Permata Sari^{1,a)}, Salamun Hadi Subroto^{2,b)}, Faruq Haroky^{2,c)}

¹*STKIP Majenang, Jalan Raya Pahonjean KM. 2 Majenang. Cilacap 53257, Indonesia*

²*Universitas Tangerang Raya, Jl. Putera Utama, Ps. Kemis, Kec. Ps. Kemis, Kabupaten Tangerang, Banten 15560, Indonesia*

✉: ^{a)}fitapermata@gmail.com, ^{b)}salamunhs@gmail.com, ^{c)}faruqht@gmail.com

Abstract

Increasing technology in this modern era of globalization can be applied to the world of education as a facility to facilitate the learning process delivered. Applying technology can help to learn that are hampered by distance can be overcome by distance learning. Distance learning has not yet become a part of most schools in Indonesia, especially elementary schools. So, there is a need for further research to produce audio-visual animation media so that it can help to learn for elementary school students. This type of research is an educational R&D development research (Educational Research and Development) referring to the ADDIE development model, which consists of five stages: Analyze, Design, Development, Implementation, and Evaluation. The type of data used is descriptive qualitative and quantitative data. Techniques for data collection are using questionnaires and questions. This shows no difference between using audio-visual animation learning media for science-themed to permanently save energy and other media provided by educators in schools to improve students' conceptual understanding and creativity.

Keywords: animation, audio-visual, science, concept understanding, creativity

INTRODUCTION

The technology that has developed into the cause of smartphones cannot be separated from life. This can also impact academic achievement, affecting school life (Lee & Lee 2017). Smartphones have become a mandatory item for everyone (Timbowo 2016). The development of technology and information is used in education as a means of learning online or offline (Irwandani & Rofiah 2015). Distance learning is the main thing in Indonesia. Students, parents, and educators face new challenges due to the sudden change in the learning system at school from being at home. Elementary school students need more help learning (Kocaktufan & Kayaaslan 2020). Schools need resources to rebuild the learning process when learning activities begin again.

The world was shocked by the COVID-19 pandemic at the beginning of 2020, and it impacted the economy, education, and social fields (Sampurno, Kusumandyoko & Islam 2020). Educators and students are required to adapt quickly so that this affects the development of the science learning system (Sadikin & Hamidah 2020). The COVID-19 pandemic will not subside until 2021. Learning media is expected to be able to shape individuals, teach them to act, and behave in certain situations (Efendi, Adi, & Sulthoni 2020). Online learning is effective for interacting with educators and students in virtual classrooms. Online learning can make students learn independently and increase their motivation (Sheu

& Chu 2017). Learning only using printed books without being combined with other media feels boring and less interesting for students. Students are required to be independent in finding learning information, and educators are the only facilitators who accompany students to learn (Pambudi, Efendi, Novianti, Novitasari & Ngazizah 2018).

Technological life is developing, significantly influencing the entertainment market (Lukman, Hayati & Hakim 2019). Students have different learning styles: visual, audio, and kinesthetics. Learning can run effectively, and students can understand the material well with technology (Sari, Nikmah, Kuswanto & Wardani 2020). An exciting animation video from the product form and presentation, the material in the animated video follows the curriculum and contains educational elements (Ribeiro 2016). Learning using simple audio-visual media can help students choose and develop their thinking in understanding and solving problems independently (Andriana, Vitasari, Oktarisa & Novitasari 2017). Learning using audio-visual learning media can invite students to think creatively and imagine (Aytekin & Sakarya 2007). Understanding concepts still lacking in science makes educators try to apply innovative media, namely audio-visual media, in science learning (Astuti, Istiyati & Sadiman 2014). Students can experiment with their own creativity. Student-led investigations can encourage the development of creativity and critical thinking (Eraikhuemen & Ogumogu 2014).

Learning media in audio-visual animation can be applied in elementary schools by attracting students to be more enthusiastic about learning. Animated videos are filled with the subject matter and used as learning media in elementary schools. Animated media is attractive so that it can be used in elementary schools. This study aimed to produce media and determine the effectiveness of Audio-Visual Animation in improving the Concept Understanding and Creativity of Elementary School Students.

The use of smartphone media is still limited in certain areas. The COVID-19 pandemic invites educators and students to carry out online learning. Learning that is applied in schools today is a combination of online and offline learning following the new normal era. Problems related to understanding concepts, creativity, and using smartphone media were still encountered during the learning process. Several educators expressed this in the elementary school environment. Suggested solutions to problems that exist in the school environment, as well as the expected results of the problems and solutions provided, are described in FIGURE 1.



FIGURE 1. Research Framework

The problem in this research is the understanding of concepts that are still weak in the offline or online learning process, the use of smartphones in learning is still lacking, and the creativity of elementary school students is still weak. The solution in this research is designing learning based on technology and the utilization of smartphones in learning. Media products resulting from this research are natural science Audio-Visual Animation media for elementary students, and that is science mobile learning.

The urgency of this research is to increase the utilization and quality of learning by using technology as an alternative media that is more attractive in the new normal era. Expanding access to learning for educators and students so they can learn anytime and anywhere using a smartphone. They are increasing access to education using smartphones as a medium for independent learning for students. Using audio-visual animation media as interactive learning media is expected to overcome the problem of learning to understand concepts and creativity.

METHODS

The type of research is the development of R & D education (Educational Research and Development), referring to the ADDIE development model, which consists of 5 stages, namely: 1) Analysis, 2) Design, 3) Development, 4) Implementation 5) Evaluation (Evaluation). The type of data used is descriptive qualitative and quantitative data. The techniques for collection data is using questionnaires and tests for understanding the concepts and creativity of students. The final product of the research is audio-visual animation media for science learning in elementary schools to improve students' conceptual understanding and creativity.

This research was conducted in July – August 2021 and was carried out at Pahonjean 5 Elementary School in Majenang sub-district, Cilacap Regency. The research subjects were fourth-grade students in each elementary school. Prosedur Pengembangan ADDIE diuraikan pada TABLE 2 (Sugiyono 2015).

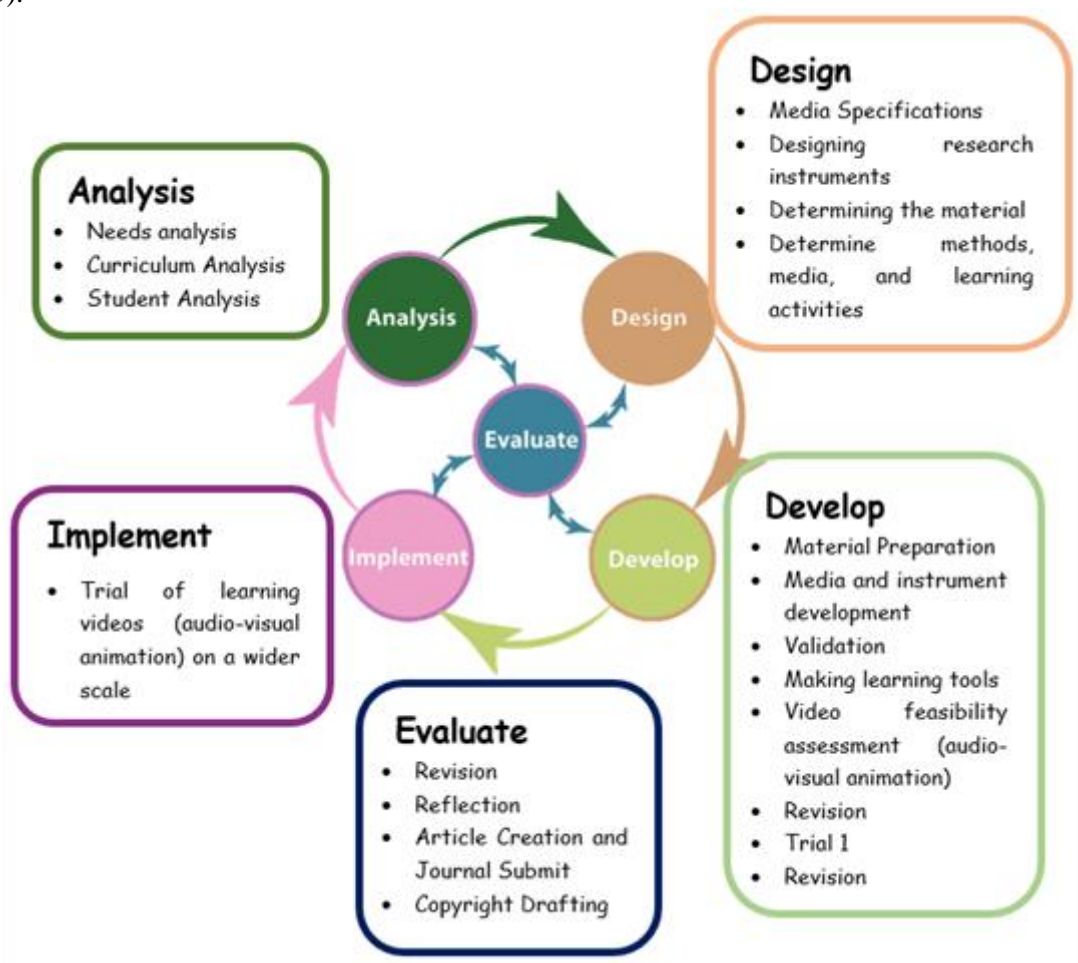


FIGURE 2. ADDIE Development Procedure

Two data collection instruments are used, namely the test instrument in the form of multiple-choice questions and essays and the non-test in the form of a questionnaire. Quantitative analysis determines the increase in students' conceptual understanding and creativity. Science audio-visual animation development instruments consist of product validation instruments and data collection, which are presented in TABLE 1 and TABLE 2.

TABLE 1. Product Validation Instrument

No	Validator	Media (Aspect)	Question	
			Concept Understanding	Creativity
1	Material Expert	Learning Completeness of contents	Test grid	Test grid

No	Validator	Media (Aspect)	Question	
			Concept Understanding	Creativity
2	Media Expert	Materials, examples, and practice questions	Concept Understanding Test	Creativity Test
		Program operation		
3	Educators and Peer Reviewers	Display quality	Concept Understanding Test	Creativity Test
		Quality of illustrations		
		Program development		
		Learning		
		Completeness of contents		
		Program operation		
		Display quality		
		Illustration quality		
		Program development		

TABLE 2. Data Collection Instruments

No	Instrument
1	Concept Understanding Test (Multiple Choice Questions)
2	Creativity Test (Explanation and Multiple-Choice Questions and Mini Practice)
3	Student Response Questionnaire

The first stage is done by creating characters or figures in an audio-visual animation video with the Supermii and Zepeto mobile phones and slightly editing them using the Adobe Photoshop CS6 application on a laptop. Making characters is accompanied by creating a storyline, storyboarding, and combining images and sounds to make audio-visual animations. The characters are created using the Supermini and Zepeto applications on mobile phones and Adobe Photoshop CS6 applications on laptops. The editing process and moving images use the KineMaster Diamond application on mobile phones and Wondershare Filmora on laptops. The display of the process of making audio-visual animation media can be seen in FIGURE 3 and FIGURE 4.

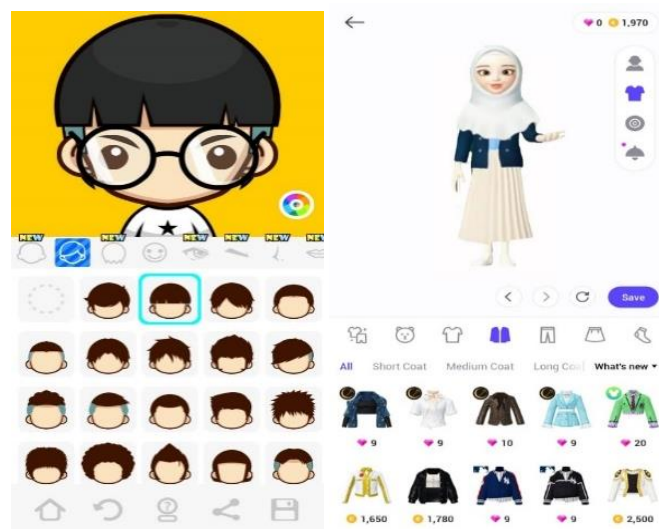


FIGURE 3. The Process of Making Characters using the Supermii and Zepeto Applications on Mobile



FIGURE 4. View Editing with the Kinemaster Diamond Application on the handphone

The research instruments include product assessment sheets, student response questionnaires, and concept understanding and creativity tests. The research design is a one-group pretest-posttest design. The research subjects were elementary school students for the 2021/2022 academic year, 24 students in class VI for the initial trial, and 36 in class IV for the main field trial. The data analysis technique used to determine the difference in the results of increasing conceptual understanding and creativity is the MANOVA test, with a significance level of 0.05.

The prerequisite test was carried out before analyzing the MANOVA test. The prerequisite test steps were the Multivariate Normality test and the homogeneity test of the variance-covariance matrix. If the prerequisite test has been met, then the MANOVA test is carried out using the IBM SPSS Statistics 21 software.

RESULTS AND DISCUSSION

The results of development research are known differences in learning outcomes using audio-visual animation media and without the developed audio-visual animation media. The results are known from the results of several analyzes that have been carried out. The product trial resulted in the test results for understanding the concept and creativity of elementary school students. The trial stage assessed the revised learning media products based on suggestions from the validator. The trial was carried out to get the quality value of the audio-visual science animation media product based on an assessment by 24 students with various academic abilities, using instruments that expert lecturers have validated. The calculation process uses a spreadsheet. The results of the media product assessment are presented in TABLE 3.

TABLE 3. Test Results of Audio-visual Animation Media Product Assessment

Theory	Media	Average
3.77	4.68	4.22
Good	Very Good	Good

The statistical test used was multivariate analysis (MANOVA) to determine the effect of audio-visual animation media in science to improve elementary school students' conceptual understanding and creativity. Prerequisite tests are carried out, namely:

1. Multivariate Normality Test

Normality analysis obtained a significance value of more than 0.05. This means that the data of the experimental and control groups are normally distributed.

2. Homogeneity test of the variance-covariance matrix

The results of the homogeneity test using Box's Test obtained a significance value of more than 0.05 indicating the value of concept understanding and creativity have relatively the same variance.

The Manova test results showed differences between the independent variables (science audio-visual animation media) and all the dependent variables (concept understanding and creativity). The development of audio-visual animation media aims to improve elementary school students' ability to understand concepts and creativity. This media is suitable for use in the science learning process in and

outside the classroom based on the results of trials on elementary school students. Feasibility assessments were also carried out by material and media experts and primary school classroom teachers. Audio-visual animation media is said to be flexible and easy to use anywhere.

The results of the MANOVA analysis show that the significance value shows a value of $0.839 > 0.05$ in the class section and $0.000 < 0.05$ in the intercept. The conclusion that can be drawn from this multivariate test is that there is no difference between the use of audio-visual animation learning media for science on the theme of always saving energy and the sub-theme of various types of energy and other media provided by teachers in schools to improve students' conceptual understanding and creativity. This is because other media used also use video media displayed to students.

The results of the effective contribution given by each variable in each class are almost the same, and even the same means that there is no difference in effectiveness for each class. Because the media used in different classes are almost the same. The effective contribution in the trial using audio-visual animation in science improves understanding of concepts and creativity. The effective contribution of the experimental and control classes was 74.83% and 66.94% to improving concept understanding and creativity.

The manufacture of IPA audio-visual animation media products is presented in Figure 3, and the resulting IPA audio-visual animation media products are presented in FIGURE 5.



FIGURE 5. Sciences Audio-Visual Animation Media Products

The resulting media is in the form of files in *.mp4 format, which can be accessed on Android using the open video application on mobile phones and computers.

1. Products are accessed using Android or a computer online and offline.
2. Products are used during the learning process inside and outside the classroom.
3. The product developed explains the theme of always saving energy, the sub-theme of various types of energy.
4. Materials and questions aim to improve students' conceptual understanding and creativity.

Science audio-visual animation media is applied to fourth-grade students according to the learning material in the media, namely the theme of always saving energy. Products can be used according to the materials needed. Media distribution is done through YouTube and WhatsApp.

Audio-visual animation media that is applied affects elementary school students' ability to understand concepts and creativity. This is related to several studies, learning animation video media in elementary school science subjects that were developed are feasible and effective to be used in learning activities (Efendi et al. 2020; Fitri 2018; Hapsari & Zulherman 2021). Animated video media in science learning can improve learning achievement and is suitable for use in the learning process (Ma'wa et al. 2021). Audio visual media can invite students to master the concept concretely. It was developing the character of curiosity, courage, responsibility, honesty, and being active in science learning (Wulandari, Ruhayat & Nulhakim 2020). Audio-visual animation learning media products that have been made are said to be influential in the learning process and can increase elementary school

students' ability to understand concepts and creativity, although not significantly. The use of media that is almost the same between the control and experimental classes causes a not-so-significant difference.

This development research makes it easier for educators and students to engage in learning activities in the classroom and at home. Learning that is carried out a mixture of online and offline requires educators to be creative. Audio-visual animation video teaching media can facilitate educators in providing material explanations to students. Audio-visual animation videos are made active and passive as desired. The making of this media is made not too big so that all students in the class can access it. The media is uploaded on the YouTube channel to make it easier to access by anyone at any time. Students are made to focus and not feel bored when learning to use videos. This development research is almost the same as research on developing audio-visual media using PowToon (Raihanati, Jamaludin & Taufik 2020). It is difficult for educators to make video media themselves if educators are less enthusiastic about making their own media. Using audio-visual media is straightforward to use using existing videos, and it isn't accessible if educators are less creative in developing media.

The IPA audio-visual animation media used did not provide a significant difference. This is because almost all the media used are the same. These things can be successfully done after completing the study hours. Audio-visual animation media can be applied and used for learning in schools. This is following research from (Awalia, Pamungkas & Alamsyah 2019) that animated learning media on Android can provide understanding to class IV students regarding subjects. Audio-visual animation media, which contains educational videos, can be easily accessed everywhere. Thus, audio-visual animation can be used as a source for individual uses and for teaching and learning activities in class (Lestari et al. 2021). The description of the research is in line with the research conducted. Multimedia is designed using the Adobe Animate CC 2019 application and contains syntaxes of cognitive learning (Dhanil & Mufit 2021). The research is the same as the multimedia used in this study, in the form of audio-visual animation media.

Media use for classroom learning requires validation by media and material experts, and trials are carried out on students to determine the feasibility of media (Sari, Prasetyo & Kuswanto 2020). The media used in learning is feasible according to the results of the validation and trials carried out. Audio-visual animation products are suitable after going through the expert validation process (material and media experts), as well as comments and student responses using questionnaires on small trials and significant tests. This is following research from (Nomleni & Manu 2018). These results led to the final product as an audio-visual animation aid. The science theme is always about saving energy for fourth graders. The resulting product can increase a student's understanding of concepts and creativity, although this is unimportant. Audio-visual animation media is appropriate for use during the learning process (Isdayanti, Nulhakim & Syachruroji 2020). The use of media that requires Android is currently essential in the world of education because everything is online and technology.

CONCLUSION

The conclusions of this study indicate that the audio-visual animation media of science to improve conceptual understanding and creativity of elementary school students contains material of various kinds of energy which is categorized as suitable for use in the science learning process in elementary schools based on a feasibility assessment with a good category. Audio-visual animation media can be used for the learning process in and outside the classroom. The result of increasing concept understanding and creativity is a difference between the control and experimental classes with a significance level of > 0.05 . This shows that there is no difference between using audio-visual animation learning media for science on the theme of always saving energy and other media provided by teachers in schools to improve students' conceptual understanding and creativity. This is because other media used are also in the form of learning videos.

ACKNOWLEDGMENT

This research was supported by STKIP Majenang and the Ministry of Education, Culture, Research, and Technology. We thank our colleagues from Pahonjean 5 Elementary School and Jenang 10 Elementary School in Cilacap City, that greatly assisted the research.

REFERENCES

- Andriana, E, Vitasari, M, Oktarisa, Y & Novitasari, D 2017, 'Pengembangan Multimedia Pembelajaran IPA Berbasis Kearifan Lokal di Sekolah Dasar', *Jurnal Pendidikan Sekolah Dasar*, vol. 3, no. 2, pp. 186-200.
- Astuti, WP, Istiyati, S & Sadiman, S 2014, 'Penggunaan Media Audio Visual untuk Meningkatkan Pemahaman Konsep Perubahan Kenampakan Bumi', *PGSD UNS*, vol. 449, pp. 28-31.
- Awalia, I, Pamungkas, AS & Alamsyah, TP 2019, 'Pengembangan Media Pembelajaran Animasi Powtoon pada Mata Pelajaran Matematika di Kelas IV SD', *Kreano, Jurnal Matematika Kreatif-Inovatif*, vol. 10, no. 1, pp. 49-56.
- Aytekin, P & Sakarya, I 2007, 'How Technology Is Integrated Into Science Education in a Developing Country : North Cyprus Case', *Turkish Online Journal of Educational Technology*, vol. 6, no. 3, pp. 54-61.
- Dhanil, M & Mufit, F 2021, 'Design and Validity of Interactive Multimedia Based on Cognitive Conflict on Static Fluid Using Adobe Animate CC 2019', *Jurnal Penelitian & Pengembangan Pendidikan Fisika*, vol. 7, no. 2, pp. 177-190.
- Efendi, YA, Adi, EP & Sulthoni, S 2020, 'Pengembangan Media Video Animasi Motion Graphics pada Mata Pelajaran IPA di SDN Pandanrejo 1 Kabupaten Malang', *Jurnal Inovasi Teknologi Pembelajaran (JINOTEP)*, vol. 6, no. 2, pp. 97-102.
- Eraikhuemen, L & Ogumogu, A 2014, 'An Assessment of Secondary School Physics Teachers Conceptual Understanding of Force and Motion in Edo South Senatorial District', *Academic Research International*, vol. 5, no. 1, pp. 253-262.
- Fitri, A 2018 'Penggunaan Media Audio Visual dalam Pembelajaran IPA untuk Meningkatkan Hasil Belajar di SDN Telukjambe II', *Jurnal Sekolah Dasar: Elementary School Journal*, vol. 1, no. 3, pp. 66-74.
- Hapsari, GPP & Zulherman, Z 2021, 'Pengembangan Media Video Animasi Berbasis Aplikasi Canva untuk Meningkatkan Motivasi dan Prestasi Belajar Siswa', *Jurnal Basicedu*, vol. 5, no. 4, pp. 2156-2163.
- Irwandani, I & Rofiah, S 2015, 'Pengaruh Model Pembelajaran Generatif terhadap Pemahaman Konsep Fisika Pokok Bahasan Bunyi Peserta Didik MTs Al-Hikmah Bandar Lampung', *Jurnal Ilmiah Fisika Al-Biruni*, vol. 4, no. 2, pp. 165-177.
- Yanti, I, Nulhakim, L & Syachruraji, A 2020, 'Pengembangan Media Pembelajaran Audio Visual Berbasis Adobe Flash Pada Materi Daur Hidup Hewan', *Jurnal Ilmiah Pendidikan Dan Pembelajaran*, vol. 4, no. 2, pp. 390-406.
- Kocaktufan, Z & Kayaaslan, B 2020, 'Crushing the Curve, the Role of National and International Institutions and Policy Makers in COVID-19 Pandemic', *Turkish Journal of Medical Sciences*, vol. 50, pp. 495-508.
- Lee, C & Lee, SJ 2017, 'Prevalence and Predictors of Smartphone Addiction Proneness Among Korean Adolescents', *Children and Youth Services Review*, vol. 77, pp. 10-17.
- Lestari, KP, Nasbey, H & Raihanati, R 2021, 'The Development of "Poster Equipped with Video (POSEVI)" on Fluids at Rest Topic for 11th Grade Students', *Jurnal Penelitian Dan Pengembangan Pendidikan Fisika*, vol. 7, no. 1, pp. 91-98.
- Lukman, A, Hayati, DK & Hakim, N 2019, 'Pengembangan video animasi berbasis kearifan lokal pada pembelajaran IPA kelas V di Sekolah Dasar', *Elementary*, vol. 5, no. 2, pp. 153-166.
- Ma'wa, J, Amir, SD, Umar, NH, Rahmiati, S & Muhiddin, NH 2021, 'Pengembangan Media Pembelajaran Audiovisual Materi Sistem Pencernaan Manusia', *Journal Lepa-Lepa Open*, vol. 1, no. 1, pp. 121-124.

- Nomleni, FT & Manu, TSN 2018, 'Pengembangan Media Audio Visual dan Alat Peraga dalam Meningkatkan Pemahaman Konsep dan Pemecahan Masalah', *Scholaria: Jurnal Pendidikan Dan Kebudayaan*, vol. 8, no. 3, pp. 219-230.
- Pambudi, B, Efendi, RB, Novianti, LA, Novitasari, D & Ngazizah, N 2018, 'Pengembangan Alat Peraga IPA dari Barang Bekas untuk Meningkatkan Motivasi Belajar dan Pemahaman Siswa Sekolah Dasar', *Indonesian Journal of Primary Education*, vol. 2, no. 2, pp. 28-33.
- Raihanati, L, Jamaludin, U & Taufik, M 2020, 'Pengembangan Media Pembelajaran Audio Visual Powtoon Berbasis Kontekstual Pada Mata Pelajaran IPS Kelas IV', *Attadib: Journal of Elementary Education*, vol. 4, no. 2, pp. 1-11
- Ribeiro, JLP 2016, 'A Plane Mirror Experiment Inspired by a Comic Strip', *Physics Education*, vol. 51, no. 1.
- Sadikin, A & Hamidah, A 2020, 'Pembelajaran Daring di Tengah Wabah Covid-19 (Online Learning in the Middle of the Covid-19 Pandemic)', *BIODIK: Jurnal Ilmiah Pendidikan Biologi*, vol. 6, no. 1, pp. 214-224.
- Sampurno, MBT, Kusumandyoko, TC & Islam, MA 2020, 'Budaya Media Sosial, Edukasi Masyarakat, dan Pandemi COVID-19', *SALAM: Jurnal Sosial Dan Budaya Syar'i*, vol. 7, no. 6, pp. 529-542.
- Sari, FP, Nikmah, S, Kuswanto, H & Wardani, R 2020, 'Development of Physics Comic Based on Local Wisdom: Hopscotch (engklek) Game Android-Assisted to Improve Mathematical Representation Ability and Creative Thinking of High School Students', *Revista Mexicana de F'isica E*, vol. 17, no. 2, pp. 255-262.
- Sari, FP, Prasetyo, H & Kuswanto, H 2020, 'Physics Comics Learning Media Based on Engklek Traditional Games on Parabolic Motion Topics to Improve Creativity', *Journal of Gifted Education and Creativity*, vol. 7, pp. 83-92.
- Sheu, JJ & Chu, KT 2017, 'Mining Association Rules Between Positive Word-of-Mouth on Social Network Sites and Consumer Acceptance: a Study for Derivative Product of Animations, Comics, and Games', *Telematics and Informatics*, vol. 34, no. 4, pp. 22-33.
- Sugiyono, S 2015, 'Metode Penelitian Kuantitatif, Kualitatif, dan R&D', Alfabeta, Jakarta.
- Timbowo, D 2016, 'Manfaat Penggunaan Smartphone sebagai Media Komunikasi (Studi pada Mahasiswa Jurusan Ilmu Komunikasi Fakultas Ilmu Sosial dan Politik Universitas Sam Ratulangi)', *Acta Diurna Komunikasi*, vol. 5, no. 2.
- Wulandari, Y, Ruhiat, Y & Nulhakim, L 2020, 'Pengembangan Media Video Berbasis Powtoon pada Mata Pelajaran IPA di Kelas V', *Jurnal Pendidikan Sains Indonesia (Indonesian Journal of Science Education)*, vol. 8, no. 2, pp. 269-279.

