Development of Augmented Reality Based Ebook to Improve the Quality of Learning

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ABSTRACT

Conventional learning media implemented by teacher during a learning and teaching process is less attractive for the students so it causes boredom during the learning process. Such reality and circumstances have become the basic idea of the current researcher to utilize students' gadgets as a beneficial media for the learning process. In this case, researcher developed a learning media in the form of a feasible, practical, and effective augmented reality-based ebook on the subject of audio and video processing techniques of class XII Multimedia. This development used ADDIE model through the stages of analysis, design, development, implementation and evaluation. Feasibility test was conducted by the material and media experts. The media trial was done on 27 students, obtaining both quantitative and qualitative data. The quantitative data was further analyzed through percentage technique, while the qualitative data was analyzed descriptively. The data collection was done using a questionnaire as the research instrument. Furthermore, evaluation was performed to get information on how this ebook product was interesting and useful during the learning process. The review results from the material expert content was 93%, while the review results from the media expert was 98%, which interpreted that each was very feasible. Meanwhile, the results of the teacher response was 96%, while the results of the student response was from individual test, in which the big and small scale was 89.29%. Furthermore, the results of the t test pre-test and post-test showed deviation freedom of 26, sig.2 tailed value of 0.000 with a 95% confidence level with a mean pre-test of 60.89% and a mean post-test of 88.70%, thus it indicates an increase of 27.81 points. Based on the results obtained from several experts, the response of teachers, the response of students and the results of test evaluations on students, it can be concluded that the augmented reality-based ebook product is very feasible, practical and effective to be used as a book accompanying the students during the learning process.

Keywords

Ebook, Augmented Reality, Learning Quality

Introduction

The condition of industry 4.0 requires a learning process that can liberate the students and is relaxing in during the learning process, in this case the teacher has a vital role to improve the human resource quality. (Wong, KH 2019) Conventional learning media applied by a teacher during learning and teaching process is considered less-attractive to the students, thus it is necessary to make an innovative and practical learning media. An innovative learning media will greatly help students to construct their existing knowledge to become more unique and varied (Chaerunisa. 2019). This is supported by further development of computer and gadget devices that support the generation of digital native so that students can easily get information through such devices. Along this development, many students who are able to obtain such devices. To some extent, this affects the student life style, including in the context of learning. When students begin to get bored, they will look for other activities to remove the boredom, so that the students prefer to play with their smartphones than reading their lesson book or just listen to the explanation delivered by the teacher, cause the learning goal to become more and more difficult to achieve. Unfortunately, they use their smartphone and gadgets more to access social media, playing game or others which are not related to the learning studied, rather than using the devices as a learning media, while the learning goal is expected to be achieved.

Such reality and circumstances have become the basic idea of the current researcher to utilize the student computer or gadget as a beneficial learning media, given the presence of media and technology that is very important for learning process as an interactive media in the form of augmented reality-based ebook that gives interesting impression. In addition, this media also gives a novel media feeling for students (Mustaqim, 2016) since augmented reality

provides real illustration so that the students become interested in using learning media.

Ebooks utilize technological advances (Makdis, 2020) in learning process. Ebook developed were stored in the electronic device such as mobile phones, laptops, iPad, or computer, so students can bring the material subjects anywhere without feeling burden. Students can also read this media when they are alone. In other words, ebook is more flexible compared to printed book.

Augmented Reality is a concept of combining the virtual world into the real world. Virtual world do was made to improve the users' perception to understand the information of the object recognized. (Azuma in spade, Panchoo, and Bhoyroo. 2016: 125) Augmented Reality is defined as the use of digital computer, other special devices, and software device in real time to generate a simulation or environmental alternative, which is believed as something real or true by the users. Applications that apply Augmented Reality (AR) technology aim to provide information to users in a clear, real-time and interactive manner.

The advantages of augmented reality-based ebook is to give impression of a more attractive media which is not only in the form of text, but can include images, videos or sound, so it is more interesting than conventional subject book.

Furthermore, subjects that will be used as the concept of making ebook media based on augmented reality, is the subject of audio and video processing techniques of moving subject capture techniques in class XII of SMK Wijaya Putra. Since the teacher becomes the facilitator (Ulfiyani, 2016), he must be able to pack the learning to be more attractive by using a more appropriate techniques and methods in order to improve the learning quality through the assistance of an augmented reality-based ebook instructional media.

Audio and video processing technique subject is a subject which learns about the technique of taking pictures, audio and video editing. Materials of this learning subject is the use of picture taking equipment by using camera as well as audio and video editing of the picture taking process that has been done.

According to constructivism, students are responsible to self-learning. Students build their knowledge based on the experience obtained from the environment. Such approach requires students' active involvement, while the teacher responsibility teacher is to provide a conducive atmosphere for the learning process. Teachers need to provide appropriate and efficient materials, provide support, and motivate the students, so that they can receive and process their own knowledge. The current development of multimedia technology is able to support a learning process based on this approach which can be realized through a productive and promising learning media as new learning paradigm which able to provide space and innovative tool to meet the students need where previously not possible to do (Heider, Laverick & Bennett, 2009).

Referring to what has been described, it is necessary to develop a learning media, namely the development of ebooks based on Augmented Reality in the subject of audio and video processing techniques in class XII of the Multimedia Department. The development of augmented reality-based ebook is expected to provide a positive impact to improve the learning quality (Vold, T. 2020).

The purpose of this study was to produce a teaching material in the form of feasible, practice and effective augmented-reality-based ebooks on the subject of Audio and Video Processing Techniques in class XII Multimedia so that learning quality can be achieved.

Methods

The current research of the development of augmented-reality-based ebooks was done in SMK Wijaya Putra Surabaya in academic year of 2020/2021 at the Department of Multimedia class XII involving 27 students. This study used ADDIE model as a reference (Analysis, Design, Development, Implementation, and Evaluation). The model was structured as programmed with systematic activities in efforts to solve learning problem related to learning media which is appropriate to students learning needs and characteristics.

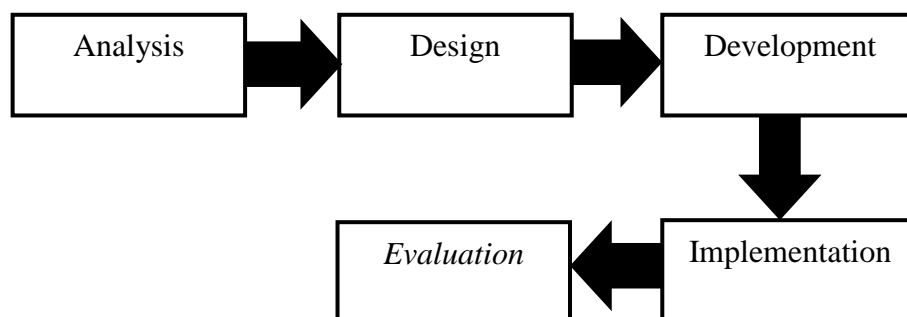The research stages of ADDIE development is presented in the following figure:

Figure 1. Steps for the ADDIE development model
(Source: adapted from Sugiyono, 2015: 200)

The data collection method used in the current research is: (1) Validity (a) material experts validity covers aspects of content feasibility, presentation feasibility, and language feasibility, while (b) media experts validity covers graphics feasibility and visual engineering feasibility; (2) Tests, in the form of students learning outcomes on aspects of knowledge arranged in the form of a minimum assessment criteria (AKM) model, in which the questions include multiple choice, multiple complex, matching, short answer, and descriptions, with a score of at least 65 in accordance with the national KKM (minimum score criteria) (Muhammad, Hamid. 2018); (3) Questionnaire, in the form of validity and response questionnaire derived from the peer response as well as the students response results.

Data analysis techniques used, was: (1) descriptive qualitative analysis (Agung, 2012) conducted by collecting and gathering information from qualitative data in the form of input, improvements suggestion, and comments contained in the assessment instruments sheet or questionnaire of this research and development. The analysis results were then used to revise the product developed; (2) descriptive quantitative analysis used for processing the data obtained from the questionnaire in the form of descriptive percentages, the following formulas are used:

To determine the validity level of learning media in the form of ebook developed, the following qualification assessment criteria was used, as proposed by S Arikunto, 2010:

Table 1. Guidelines for assessment questionnaire

Answer options	Score
Strongly agree/Very well	5
Agree/Fine	4
Doubt / Enough	3
Not agree/Poor	2
Strongly disagree/Very Poor	1

Table 2. Material and Media Expert Questionnaire Data Validity Category

No.	Performance (%)	Qualification	Information
1	81 - 100	Strongly agree/Very well	Strongly feasible/does not need improvement
2	61 - 80	Agree/Fine	Feasible/Partially revised
3	41 - 60	Doubt/Enough	Less feasible/needs revision
4	21 - 40	Not agree/Poor	Not Feasible/full revision
5	<20	Strongly disagree/very poor	Very not feasible/total revision

(S Arikunto, 2010: 24 through researcher modification)

Results

This research produced an augmented reality-based ebook for audio and video processing material subject of XII class of SMK. In order to see the video, AR book application is needed in the ebook to run the augmented reality by downloading and installing the application on the smartphone.

1. Analysis stages

    Based on observations that have been done at schools by interviewing students and some teachers of audio and video processing subject, it was known that they used conventional media and package book, so it is possibly contextual and not in accordance with the learning needs of audio and video processing that supposedly based on digitizing media.

2. Design Stages

    In this stage, the augmented reality-based ebook was designed by adjusting the core competencies, basic competencies as well as a syllabus based on the 2013 curriculum. This ebook used B5 size, space scale of 1.15; 12pt font size, and Cambria font. The results of ebook and use instruction book is as follow.
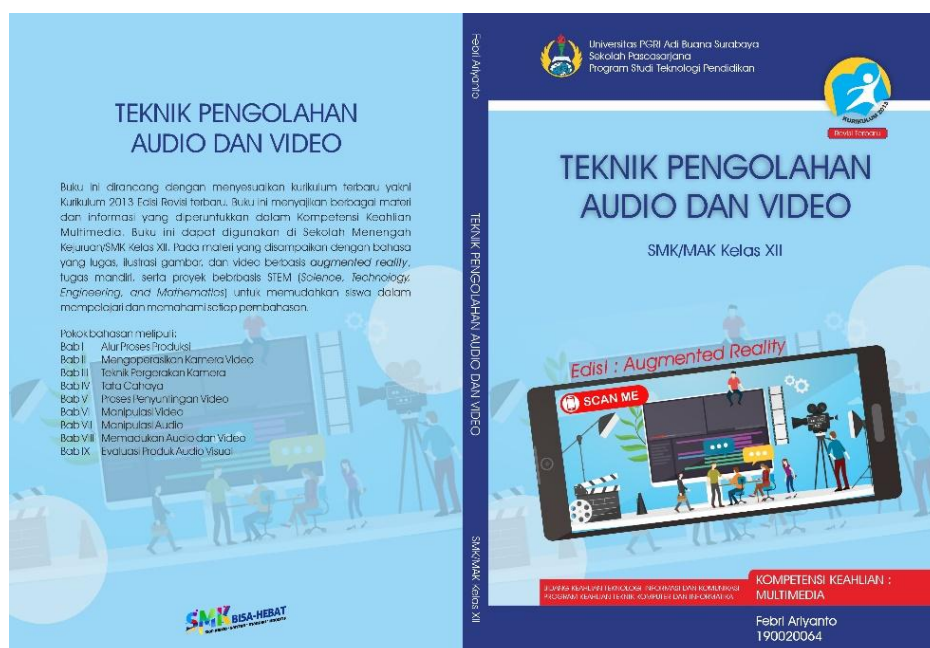

Figure 2. AR-based ebook cover

Figure 3. Use Instruction Book Cover

3. Development Stages
    This stage was the realization of the media that has been designed in the previous stage by using Corel Draw and Ms Word applications. The development of visual augmented reality media used Unity 3D and vuforia applications which provide **Scan Me** instruction on the ebook cover and some markers were placed on the content of each chapter. Each chapter contains media visual in the form of video taken from a private document. The following is the displays of the application and augmented reality-based media scan marker results.
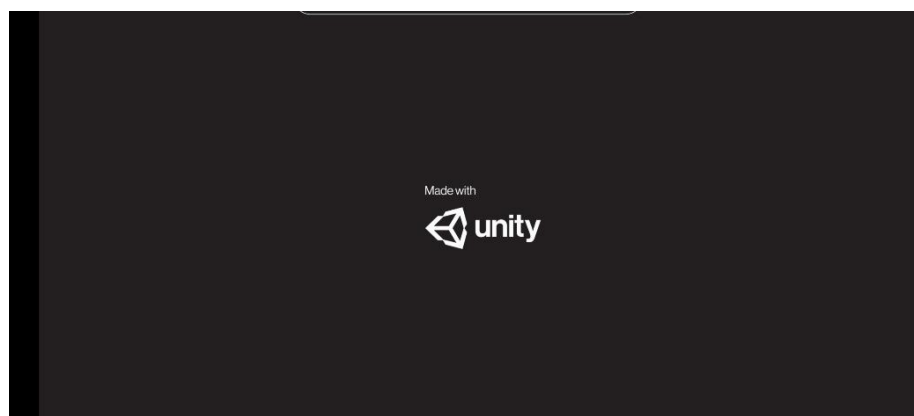

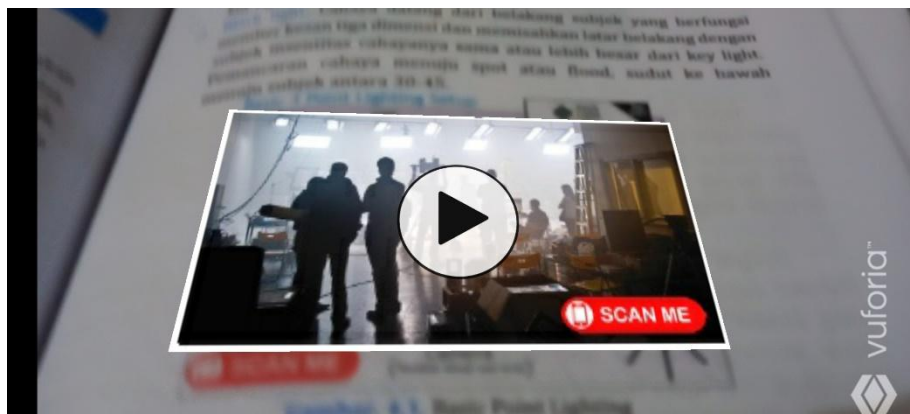**Figure 4.** Display of AR book application

Figure 5. Display of AR scan me marker

4. Implementation Stages

The implementation stage was the trial test of product that has been developed in order to view whether the media can be accepted or not. In this research, the trial was done in XII multimedia class through several stages including individual test consists of three students who have different capability level, small scale test of nine students of a part of a class, and large scale test which involves one class during audio and video processing technique subject.

5. Evaluation Stages

   a. Results of material expert validity

   Based on the activity, content feasibility, presentation feasibility, and language eligibility aspects, the augmented reality-based ebooks obtained a percentage of 93%. When the percentage was converted to the criteria table of validity test, the augmented reality-based ebook is classified as valid and otherwise very feasible to be used in learning process.

   b. Results of Media Expert Validity

   Based on the activity, graphics feasibility, and visual engineering feasibility aspects, the augmented reality-based ebook got a percentage of 98%. Based on the criteria table of validity level, this augmented reality-based ebook is classified as valid and otherwise very feasible to be used in learning process.

   c. Results of Teacher/Peer Response Evaluation

   According to the activities of teacher/peer evaluation, the augmented reality-based acquire 96% which based on the criteria table of validity test is classified as valid and otherwise very feasible to be used in learning process.

   d. Results of student response assessments

   In order that this augmented reality-based ebook is considered as practical in the use and application, then students' response is needed to obtain maximum results. The students' response was obtained by three stages.

   The individual test trial on 3 students on the augmented reality-based ebook contains four aspects of feasibility, those are display feasibility, visual engineering feasibility, learning feasibility, and benefits feasibility aspects. In order to obtain full scores, then the four percentages were summed up and divided by four, $\frac{87.88\% + 86.6\% + 86.6\% + 87.92\%}{4} = 87.25$. Furthermore, in order to obtain full score from the small scale test result of 9 students, the four percentages were also summed up and divided by 4 $\frac{89.24\% + 90.63\% + 89.35\% + 90.12\%}{4} = 89.83$. In the case of small scale test of 27 students, the same method was used, obtaining $\frac{92.16\% + 90.22\% + 89.65\% + 91.12\%}{4} = 90.79$.

   The results of individual test, small scale test, and large scale test were converted based on the product feasibility table, obtaining a very good and feasible

classification to be used for learning process.

e. The results of t test analysis

Product effectiveness was determined based on the students learning outcomes by using questions before using augmented reality-based ebook media called pre-test as well as questions after using the ebook media called post-test. All tests were carried out online through workspace google form to make it easier to correct answers that were automatically set by the system.

The results of the t test were used to determine the difference level among the students mean score between before and after using the augmented reality-based ebook media as a means to improve the learning quality and motivate the students to learn in Audio and Video Processing Subject of XII multimedia class major. The learning outcomes used test score based on minimum competence assessment (AKM) during before and after using the media. The results of the trial test of pre-test and post-test is presented as follow:

Table 3. One Sample Statistics and One Sample Test Table

	N	Mean	Std. Deviation	Std. Mean Error
Pre-test	27	60.89	15.328	2.950
Post-test	27	88.70	7.980	1.536

	t	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Differences	
					Lower	Upper
Pre-test	20.641	26	.000	60.889	54.83	66.95
Post-test	57.760	26	.000	88.704	85.55	91.86

The table above shows that the number of respondents (students) involved was 27 students who have pre-test and post-test score with deviation freedom of 26 and sig.2 tailed value 0.000 with a confidence degree of 95%. The pre-test and post-test mean score was 60.89 and 88.70, respectively. The lowest score for the student's pre-test was 34 and the highest was 85, while the lowest score for the post-test was 72 and the highest was 100. Based on these results, it shows that the student's score increased by 27.81 points or 45.67%.

Based on the results, it shows that 16 students had score below KKM during the pre-test, while all students obtained score above KKM during Post-test. This means that the use of *augmented reality-*based *ebook* media is effective and feasible.

Discussions

Research results showed that based on the interviews results to some students and teachers on audio and video processing technique subject, they used conventional media in which students tend to do the task not seriously do matter, get bored, saturated, fear, and cheating (Rolisca, RUC and Achadiya, BN 2014). Therefore, it is possible if they are contextual and not in accordance with the learning needs of audio and video processing that is supposed to be future industry 4.0 based digitizing media. Researchers previously said that AR has demonstrated extreme use to increase students' motivation during learning process (Jorge Bacca, Silvia Baldiris and Ramon Fabregat, 2014).

Related with learning media of what students needed, so that they become more interested in learning (Qumillaila, 2017), it is suitable for the to learn through the assistance of a smartphone that

can apply the technology of augmented reality as a medium which is able to attract the students' attention. According to (Bicen, H & E. Bal 2016) augmented reality also provides learning materials which are easy to improve and motivate the students to be success in interacting. The students even expressed that augmented reality should be used in all of the trainings because it can increase students' imagination in learning and students also understand easily when they use their smart phones to learn.

The utilization of learning media in the form of ebook must use augmented reality application that has been installed in android smartphone (Setiawan, 2019) called AR-Book. There is a marker writer as scan me in each chapter of the ebook. In order to see whether the augmented reality is running or not was done by downloading the AR-Book application by scanning the marker contained on the ebook media that later show a learning video as in the picture below
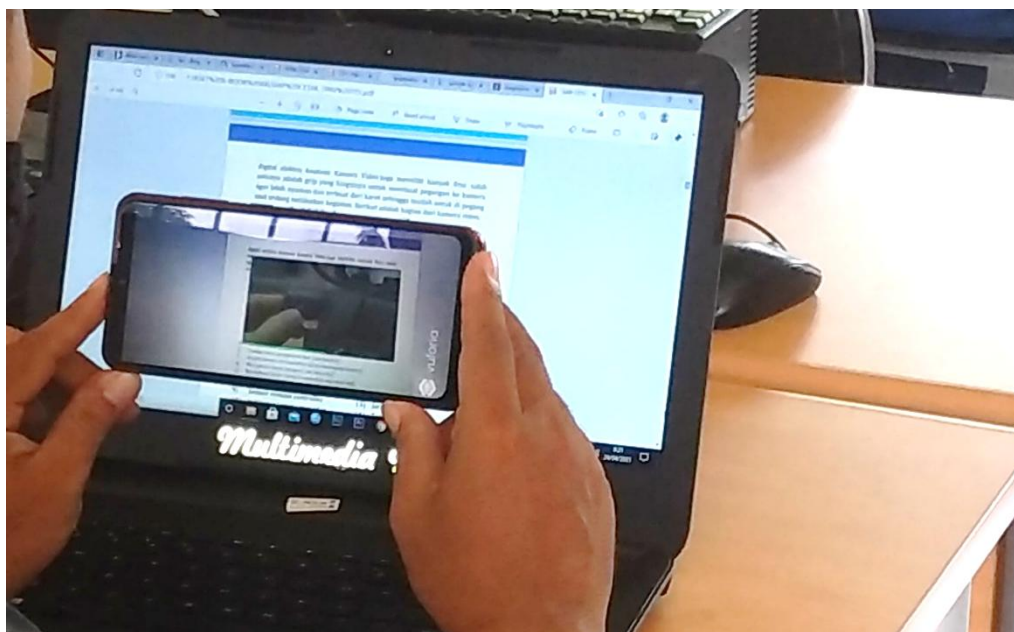

Figure 6. Utilization of *AR-Book*

The utilization of augmented reality technology in developing learning media provides different experience, both for teachers and students. Augmented reality can be used to bridge the gap between practical learning and theoretical practices along with the components of the real and virtual world (Antonioli et al, 2014: 96-107). Based on media that has been developed through formative evaluation stages, started from the expert material and expert media evaluation, teachers and peer evaluation and student evaluation covering individual test, small scale test, and large scale test. Based on the validity test results of augmented reality-based ebook media, a mean score of 4.5 was obtained, thus considered as valid and feasible for all stages of further research. The advantages of augmented reality method is able to show more appealing visual with the object of three dimensions that seemed to

exist in the real environment from the interactive side because it uses a marker to display the three-dimensional object particularly directed to the camera (Pradana, RW 2020). In addition to the concept that application used can increase the students reasoning and imagination. The weakness of this augmented reality-based media is that it takes up large storage space on students' android smartphone (Effendi, 2018).

Research that was done by (Cai, S., Wang, X., & Chiang, F K. 2014) revealed that AR tool has been tested practically at junior high school in Shenzen China. Based on the data analysis and discussion, it was concluded that (a) AR tool significantly improved the learning as a computer-assisted learning tool , (b) AR tool is also more effective to reach the low-scored students than the excellent students, (c) students generally gave a positive response to the AR software device, (d) students

are correlated positively with the evaluation results of the software device that was developed by researchers. Based on the analysis references, the application of AR method showed tangible evidence that really help all learning process especially students whose accomplishments are low.

Technology of augmented reality has the high potential in education. Ukraine has implemented augmented reality technology, not only in junior high school but also in some of the universities on the subjects which specifically teach students to develop augmented reality technology (Anna V. I atsyshyn, 2020). In the academic year of 2019, an augmented reality research technology laboratory has been established to increase the students' interest on educational material, increase the students' motivation for independent learning and cognitive activities. The current trend of educational project implementation was mostly implemented through augmented reality. In addition, this reality technology can be used to teach various science discipline in education. The application of augmented reality significantly affects the students learning outcome and increase the graduates competitiveness in order to become a reliable worker.

Acknowledgement

Conclusion

This research and development has produced a learning media in the form of an ebook based on augmented reality (AR) on the subject of Audio and Video Processing Techniques in XII class at the SMK/MAK level. Through this development model, a feasible media was obtained and used in SMK learning through several stages of product validity and feasibility test. To foster the quality of learning by looking at the results of the feasibility of the media based on the validity results of the material experts and media experts, it was stated that the product was declared suitable to be used as an augmented reality-based ebook media. Based on the teacher/peer and students response, it was obtained that augmented reality-based ebook media have good response. This means that this media is very effective and feasible to be used and increase the learning quality. This research expected that ebook of other subjects can be developed as well so that it can solve other subjects' problem. Furthermore, another much higher learning media than augmented reality is needed to be developed which is Artificial Intelligence (AI).

References (APA 6th edition)

[1] Agung, AA Gede. (2012). Metodologi Penelitian; Suatu Pengantar. Singaraja: Fakultas Ilmu Pendidikan Universitas Pendidikan Ganesha.

[2] Antonioli, M., Blake, C., & Sparks, K. (2014). Augmented reality applications in education. *The Journal of Technology Studies*, 96-107.

[3] Arikunto, Suharsimi. (2010). Prosedur Penelitian Suatu pendekatan Praktek. Jakarta: Rineka Cipta.

[4] Bacca Acosta, J. L., Baldiris Navarro, S. M., Fabregat Gesa, R., & Graf, S. (2014). Augmented reality trends in education: a systematic review of research and applications. *Journal of Educational Technology and Society, 2014, vol. 17, núm. 4, p. 133-149.*

[5] Bicen, H., & Bal, E. (2016). Determination of Student Opinions in Augmented Reality. *World Journal on Educational Technology: Current Issues*, *8*(3), 205-209.

[6] Cai, S., Wang, X., & Chiang, F. K. (2014). A case study of Augmented Reality simulation system application in a chemistry course. *Computers in human behavior*, *37*, 31-40.

[7] Chaerunisa, F. D. (2019, May). MEMBANGUN KREATIFITAS DAN

INOVATIF PESERTA DIDIK MELALUI INTERNET SEBAGAI MEDIA PEMBELAJARAN. In *Prosiding Seminar Nasional Pendidikan FKIP* (Vol. 2, No. 1, pp. 678-687).

[8] Efendi, M. Y., Lutfi, I., Utami, I. W. P., & Jati, S. S. P. (2018). Pengembangan Media Pembelajaran Sejarah Augmented Reality Card (Arc) Candi–Candi Masa Singhasari Berbasis Unity3D pada Pokok Materi Peninggalan Kerajaan Singhasari untuk Peserta Didik Kelas X KPR1 SMK Negeri 11 Malang. *Jurnal Pendidikan Sejarah Indonesia*, *1*(2), 176-187.

[9] Heider, K., Laverick, D., & Bennett, B. (2009). Digital textbooks: The next paradigm shift in higher education?. *AACE Review (formerly AACE Journal)*, *17*(2), 103-112.

[10] Iatsyshyn, A. V., Kovach, V. O., Lyubchak, V. O., Zuban, Y. O., Piven, A. G., Sokolyuk, O. M., ... & Shyshkina, M. P. (2020). Application of augmented reality technologies for education projects preparation.

[11] Makdis, N. (2020). Penggunaan ebook Pada Era Digital. *AL-MAKTABAH*, *19*(1).

[12] Muhammad, Hamid. (2018). Panduan Penilaian Hasil belajar dan Pengembangan Karakter Pada Sekolah Menengah Kejuruan. Direktorat Pembinaan SMK, Kementerian Pendidikan dan Kebudayaan.

[13] Mustaqim, I. (2016). Pemanfaatan Augmented Reality sebagai media pembelajaran. *Jurnal Pendidikan Teknologi dan Kejuruan*, *13*(2), 174-183.

[14] Pradana, R. W. (2020). PENGGUNAAN AUGMENTED REALITY PADA SEKOLAH MENENGAH ATAS DI INDONESIA. *Jurnal Teknologi Pendidikan: Jurnal Penelitian dan Pengembangan Pembelajaran*, *5*(1), 97-115.

[15] Qumillaila, Q., Susanti, B. H., & Zulfiani, Z. (2017). Pengembangan augmented reality versi android sebagai media pembelajaran sistem ekskresi manusia. *Cakrawala Pendidikan*, (1), 57-69.

[16] Rolisca, R. U. C., & Achadiyah, B. N. (2014). Pengembangan Media Evaluasi Pembelajaran Dalam Bentuk Online Berbasis E-Learning Menggunakan Software Wondershare Quiz Creator Dalam Mata Pelajaran Akuntansi SMA Brawijaya Smart School (Bss). *Jurnal Pendidikan Akuntansi Indonesia*, *12*(2).

[17] Setyawan, B., & Fatirul, A. N. (2019). Augmented Reality dalam pembelajaran IPA bagi siswa SD. *Kwangsan*, *7*(1), 286912.

[18] Sugiyono, P. (2015). Metode penelitian kombinasi (mixed methods). *Bandung: Alfabeta*, *28*.

[19] Sungkur, R. K., Panchoo, A., & Bhoyroo, N. K. (2016). Augmented reality, the future of contextual mobile learning. *Interactive Technology and Smart Education*.

[20] Ulfiyani, S. (2016). Pemaksimalan Peran Guru dalam Pembelajaran Keterampilan Berbicara di Sekolah. *Transformatika: Jurnal Bahasa, Sastra, dan Pengajarannya*, *12*(2), 105-113.

[21] Videnovik, M., Trajkovik, V., Kiønig, L. V., & Vold, T. (2020). Increasing quality of learning experience using augmented reality educational games. *Multimedia Tools and Applications*, *79*(33), 23861-23885.

[22] Yip, J., Wong, S. H., Yick, K. L., Chan, K., & Wong, K. H. (2019). Improving quality of teaching and learning in classes by using augmented reality video. *Computers & Education*, *128*, 88-101.