# JOURNAL OF DIGITAL EDUCATIONAL TECHNOLOGY
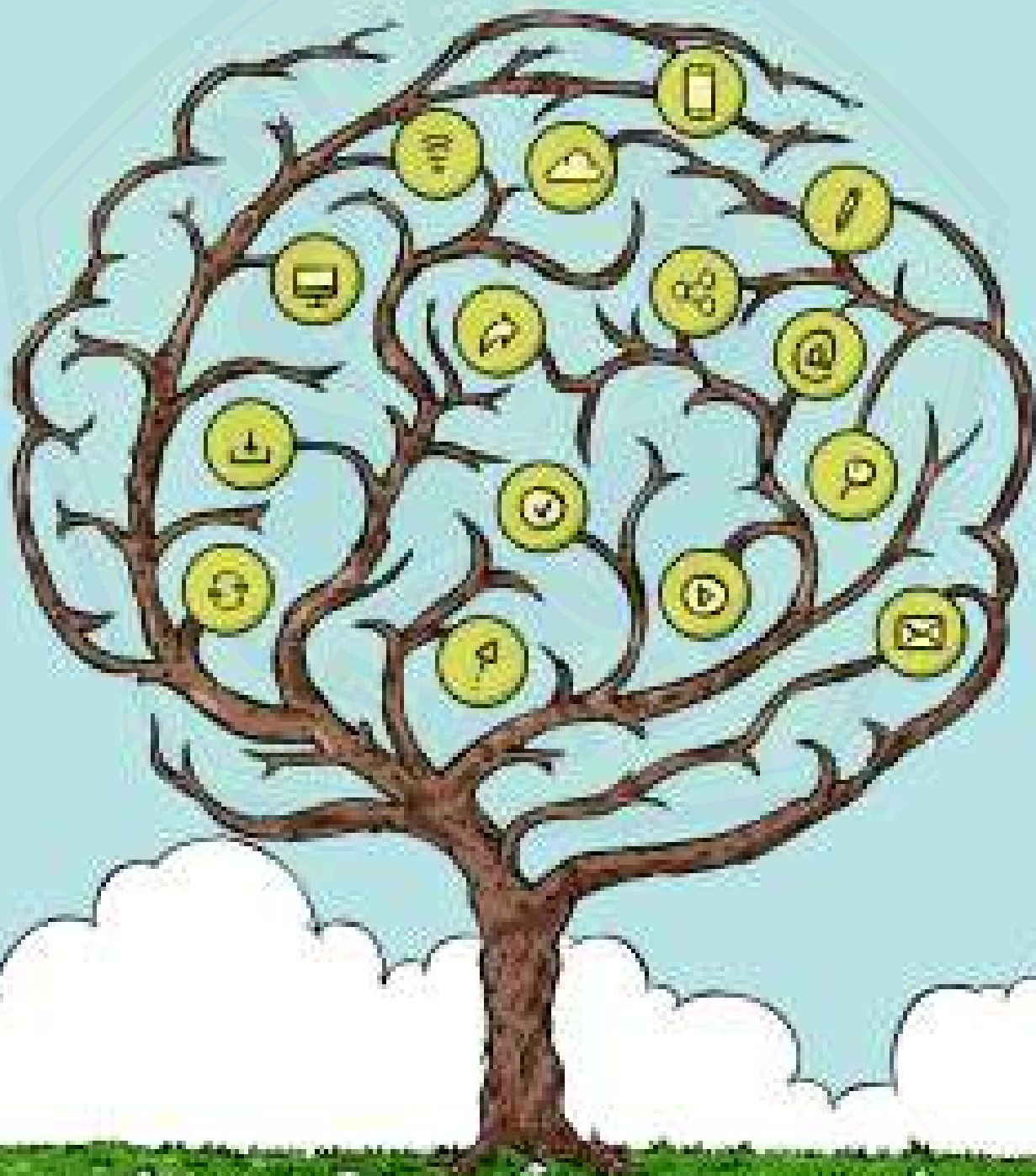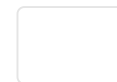
# Editorial Office

**Stamatios Papadakis**, University of Crete (Greece)
E: stpapadakis@edc.uoc.gr
W: https://ptpe.edc.uoc.gr/en/staff/32380/82
RG: https://www.researchgate.net/profile/Stamatios-Papadakis-2

**Albina R. Shaidullina**, Almetyevsk State Oil Institute (Russia)
E: albina-plus@mail.ru
Scopus Author ID: 56142606600
ORCID: https://orcid.org/0000-0002-0648-4312

**Zehra Gabillon**, University of French Polynesia (French Polynesia)
W: https://www.upf.pf/fr/zehra-gabillon
Academia: https://upf-pf.academia.edu/ZehraGabillon
RG: https://www.researchgate.net/profile/Zehra_Gabillon
Google Scholar: https://scholar.google.com/citations?
user=wefQw8AAAAAJ&view_op=list_works&sortby=pubdate

**Cem Birol**, Final International University (Cyprus)
E: cem.birol@final.edu.tr
W: https://staff.final.edu.tr/cem.birol
Google Scholar: https://scholar.google.com/citations?
user=FQolG4YAAAAJ&view_op=list_works&sortby=pubdate

**Mehmet  Karakus**, Pedagogical University of Krakow (Poland)
E: karakusmehmet44@gmail.com
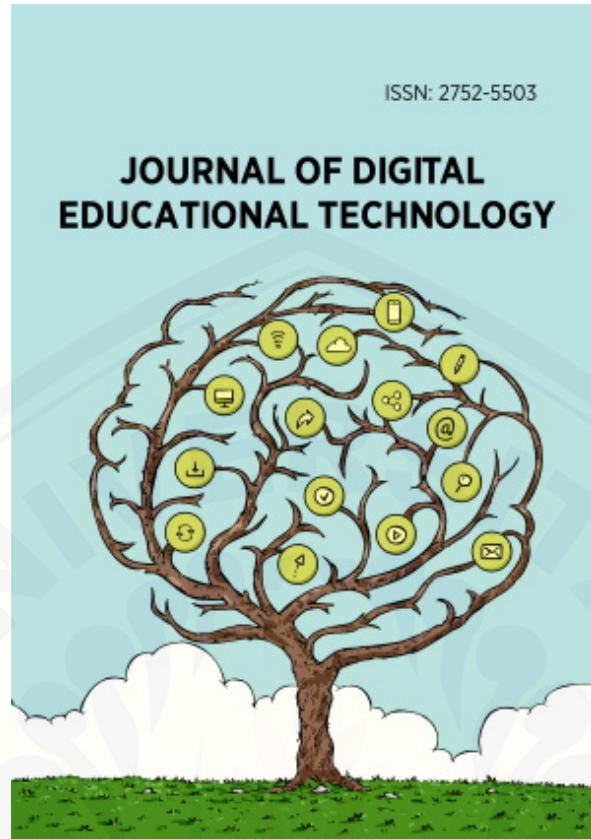W: https://pureportal.coventry.ac.uk/en/persons/mehmet-karakus
ORCID: 0000-0002-3628-9809

# Managing Editor

**Dr. Esma Usak, MD**, Bastas Publication

Editorial board member list of JDET is currently being updated.

We invite you to submit your applications to become an associate editor, a member of the international editorial board or a reviewer.

**ISSN: 2752-5503**

**JOURNAL OF DIGITAL EDUCATIONAL TECHNOLOGY**

Research Article

# Development of Thematic E-Comic Based on Augmented Reality

Rafiantika Megahnia Prihandini [1] , Bea Hana Siswati [2*]

[1] Department of Mathemathic Education, University of Jember, East Jawa, INDONESIA
[2] Department of Biology Education, University of Jember, East Jawa, INDONESIA
*Corresponding Author: beahana.fkip@unej.ac.id

| ARTICLE INFO | ABSTRACT |
|---|---|
| | Considerable changes in the world of education are required due to the COVID-19 pandemic. The commonly implemented offline learning class can no longer be done. Alternatively, online learning becomes the only option to be implemented. This consequently affects the students' ability in understanding the learning material presented by the teachers. Therefore, teachers are expected to develop varied interesting learning media to help students understand the learning material better. This research aims at describing the design of e-comic based on augmented reality and determining its validity on flat-plane learning material. This developmental research uses ADDIE development model with five stages, namely analyze, design, develop, implement, and evaluate. The results of the validation assessment from the content expert, learning design expert, and the learning media expert obtained 95%, 92%, and 98%, respectively with very good categories. The overall validation results from the experts and individual trials were categorized as very good.<br><br>**Keywords:** augmented reality, thematic e-comic, mathematics learning media |

## INTRODUCTION

Teachers are the designers of learning who are expected to develop learning activities and to use various learning media and learning resources, with the goal of creating an effective and efficient learning process. There are many types of innovative learning media that can be used, such as print media, models, audio, audio-visual, and interactive learning media. According to the Association of Education and Communication Technology (AECT), media is a tool that can be used to deliver messages in an activity. According to Sutrisman (2014, p. 15), learning media are graphic, photographic, electronic objects that can be used to remake information in the form of written forms, images, videos, and audios. In addition, learning media develops following technological developments. Interactive learning media can be one of the ways that teachers can use in the learning activities to help students understand the learning material more successfully. Teachers can make technology-based learning media, namely interactive learning media.

The results of a class observation indicated that the learning activities carried out by the teacher were not satisfactory. Moreover, the teacher did not use various types of learning media and only used one textbook as the learning source. In addition, sometimes the teacher only provided a YouTube link for the students to explain the learning material. As a result, the students found it hard to understand the learning material. In elementary school level of education, the use of learning media has an important role. Teachers should pay attention to the use of learning media because students at the elementary school level have difficulties and limitations in understanding abstract concepts.

The students' difficulties in understanding the flat plane material were also suggested by the results of evaluation done by the teacher. It was found that most of the students had difficulties in understanding the concepts of the flat plane learning material, especially in understanding the definition and the classification of a plane. Therefore, it is extremely necessary to create or use a learning media that can be used to help students understand the concepts of the flat plane learning material more successfully.

Augmented reality-based e-comic learning media can be used as an alternative to solve this problem. Augmented reality or AR is a technology that combines virtual reality with the real world. In recent years, the rapid development of AR technology has aroused the attention of many people. Flat-plane material will be very suitable when presented using AR-based learning media because the students can learn the flat-plane material through the objects they usually see in their everyday life (Kaufmann, 2003).

The previous research, that is closely related to this research, for example, explained that students' learning achievement could be improved by using interactive learning media by applying media development procedures (Coal,

**Table 1.** Achievement rate conversions on a five scale

| Achievement rate (%) | Qualification | Description |
|---|---|---|
| 90-100 | Very good | No revision needed |
| 75-89 | Good | Minor revision |
| 65-79 | Enough | Revision required |
| 55-64 | Poor | Major revision needed |
| 1-54 | Very poor | Product remake |

2015). Problem-based learning-based e-comic learning media is feasible to be used in learning activities (Laksmi & Suniasih, 2002). The results of the validity test from the learning content expert, the learning design expert, the learning media expert indicate a very good category, and the results of the individual try-out also obtained a very good qualification. In addition to the two previous research, developmental research was conducted on *AR-mobile educational* game, which was developed to help children learn reading, writing, and arithmetic. In this research, it was concluded that the respondents were interested in the use of *AR,* which was applied to the *animal quiz* game (Indriasih et al., 2020).

Based on that previous research, the results of observations and interviews with students and teachers, the researcher would like to describe the design and to reveal the validity of AR-based e-comic media on flat-plane material.

## METHOD

This research is a research and development that uses the ADDIE model. The ADDIE model consists of five steps, namely: Analyze, design, development, implementation, and evaluation (Branch, 2009). The e-comic media was developed following these stages and through product testing, namely expert testing, and individual testing. The test subjects of this research were learning content experts, learning design experts, and learning media experts. This research used a non-test data collection method in the form of a questionnaire. The questionnaires were given to the validators, to determine the feasibility of the e-comic media from learning content experts, learning design experts, and learning media experts, to determine the effectiveness of AR-based e-comic learning media. The data analysis technique used in this research was quantitative descriptive analysis and qualitative descriptive analysis. The quantitative descriptive analysis was used to analyze the data from the expert validation results and the individual test subject response questionnaires in the form of percentage descriptive (**Table 1**). To provide meaning and decision making by using the qualitative descriptive analysis technique, as follows (Tegeh, 2018).

## RESULTS AND DISCUSSION

The solution to the problems faced by the students of SDN Panti 3 Elementary School, Panti District, Jember Regency is to develop an AR-based e-comic. In connection with the problems faced, the learning media was developed following the ADDIE procedure. This model consists of five main stages, namely (A) analysis, (D) design, (D) development, (I) implementation, and (E) evaluation.

The analysis stage consists of needs analysis, curriculum analysis, student characteristics analysis, and the analysis of criteria for good learning media. A need analysis was conducted by interviewing the fifth-grade teacher at SDN 3 Panti Elementary School to determine the needs in the learning process, especially in learning mathematics. The results of the needs analysis show that teachers always used books and video from YouTube links for online learning activities. The content of the flat field learning material in the students' handbook did not cover the complete material, and the teacher rarely used learning media during online learning. Therefore, it is necessary to develop AR-based e-comic learning media. This is also supported by Piaget's (1945) theory, which explains that there are stages related to the learning development of a person's ability (children). According to Piaget (1936), elementary school students (8-11 years old) are still at the stage of concrete operations, in which they need concrete objects to learn or translate new concepts. Therefore, at this stage, the use of learning media in the learning activities is necessary because the students are still thinking concretely, not yet able to think abstractly. The use of learning media will help the students understand the learning material more easily. The analysis stage is the stage of solving problems, so that teachers can develop learning media that are suitable for the school conditions and students. The students are considered successful in learning when they are able to master the learning material well. This surely cannot be separated from the learning activities and the learning media used during the learning process (Utami, 2021).

Design stage, at this stage concept design was obtained from the integrative e-comic media which consisted of seven steps, including: story ideas, determining characters, determining themes, determining settings, compiling story frameworks, connecting material with stories, compiling integrative e-comic story frameworks. At this stage, the e-comic was created using Canva App, which was then uploaded in Play Store, in order that the students can download the Application easily, and that the students can read the learning material via their smart phones.

Development stage, at this stage the trial activities were carried out in two stages, namely:

(1) The learning material expert test and learning media expert test. At this stage, the prototype was reviewed, and feedbacks were given by the reviewers to improve the learning media being developed.

(2) Student response questionnaire. The results of the questionnaire were to show how much the students enjoyed the learning activities with integrative e-comic media.

Implementation stage, this stage was carried out after the integrative e-comic media was declared feasible to be used as the learning media. The next step was to apply the learning media. Based on the implementation of the integrative e-comic media, the students were then asked to give an assessment or responses on the integrative e-comic media. The assessment was done in the form of answering a questionnaire (yes-no). The questionnaire was adjusted to what the students felt after learning by using the learning media. Evaluation stage, this stage was carried to improve and
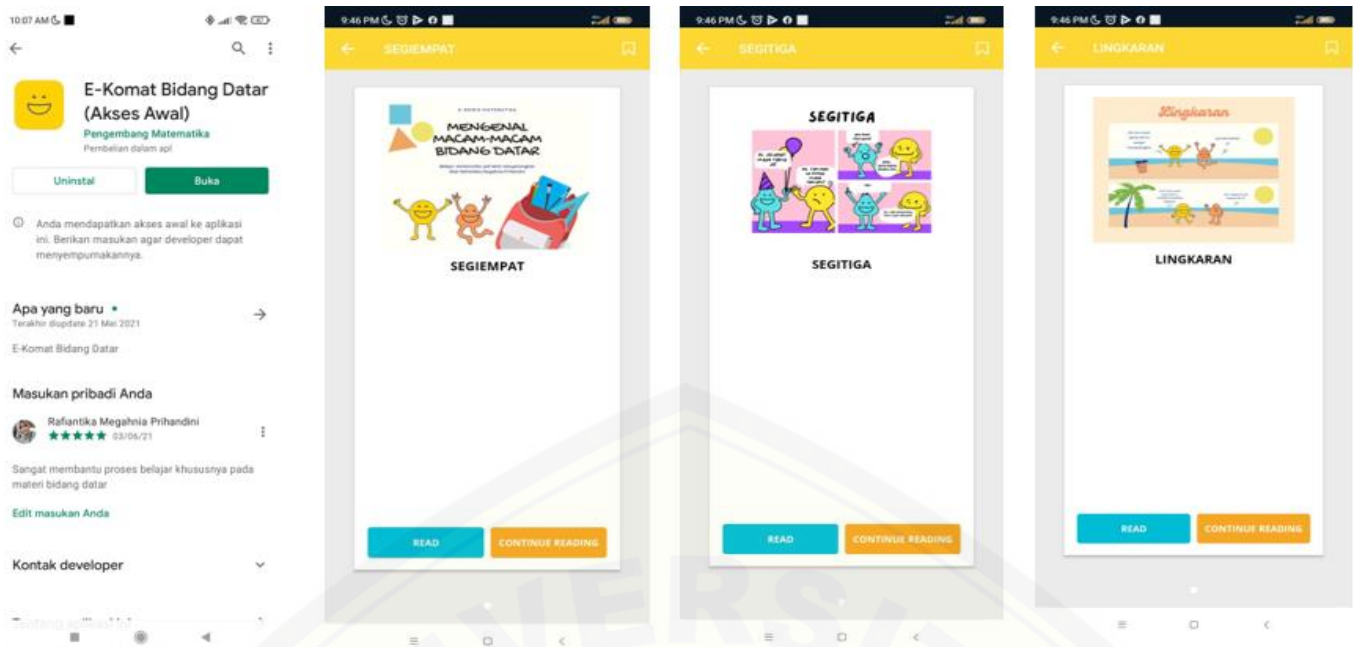
**Figure 1.** Integrated augmented reality-based thematic e-comic display



**Figure 2.** E-comic with QRCode display-1

perfect the product. The evaluation was based on the criticisms and suggestions from the experts (learning media and materials), as well as the results of student responses. These feedbacks were used as the basis to improve the research products.

The product of this research is in the form of learning media, namely AR-based e-comic media. The validation results by the learning content expert obtained 95% which was categorized as very good category. Moreover, the results of the learning design experts obtained 92%, which was also categorized as very good, and finally the results of the learning media expert obtained 98% which was in the very good category. It can be concluded that the overall results of the expert validation and qualified individual trials were very good. Based on the feedbacks and the suggestions of the test subjects, the description, or the visualization of the revisions from the learning media experts is, as follows. The results of the AR-based e-comic media review indicate that the score of the learning content, namely the flat field material, was distributed on score 4 (very good) and 3 (good). The quality of the material aspect has very good criteria with a percentage of

95% from the learning content experts whose assessment criteria include the followings:

1. material relevance,
2. content truth, and
3. language and typography.

The results of the review from the learning design expert obtained a score of 4 (very good), 3 (good). From the results of the score distribution, the result of 92% was obtained with very good criteria. The assessment criteria for the learning design aspects include the followings:

1. e-comic display and
2. e-comic appeal.

The results of the review from the learning media experts on the components of the learning material were distributed on a score of 4 (very good), 3 (good). From the results of the distribution of these scores, the final results obtained with a percentage of 98% very good criteria. The aspects of the assessment criteria for learning media include the followings:

1. effectiveness of use,
2. usability, and
3. visual communication.

The final result of the development of problem-based learning-based e-comic learning media can be seen in **Figure 1**.

The developed e-comic consists of three subjects, namely quadrilateral, triangle, and circle. The three subjects were developed using the AR approach. This e-comic is also integrated with the Assembler application. With this application students can see objects in everyday life in 3D, so that students can learn flat-plane material more easily. The developed e-comic was equipped with QRCode. This QRCode will be a marker that will be connected to the 3D image. The workings of this media can be seen in **Fgure 2**.
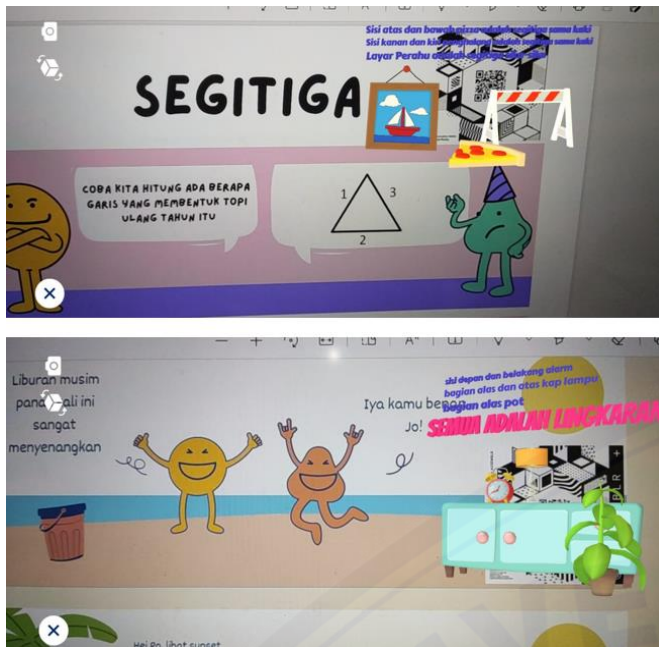
**Figure 3.** E-comic with QRCode display-2

The display when the QRCode on the e-comic has been scanned via a cellphone can be seen in **Figure 3**.

The results of this research on the AR-based e-comic which produces problem-based learning-based science comics indicate that it can be used to improve the students' thinking skills. The implementation of e-comic media in learning mathematics is more effective than that of the lecturing method. AR-based e-comic learning media can help students understand the learning material, it can improve students' critical thinking skills, especially in relation to students' ability to solve problems in learning. In addition, it is expected that this AR-based e-comic learning media can motivate students in studying the learning material, so that they can understand the material presented more easily. This is in line with the results of the research conducted by Nurrita (2018), which explains that learning media has many benefits, such as, it can be used as a guide for teachers to achieve the learning goals successfully. Moreover, learning media can also be used to increase students' motivation and interest in learning, the teaching and learning process can be implemented more easily, and it can also improve students' learning efficiency (Nurrita, 2018). Learning media that are well designed and well suited to the students' needs will be able to help students absorb the learning materials more easily and can be used by teachers as a means to explain abstract material (Audie, 2019).

## CONCLUSION

The development of this AR-based e-comic learning media uses the ADDIE development model which consists of five stages, as follows: analyze, design, development, implementation, and evaluation. The AR-based e-comic learning media is feasible to be implemented in learning activities. The results of the validity test from learning content experts, learning media experts, and learning design experts indicate that the learning media is in very good category. The results of this research can be used as a reference to conduct further developmental or experimental studies.

## REFERENCES

Audie, N. (2019). The role of learning media to improve student learning outcomes. In *Proceedings of the National Seminar on Education FKIP Sultan Ageng Tirtayasa University* (pp. 586-595).

Branch, R. M. (2009). *Instructional design: The ADDIE approach*. Springer Science & Business Media. https://doi.org/ 10.1007/978-0-387-09506-6

Coal, H. H. (2015). Development of interactive learning media on integer operations. *Muallimuna: Journal of Madrasah Ibtidaiyah, 1*(1), 1-12. https://doi.org/10.31602/muallimu na.v1i1.271

Indriasih, A., Sumaji, S., Badjuri, B., & Santoso, S. (2020). Development of e-comic as a learning media to improve life skills for early childhood. *Educational Reflections: Scientific Journal of Education*, *10*(2), 154-162. https://doi.org/10.24176/re.v10i2.4228

Kaufmann, H. (2003). Collaborative augmented reality in education. *Institute of Software Technology and Interactive Systems, Vienna University of Technology*. https://www.ims. tuwien.ac.at/publications/tuw-137414.pdf

Laksmi, N. L. P. A., & Suniasih, N. W. (2002). Development of e-comic learning media based on problem based learning on water cycle materials in science content for class V elementary school. *Scientific Journal of Education and Learning, 5,* 1.

Nurrita, T. (2018). Development of learning media to improve student learning outcomes. *Misykat, 3*(1), 171-187. https://doi.org/10.33511/misykat.v3n1.171

Piaget, J. (1936). *Origins of intelligence in the child*. Routledge & Kegan Paul.

Piaget, J. (1945). *Play, dreams and imitation in childhood*. Heinemann.

Sutrisman, A. (2014). Perbedaan tingkat pengetahuan, sikap dan tindakan dalam pemeliharaan kebersihan gigi dan Mulut (PHPM) sebelum dan sesudah penyuluhan kesehatan gigi [Differences in knowledge levels, attitudes and actions in maintaining dental and oral hygiene (PHPM) before and after dental health counseling]. *Jurnal Valid, 11*(2), 8-17.

Tegeh, I. M. (2018). Development of comic strip media with ADDIE model in science subjects to increase learning motivation of class V students at SD Negeri 1 Sari Mekar. *Undiksha Edutech Journal, 6*(2), 245-255.

Utami, R. P. (2021). The importance of learning media development in teaching and learning process activities. *Dharma Pendidikan* [*Education Dharma*]*, 12*(2), 62-81.