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Developing of Augmented Reality Media Containing Grebeg Pancasila for Character Learning in Elementary School

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ABSTRACT

Augmented reality media containing Grebeg Pancasila is the right tool for character learning in elementary schools. This research aims to (1) develop AR media containing Grebeg Pancasila for character learning in elementary schools, (2) find out its feasibility, and (3) test its effectiveness. The method used was the ADDIE (Analysis, Design, Development, Implementation, and Evaluation) model. This research was conducted in elementary schools in Blitar City. The data were collected using literature study, observation, interviews, and questionnaires. The data were then analyzed qualitatively and quantitatively. The findings indicate that 3D AR media containing Grebeg Pancasila adds to the reality of the Grebeg Pancasila rite as the content of local wisdom in character learning. This media aims to provide complete knowledge about Grebeg Pancasila and support the learning of mutual cooperation. The media is attractive, portable, user-friendly, usable, and following the development of the 21st century. AR media containing Grebeg Pancasila was feasible for field testing through descriptive and inferential statistical tests. It has been proven that the media has a positive effect on the effectiveness of elementary school students' mutual cooperation character learning with a Sig 2-Tailed value of 0.00 (< 0.05).

1. INTRODUCTION

Technology is needed in various aspects of our lives in this modern era [1]. Education is an important aspect to be integrated with technology because education can develop the quality of the nation's next generation. Based on the data from the International Telecommunication Union (ITU) regarding the determination of the ICT Development Index (IDI) ranking, Indonesia is ranked 108 out of 167 countries in the world [2]. Meanwhile, according to the research results from the Ministry of Communication and Information of the Republic of Indonesia and UNESCO in 2014, 30 million Indonesian children and youth have become Internet and digital media users. A total of 80% of 30 million children are Internet users [3]. There are child and adolescent Internet users in Indonesia, both in urban and rural areas.

In line with technological developments, educational institutions should be ready and aggressively innovate to modify learning activities in the classroom. However, this readiness is not followed by actions/innovations that can be applied in schools. Currently, many lessons have not fully utilized technology-based media. The currently available media are only printed books (containing material, sample questions, and simulations) [4], whiteboards, printed pictures, and other print media available in schools. Not only do teachers have a lack of media, but their skills in making media are very low. Most teachers still have difficulties creating and developing technology-based media (e.g., multimedia) [5, 6]. They use the available media from the government and developers more often.

Print media is seen as not in line with the characteristics of students at school [7]. Each student at different levels has a varied character. They have characteristics that should be recognized and understood by the teacher. These characters should be taken into consideration in choosing learning media in schools. For example, elementary school students are easily bored, like something different/new, and are familiar with technology [8]. By considering these characters, teachers should choose media that are in line with the students' characters, such as technology-based media. This type of media is preferred at any level of education because technology-based media will help teachers to attract students' interest and attention in learning so that interactive learning occurs.

The advantage of interactive learning media is that the students adopt it since technology-focused learning makes them more appropriate with the content and improves academic performance [9]. In addition, interactivity in AR learning media has usable features that allow the users to carry out activities in their own software. In contrast with traditional media, it is less effective in improving student participation in learning.

Interactive learning systems that utilize technology can be sourced from various technological media. One of them is Augmented Reality (AR) media. Based on the results of interviews with principals and Islamic/general elementary

school teachers in Blitar City, AR learning media has not been widely used in elementary schools. Although some teachers have used PowerPoint, videos, or pictures in learning, AR media has never been practiced in learning. PowerPoint, videos, or pictures are applicable and feasible [10, 11]. These media provide possibility of face-to-face meetings between teachers and students so that the teachers can observe student responses directly [12]. The teachers are accessible in operating those media since they get workshops frequently.

AR is an optical technology that combines virtual objects into the real world in real time [13, 14]. AR technology combines various virtual objects into the real world and can be implemented in smartphones as learning media innovations [13, 15, 16]. AR becomes an irresistible technology because it provides more immersive material that no virtual tool can do. The various facilities offered by AR can be used in various fields including education.

The use of AR technology in education needs to be continuously developed starting from the elementary school level. Another thing that needs to be developed is media based on local wisdom to support character learning. Many studies on local values in education found that education should promote local values as its basis and content to keep its authenticity [17]. Local values are known as local wisdom. It is the integration between sacred values and numerous values in society. As the implementation, the teachers use local wisdom as learning sources for the students such as learning material related to the local wisdom [18, 19]. In accordance with the government's policy in education, it explains that learning process at elementary school must contain about local capability and uniqueness [20, 21]. It aims to create students' understanding on the excellence and wisdom in their environment.

Similar research was conducted by Saripudin et al. [22-24] that currently, many studies on character education integrate local wisdom and culture as teaching materials. Some researchers think that character education comes from the concept of cultural values, personality, and the correlation between the two. In line with that, culture becomes local wisdom and a source of character education [25]. This contrasts with the real conditions in elementary schools where the use of local wisdom in educational and learning content is still very minimal.

Indonesia is rich in cultural values such as the Grebeg Pancasila rite. Grebeg Pancasila is a culture of Blitar City to internalize values and character in society, including elementary school students. Therefore, the implementation is always optimized by the government because it is so full of symbolic meanings and values that it is suitable for internalizing character in each rite procession. Grebeg Pancasila is useful for instilling Pancasila values in the community, including elementary school students. The Grebeg Pancasila rite has many symbols, meanings, internalization of values, character, multiliteracy learning, and multicultural education [26-29].

Grebeg Pancasila as a strategy for optimizing the internalization of Pancasila values should be used for learning in elementary schools. This is reinforced by the Regional Regulation or PERDA No. 34 of 2004 concerning the Work Procedure of the Regional Information, Communication, and Tourism Office of Blitar City. This rite must be followed by all levels of society, including the government, cultural circles, artists, the private sector, traders, students, and the public [26, 30]. Based on the Mayor's Circular, elementary school students are not required to participate in the procession directly because their physical condition is not strong enough to participate in all the rites. However, for schools located in the city center, it is mandatory to watch the procession accompanied by the teacher, and for schools that are not passed by the procession route, they are closed and are encouraged to watch the procession accompanied by their parents.

Various studies have shown that this rite has proven to be effective for learning the values of Pancasila, multiliteracy, multiculturalism, and mathematics in elementary schools [26, 28, 31]. Nonetheless, this material has not been internalized in-depth for character learning because elementary school students are not directly involved in every process, so the essence is not well understood [27]. AR media accommodating Grebeg Pancasila reinforces character learning related to faith and piety to God Almighty, and noble character with global diversity, mutual cooperation, independence, critical thinking, and creativity. Internalization of character values in AR media accommodating Grebeg Pancasila focuses on mutual cooperation. The value of mutual cooperation must be instilled in children as provisions to live in state. Mutual cooperation is closely related to collaboration. Therefore, technology-based media such as AR are needed to display Grebeg Pancasila material to teach character in schools.

The use of smartphones with AR multimedia as a character learning facility is very effective because it is attractive to students, especially elementary school students [32]. However, its use is still minimal in the character learning process. For content involving multidimensional objects, AR helps a lot in building object abstractions for student understanding. Some similar research has studied this issue. Syawaludin and Rintayati [33] highlighted the development of interactive multimedia-based AR media products in elementary schools. This study showed that the development of AR media was feasible to use to improve the critical thinking skills of elementary school students. Hamzahet al. [34] examined the development of AR applications for computer network learning. The findings conclude that AR applications are accepted by students in learning at school. Enzai et al. [35] developed AR media using the Assemblr application. The findings showed that the AR system developed could be implemented by teachers to their students.

From these findings, AR media have been developed by previous researchers. The researchers also develop AR media in schools. However, the content of the AR media is different from the previous findings. The content of the AR media developed in this study is in the form of Grebeg Pancasila. This material is rarely given in schools and is only available in Blitar City, Indonesia. The material of Grebeg Pancasila leads to the character education of students in schools. Research on Grebeg Pancasila is still very rare because the material only exists in certain areas. Thus, there is no doubt that this research is unique.

Based on the problems above, this research aims to (1) develop AR media containing Grebeg Pancasila for character learning in elementary schools, (2) find out its feasibility, and (3) test its effectiveness.

2. METHODS

This research is development research. The research approach follows the Analysis, Design, Development,

Implementation, and Evaluation (ADDIE) development model. ADDIE is an instructional design in the form of a general process and is traditionally used to develop CBT products and multimedia-based websites. In general, this development model consists of 5 important steps, namely Analysis, Design, Development, Implementation, and Evaluation [36-38] as shown in Figure 1. Figure 1 is a step-by-step ADDIE model. The description is as follows.

2.1 Analysis

The analysis stage was carried out with a needs analysis and work analysis by determining the current conditions, desired conditions, and types of problems that arose from needs [37]. This analysis was done through direct interviews with students, classroom teachers, and the principals of the curriculum in elementary schools. From the results of interviews with the two schools, it was found that schools needed a learning media that supports learning during the pandemic and can be used for learning at home and school as shown in Table 1. Considering that the Grebeg Pancasila rite is impossible for students to face and learn directly, AR media was created.

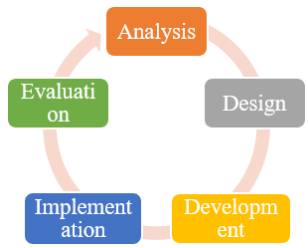


Figure 1. ADDIE model (adapted and modified from Almelhi, 2021 [37])

Table 1. Needs analysis

Title	Augmented Reality Multimedia of Grebeg Pancasila
Goal student	Students can know the local wisdom of the Grebeg Pancasila rite. Students can show the stages of local wisdom of the Grebeg Pancasila rite. Students can use the content of the Grebeg Pancasila local wisdom material for character learning.
Teacher	Teacher can explain the stages of local wisdom of the Grebeg Pancasila rite. Teacher can use the content of the Grebeg Pancasila local wisdom material for character learning.
User	Teachers, Parents, Students
Animation	AR animation explains the Grebeg Pancasila rite procession which contains the values of Pancasila as the character of the Indonesian nation.
Object	The main characters who become the models of the media are played by a pair of brothers named Panca (Five) and Sila (Principles). They are described as Blitar characters who explain the stages and processions of the Grebeg Pancasila rite, and the values and characters contained. Pictures of the Grebeg Pancasila rite procession from beginning to end, AR videos and illustrations.
Interactivity	There is a menu of the steps of the Grebeg Pancasila rite procession, namely Opening, Preparation, Bedhol Pusaka, Tirakatan Night, Handover of 5 Relics 1, Procession, Handover of 5 Relics 2, Cultural Ceremony, Carnival of Gunungan Lima, Pancasila Festival, Closing, and Complete Video of Grebeg Pancasila. Each event was carried out concisely and thoroughly through a dialog with the content in the form of rite photos, videos, and AR illustrations with a marker. This media application can be operated randomly via a smartphone, replayed as desired, and be a media for children's entertainment that can be played anytime and anywhere.

2.2 Design

The design stage is a multimedia design that includes the creation of materials, questions and answers, images, and buttons that are inserted into the media [39]. The activities are (1) designing the material displayed in the media; (2) making a flowchart that describes the program; (3) making application navigation as a program flow plan; (4) collecting teaching materials in the form of images, photos, animations, audio, and video needed that support the making of the media; and (5) creating 3D design and animation of the Grebeg Pancasila rite procession, as well as. The stage of material creation is produced at the step of designing the material displayed in the media. The question and answer stage is carried out in the step of making flowchart describing program. The drawing design stage is accomplished at the step of collecting teaching materials such as pictures, photos, animation needs, audio, video supporting the creation of media. The design stage of buttons in media is carried out at the design and animation stage of 3D about the Grebeg Pancasila ceremony.

2.3 Development

The preparation of the development stage included (1) determining the method (Marker-Based-Tracking), establishing the unity game engine (Unity Web, Windows, Mac, Android, and iOS platforms), preparing assets, and preparing 3D objects created using Maya, Cinema 4D, 3ds Max, Cheetah3D, Modo, Lightwave, Blender and SketchUp; (2) creating licenses, databases, and target images on Vuforia; (3) setting and configuring Unity for AR creation' (4) adding Vuforia components to Unity and 3D objects; (4) compiling into an android installation package.

2.4 Implementation

In the implementation stage, the researcher applied this media in learning to find out the weak points faced by students [37]. In this study, the implementation was carried out by validating multimedia products to determine the feasibility through validation by the media and material experts. After that, the researchers made improvements according to the suggestions from the experts. Then, the researchers distributed the media. The last step was applying or testing the revised multimedia technology from experts to users, namely teachers and students.

2.5 Evaluation

The evaluation stage is a systematic and organized

assessment to achieve goals [37]. In this stage, the researcher (1) determined evaluation criteria, (2) selected evaluation tools (calculation of questionnaire data), (3) analyzed media feasibility, (4) analyzed media practicality on user benefits and convenience, and (5) analyzed the effectiveness of the media.

This study was conducted in 2 elementary schools and Islamic elementary schools, namely Sekolah Dasar Negeri Sentul 02 and Madrasah Ibtidaiyah Pesantren Kota Blitar. The subjects of this study were the third-grade students at elementary school and Islamic elementary school. The sample size was 80 students with the following details.

A total of 20 students were involved in the small-scale trial consisting of 10 students from SDN Sentul 02 and 10 students from MI Pesantren. This small-scale trial was used to determine the feasibility of the product in terms of readability and to test the validity and reliability of the instrument. The research instruments were questionnaires, student books, and pre-test and post-test questions.

A total of 60 students became the sample for the application trial or experimental large-scale trial, 30 students from SDN Kepanjen Los 2 and 30 students from MIN Gedog, respectively with the details of 15 grade 3A students at SDN Kepanjen Lor 2 and 15 grade 3A students at MIN Gedog Kota Blitar as the experimental group. The control group was 15 grade 3B students at SDN Kepanjen Lor 2 and 15 grade 3B at MIN Gedog Kota Blitar. This trial was used to obtain the practicality of the usefulness and ease of use of the media.

The data were collected using literature study, observation, interviews, and questionnaires. The data collection instruments were literature study sheets, observation sheets, interview guidelines, and questionnaire sheets. The literature study sheet was used to find information about concepts and indicators from AR media, character learning, and Grebeg Pancasila. The observation sheet was used to observe the initial state of media availability and character learning of elementary school students in the research sample area. The interview guide was a guide for interviewers to interview the informants regarding media needs, media conditions, student character conditions, etc. The questionnaire sheet was used to determine the usefulness and convenience of AR media containing Grebeg Pancasila for the users (teachers and students). The questionnaire statements addressed to the students are based on the level of student development.

The data were then analyzed qualitatively and quantitatively. Qualitative data were obtained from interviews, observations, and literature studies to improve the quality of the media while quantitative data were obtained from a questionnaire containing a Likert scale calculation with 4 options. Then, the results of the questionnaire were calculated for the average percentage to determine the feasibility criteria for the media as well as an assessment of the usefulness and convenience for teachers and students. After the data had been transformed, the rating scale calculation was done with the following formula [13]:

$$P = \frac{\text{actual score}}{\text{ideal score}} \times 100\%$$

Note:
P = Percentage.

The interpretation scale was made by dividing the criterion score into four in a continuum. Then, the results were categorized as in Figure 2 [13]. Qualitative data, such as validators' comments and suggestions, served as the basis for revising multimedia interactions and learning.

Figure 2. Criteria score [40, 41]

3. RESULTS AND DISCUSSION

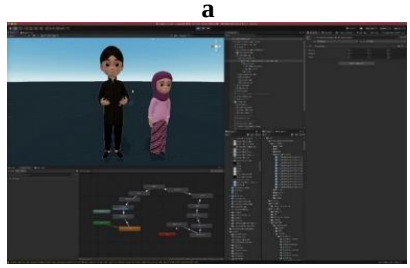
3.1 Development of augmented reality media containing Grebeg Pancasila

3.1.1 Media development process

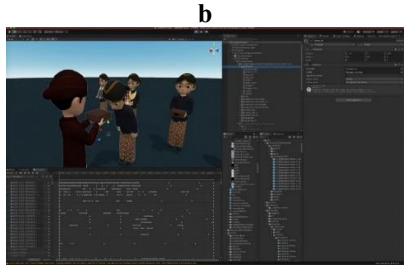
Media produced by Augmented Reality technology is based on the local wisdom of the Grebeg Pancasila rite for character learning. The first step taken was the pre-production stage in the development of media through observation, interviews, and distributing questionnaires to teachers and students in elementary schools and Islamic elementary schools. From the data obtained, it was found that students did not understand the local wisdom of the area (Grebeg Pancasila rite).

The next stage was the design and development of the initial product. The design of media products began with designing materials that contain images, photos, animations, audio, and video. The 3D design and animation of the Grebeg Pancasila rite procession were made using Maya, Cinema 4D, 3DS Max, Cheetah 3D, Modo, Lightwave, Blender, and SketchUp applications.

a



b



c

Figure 3. a. Animating; **b.** Rendering; **c.** Editing

The first process, modeling, was to make the shape of the object. The second, texturing, was to color the object model [42]. The third process was animating, changing the stationary model into a moving and rotating object [43] as shown in Figure 3a. The next step was rendering by storing and creating a package of animations, images, photos, and videos that is more realistic when AR models are placed in the real world (Figure 3b).

The last stage of editing was merging the files into a complete video file adding sound effects related to the explanation of each content by internalizing values and characters between the characters, Panca and Sila, in each event as shown in Figure 3c.

The character values internalized through the Grebeg Pancasila rite AR technology media are the profile of Pancasila students which include faith and piety to God Almighty, noble character, global diversity, mutual cooperation, independence, critical thinking, and creativity. This is in line with the opinion of Ref. [44] that the relationship between Grebeg Pancasila and education in Indonesia can absorb all the values contained in Pancasila if the management of Pancasila activities is directed at learning patterns of Pancasila values through processions.

After editing, the researchers created licenses, databases, and target images on Vuforia, setting, and configuring Unity for AR creation. With Unity, the users can take full advantage of the built-in functions such as adding animation to objects, using shaders and materials, manipulating with scripts, and providing interactivity [45]. Vuforia components were added to Unity and 3D objects, and they were compiled into an android installation package so that the application can be downloaded via Playstore with the Assemblr platform. The process of downloading the Assemblr platform will appear with a list of content groups, one of which is Grebeg Pancasila. After the content of Grebeg Pancasila is selected, a display will appear. If the user clicks More, a media event will appear for every Grebeg Pancasila rite. The stages of implementation of the Assemblr platform were (1) opening, (2) preparation, (3) bedhol pusaka, (4) handover of 5 relics 1, (5) procession, (6) handover of 5 relics 2, (7) cultural ceremony, (8) carnival of Gunungan lima, (9) Pancasila festival, and (10) closing.

3.1.2 Feasibility

Table 2. Media expert validation

Aspect	Number of Items	Ideal Score	Actual Score	Percentage
PD	3	30	29	96.7%
IU	3	30	24	80.0%
A	2	20	17	85.0%
U	1	10	8	80.0%
SC	1	10	8	80.0%
Mean				84.3%

Note: PD: Presentation Design, IU: Interaction Usability, A: Accessibility, R: Reusability, SC: Standards Compliance.

This analysis provides preliminary findings regarding the implementation of the media from an overview of the expert validation of the Grebeg Pancasila rite media. The media was validated by two experts, namely material and media experts. Besides, the teachers and the students are involved in validation. The material was tested by a graphomics lecturer and elementary school teachers. The parameters used in this assessment were three important aspects in electronic media, namely general aspects, software engineering, and visual communication [13]. Table 2 shows the results of expert validation related to media and continuum aspects.

The AR-based Grebeg Pancasila rite media was declared feasible to be implemented in character learning related to faith and piety to God Almighty and noble character, global diversity, mutual cooperation, independence, and critical thinking, and creativity. AR has quality information if the information conveyed through the media is useful for students [46]. Based on the assessment of media experts, the total score was 84.3%. This score was included in the good category, so it was not revised.

To determine the visibility of the media, black box testing was done to see the input, treatment, response, and sensitivity, output, or change in events. This is as stated by Wantoro et al. [47] that black-box testing only focuses on the functionality requirements of the system being built. Therefore, alpha testing and beta testing were done [13]. Alpha testing was performed by users in a development environment by an internal team before releasing to external users to avoid disappointment because of defects or application failures when they use this system. In addition, alpha testing is often used for software as a form of internal acceptance testing before the software is beta-tested.

Testing was done in a black box by only considering the input from the system and the output from the input. This is as stated by Wantoro et al. [47] that black-box testing focuses on the functionality requirements of the system being built. This test was done to start augmented reality before playing the media. The user must select a theme from the camera against the marker. According to Ref. [48], before doing the test, we must formulate a test plan by determining the menu being tested with the details of the test. After, the functions of the available buttons, moving scenes, scrollbars, and sliders are tested. The target testing against markers can be seen in Table 3.

Table 3. Target test

No.	Results
1	Tracking works normally at various camera distances with varying markers.
2	The display looks ideal in the tracking process with varying viewing angles of 45^0 from the target.
3	Loading takes time and depends on connection and device.
4	The object display setting is directly on the screen.

Table 4. Distance test

Tilt Angle	Distance (cm)
15	10, 15, 25, 50
30	10, 15, 25, 50
45	10, 15, 25, 50
60	10, 15, 25, 50

The successful testing of the distance between the camera and the marker, light reflection, and the tilt angle of the camera with minimal lighting of bright lights or cloudy sunlight can be seen in Table 4. The results of testing on markers and cameras to show augmented reality can be seen properly in general positions. The tests were carried out at 10, 15, 25, 50 cm and were influenced by light reflection and camera tilt. The minimum distance of the marker to the camera was 8 cm and the maximum distance of the marker to the camera was 50 cm with a minimum angle of 0° and a maximum angle of 45°. The

minimum and maximum distances as well as the minimum and maximum camera tilt angles are influenced by light; if there is a light reflection, the augmented reality will not appear. Based on the results of the application testing, the AR-based media application built has been running as expected. This is in line with the findings of Ref. [47] in which the functional aspect of the AR application at Pramuka Garden Residence received a score of 100%, suggesting that the application can work well.

After alpha testing, the next step is beta testing. Beta testing is a method to check and certify software. It is used to describe the external testing process where software can be distributed to others, such as users, who have the potential to use the software for everyday life. Beta testing affects the final stages of software development and is usually an acknowledgment that the software is ready for use by the user. This is in line with the opinion of Ref. [49] that beta testing is testing the final result by running and pasting the application.

The results of the respondents' answers indicate that the application is easy to use and helps them to understand the material. It is also interesting and satisfying, and they want to have it. The table shows that media validation by users in a limited trial obtained an average percentage of the feasibility of 88.00% (very good) (Table 5).

In the material section of the media, validation was carried out by material experts, namely elementary school teacher education lecturers and the third-grade teachers at elementary schools/Islamic elementary schools The results of the material expert validation can be seen in Table 6.

Table 6 shows the scores given by the material experts from the highest to the lowest; they are feedback quality, content quality, and final goal fulfillment. From these results, the total average value of all aspects is 86.5% (very good).

Table 5. User validation

No.	Aspect	Ideal Score	Actual Score	Qualification
1	Navigation keys in multimedia	5	5	80.00%
2	Multimedia display	5	4	83.36%
3	Multimedia Ease of Use	5	5	83.33%
4	Material Understanding	5	4	80.00%
5	Multimedia Interactivity	5	4	80.00%
	Mean			88.00%

Table 6. Media expert validation

Aspect	Number of Items	Ideal Score	Actual Score	Percentage
CQ	4	40	34	85.0%
LGA	9	90	73	81.1%
FA	1	10	9	90.0%
M	1	10	9	90.0%
Mean				86.5%

Note: CQ: Content Quality, LGA: Learning Goal Alignment, FA: Feedback and Adaptation, M: Motivation.

3.2 AR Media containing Grebeg Pancasila for character learning

3.2.1 Media profile

Grebeg Pancasila is a culture of Blitar City to internalize values and character in society, including elementary school students. The AR media containing Grebeg Pancasila has been developed with the following description.

Figure 4 shows the display of AR media opened via a smartphone. This media is made into an application that can be downloaded via the Playstore with the Assemblr platform. The name of this media application is Grebeg Pancasila. The initial design of the application is an Assemblr icon (see Figure 4b). The icon will display the content, one of which is the Pancasila Grebeg dashboard. After logging into the Grebeg Pancasila application, the users will see the media event display for each Grebeg Pancasila rite as shown in Figure 4e.

Figure 4. Smartphone initial display (a), Assemblr icon (b), Content group display (c), Grebeg Pancasila dashboard (d), and event list (e)

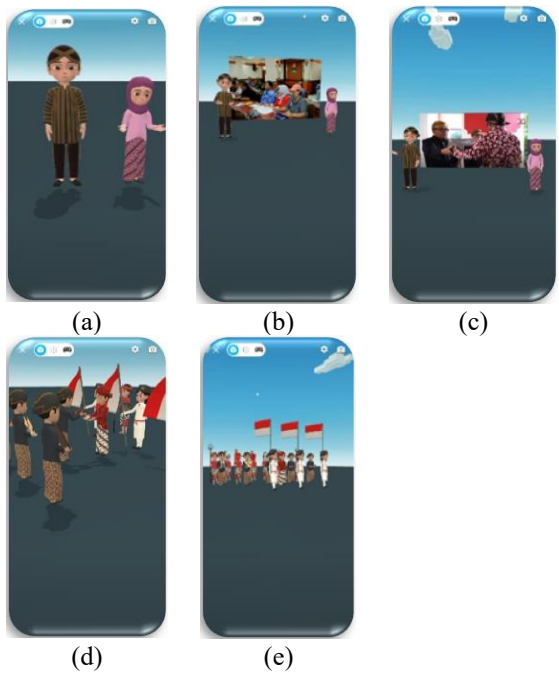


Figure 5. Opening (a), Preparation (b), Bedhol Pusaka (c), Handover of 5 relics (1) (d), Procession (e)

After the AR media containing the Pancasila Grebeg is open, the display of the Pancasila Grebeg material will be as shown in Figure 5a. Every step in the material for Grebeg Pancasila is explained by a cartoon illustrator, from the opening to the procession. The profile of AR media containing Grebeg Pancasila is also more complete with interactive images between the illustrated images and the stories conveyed. Each image presented is conveyed by the illustrator of the cartoon image. In general, the form of AR media containing Grebeg Pancasila is 3D which is compiled into an Android installation package. AR media containing Grebeg Pancasila supports character learning related to faith and piety to God Almighty and noble character with global diversity, mutual cooperation, independence, critical thinking, and creativity. The internalization of character values in AR media containing Grebeg Pancasila focuses on mutual cooperation. The value of mutual cooperation must be instilled in children to avoid a shift in ethical values in the life of the nation and state. Mutual cooperation is closely related to cooperation [50].

AR media containing Grebeg Pancasila can be widely implemented in various media, such as smartphones, cards, books, magazines, or worksheets. The advantages of AR media containing Grebeg Pancasila include being portable, friendly, and usable in accordance with related developments in the 21st century. Portable means that the media is practical and efficient to use. Friendly means that the media is in accordance with the character of elementary school children. Usable means using features that enable the users to run the application in accordance with 21st-century developments. This is in line with Ref. [47] that AR media with 3D display helps users to provide real information.

3.2.2 The effect of media

AR media containing Grebeg Pancasila influences student character learning. From the results of the effectiveness test, AR media is proven to be effective to be applied in character learning in the classroom as illustrated in quantitative and qualitative data. Quantitative data were obtained from the small-scale trial data. Based on the data, three important aspects were obtained, namely knowledge, attitudes, and skills. In the knowledge aspect, the students identify the local wisdom of Ritus Grebeg Pancasila. In the attitude aspect, the students demonstrate the stages of Ritus Grebeg Pancasila. In the skill aspect, the students adopt the content in local wisdom of Ritus Grebeg Pancasila for character learning. The following table shows the distribution of learning outcomes on the knowledge aspect.

The Table 7 illustrates the student learning outcomes of the knowledge aspect ranging from 83 to 88 which was the highest score achieved by 8 students or 40%. Then, the score ranging from 71 to 76 was the second-highest score achieved by 6 students or 30% while the highest score from 95 to 100 was only achieved by 2 students or 10%. On the aspect of attitude, student learning outcomes are shown in the following Table 8.

In the attitude aspect, the highest student learning outcomes ranged from 89 to 94 achieved by 7 students or 35%, from 77 to 82 achieved by 6 students or 30%, from 71 to 76 achieved by 4 students or 20%, and the lowest ranged from 95 to 100 by 1 student or 5%. Learning outcomes on the aspect of student skills can be seen in the Table 9.

From the Table 9, the lowest score ranged from 99 to 100 achieved by 1 person or by 5%. The scores ranging from 87 to 92 were achieved by 2 students or 10%. The highest score from 81 to 86 was obtained by 9 students or 45%.

Table 7. Distribution of learning outcomes of knowledge aspect

Interval Class	Score Range	Frequency	Percentage (%)
1	71-76	6	30
2	77-82	3	15
3	83-88	8	40
4	89-94	1	5
5	95-100	2	10
Total		20	100

Table 8. Distribution of learning outcomes of attitude aspect

Interval Class	Score Range	Frequency	Percentage (%)
1	71-76	4	20
2	77-82	6	30
3	83-88	2	10
4	89-94	7	35
5	95-100	1	5
Total		20	100

Table 9. Distribution of learning outcomes of skill aspect

Interval Class	Score Range	Frequency	Percentage (%)
1	75-80	4	20
2	81-86	9	45
3	87-92	2	10
4	93-98	4	20
5	99-100	1	5
Total		20	100

Table 10. Distribution of student learning outcomes

No.	Score Range	Frequency	Percentage	Criteria	
				Completed	Uncompleted
1	73-78	6	30	6	-
2	79-84	5	25	5	-
3	85-90	5	25	5	-
4	91-96	3	15	3	-
5	97-100	1	5	3	-
			100	20	-
Percentage				100%	-

The effectiveness of the book teaching material product developed based on the analysis of student learning outcomes showed that all students obtained a score of 70 out of 100. The learning outcomes in using the teaching materials of the Grebeg Pancasila thematic book proportionally can be seen in the Table 10.

Based on the table of student learning outcomes proportionally according to the three aspects, the highest scores ranging from 73 to 78 were obtained by 6 students or 30%, and the lowest from 97 to 100 was obtained by 1 person or 5%.

Some data explains character learning in schools. The character shown by students after studying the material for Grebeg Pancasila is mutual cooperation. This character was measured using an observation sheet. In this research, pre-test was conducted. Then, the researchers gave treatment by applying AR media containing Grebeg Pancasila to the experimental and control groups. The final stage was to do a post-test from observing the mutual cooperation character and analyze the results.

The data were then analyzed using inferential statistics (paired test and independent t-test) with SPSS 22. The results of the pre-test/post-test descriptive analysis (experimental and control groups) showed an increase in the students' mutual

cooperation average scores. It means that students demonstrate mutual cooperation better than before. To clarify the data, the following Table 1 shows the tendency of the pre-test and post-test scores of the experimental group and the mutual cooperation of the control group.

Table 11. The tendency of mutual cooperation character score

Group	Criteria	Pre-test		Post-test	
		F	%	F	%
Experimental Group	Very High	0	0.00	5	16.67
	High	2	6.67	22	73.33
	Low	27	90.00	3	10.00
	Very low	1	3.33	0	0.00
Control Group	Very High	0	0.00	0	0.00
	High	4	13.33	9	30.00
	Low	23	76.67	21	70.00
	Very low	3	10.00	0	0.00

Table 12. The result of independent t-test

Variable	Equal variances assumed		Note:
	Sig. (2-tailed)	Asymp.	
Mutual Cooperation	0,000	Sig. < 0.05	There is a difference

Table 11 shows that, in general, there was an increase in the experimental group but not in the control group. After performing descriptive statistical analysis, the researchers performed inferential statistical tests to generalize the data. The inferential statistical tests used were paired t-test and independent t-test. Before carrying out the t-test, the researchers performed the prerequisite tests for normality and homogeneity on the data obtained. The results of the normality test showed Sig. > 0.05 (H0 is accepted), so, the data were normally distributed. The results of the homogeneity test showed Sig. > 0.05 (H0 is accepted), meaning that the data came from a homogeneous population. Thus, the data has met the prerequisite tests to perform the t-test.

The first t-test was paired t-test to determine whether there were differences in the students' mutual cooperation before and after learning by using AR media containing Grebeg Pancasila. The results of the paired t-test showed a Sig 2-Tailed value of 0.00 (< 0.05), which means that there were differences in the students' mutual cooperation before and after learning using the media.

Then, independent t-test was conducted to determine whether there was a difference between students who attended the class using AR media containing Grebeg Pancasila and those who did not. Table 12 shows the results of the independent t-test on the observation data of the students' mutual cooperation.

Table 12 shows the results of the independent t-test. The value of Sig 2-Tailed was 0.00 (< 0.05). It means that there were differences in the mutual cooperation character of students who attended the class using AR media containing Grebeg Pancasila. From the results of statistical analysis, qualitative data were also obtained, which described the indicators of mutual cooperation as a result of the development of the media.

The indicators of mutual cooperation in this research consist of three aspects, namely (1) collaboration, (2) care, and (3) share. This is in accordance with the opinion of reference [51] on the Strategic Plan of the Ministry of Education and Culture for 2020--2024 which contains the Pancasila Student Profile which is the embodiment of Indonesian students as lifelong students who have global competence and behave in accordance with Pancasila values, with six main characteristics, namely faith and piety to God Almighty, having noble character, global diversity, mutual cooperation, independence, critical thinking, and creativity. For the mutual cooperation aspect, Indonesian students can work together, namely the ability to carry out activities together voluntarily so that they can run smoothly, easily, and lightly.

The use of AR media to improve the mutual cooperation of the third-grade students at elementary school in this research is appropriate. This finding is following the opinion of Ref. [32] stating that AR media can increase the effectiveness of character learning for elementary school students. The findings indicate that multimedia AR technology can improve the students' mutual cooperation in learning. This finding is in accordance with the opinion of Ref. [52] suggesting that students' character can be formed through habituation of using AR multimedia to strengthen the character of elementary school students.

Learning the local wisdom of the Grebeg Pancasila rite as the content of learning materials can also increase students' overall understanding of the Grebeg Pancasila rite as Indonesian local wisdom. The findings of this study are in line with those of Ref. [28] showing that Grebeg Pancasila is a means of instilling Pancasila values into society. In addition, the findings on the use of local wisdom of the Grebeg Pancasila rite as learning material are also in line with the findings of Ref. [28] developing the AR Holobox technology with the Pancasila Grebeg rite material in elementary school learning.

The improvement of students' mutual cooperation through AR media containing Grebeg Pancasila was obtained from (1) characterization, (2) message conveyed by the characters, and (3) AR features. This finding is in accordance with the results of research conducted by Ajnikhah et al. [53, 54] that the role of the character in a story can motivate students to imitate it and the message provides moral lessons, one of which is the internalization of the value and character of mutual cooperation. This character can also be instilled in students through multimedia AR technology used in classroom learning. Furthermore, Lubis et al. [32] stated that AR features can be used to attract students' attention so that they can enjoy and understand the stories in the AR media.

4. CONCLUSION

Some conclusions were drawn from this research. First, AR media containing the Grebeg Pancasila was in 3D, and the animation of the ritual procession was made with the Assemblr application. This media serves to add to the reality of the Grebeg Pancasila rite as the content of local wisdom in character learning for the millennials. This media was made to provide knowledge about Grebeg Pancasila and support the learning of mutual cooperation. This media has advantages such as being attractive, easy to use, portable, user friendly, usable, and following the development of the 21st century. Second, the improved media was declared feasible to be tested through descriptive and inferential statistical tests (paired and independent t-tests). Third, the media has been proven to have a positive effect on the effectiveness of learning the mutual cooperation of elementary school students with a Sig 2-Tailed

value of 0.00 (< 0.05), which means that there are differences in the students' mutual cooperation before and after learning using the media.

The disadvantage of the media is it can only be applied in certain learning (citizenship education). Therefore, future researchers can develop AR media to be implemented in several materials at every level of education. They can also overcome this limitation by modifying AR media based on local wisdom in other areas, such as *Sekaten* tradition in Surakarta, Gebyag *Cah Angon* tradition in Kebumen, etc.

REFERENCES

[1] Raja, R., Nagasubramani, P.C. (2018). Impact of modern technology in education. Journal of Applied and Advanced Research, 3(1): 33-35. https://doi.org/10.21839/jaar.2018.v3S1.165

[2] Sanou, B. (2015). Measuring the Information Society Report 2015 Executive Summary. Switzerland: CH-1211 Geneva Switzerland. https://www.itu.int/pub/D-IND-ICTOI.

[3] Broto, G.S.D. (2017). Riset Kominfo dan UNICEF mengenai perilaku anak dan remaja dalam menggunakan internet. Available: www.kominfo.go.id.

[4] Fahmi, S., Priwantoro, S.W., Cahdriyana, R.A. (2018). Development and effectiveness of interactive learning media for mathematical logic and set towards students' self confident on computer. International Journal of Engineering & Technology, 7(4): 96-99.

[5] Wijaya, T.T., Tang, J., Purnama, A. (2020). Developing an interactive mathematical learning media based on the tpack framework using the hawgent dynamic mathematics software. In International Conference for Emerging Technologies in Computing, London, UK, pp. 318-328. https://doi.org/10.1007/978-3-030-60036-5_24

[6] Kristiawan, M., Muhaimin, M. (2019). Teachers' obstacles in utilizing information and communication technology. International Journal of Educational Review, 1(2): 56-61.

[7] Widodo, S.A. (2018). Selection of learning media mathematics for junior school students. Turkish Online Journal of Educational Technology-TOJET, 17(1): 154-160.

[8] Roorda, D.L., Zee, M., Koomen, H.M. (2021). Don't forget student-teacher dependency! A Meta-analysis on associations with students' school adjustment and the moderating role of student and teacher characteristics. Attachment & Human Development, 23(5): 490-503. https://doi.org/10.1080/14616734.2020.1751987

[9] Sanmugam, M., Selvarajoo, A., Ramayah, B., Lee, K.W. (2019). Use of Nearpod as interactive learning method. INTED2019 Proceedings, 1: 8908-8915. https://doi.org/10.21125/inted.2019.2219

[10] Winarto, W., Syahid, A., Saguni, F. (2020). Effectiveness the use of audio visual media in teaching Islamic religious education. International Journal of Contemporary Islamic Education, 2(1): 81-107. https://doi.org/10.24239/ijcied.Vol2.Iss1.14

[11] Mahardika, A.I., Wiranda, N., Arifuddin, M., Kamal, M., Erlina, M., Hayati, M. (2021). The student response to interactive e-modules to support science literacy in distance learning physics. International Journal of Innovative Science and Research Technology, 6(11): 258-261.

[12] Fleischmann, K. (2021). Hands-on versus virtual: Reshaping the design classroom with blended learning. Arts and Humanities in Higher Education, 20(1): 87-112. https://doi.org/10.1177/1474022220906393

[13] Fatimah, S., Setiawan, W., Junaeti, E., Surur, A.S. (2019). Development of smart content model-based augmented reality to support smart learning. Journal of Science Learning, 2(2), 65-70. https://doi.org/10.17509/jsl.v2i2.16204

[14] Martín-Gutiérrez, J., Fabiani, P., Benesova, W., Meneses, M.D., Mora, C.E. (2015). Augmented reality to promote collaborative and autonomous learning in higher education. Computers in Human Behavior, 51: 752-761. https://doi.org/10.1016/j.chb.2014.11.093

[15] Arslan, R., Kofoğlu, M., Dargut, C. (2020). Development of augmented reality application for biology education. Journal of Turkish Science Education, 17(1): 62-72. https://doi.org/10.36681/tused.2020.13

[16] Ponnusamy, V., Natarajan, S., Ramasamy, N., Clement, C., Rajalingam, P., Mitsunori, M. (2021). An IoT-enabled augmented reality framework for plant disease detection. Revue d'Intelligence Artificielle, 35(3): 185-192. https://doi.org/10.18280/ria.350301

[17] Kartadinata S., Pd., M. (2018). Pedagogi Pendidikan Kedamaian. Bandung: UPI Press. http://upipress.upi.edu/produk/buku_detail/47/Pedagogi_Pendidikan_Kedamaian.

[18] Sumardjoko, B., Musyiam, M. (2018). Model of civic education learning based on the local wisdom for revitalizing values of Pancasila. Journal Cakrawala Pendidikan, 37(2): 201-211.

[19] Albantani, A.M., Madkur, A. (2018). Think globally, act locally: The strategy of incorporating local wisdom in foreign language teaching in Indonesia. International Journal of Applied Linguistics and English Literature, 7(2): 1-8.

[20] Hadi, S., Andrian, D., Kartowagiran, B. (2019). Evaluation model for evaluating vocational skills programs on local content curriculum in Indonesia: Impact of educational system in Indonesia. Eurasian Journal of Educational Research, 19(82): 45-62. https://doi.org/10.14689/ejer.2019.82.3

[21] Fauzi, A. (2019). Effectiveness of integrated science textbook on volcanic eruption theme with creative problem solving to improve students' preparedness. In Journal of Physics: Conference Series, 1185(1): 012084. Publishing. https://doi.org/10.1088/1742-6596/1185/1/012084

[22] Anggraini, P., Kusniarti, T. (2017). Character and local wisdom-based instructional model of bahasa indonesia in vocational high schools. Journal of Education and Practice, 8(5): 23-29.

[23] Ereş, F. (2015). Vatandaşlık eğitimi ve karakter eğitimi politikalarının değerlendirilmesine yönelik nitel bir çalışma. Mehmet Akif Ersoy Üniversitesi Eğitim Fakültesi Dergisi, 1(36): 120-136.

[24] Saripudin, D., Komalasari, K. (2016). Culture-based contextual social studies learning for development of social and cultural values of junior high school students. The Social Sciences, 11(23): 5726-5731.

[25] Guseynov, A.A. (2017). Pervaya filosofiya kak nravstvennaya filosofiya [The First Philosophy as The Moral Philosophy]," Voprosy Filosofii, 77(7): 66-74.

[26] Septinaningrum, Agustin, M., Nugraha, L. (2019). An analysis of multikultural values actualization in Grebeg Pancasila Rite, Blitar, East Java. Proceeding the 4th International Seminar on Social Studies and History Education (ISSSHE), pp. 507-521.
[27] Septinaningrum, S., Rahman, R., Supriatna, M., et al. (2019). Multiliteracy in the rite of grebeg pancasila as amedium for character education in digital era. In Proc. 2nd Int. Conf. Local Wisdom, Padang, West Sumatera, Indonesia, pp. 389-396. https://doi.org/10.4108/eai.29-8-2019.2289006
[28] Putriana, D., Warsono. (2019). Grebeg Pancasila sebagai Sarana Penanaman Nilai-Nilai Pancasila (Studi Kasus di Kota Blitar). Kajian Moral dan Kewarganegaraan, 7(2): 1237-1252. https://doi.org/10.1017/CBO9781107415324.004
[29] Zummi, N.Q.A. (2016). Kajian makna dan nilai karakter pada ritus grebeg Pancasila di Kota Blitar serta keterkaitannya bagi pendidikan IPS. Doctoral dissertation, Universitas Negeri Malang.
[30] Hudayanti, E. (2018). Strategi optimalisasi grebeg pancasila sebagai wisata budaya. Tourism, Hospitality and Culinary Journal, 3(2): 44-58.
[31] Septinaningrum, S., Hakam, K.A., Setiawan, W., Agustin, M., Sopandi, W., Surur, A.S. (2021). Technology of holobox augmented reality grebeg pancasila rite for mathematics learning in elementary school. In Journal of Physics: Conference Series, 1869(1): 012119. https://doi.org/10.1088/1742-6596/1869/1/012119
[32] Lubis, A.H., Wangid, M.N. (2019). Augmented reality-assisted pictorial storybook: Media to enhance discipline character of primary school students. Elementary School Forum (Mimbar Sekolah Dasar), 6(1): 11-20 https://doi.org/10.17509/mimbar-sd.v6i1.16415
[33] Syawaludin, A., Rintayati, P. (2019). Development of augmented reality-based interactive multimedia to improve critical thinking skills in science learning. International Journal of Instruction, 12(4): 331-344. https://doi.org/10.29333/iji.2019.12421a
[34] Hamzah, M.L., Rizal, F., Simatupang, W. (2021). Development of augmented reality application for learning computer network device. International Journal of Interactive Mobile Technologies, 15(12): 47-64. https://doi.org/10.3991/ijim.v15i12.21993
[35] Enzai, N.I.M., Ahmad, N., Ghani, M.A.H.A., Rais, S.S., Mohamed, S. (2021). Development of augmented reality (AR) for innovative teaching and learning in engineering education. Asian Journal of University Education, 16(4): 99-108. https://doi.org/10.24191/ajue.v16i4.11954
[36] Alnajdi, S.M. (2018). The Effectiveness of designing and using a practical interactive lesson based on ADDIE model to enhance students' learning performances in university of Tabuk. Journal of Education and Learning, 7(6): 212-221. https://doi.org/10.5539/jel.v7n6p212
[37] Almelhi, A.M. (2021). Effectiveness of the ADDIE model within an E-learning environment in developing creative writing in EFL students. English Language Teaching, 14(2): 20-36. https://doi.org/10.5539/elt.v14n2p20
[38] Zhang, J. (2020). The construction of college English online learning community under ADDIE model. English Language Teaching, 13(7): 46-51. https://doi.org/10.5539/elt.v13n7p46
[39] Bani, M., Masruddin, M. (2021). Development of Android-based harmonic oscillation pocket book for senior high school students. JOTSE: Journal of Technology and Science Education, 11(1): 93-103. https://doi.org/10.3926/jotse.1051
[40] Chen, T.L., Hsiao, T.C., Kang, T.C., Wu, T.Y., Chen, C.C. (2020). Learning programming language in higher education for sustainable development: Point-earning bidding method. Sustainability, 12(11): 4489. https://doi.org/10.3390/su12114489
[41] Eko Putro Widoyoko, S. (2016). Penilaian hasil pembelajaran di sekolah. Yogyakarta: Pustaka Pelajar.
[42] Müller, L., Pfeuffer, K., Gugenheimer, J., Pfleging, B., Prange, S., Alt, F. (2021). Spatialproto: Exploring real-world motion captures for rapid prototyping of interactive mixed reality. In Proceedings of the 2021 CHI Conference on Human Factors in Computing Systems, Yokohama, Japan, pp. 363. https://doi.org/10.1145/3411764.3445560
[43] Kadyrov, R.I. (2021). Developing of USDZ models for 3D digital analysis results visualization in augmented reality. Scientific Visualization, 13(1): 83-103. https://doi.org/10.26583/SV.13.1.07
[44] Zainuddin, H.M. (2020). Implementation of grebeg pancasila values against the character of children in primary schools. In Proceedings of the 4th International Conference on Learning Innovation and Quality Education, Surakarta, Indonesia, p. 46. https://doi.org/10.1145/3452144.3452190
[45] Widiaty, I., Riza, L.S., Abdullah, A.G. (2015). A preliminary study on augmented reality for learning local wisdom of Indonesian batik in vocational schools. In 2015 International Conference on Innovation in Engineering and Vocational Education, Indonesia, pp. 32-35. Atlantis Press. https://doi.org/10.2991/icieve-15.2016.8
[46] Riani, A., Utomo, E., Nuraini, S. (2021). Development of local wisdom augmented reality (AR) media in elementary schools. International Journal of Multicultural and Multireligious Understanding, 8(6): 154-162.
[47] Wantoro, A., Nurmansyah, A. (2020). penerapan augmented reality (AR) dengan kombinasi teknik marker untuk visualisasi model rumah pada perum pramuka garden residence. Jurnal Teknoinfo, 14(2): 95-98. https://doi.org/10.33365/jti.v14i2.654
[48] Prasetia, R., Hidayat, E.W., Shofa, R.N. (2018). Pengembangan Aplikasi Panduan Pengenalan Kampus Universitas Siliwangi Berbasis Augmented Reality Pada Perangkat Android. Jurnal Teknik Informatika dan Sistem Informasi, 4(3): 478-487.
[49] Ramedhan, E., Kartowisastro, I.H. (2020). Application of augmented reality technology to visualitation a 3d apartment market with markeless method. Int. J. Sci. Technol. Res., 9(3): 5319-5325.
[50] Horita, Y. (2020). Greater effects of mutual cooperation and defection on subsequent cooperation in direct reciprocity games than generalized reciprocity games: Behavioral experiments and analysis using multilevel models. PloS One, 15(11): e0242607. https://doi.org/10.1371/journal.pone.0242607
[51] The Ministry of Education and Culture. (2020). Strategic plan of the Ministry of Education and Culture for the Year 2020-2024. p. 174.

https://www.kemdikbud.go.id/main/tentang-kemdikbud/rencana-strategis-renstra.
[52] Rachmawati, R., Wijayanti, R., Anugraini, A.P. (2020). Pengembangan eksplorasi MAR (Matematika Augmented Reality) dengan penguatan karakter pada materi bangun ruang sekolah dasar. Delta-Pi: Jurnal Matematika dan Pendidikan Matematika, 9(2): 92-105.
[53] Ajnikhah, U., Saputra, H.J., Purnamasari, V. (2020). pengembangan media buku bergambar mabarung (macam-macam bangun ruang) untuk pembelajaran matematika kelas 5 sd. JANACITTA, 3(1): 7-18.
[54] Haryani, P., Triyono, J. (2017). Augmented reality (Ar) sebagai teknologi interaktif dalam pengenalan benda cagar budaya kepada masyarakat. Simetris: Jurnal Teknik Mesin, Elektro Dan Ilmu Komputer, 8(2): 807-812. https://doi.org/10.24176/simet.v8i2.1614