

Development of “ARCIL” Media in Prehistoric Culture Materials for Junior High School Students

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Abstract—The purpose of this research and development is to produce learning media that are real, concrete, and interesting using augmented reality (AR) technology on learning material that contain pre-literate cultural products. This research and development uses ADDIE instructional design from the RnD method with five stages namely analysis, design, development, implementation, and evaluation. The data obtained is quantitative and qualitative data. Research instruments in the form of closed questionnaires with a level scale of 1-4 to obtain quantitative data and open questionnaires to obtain qualitative data about product usage advice. The results of the study show that, media eligibility based on the assessment of linguists obtained a 90.625%, material experts obtained a 94.12%, media experts obtained a 97.62%. Media practicality tests based on user responses by education practitioners gained a 90.91% and by students obtained a 90.58% score. Based on the results of the study, ARCIL learning media is very valid and practical to use in the learning process. There are several suggestions for further research, namely, (1) Adding other types of prehistorical culture results that are more diverse, (2) Provide variations in the form of other learning materials that are more diverse, (3) The addition of audio explanations so that students better understand the explanation of the material presented.

Keywords—development, learning media "ARCIL", prehistoric culture

1 Introduction

Learning media is a tool used by teachers in the teaching process and makes it easier for students to accept learning. The use of media in the learning process can provide a visual image of a phenomenon that occurs so that students can find out how a phenomenon occurs without having to go into the field [1]. One of the materials that need to be visualized better is contained in one of the lessons in the even semester VII class, namely the Social Studies subject on Cultural Outcomes of the Pre-literate Period. The material is contained in Basic Competence (KD) 3.4.

Experts have tried to help students understand the material through the use of primary data in the form of artifacts and ecofacts [2]. However, there are still some

obstacles to understanding the pre-literate subject matter from the primary evidence, namely (1) the few and the scarce number of results from pre-literate culture and research samples, and (2) students have difficulty in analyzing these relics, sources, and evidence because students have limited knowledge [3].

Giving understanding for students to pre-literate material by using textbooks has not been able to provide a complete understanding. Materials that are only described through text and two-dimensional images make students not understand the material thoroughly [4]. So to understand the material, tools are needed that can provide better information, through learning media. Not only that but learning media can also help students learn independently [5].

The 21st-century paradigm requires teachers to follow the development of technology and information quickly. Teachers are required to have the ability to implement technology in learning through learning media [6]. This is not without reason, because the use of technology in learning provides an open space for improving the quality and creativity of teachers in managing to learn [7]. So that the learning media by implementing 21st Century technology is more varied.

One variation of technology that can be used to visualize subject matter is augmented reality (AR). This technology can combine 2-dimensional and 3-dimensional virtual objects into a real environment then the objects are projected into real-time [8]. These virtual objects function to display information that cannot be directly received by the human sense of sight. This technology is useful as a tool that serves to help the user's perception and interaction with the real environment. Users can be helped in carrying out activities in the real world with information displayed by virtual objects [9]. So with the use of this technology objects and phenomena that cannot be observed directly can be well illustrated.

Previous research conducted by Sudarmayana, et. al [10] conclude that learning media based on augmented reality book simulations of animal breeding is feasible to use in learning. Another research that has been carried out by Putri [11] concluded that "siAR" as a learning media has been proven to be feasible, practical, and effective so that it can be implemented in learning activities for Integrated Social Studies subjects for class VII in SMP/MTs.

The results of this development are expected to present media that are more interactive, effective in use, can be widely implemented in various media, simple object modeling, because it only displays a few objects, manufacture that does not take too much cost, and is easy to operate. Through augmented reality, students not only know the material in terms of two-dimensional images but can present the form of the Cultural Results of the Pre-literate period in the real world. Thus, the presentation of cultural products in prehistoric times in augmented reality packaging is expected to provide new and real experiences as if seeing directly the results of these cultures without having to come to museums or other historical places.

2 Method

This research method uses research development or Research and Development. The activities in this research begin with basic research activities to obtain information on needs assessment, then development activities are carried out with the aim of realizing the product and assessing its feasibility of the product [12].

The research and development model of learning media "ARCIL" is adapted from the ADDIE model. This model was developed by Dick and Carry [13] which aims to design a learning system for students. This model consists of analysis, design, development, implementation, and evaluation. The procedures in this study can be seen in Figure 1.

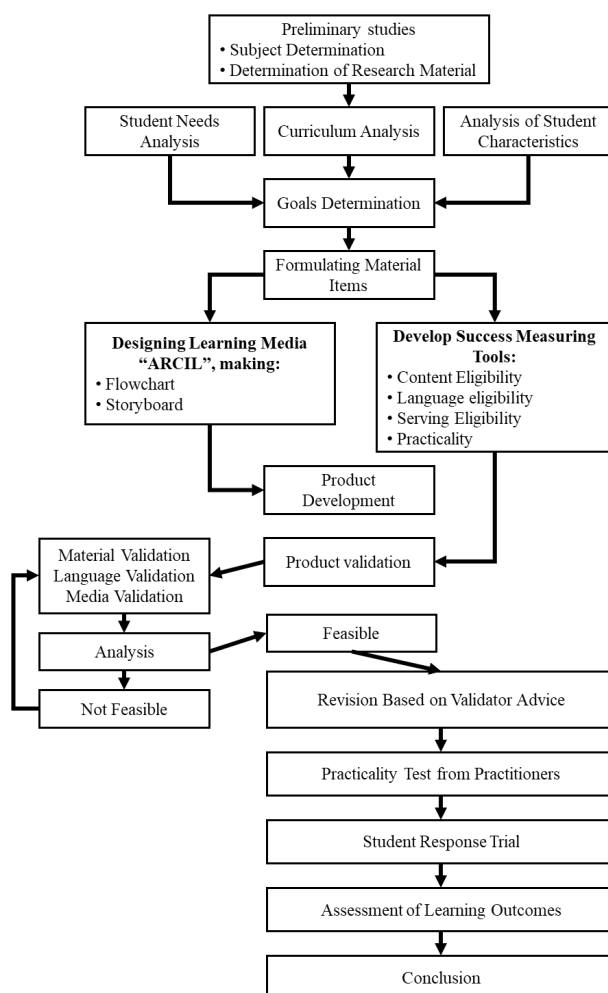


Fig. 1. Research procedure

The analysis phase aims to collect supporting data from an analysis of needs, curriculum analysis, and analysis of student characteristics. The second stage, namely design had some steps, namely: (a) Formulating learning objectives, (b) Formulating material points, (c) Compiling media success measurement tools, (d) Making flowcharts, and (e) Making Storyboards. The development stage consists of (a) product creation, (b) media validation by experts, namely media, material, and language experts, and (c) revision of media products based on input, suggestions, and corrections from experts. The implementation stage is the stage of applying the media after the validation process carried out by the expert is declared valid. The last stage is the evaluation stage to observe whether the learning media developed is successful and suitable for the initial objectives of research and development.

This research was conducted at SMP Negeri 1 Bojonggede with the research subject of 25 seventh-grade students and social studies teachers as field practitioners. The type of data collected consists of two types of data, namely qualitative and quantitative. Data with quantitative categories is the main data in the form of data obtained from the results of the assessment of the learning media "ARCIL" conducted by language experts, material experts, media experts, learning practitioners, and students. Quantitative data was obtained in the form of an assessment score. Meanwhile, data with qualitative categories were obtained from an assessment of the research and development process of learning media in the form of suggestions and criticisms from language experts, media experts, material experts, field practitioners, and students.

The research instrument used was a material expert validation questionnaire, media expert validation questionnaire, linguist validation questionnaire, and student trials as targets in the use of ARCIL learning media. The data collection technique uses a Likert scale, so to determine the interpretation of the score, it can be searched using the following formula:

$$P = \frac{TSe}{TSh} \times 100\% \quad (1)$$

Description:

P : Practicality Percentage

TSe : Total Empirical Score Obtained

TSh : Maximum Total Score

3 Result and discussion

Research and development of learning media "ARCIL" (Augmented Reality for Social Learning) on the material of Cultural Products for Class VII students were tested at SMP Negeri 1 Bojonggede. This research was validated by several experts. This research takes 3 (three) months starting in January with the analysis stage until March 2021 with the evaluation stage with the following:

3.1 Analysis stage

The analysis is the first stage which aims to obtain the supporting data that underlies the making of the "ARCIL" learning media. This stage includes:

Needs analysis. Based on the results of interviews with Maesaroh as a social studies teacher for class VII, it was found that students were less active in learning activities. Students still have a dependence on the teacher in understanding the material. So that learning seems one-way and less than optimal. In addition, the use of learning media in SMP Negeri 1 Bojonggede is still not optimal, especially on the material of Pre-literate Culture Products. The material is usually only described through text, two-dimensional images, and minimal illustrations so students do not know what the real form of the cultural product is.

Curriculum analysis. This analysis aims to formulate indicators and learning objectives based on Core Competencies (KI) and Basic Competencies (KD) that apply in SMP Negeri 1 Bojonggede. Based on the results of observations and interviews that have been carried out, it is known that SMP Negeri 1 Bojonggede has implemented the 2013 curriculum. So that all curriculum devices refer to the 2013 curriculum.

Analysis of student characteristics. the observations that have been carried out found that in general students have followed the learning quite well. However, students tend to be lazy to bring textbooks to school for various reasons, namely they are too thick, heavy, and inconvenient. The lazy characteristics of students in the teenage age range are usually caused by emotional instability who do not want to be bothered with things they consider to be troublesome and do not think carefully when making decisions [14].

3.2 Design stage

At this stage, the author takes several steps, so that this design stage can make it easier for the author to develop the "ARCIL" learning media product. The following are some of the steps in the design stage, namely:

Formulate learning objectives. The purpose of this learning was developed for the material of Cultural Outcomes of the Pre-literate Period as a reference for the behavior of student learning outcomes that are expected to occur, be owned, or mastered by students after participating in learning activities. Based on the indicators of competency achievement that have been determined and analyzed in the previous stage, then it is lowered into learning objectives. The learning objectives formulated are: 1) students can describe the development of Indonesian society in the pre-literate era archaeologically, 2) students can classify the cultural results of the Indonesian people in the pre-literate era archaeologically, and 3) students can identify the characteristics of the Cultural Outcomes of the Pre-literate period based on the division of time.

Formulate the details of the material. Preparation of the format of these material items that will be transferred to students in the classroom. This arrangement is carried out by carrying out several steps, namely (1) identifying competency standards and basic competencies, (2) identifying the types of learning materials, (3) determining the

types of materials following competency standards, and (4) selecting sources of teaching materials.

Develop assessment tools. This tool to measure success is in the form of a questionnaire compiled by taking into account the aspects of content feasibility, language feasibility, presentation feasibility, and practicality.

Designing learning media "ARCIL". In this sub-stage, which is carried out in the development of flowcharts and storyboards for making ARCIL learning media.

3.3 Development stage

The development stage of the learning media "ARCIL" is based on the results of validation by experts and product revisions. The development steps are described as follows:

Product development. There are several stages of making ARCIL learning media products. In the first stage, researchers conducted field research by visiting the National Museum or commonly known as the Elephant Museum in Jakarta. There are several cultural products of the pre-literate period on display, namely nekara, oval ax, square ax, and flake tools. However, due to the limited availability of pre-literate cultural products in museums, researchers also conducted literature studies and looked for references to other cultural products through videos on YouTube [15]–[17]. In the second stage, the researcher makes a 3-dimensional design based on the results of the research that has been done. The 3-dimensional design of the prehistoric culture was created with the help of 3Ds Max software. After the 3-dimensional design is completed, the next stage is making markers with the help of Photoshop software. Markers are made with a barcode design to make it easier for researchers when connect markers and 3-dimensional objects. After the marker has been created, the next step is to combine the 3-dimensional object with the marker. In this process, the researchers did use Unity software. This software is the main tool in making an augmented reality. After the 3-dimensional objects and markers have been combined and become augmented reality, the next step is to package AR into the application to make it easy to use. Vuforia SDK is software used in the process of packaging AR into applications. In addition, through this software, supporting features of this learning media are also added, such as features of learning materials, learning objectives, learning videos, quizzes, and quiz answer keys that have been designed and designed in the previous stage. It takes one month to make media products from January to February 2021. The following is the initial appearance of the “ARCIL” learning media that has been made:



Fig. 2. Initial product display learning media "ARCIL"

Validation. Validation activities are carried out by linguists, material, and media experts who have expertise in their respective fields using instruments that have been designed at the design stage. At this validation stage, data are obtained in the form of comments, suggestions, and input that are used to make improvements to the media products that have been developed. In addition, at this stage, the score calculation data obtained is also obtained to assess the validity of the media being tested. The following are the results of validation by several experts:

Media expert validation. Validation on the media aspect was carried out by Eka Pramono Adi, SIP, M.Si as a Lecturer in the Department of Educational Technology, Faculty of Education, Universitas Negeri Malang. This validation stage was carried out on March 13, 2021. The results of the validation for the assessment of the media aspect are presented in Table 1:

Table 1. Media validation result

No.	Aspects	Score
1	“ARCIL” Components	27
2	Display Organizing	27
3	Interactivity	8
4	Overall Rating	20
Total Score		82
Percentage		97,62%

Source: Primary Data Processing (2021)

Table 2. Recapitulation of qualitative data result of media validation

Aspects	Komentar
Suggestions	Optimize the supporting components, such as Utilization Instructions (can be in the form of video/screencast tutorials), References/credit titles, and Prefaces. Potential to be integrated with the LMS of the institution/school.
General Opinion	In general it is quite good. Worth to be implemented/tested.
General Conclusion	Appropriate for further use in learning activities for the material of Cultural Results of the Pre-literate for VII th Class students.

Source: Primary Data Processing (2021)

Based on the assessment table by media experts, the responses were very valid. This is evidenced by the total score for all assessed aspects of 82. If divided by the number of assessment aspects, the average score is 3.90 with validity score is 97.62%. The percentage of validity is in the range of 85% - 100% which is categorized as very valid and can be tested with some improvements from the advice of experts [18].

Linguist expert validation. The validation of the linguists was carried out by Mr. Dr. Didin Widyartono, M.Pd, as Lecturer of the Indonesian Language and Literature Study Program, Faculty of Letters, Universitas Negeri Malang. The validation stages in the linguistic aspect will be carried out on March 15, 2021. The results of the validation by linguists are presented in Table 3.

Table 3. Practicality test result data by learning practitioners

No	Aspects	Score
1	Using the rules of good and correct language	3
2	The language used is simple and easy for students to understand	4
3	The accuracy of the arrangement of sentence structure	4
4	Accuracy of use of terms	4
5	Use communicative and informative language	4
6	Interesting sentence structure and explanation	4
7	Correct use of uppercase and lowercase letters	3
8	Clarity of language selection	4
9	Suitability of language with students' cognitive level	4
10	Effective and efficient use of language	3
11	Accuracy in the use of local terms or language in describing materials or information properly	4
12	The sentences used can convey the content of the material or information well	4
13	The sentences used are simple and in accordance with the target	4
14	Spelling accuracy	3
15	Use standard language	3
16	Consistency in the use of punctuation and symbols	3
Total Score		58
Percentage of validity		90,625%

Source: Primary Data Processing (2021)

Table 4. Recapitulation of qualitative data result of language validation

Aspects	Comment
Suggestions	Small corrections are needed in terms of linguistic aspects of the product, for example writing 'di' which indicates where to be separated, writing commas, writing 'di' in the title (the letter 's' remains small), 'then' should be followed by a comma, etc.
General Opinion	It's good, but there are still some inaccuracies in the correct use of Indonesian.
General Conclusion	Appropriate for further use in social studies learning activities for the Materials of Cultural Results for the Class VII SMP/MTs with revisions in accordance with the criticisms and suggestions given by the validator.

Source: Primary Data Processing (2021)

Based on the results of the validation of the linguistic aspect, the assessment was very valid. This can be seen from the total score for the assessed aspects of 58 with an average rating of 3,625. As well as the quality standard of learning media products obtained by the percentage of validity of 90.625%. The percentage of this score is in the value range of 85% - 100% categorized as a very valid assessment and can be tested with some improvements from the validator [18].

Material expert validation. The validation of the material experts was carried out by Mr. Anda Sudanisjasto, S.Pd as a social studies teacher at SMP Negeri 1 Bojonggede. The validation stage in the material aspect is carried out on March 15, 2021. The results of the validation by material experts are presented in Table 5.

Table 5. Material expert validation assessment results data

No	Aspects	Score
1	Content Eligibility	33
2	Language Aspect Assessment	12
3	Visualization	7
4	Evaluation Questions	12
Total Score		64
Percentage		94,12%

Source: Primary Data Processing (2021)

Table 6. Recapitulation of qualitative data result of material validation

Aspects	Comment
Suggestions	The learning materials are in accordance with the competencies that must be mastered by students but it would be better if other features were added to support the material to be mastered, such as adding apperception at the beginning of the media and adding group assignments in the form of LKPD. In addition, the appearance of the material is designed to be attractive by giving color effects and adding objects as well as changing the size of the 3-dimensional projection of objects from the Pre-literate culture.
General Opinion	The media has been made very attractively, it can be used as an innovation in learning.
General Conclusion	Appropriate for further use in social studies learning activities for the Materials of Cultural Results for the Class VII SMP/MTs with revisions following the criticisms and suggestions given by the validator.

Source: Primary Data Processing (2021)

Based on the validation assessment table by material experts, the responses were very valid. This is evidenced by the acquisition of a total score for all assessed aspects of 64. If divided by the number of assessed aspects, the average scorer is 3.765 and the percentage of validity (V) is 94.12%. The percentage of validity is in the range of 85% - 100% which is categorized as very valid and can be tested with some improvements from suggestions from the validator [18].

Revision. Based on the results of the validation that has been carried out by media experts, it can be concluded that ARCIL learning media is suitable for use in learning activities. Media experts are of the opinion that ARCIL's learning media, in general, are quite good and feasible. However, there are some suggestions for optimizing the supporting components such as the following:

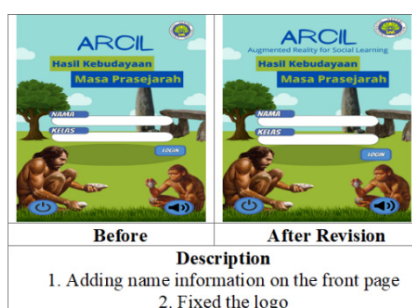


Fig. 3. Initial appearance of learning media "ARCIL" before and after revised
(Source: Research documentation)



Fig. 4. Main material menu display learning media "ARCIL" before and after revised
(Source: Research documentation)



Fig. 5. Display of learning media markers before and after revised (Source: Research documentation)

3.4 Implementation

After developing and revising based on suggestions and comments, the next step is for the researcher to implement it. In this stage, the revised "ARCIL" learning media is then implemented for students. The implementation of this learning media by conducting trials involving teachers as field practitioners and 25 seventh-grade students at SMP Negeri 1 Bojonggede in the offline learning process. Students are asked to respond to the use of the learning media "ARCIL" by filling out the questionnaire that has been distributed.

Practicality test from practitioners. The practicality test by learning practitioners was carried out by Maesaroh, SP. EK. Assessments from learning practitioners are used to see whether the "ARCIL" learning media can be said to be practical. The results of the practicality test by learning practitioners are presented in Table 7.

Table 7. Practicality test result data by learning practitioners

No	Aspects	Score
1	The suitability of the time available in learning with the ease of operation of learning media	3
2	The ability to learn media as a tool for achieving learning indicators/objectives	3
3	Student interest when learning by utilizing the developed learning media	4
4	The ability to learn media to be used repeatedly according to learning materials	4
5	The ability to learn media to create a sense of fun for students	4
6	The ability to learn media in creating student's motivation to study	4
7	The ability to learn media in helping students understand information	3
8	The ability of learning media in spurring students' creativity	4

No	Aspects	Score
9	The ability to learn media spurring students' creativity	4
10	The ability to learn media as a stimulus for student learning	3
11	The suitability of learning media as a learning resource	4
Total Score		40
Percentage		90,91 %

Source: Primary Data Processing (2021)

Table 8. Recapitulation of qualitative data practical assessment by field practitioners

Aspects	Comment
Suggestions	Suggestion: The media used must make it easier for children to help in learning. Criticism: The application cannot be used by all students due to internet and quota constraints
General Opinion	The application used is good, only not all students can use it because some students do not use android phones.

Source: Primary Data Processing (2021)

Based on the table of practicality test results above, it can be seen that the practicality test carried out received a very practical response. This is evident from the results of the assessment for the assessed aspects obtained a total score of 40 and divided by the number of assessed aspects, the average score obtained is 3.64. In addition, the assessment score for learning media products obtained a percentage of practicality tests by learning practitioners as a whole of 90.91%. The percentage of the score is in the range of 85% to 100% so this assessment is stated in the very practical category [18].

Student response trial. Trials on students were carried out by distributing questionnaires to the remaining 25 class VII students who had taken the cultural results of the pre-literate period. Based on the distribution of the ARCIL learning media questionnaire, the results showed that the student's response was very good. This is evident from the results of the assessment for learning media "ARCIL" obtained a score of 79.71 with an average score obtained of 3.62. Assessment of the response score obtained for the learning media "ARCIL" obtained a practicality percentage of 90.58%, this practicality percentage is in the range of 85% - 100% so it is stated in the Very Practical category [18].

4 Conclusion

After obtaining the results of research data processing, analysis, and discussion that have been described regarding the learning media "ARCIL" with the following conclusions:

The design of the learning media that resulted from this research and development was named the Learning Media "ARCIL" for the material of the Cultural Results of the Pre-literate Period for grade VII junior high school students which can be operated using an Android-based mobile phone. This design produces needs analysis data, curriculum analysis, student characteristics analysis, learning tools, success measurement tools, storyboards, and flowchart which aim to simplify the development process.

The development of this research resulted in the learning media product "ARCIL" being able to visualize the Materials of Pre-literate Culture Results for grade VII junior high school students using augmented reality technology using markers. This media is also equipped with features to support learning, namely learning videos, learning materials, quiz questions, and discussions.

The feasibility of "ARCIL" learning media is based on the assessment of linguists, material, and media experts. The feasibility of the learning media "ARCIL" based on the assessment of linguists obtained an assessment with very decent criteria with an average final score of 3.625, the assessment of material experts developed obtained very decent criteria with an average final score of 3.765, the assessment of developed media experts obtained very decent criteria with an average final score of 3.90.

The practicality test of the learning media "ARCIL" by class VII students and field practitioners resulted in a very practical category with an average final score of 3.64 by learning practitioners and a final score of 3.62 by students.

Based on the results of the research and discussion, suggestions that can be put forward for further research are, (a) adding more diverse types of Pre-literate cultural products, (b) providing variations in the form of other, more diverse learning materials, (c) adding audio explanation so that students better understand the explanation of the material presented. These suggestions are expected to be used as reference material or consideration for further research.

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