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Development of Android-Based Learning Media on Ecosystem Materials to Train Students' Cognitive Ability

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Abstract

The background of this research refers to the importance of the use of information technology in education. In connection with implementing online learning due to the pandemic, they also support the development of learning media by utilizing information technology. The results of the national examination on ecosystem material in Wonosobo Regency in 2019 are still not optimal. Based on the results of interviews and filling out questionnaires by teachers and students, the learning media used in the ecosystem material is less attractive to students so that it makes learning interest low and has an impact on learning outcomes. This study aims to develop Android-based learning media on ecosystem materials that can be used to support learning. The research method used is Research and Development with a 4-D model that has been modified into define, design, and develop. Retrieval of data in this study using interview guidelines, validation sheets, response questionnaires, and question sheets. The results showed that based on the material and media expert validation of the developed Android-based learning media, the criteria were very valid with an average percentage of 88% and 98.27%. Meanwhile, the responses of students and teachers to Android-based learning media get an average percentage of 84.93% and 92.18% with very high criteria. Based on the results of the evaluation to train students' cognitive abilities, it got a percentage of 91.25% with a very high success category. The development of Android-based learning media is expected to be used as a reference in learning activities.

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INTRODUCTION

Learning media is one of the supporting factors in realizing innovation in biology learning. Learning media is a tool to convey messages and is able to influence the thoughts, feelings, actions, interests and attention of students (Cahyadi, 2019: 3). Students will understand much better if the material is presented clearly and in various forms. The use of learning media that integrates images and text will be much more helpful for students' understanding (Schwan & Cress, 2017: 3).

Muyaroah and Fajartia (2017: 83) report that the learning outcomes of students are higher when using Android-based learning media compared to those who do not use it. Through good understanding from students, the learning outcomes obtained increase. Learning using Android-based applications is proven to increase students' interest in learning compared to before using (Handayani & Suharyanto, 2016: 389). Learning using Android has an impact on students in the form of learning motivation, cognitive understanding and the emergence of a sense of pleasure Anggraini and Kustijono (2016: 18). Android is an operating system for Linux-based mobile devices which includes an operating system, middleware, and applications (Safaat, 2011: 1-3). According to Nugroho (2018: 106) learning using Android is considered easier and more practical by students.

The percentage of achievement of the national exam results in Wonosobo Regency on ecosystem material in 2019 is 59.71%. The results of interviews with biology teachers indicate that the learning process is still using the lecture and discussion method. The learning media used in learning are in the form of power points and printed books. The teacher also explained that the size of the printed book which is relatively thick often makes students lazy to study outside of learning because it is less efficient to carry or use anywhere and anytime. The limitations of printed books also hinder students from learning independently or outside school learning. This has an impact on students' learning outcomes that are not optimal.

Based on the results of interviews with 15 class X students, the learning media used in ecosystem material is less attractive and monotonous, thus making ecosystem material difficult to understand. Learning media is said to be less attractive in terms of design or appearance, supporting learning media such as colors and shapes, and their use which are still conventional and not modern. It is said to be monotonous because the content of the media used in schools is less varied, which are only images and text. Students are much more interested in various learning media using pictures, videos, and charts, as visual elements then combined with audio and narration as explanatory elements. By combining these elements students will understand better in digesting the contents of a learning material that is delivered (Wijoyo, 2018: 9).

In determining the right media to use in learning, further observations were made related to the potential possessed by students and the conditions that were happening. The potential is that most students already own and use smartphones. There are more students who have smartphones than those who have laptops or computers. In connection with the condition of education in Indonesia, due to the Covid-19 pandemic, learning has to be carried out at home online. This is a supporting factor for the development of learning media that utilizes technology which is relevant to the potential of students, namely smartphones. Another reason for

developing learning media with the use of technology is related to education in the XXI century which demands that learning be carried out by utilizing technology.

Seeing the problems and potentials based on the results of interviews by teachers and students as well as current conditions, the idea emerged to develop a learning media that was more attractive in terms of content, design, and supporting components, did not hinder students' learning to learn independently, efficiently and more modern on the material ecosystem. The learning media that will be developed will contain material in the form of text, pictures and learning videos. The advantages of the media to be developed include that it can be used anytime and anywhere because it can be accessed using a smartphone that is smaller and lighter in size, does not require a computer, and can be operated offline. The learning media in question is Android-based learning media on ecosystem material. Media development using Android is considered more practical and easier (Nugroho, 2018: 94).

RESEARCH METHOD

The development of Android-based learning media on ecosystem material is a research development (Research and Development) with a 4-D development model. According to Thiagarajan (1974: 5) the 4-D model has four stages, namely define, design, develop, and dissemination, but in this study only up to the develop stage. The research was conducted at MAN 2 Wonosobo. The research was carried out only up to product trials. The sample in this study were ~~32 students of~~ class X MIA 2 at MAN 2 Wonosobo with simple random sampling technique or simple random sampling. Media that has been developed is then given to the media validator and material to be validated. Aspects assessed by material experts include material coverage, material accuracy, up-to-date and contextual, presentation techniques, presentation support, and presentation delivery. Meanwhile, the assessed aspects include aspects of appearance and language. Validation is carried out using an instrument in the form of a questionnaire. The suggestions and comments given by the validator are then used as material for improving learning media. Furthermore, the media is given to teachers and students to be asked for their responses. The instrument used was a response questionnaire.

The implementation of media in learning is carried out in three meetings. The first meeting was the stage of introducing the media to students, the activities carried out included downloading, applying the media as well as using the media as a learning tool. At the second meeting the students filled out a questionnaire on the responses to the learning media that had been used. At the third meeting students worked on evaluation questions in the form of multiple choice questions to train cognitive abilities after using the media. All data obtained were then analyzed descriptively using descriptive statistics. Descriptive statistics provide a description of characteristics of the object under study. Activities in descriptive statistics include collecting data which will then produce statistical measures such as frequency. In addition, to make the data easier to read can be summarized in tabulated form.

RESULTS AND DISCUSSION

The advantage of this android-based learning media is that it can be applied anywhere and anytime, containing ecosystem materials packaged in the form of interesting text, images, and videos. In addition,

Android-based media can also be used offline. The drawback of android-based learning media in this ecosystem material is that it has not been able to help the maximum achievement of K.D 4.10. Basic Competency 4.10 contains the presentation of work by students regarding the interaction between ecosystem components. The media has not been able to help optimally in achieving K.D 4.10 because the learning media developed is offline media so that in the media there are no facilities that support direct interaction between teachers and students. Nevertheless, the learning media can still be used in helping the achievement of K.D 4.10, the teacher can use the video in the media as analytical material for students, then students can pour the results of their analysis into a work.

Results of Material Validation on Android-Based Learning Media on Ecosystem Materials

Material validation is carried out based on six aspects, namely material coverage, material accuracy, freshness and contextual, presentation techniques, material presentation support, and learning delivery. The recapitulation of the results of the assessment by material experts can be seen in Table 1.

Tabel 1. Results of Material Validation

No.	Aspect of Assessment	Percentage
1.	Material Coverage	83.33%
2.	Material Accuracy	87.5%
3.	Up to date and contextual	100%
4.	Presentation technique	75%
5.	Supports of presentation	100%
6.	Presentation	83.33%
	Average percentage	**88%**
	Criteria	**very valid**

In the aspect of material coverage consists of three indicators. The material depth indicator gets a score of 4 or a maximum score. Meanwhile, the material suitability indicator and the breadth of the material get a score of 3, this is because there are still some materials that need to be completed, such as the section on ecosystem types. in this section, it is necessary to add the characteristics of the ecosystem.

In the aspect of accuracy, the material consists of two indicators. The factual accuracy indicator gets a maximum score of 4.While theoretical accuracy gets a score of 3, this indicator has not yet obtained a maximum score because the material components in the media can still be supplemented by adding material from other sources to make it more accurate. According to BSNP as quoted by Rahmatih et.al. (2017: 164) that good teaching materials must pay attention to the appropriateness of the content, at least referring to the goals to be achieved by students.

Up to date and contextual aspects consist of three indicators, namely conformity with the development of science, recent features, and concrete examples with each obtaining a maximum score. The hat is because the concept of delivering material is in accordance with current developments in science and technology. According to research conducted by Rosalina et. al. (2020: 53) cutting-edge learning media, namely media that is in accordance with the conditions and developments of the times.

In the aspect of the presentation technique, it consists of four indicators, namely the logic of presentation, the clutter of presentation, the coherence, and the balance of the sub-chapters with each score 3. On these indicators have not obtained the maximum score because there are still sub-material that would be better if added so that delivery more coherent and balanced so that it can make it easier for students to understand the material.

The supporting aspects of the presentation of the material consist of two indicators, namely the suitability of the material illustrations and the generation of learning motivation where each one gets a maximum score of 4. According to the results of the analysis in research conducted by Pralisaputri et.al. (2016: 152) shows that students like a learning medium in which a lot of pictures are used. This is relevant to the results of the validation on the supporting aspects of the presentation in the form of images.

The last aspect is the delivery of learning with three indicators. Indicators of student involvement get a maximum score of 4. Setiawan and Wiyardi (2015: 29) convey that media that actively involves students can improve student understanding. As for the interactive communication indicators and scientific approach, it gets a score of 3 because the learning media developed are media that support independent learning so that it does not involve direct communication between students and teachers. In accordance with the comments and suggestions from the validator, some errors in the learning media have been corrected. In the sub-chapter on ecosystem types, features have been added.

The results of the overall evaluation by material experts, learning media get an average percentage of 88%. This shows that the material expert stated that Android-based learning media on ecosystem materials in the criteria of "Very Valid" are used as learning media.

Results of Media Validation on Android-Based Learning Media on Ecosystem Materials

The media validation assessment that has been carried out is based on two aspects, namely aspects of language and user interface or presentation. Recapitulation of the results of media validation can be seen in Table 2.

Tabel 2. Result of Media Validation

No.	Aspects of assessment	Persentage
1.	Language	100%
2.	User interface	96,4%
	Average percentage	**98.2%**
	Criteria	**Very Valid**

In the linguistic aspect, it consists of 6 indicators including straightforwardness, legibility, suitability with student development, conformity with Indonesian language rules, use of terms and symbols, and ability to motivate. Each indicator gets a score of 4. This shows that when viewed from a language perspective, Android learning media is good. Septiana et al, (2020: 60) reported that the aspect of language in the preparation of learning media is one of the aspects that need to be considered because it is a supporting factor in children's understanding.

In the presentation aspect or the user interface consists of 5 indicators. These indicators include consistency, color, layout, typography, and imagery. From all these aspects, it gets a score of 4 or the maximum score except for the layout indicator on the element position sub-indicator in the application and the image explanation sub-indicator with a score of 3. The validator states that it is necessary to write an image source and add an image so that the explanation of the material is more complete and easy to understand. In accordance with the comments and suggestions of the validator, some deficiencies in the media have been fixed.

Overall evaluation results by material experts, the validity of learning media gets an average percentage of 98%. This shows that media experts stated that Android-based learning media on ecosystem materials in the criteria of "Very Valid" are used as learning media.

Teachers' Responses to Android-Based Learning Media on Ecosystem Materials

The response given by the biology teacher consists of four aspects. The results of each aspect obtained a different percentage. The aspects assessed consist of aspects of use, use, material, and appearance. Recapitulation of the results of teacher responses can be seen in Table 3.

Tabel 3. Teacher Responses to Android-Based Learning Media

No.	Aspects of assessment	Percentage
1.	Use	100%
2.	Usability	100%
3.	Material	93.75%
4.	Presentation	75%
	Average percentage	**92.18%**
	Criteria	**Very High**

The usage aspect consists of one indicator, namely the ease of installing and operating learning media with a score of 4. Obtaining a maximum score in this aspect indicates that the learning media is easy to install and operate. In the usability aspect, it consists of seven indicators with statements about the usefulness of learning media. Each of these indicators gets a maximum score of 4. This shows that the learning media developed are beneficial for teachers and students. Mustaqim and Kurniawan (2017: 43) report that good media is media that is useful and easy to use.

The second aspect is the material aspect which consists of five indicators, namely the delivery of the material, the accuracy of the material, the suitability of the basic competencies, the order of the material, the ease of understanding. From this aspect, all indicators get a score of 4 except for the accuracy of the material with a score of 3. As for the display aspect, it gets a score of 3 on each indicator, namely the appearance of the media and the use of components such as writing, pictures, and videos. Even so, the teacher said that the learning media was good and worthy of being used as a learning medium. From the data obtained, the teacher's responses indicate that Android-based learning media on ecosystem materials are in the "Very High" criteria and are valid for use as learning media.

Student Responses to Android-Based Learning Media on Ecosystem Materials

The student response questionnaire was filled in by ~~32~~ students, consisting of 14 assessments divided into three aspects, namely the appearance aspect, the material aspect, and the usability aspect. Each student gives a

different response score on each item of the statement. Then the score is analyzed and presented in the form of a percentage. The following is a recapitulation of the results of students' responses to Android learning media for the ecosystem.

Tabel 4. Results of Students' Responses to Android-Based Learning Media

No	Aspects of Assessment	Percentage
1	Presentation	83.14%
2	Material	83.59%
3	Usability	87.96
	Average percentage	**84.93%**
	Categori	**Very High**

The display aspect consists of seven responses. Based on the responses given by ~~32~~ students, the assessment item that received the highest response was the fourth item which stated that pictures and videos can provide learning motivation for students. On these items there were 17% students who gave a score of 4 and 16% students gave a score of 3. While the lowest assessment item in the aspect of appearance was the 7th item regarding the model and size of the letters used. Even though this item received the lowest rating, its value was still in the high category. where there are 29% students giving a score of 3 and 2 %students giving a score of 4.

In the material aspect, it consists of two points of response with the highest score on item 8 regarding the delivery of material in the media that is easy to understand. On this item, there were 13% students who gave a maximum score of 4, and there were 19% students who gave a score of 3. The lowest point in this aspect was in the 9th item regarding the relationship between material and daily life. There were 9% students who gave a score of 4 and 23% students gave a score of 3.

In the usage aspect, it consists of five points of response. The highest acquisition is in item 12 regarding the accuracy of the media for use in learning. On these items there are 24 students who gave a score of 4 and 8% students who gave a score of 3. While the items that got the lowest score were in item 10 regarding the ease of using learning media. On these items, there were 13% students who gave a score of 4 and 19% students who gave a score of 3.

According to Sungkono (2008: 79) learning media is valid if it meets predetermined criteria such as conformity with learning objectives, efficiency, makes it easier for users, content of material, and appearance of media. After students use Android-based learning media, then students work on questions to train cognitive abilities. The questions to be worked out were in the form of multiple choice questions totaling 25 items. These questions represent each sub-material of the ecosystem. These sub-materials include ecosystem components, food chains, food webs, energy pyramids, biomass pyramids, interactions between ecosystem components, biogeochemistry, nitrogen cycle, water cycle, carbon cycle and sulfur cycle.

Tabel 5. Student Learning Outcomes After Using Media

No	Score	Amount	Category
1	71-80	1	Complete
2	81-90	12	Complete
3	91-100	19	Complete
Average			**91.25**
Amount of complete			**32**
Amount of incomplete			**0**
Highest score			**100**
Lowest score			**80**

The results of the evaluation of 32 students after using Android-based learning media stated that all students scored above the KKM with an average of 91.25. Of the whole questions, then analyzed based on the acquisition of scores in each sub-chapter of the material. The following is the result of the analysis of students' cognitive understanding per ecosystem sub-material after using learning media.

Tabel 6. Analysis of Student Learning Outcomes per Sub-Material

Indicator	Percentage
Ecosystem components	93.75%
Food chain	96.87%
Food webs	93.75%
The energy pyramid	93.75%
Biomassa pyramid	90.62%
Interaction of ecosystem components	93.75%
Biogeochemistry	84.37%
Nitrogen cycle	86.45%
Water cycle	93.75%
Carbon cycle	88.54%
Sulfur cycle	88.54%
Average	**91.25%**
Categori	**Very High**

The highest acquisition based on the evaluation results of students is in the sub-material of the food chain and the lowest percentage is in the sub-chapter of biogeochemical material. When viewed from the results of the percentage of students 'understanding on each sub-material, it can be said that after using learning media, the students' cognitive comprehension is in a very high category. Learning is said to be successful if students are

able to understand learning material well, one of which is manifested in the form of achieving cognitive learning outcomes (Kristin, 2017: 411). Thus, Android-based learning media can be used as a means of student learning, as evidenced by the high level of cognitive understanding of students in each ecosystem sub-material after using the media.

CONCLUSION

Based on the research results, it can be concluded that the developed Android-based learning media is considered very valid both in terms of material and media. According to the responses of teachers and students, learning media get very high responses. Android-based learning media on ecosystem material is considered appropriate to be used as a learning reference for students as evidenced by the high cognitive understanding of students on ecosystem material after using the developed media.

REFERENCES

Anggraini, R, & Rudy, D. (2013). Pengembangan media animasi Fisika pada Materi Cahaya dengan aplikasi berbasis *Android. Jurnal Pendidikan Fisika dan Aplikasinya, 3*(1), 11-19.

Cahyadi, A. (2019). *Pengembangan Media dan Sumber Belajar.* Serang: Penerbit Laksita Indonesia.

Handayani, T.S, & Suharyanto. (2016). Pengembangan *mobile learning* berbasis *Android* sebagai media pembelajaran pada materi Fluida Statis untuk meningkatkan minat dan hasil belajar ranah kognitif peserta didik. *Jurnal Pendidikan Fisika*, *5*(6), 384-389.

Kristin, F. (2017). Keberhasilan belajar mahasiswa ditinjau dari keaktifan dalam perkuliahan dengan menggunakan pembelajaran *active learning. Jurnal Pendidikan Dasar perKhasa,* 3(2), 405-413.

Muyaroah, S, & Fajartia, M. (2017). Pengembangan media pembelajaran berbasis *Android* dengan menggunakan aplikasi Adobe Flash CS 6 pada mata pelajaran Biologi. *Innovative Journal of Curiculum and Education Technology, 6*(2), 79-83.

Mustaqim, I. & Nanang Kurniawan. (2017). Pengembangan media pembelajaran berbasis *Augmented Reality. Jurnal Edukasi Elektri,* 1(1), 36-48.

Nugroho, A.S. (2018). Pengembangan ulangan berbasis *Android* menggunakan aplikasi *Google Form. Jurnal Sistem Informasi dan Teknologi, 1*(2), 89-94.

Pralisaputri, K, R., Heribertus, S, & Chatarina, M. (2016). Pengembangan *booklet* berbasis SETS pada materi Pokok Mitigasi dan Adaptasi Bencana Alam untuk kelas X SMA. *Jurnal GeoEco,* 2(2), 147-154.

Rahmatih, A., N. Yuniastuti. & Susanti. (2017). Pengembangan *booklet* berdasarkan kajian potensi dan masalah sebagai suplemen bahan ajar SMK Pertanian. *Journal of Innovative Science Education,* 6(2), 163-169.

Rosalina., Genta, Sahuri., Tjong, Wansen, & Abdul, Ghofur. (2020). Pelatihan pembuatan media pembelajaran untuk guru-guru SMA di Cikarang. *Academic in Action Journal,* 2(1), 52-60.

Safaat, N. (2011). *Android Pemrograman Aplikasi Mobile Smartphone dan Tabel PC Berbasis Android.* Bandung: Informatika.

Schwan, S. & Cress, U. (2017). *The Psychology Digital of Learnin.* Berlin: Springer.

Septiana, Ika., Asrofah., Muhajir, & Ahmad, Rafai. (2020). Aspek Kebahasaan Media Digital pada Pembelajaran Anak Usia Dini di Masa Pandemi Covid-19. *International Proceeding of Innovative and Transdisciplinary Student:* IPISTRANS.

Setiawan, Hendri, & Wiyardi, R, S. (2015). Penggunaan *app inventor* dalam pembuatan game edukasi berbasis android sebagai media pembelajaran yang mandiri dan interaktif untuk meningkatkan hasil belajar siswa TITL pada pengembangan pembelajaran Listrik Dasar SMK Muhammadiyah Majenang. *Edu Electronica Journal,* 4(1), 24-30.

Sungkono. (2008). Pemilihan dan penggunaan media dalam proses pembelajaran. *Jurnal Ilmiah Pembelajaran,* 1(4), 71-80.

Thiagarajan, S. (1974). *Introductional Development for Training Teacher of Receptional Children.* Washington DC: National Center for Improvement Educational System.

Wijoyo, A. (2018). Pengaruh hasil belajar peserta didik dengan menggunakan multi media pembelajaran interaktif untuk Sekolah Menengah Pertama dan Sekolah Menengah Atas. *Jurnal Informatika, 3*(1), 46-55.