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Development of mobile learning-based learning media on the distribution and management of natural resources

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Abstract

Natural resource material in geography subjects is real, conceptual, and related to the environment around students. Therefore, it is necessary to develop media that supports these needs. This is in accordance with the results of the analysis of student needs which is known as many as 15 students need learning media in the form of mobile applications. The development of mobile applications in this study is based on the analysis of the weaknesses of the previous media which only presents material conceptually. Through the analysis of these needs, it is necessary to develop mobile learning-based learning media on the distribution and management of natural resources. This development research aims to produce learning media based on mobile learning on the distribution and management of natural resources. This development research applies to the ADDIE model with four stages, including analysis, design, development, and evaluation. The product development results are in the form of an html file and an android apk named NARESa. The advantages of this learning media product are that it has an attractive appearance, is easy to use in the learning process, and presents contextual material. Suggestion from media expert validator is to add developer identity. Suggestions from material expert validators are that it is necessary to add sustainable principles and to add concept maps. The media feasibility test was carried out in class XI students of SMAN 7 Malang. Based on the results of the feasibility test, the media got a score of 84% with qualifications suitable for use. Suggestions for further research are the development of learning media that does not depend on an internet connection, so it is not slow in opening the existing features.

Keywords: media learning; mobile learning; natural resources

Introduction

The rapid development of science and technology has affected various aspects of life. This change also occurs in the aspect of education, namely through the learning process that can improve the quality of education (Budiman, 2017). Based on observations made at SMAN 7 Malang, all students have smartphones and are allowed to bring them to school. However, its use is only limited to

playing social media, playing music or videos, and playing games. The use of smartphones should support the student learning process, namely as a means of providing interesting learning media (Wicaksono, 2018). This condition highlights the need to optimize the use of smartphones as effective learning media to support the teaching and learning process.

The use of learning media is very important to support the achievement of learning goals (Smaldino et al., 2014). Learning media functions to present information that has limitations in senses, space, and time, so that learning becomes more interesting (Isnarto, 2017). This is in line with the results of the needs analysis carried out at SMA Negeri 7 Malang, which has obstacles with time constraints, so that the material has not been delivered optimally. In addition, the media used in learning activities is still limited to powerpoints, videos, and package books, but has not yet led to the use of smartphones. The use of smartphones in learning activities is easier to do, because smartphones have the same operating system as computers, can implement various multimedia forms, and have high mobility so that they can be operated more effectively (Ismanto, 2017; Indahini, 2018). Therefore, the integration of smartphones into learning activities can be further explored through the concept of mobile learning.

The use of smartphones in this learning activity can be categorized in the use of learning media through mobile learning. Mobile Learning can be an alternative learning media that uses mobile devices in the form of smartphones or tablets (Amirullah, 2017). The advantages of mobile learning in learning activities are the presentation of information that is student-centered (Wahid, 2018); has high flexibility (Sukmana & Suartama, 2018); access to easy-to-reach learning resources that are equipped with attractive visual displays (Ramadani & Nana, 2020); and the implementation of learning anywhere and anytime (Rorita, 2018). The advantages of mobile learning can be an alternative to learning that is in accordance with the development of science and technology without reducing the essence of learning (Rahardjo et al., 2019). This shows that mobile learning has great potential to be applied in subjects such as geography, which require contextual and visual-based learning approaches.

Based on the explanation above, it is necessary to develop geography learning media that is relevant to technological developments and the characteristics of geography subjects. Geography learning materials are difficult to discuss theoretically, so media is needed as a link between learning and the surrounding environment (Sumarmi, 2012). One of the main subjects discussed in geography lessons is the distribution and management of natural resources. The characteristics of this material are real, conceptual, and related to students' lives. This material is difficult to explain verbally, so it needs to be conveyed contextually and factually. Based on the analysis of the material according to the curriculum, the material on the distribution of natural resources has limitations in affordability, so it is necessary to present a real visualization of examples of the types of natural resources spread in Indonesia, so that students can understand the material well (Sufia, 2013). The results of the need analysis for grade XI MIPA 4 students, from 17 students, 59% of students prefer to learn using mobile phones, as many as 65% of students prefer to use digital learning media rather than print. There are difficulties for students in understanding the material on the distribution and management of natural resources, especially in sub-chapters 1) the potential and distribution of natural resources, and 2) natural resource management.

Hakiki (2021) previously developed mobile learning media for geography that emphasized interactive content delivery. Nevertheless, the product primarily presented conceptual material, highlighting the need for media that incorporates real-life problems to enhance students' analytical abilities. Building upon this, the present development includes improvements such as enhanced visuals and color schemes, the integration of pop-up information, and task features related to natural resource management. These refinements are designed to help achieve core competencies, especially in strengthening analytical thinking skills.

This study aims to create a learning medium that is accessible via mobile devices in HTML5 and APK formats. The developed product, named NARESa (Natural Resources in Indonesia), is intended to support geography instruction through a mobile learning-based approach.

Method

The method applied in the research and development of this learning media is the ADDIE model. The stages contained in the ADDIE model are Analyze, Design, Develop, and Evaluation (Branch, 2009). In this study, there are only four stages used, namely Analyze, Design, Develop, and Evaluation. The Implementation stage was not carried out because in this study the media produced was not applied in direct learning activities. In this study, no media effectiveness test was conducted on the results of learning activities because this study aims to produce mobile learning-based learning media. Figure 1 illustrates the stages involved in the development of the learning media.

Figure 1. Research and Development Procedures

The data collection instruments used were questionnaires and tests. The questionnaire presents several statements or questions in writing to the respondents (Sugiyono, 2019). The types of data obtained are in the form of qualitative and quantitative data. Qualitative data comes from the results of expert and student validation through a questionnaire containing suggestions about the developed product. Meanwhile, quantitative data was obtained based on the results of the calculation of the student perception questionnaire score regarding the product. The percentage obtained from the product assessment is obtained through the calculation of the score using the Likert scale. After obtaining quantitative data, the researcher then processed the data. The results of the calculation of the percentage value of the expert validation test and the media feasibility test are then analyzed with formula 1.

$$P = \frac{\sum x}{\sum xi} \text{ x } 100\% \quad (1)$$

Where

P : Persentase Scale Likert

100% : Konstanta

$\sum x$: The value score of each item

$\sum xi$: The sum of the value of the whole item

The validation data that has been calculated as a percentage is then concluded the level of validity and feasibility using the feasibility and validity interpretation table of learning media according to Arikunto (2017). Table 1 presents the score levels along with the corresponding Likert scale criteria.

Table 1. Score Levels and Likert Scale Criteria

Score	Interpretation
1	Very less suitable for use
2	Less suitable for use
3	Worth using
4	Well worth using

The percentage obtained from the product validity assessment must align with the established eligibility standards. Table 2 showing the qualification data from users' evaluations of the learning media product.

Table 2. Product User Assessment Questionnaire Data Qualification

Value Scale	Interpretation
85.01-100 %	Well worth using
70.01-85.00 %	Worth using
50.01-70.00 %	Less suitable for use
0-50.00 %	Not suitable for use

Results and Discussion

The results of this research and development activity are learning media products in the form of android applications on Natural Resources Distribution and Management materials. This media can be used as a learning resource for students to learn geography subjects. The results of this research and development were obtained by implementing the following steps.

Analysis

The first stage is the analysis of the needs for the development of learning media. The stages of needs analysis carried out are material analysis according to the curriculum, the needs of student and teacher characteristics, and the weaknesses of products that have been carried out before. The subject matter discussed is in accordance with the competencies set for students in grade XI of high school/MA Semester 1, namely Basic Competencies 3.2 and 4.2. Based on the analysis of student characteristics, it is known that as many as 15 students need learning media in the form of mobile applications in learning materials for the distribution and management of natural resources. Based on the analysis of the needs for existing media, it can be seen that the previous learning media still had shortcomings in the form of conceptual material, so there was a need for development related to contextual material. Contextual material is related to examples of problems that occur in the environment around students. This will encourage students to connect the knowledge gained with their daily lives in the community (Purwanto, 2015). Therefore, the development of contextual mobile learning media is considered necessary to meet student needs and improve the learning experience.

Design

The design stage is carried out to prepare a plan for the development of the media to be produced. The design of learning media products is carried out in several stages, including 1) determining materials based on IP and KD, 2) compiling material presentations in the media, 3) compiling learning and evaluation activities, 4) making display designs and supporting media needed in the product, and 5) compiling product assessment instruments. The topics of discussion taken were the classification of natural resources, the distribution of natural resources, and the problems of natural resource management. The target users of the product are students in grade XI SMA/MA or who have taken material on the distribution and management of natural resources and teachers at SMA Negeri 7 Malang. The assessment instruments used were validation sheets and media feasibility questionnaires.

Development

In the development stage, the researcher developed a mobile learning-based learning media product to facilitate high school/MA students in analyzing the distribution and management of natural resources. The media is presented contextually so that students are able to analyze material on the distribution and management of natural resources. The resulting product is compiled using the Articulate Storyline application as the main software and uses Canva as an additional tool to design and the app logo. At the development stage, product assessments are also carried out to measure the level of validity of the learning media that is being developed. Product assessments were carried out by validators, media experts, material experts, and feasibility tests were carried out on students and teachers at SMA Negeri 7 Malang.

Product development is carried out based on previous designs. The product developed has an HTML 5 file format and an APK that students can use through a laptop or smartphone. The learning media developed has menus including a cover, log-in page, instructions for use, Basic Competencies (KD), materials, evaluation questions, and author profiles. The topic of discussion in this learning media is the distribution and management of natural resources. In this media, learning activities are presented that discuss problems related to this topic.

Product Development Results

This research and development resulted in a geography learning media product focused on the topic of Natural Resource Distribution and Management. The product is designed as an Android-based application named NARESa. Compared to previous learning media, this product introduces several innovations. One of the updated features is the inclusion of pop-up information, which allows users to access brief and clear explanations without navigating away from the current slide. In terms of content, the novelty lies in the shift from purely conceptual material to the inclusion of contextual content, making the learning experience more relevant to students' real-life environments. The developed learning media includes various interface views, such as the initial display (Figure 2), login page (Figure 3), material interface (Figure 3), and evaluation page (Figure 4).

Figure 2. Initial Appearance

Figure 2. Login Page

Figure 3. Material Display

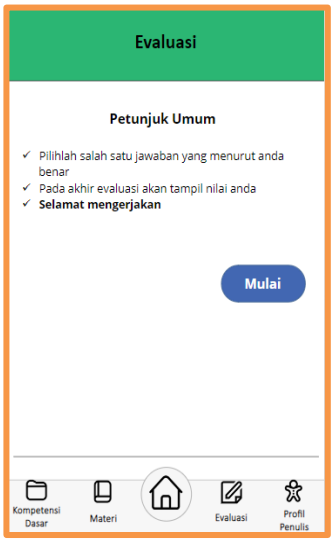

Figure 4. Evaluation View

Expert Validation Results

The products that have been developed are then validated tests. The results of expert validation are in the form of comments and suggestions to determine the feasibility of learning media and improvements so that the product is more suitable for use by students (Nurhasanah, 2021). Product validation is carried out by two experts, namely media experts and material experts. The validation of media products was carried out by a lecturer of the Department of Educational Technology, namely Mr. Eka Pramono Adi, S.IP., M.Si. and the validation of the material was carried out by a lecturer of the Department of Geography, namely Mrs. Heni Masruroh, S.Pd., M.Sc. The determination of two expert validators was based on the recommendations of the supervisor and the head of the geography department.

Media Validation Results

The validation process was conducted to assess the feasibility of the developed learning media. The feasibility data was obtained from media experts through a questionnaire based on predefined evaluation aspects. The media expert validation form consisted of 14 items covering three main aspects: content presentation, the media's impact on the learning process, and the visual appearance of the learning media. Table 3 presents the media expert's feedback and suggestions.

Table 3. Results of Media Expert Comments and Suggestions

Number	Aspects	Comments and Suggestions
1.	Serving	Good
2.	The effect of media on learning strategies	Good
3.	Overall display feasibility	Good, come with a developer identity and optimize in a format that is easily accessible to students

The results of the validation assessment are in the form of comments and suggestions related to the feasibility and improvement of the developed learning media products. According to Eka Pramono, this learning media is good, but there are two indicators that need to be considered, namely the ability of the media to increase interest in learning and the suitability of the color display and its combination. The choice of color in the development of learning media is very important. The choice of color needs to be considered, because primary colors tend to attract students' attention, but the combination of primary colors will make the eyes get tired quickly (Sulistyono, 2015). Psychologically, media can help increase students' interest in learning. Through learning media, it is possible to turn abstract things into concrete or real (Supriyono, 2018). Therefore, learning media must be designed in such a way that it can help the learning process and can increase students' interest in learning.

The media expert recommended optimizing the learning media format to ensure it is easily accessible for students. This aligns with the flexibility criteria of learning media, which should be usable in various situations and cost-effective (Nurruta, 2018). Hence, the learning media should adopt a user-friendly format to facilitate ease of use and save time during the learning process. Based on the media expert's validation assessment, the product was deemed appropriate for use without requiring any revisions. Figure 5 illustrates the display before and after the revision.

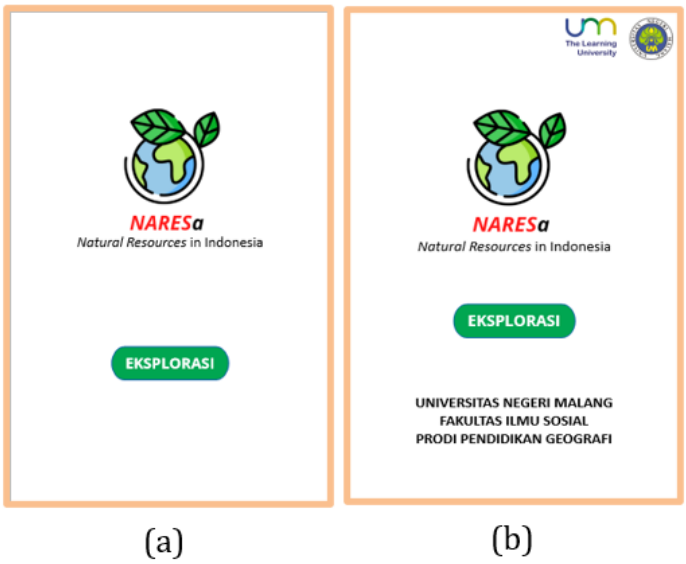

Figure 5. Image (a) Before Revision, Image (b) After Revision

Media experts' suggestions for improving this product are to add the identity of the developer institution. The revision was made by adding the logo and emblem of the State University of Malang in the upper right corner on the cover page. Another addition is the writing of the identity at the bottom by writing the University, faculty and study program of the developer.

Material Validation Results

Material validation refers to the process of evaluating the validity of the developed learning materials. The data regarding feasibility were collected through a questionnaire completed by subject matter experts, based on specific evaluation criteria. Table 4 presents the results of this expert validation. The questionnaire used by the expert validators comprised 14 items, which

assessed three key dimensions: the appropriateness of the presentation, the comprehensiveness and depth of the content, and the relevance or currency of the subject matter.

Table 4. Feedback on Learning Materials Based on Presentation, Depth, and Relevance

Number	Aspects	Comments and Suggestions
1.	Presentation of the material	The presentation of the material is good according to the KD, it is systematic, the core writing of the material has been well conveyed, it has been supported by images and videos, the media has been developed and has been given case studies, but it is necessary to add sustainable principles.
2.	Depth and breadth of subject matter	That's good, but it would be better to add a concept map that connects the indicators.
3.	Updating the subject matter	Appropriately, there is a video link to increase student insight.

The aspect of presenting the material received good comments and the material presented was in accordance with KD. The suggestion from the validator is that it is necessary to add the principle of sustainability. This is necessary because the KD taken contains a discussion of the principles of sustainable development, so this material is important to support the achievement of basic competencies. In terms of depth and breadth of subject matter, it received good comments, but there was a suggestion that a concept map should be added that connects the indicators. The existence of a concept map will help students' memory of the material presented (Zakiyatun, 2017). The last aspect is the updating of the subject matter. In this aspect, getting material comments is appropriate and there is a video link to increase student insight. In the latter aspect, he did not get advice from the validator of the material expert. Figure 6 and 7 illustrates the subject matter before and after the revision.

Figure 6. Subject Matter before Revisions

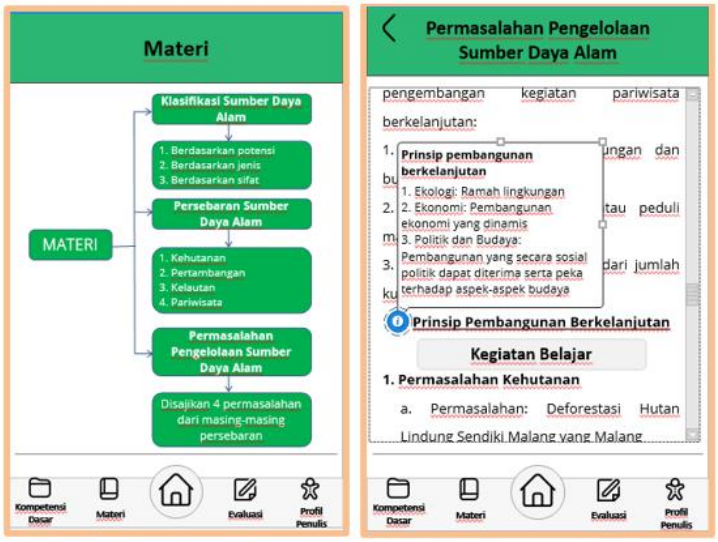

Figure 7. Subject Matter Expert Revision Results

There are two suggestions for improvement from material experts, including the addition of a concept map. With a concept map, students will know the picture between indicators, helping students find information related to the material presented. Before the revision, only 3 buttons were presented to be presented, after the revision a concept map was added with more detailed material details. The second revision is the addition of the principle of sustainable development which is presented with a pop-up feature. The addition of this sustainable principle is that the material presented is in accordance with the basic competencies used in this learning media. The basic competencies used in this research and development are to analyze the distribution and management of forestry, mining, marine, and tourism resources in accordance with the principles of sustainable development. So, the addition of sustainable principles will be able to complement the material according to the basic competencies.

Feasibility Test Results

The feasibility test was conducted with students from Grade XII Social Studies 4 and one geography teacher at SMAN 7 Malang. The test was carried out offline and involved a total of 32 students. Quantitative data were obtained from the calculation of scores from the student perception questionnaires regarding the developed product, while qualitative data were derived from open-ended responses in the same questionnaires, which included suggestions and feedback about the product. The results of this assessment are presented in Table 5.

Table 5. Product Feasibility Based on Assessment Aspects

Number	Aspects	Percentage	Interpretation
1	Media Display	89.6	Highly Worth It
2	Ease of Use	85.4	Highly Worth It
3	Material	84.1	Proper
4	Media Benefits	80.9	Proper
Product Eligibility Value		84.7	Proper

Based on the analysis of the data above, it is known that the display aspect gets the highest percentage of score of 89.6%. This is due to the selection of the right type and font size. The

typeface used is Open Sans with a size of 14. This typeface is not very formal and can be read comfortably by students. The size of the letters in the text used in this learning medium can be seen and read clearly. The color selection also affects the appearance aspect. The selection of green and white colors for the basic appearance of the application is felt to be in accordance with the material presented in it, namely natural resource management. Green is synonymous with biological natural resources in the form of trees or plants. In addition, green also means fertility and balance, so it is suitable for use for this material.

However, based on the analysis table above, it is known that the media benefit aspect gets the lowest score with a percentage result of 80.9%. This learning media is presented with attractive looks and images, but it is not able to support student involvement and make students happy when learning. This is related to student learning activities in using this media who read more and see the image/video media displayed. This media needs to be added to learning activities that encourage students to be more active in learning, for example group learning activities or discussion activities with peers. In addition, at the time of the trial, there were still several obstacles such as slow applications due to lack of internet connection support and could not be used on all types of mobile phones, for example IOS-based phones.

The results of students' perceptions regarding the learning media, obtained through the product feasibility trials, indicated a score of 84%. According to the qualification standards of the product assessment questionnaire, this score reflects a classification of "feasible." Several comments and suggestions were provided by the students, including: (1) the learning system is quite good and engaging, (2) the media is very attractive, (3) slide transitions are fast, and (4) the product is good, but due to device incompatibility, several bugs were encountered. These findings are presented in Table 6.

Table 6. Geography Teacher Assessment Results Based on Assessment Aspects

Number	Aspects	Percentage	Interpretation
1	Media Display	75	Proper
2	Ease of Use	75	Proper
3	Material	81,2	Proper
4	Media Benefits	75	Proper
Product Eligibility Value		76	Proper

Based on the analysis of the data above, it shows that the material aspect received the highest percentage of score of 81.2%. This is because the material in the learning media is presented systematically. The presentation of the material discussed starts with the definition, characteristics, distribution, and management of natural resources. In addition, the material is presented contextually by relating the topic of discussion to the phenomena that occur around the students. Presenting material in a contextual manner can make it easier for students to understand the material and achieve learning goals (Arsanti, 2018). Contextual mastery of the material is expected to support students to be responsive to the surrounding environment (Syofniati, 2019). The suggestions from the teacher regarding this media are 1) it is necessary to add moving animations or videos about the use/abuse of natural resources, 2) it is necessary to display loading animations so that students are not confused for a long time in opening something. According to Pribadi (2017), moving animations or videos in the helper show the elements in the

message clearly, as well as display objects, places, and events in a moving image format that is interesting to students.

Evaluation

The last stage is an evaluation carried out to improve learning media products in the next development which refers to the assessment of expert validation and students as users. The assessment is in the form of suggestions and inputs on the questionnaire. Through the results of the analysis of the assessment, it is used as a formative evaluation of product development. Formative evaluation is carried out by collecting data at each stage which is then used to improve the product (Tegeh, 2013). After the product is revised, it can then be used directly by students in supporting the geography learning process independently.

Product Advantages and Disadvantages

This learning media product has the advantage of having an attractive appearance. This is evidenced by the results of the assessment given by students on the aspect of media display to obtain very decent qualifications. The display on this media is considered attractive, so that it can encourage students' motivation and enthusiasm in learning the material presented (Wulandari, 2021). Another advantage of this learning media is that it is easy to use, which is evidenced by the results of student assessments on the aspect of ease of use who obtained very decent qualification scores. The third advantage is that this learning media presents contextual material, this can support students' understanding of material because it is related to real-life phenomena.

This learning media still has several weaknesses, including requiring a stable internet connection. This is related to the effectiveness of the use of learning media, so that an unstable internet connection can slow down the opening of existing features. The weakness of this product can be the basis for suggestions for further product development, so it is necessary to develop learning media that does not depend on an internet connection, so as not to be slow in opening existing features.

Conclusions

This research and development applied the ADDIE model, consisting of four stages: analysis, design, development, and evaluation, which were implemented systematically. The resulting product is a mobile learning media named NARESa, available in HTML and APK formats. It features an attractive design, ease of use, and presents contextual geography material. Validation tests indicated that the media is feasible for use, with suggestions for improvement, such as adding developer identity and integrating sustainable principles and concept maps. A feasibility test conducted on grade XI students at SMAN 7 Malang yielded a score of 84%, categorized as "decent," confirming its suitability to support student learning. However, the media still has some limitations, particularly in terms of content integration and performance optimization. Therefore, future development is recommended to create an offline-compatible version to minimize dependence on internet connectivity and to further enhance media content by linking it more closely with learning activities, thereby offering students a more active and experiential learning process.

Data Availability

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Conflicts of Interest

All authors in this publication declare no conflict of interest regarding the title, data, location, and results of the research.

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Supplementary Materials

This study does not include any supplementary materials.

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