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The Impact of Android Media Development on Students' Scientific Argumentation Skills

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Abstract. The use of information technology plays an important role in online learning. Schools must be prepared to learn to use the learning method from home during the pandemic. One alternative is to use a computer as a learning medium. Learning by utilizing computer media is very much needed in this pandemic era. This study aims to produce an ethnoscience-integrated android-based learning media that is feasible, practical, and effective to improve students' scientific argumentation skills. This study uses a 4D development model procedure. The product developed consists of a syllabus, lesson plans, android, and evaluation instruments which are validated by three expert validators. The data instrument consists of a feasibility assessment questionnaire, the practicality of learning, and a scientific argumentation ability test instrument. The validation results show that the average percentage of syllabus eligibility is 87.9% with very feasible criteria. The average percentage of eligibility for the lesson plan is 88.6% with very feasible criteria. The average percentage of android media eligibility is 85.1% with very feasible criteria. The average percentage of the feasibility of scientific argumentation instruments is 84.6% with very feasible criteria. The results of the practicality test showed that the student response was 78.6%, the teacher response was 84%, and the learning implementation was 83% with efficient criteria. The effectiveness of learning using ethnoscience-based android media shows an increase in scientific argumentation skills on moderate criteria. Based on this description, it can be concluded that this ethnoscience-based android media is feasible, practical, and sufficient to improve scientific argumentation skills, especially during the Covid pandemic.

INTRODUCTION

The closure of pre-school educational institutions, basic education to higher education levels due to the Covid-19 pandemic has had a major influence on the learning process and educational curriculum [1]. Due to the Covid-19 pandemic situation, the Indonesian government has also implemented health protocols, including physical distancing for citizens.

The implementation of physical distancing has an effect on the learning process of students from face to face in the classroom turning into online with learning from home or learning from home [2]. The government's decision to suspend all educational activities, makes related educational institutions have to provide alternatives and innovations in the educational process for students who cannot carry out the educational process directly in educational institutions [3]. One alternative is to use Android as a learning medium. The use of android as a learning medium can be an alternative as well as a solution to make students more active in the learning process [4].

In addition to the Covid-19 problem, the State of Indonesia is also faced with problems in the current era of globalization which has shifted local cultural values that should be maintained and preserved by the younger generation, especially students as agents of change [5]. This is a problem that must be solved, one way is through education. By combining scientific knowledge at school with indigenous scientific knowledge in the community [6], students will be more concerned about the surrounding environment. The application of this kind of learning is able to increase students' understanding of scientific science concepts and make learning more meaningful [7], especially now that there are still many scientific science concepts that have not been formalized in schools. In this case,

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teachers need to recognize and preserve culture in life [8] which is formalized as a learning resource with an ethnoscience approach.

In everyday life, we always interact with the local environment and culture. However, the potential of local culture has not been optimally utilized by teachers in the learning process, even the values adopted by local communities full of local wisdom are neglected in learning including science learning [9]. On the other hand, globalization has significantly shifted local cultural values. The reality of this shift in cultural values has resulted in the neglect of local cultural values. It is still rare for science learning to truly reveal the cultural realities around students. The content of the material taught has not been widely integrated with the culture [10].

The integration of ethnoscience into the science education curriculum in schools can be done by using android-based learning media that is in accordance with the conditions of the 13 around the school and in accordance with the conditions of the Covid-19 pandemic. This opportunity provides space for the world of education to assist local governments in optimizing regional potential related to ethnoscience potential. The goal is to make students more familiar with their environment and region, which basically has potential, and not to be dazzled by concepts from the outside world. Parris & Linder-VanBerschot [11] stated that ethnoscience-based learning is very necessary for students because it will teach an attitude of love for culture and the nation, and introduce students to the potential of an area so that they are more familiar with the culture of the region.

Ethnoscience-based learning that is integrated into android-based learning media is expected to contribute to increased understanding of the material that will have an impact on students' scientific argumentation skills. Scientific argumentation skills cannot develop automatically, but require stimulation from the environment. The experts explained that to support and improve these abilities, we can start by exploring how the relationships between sciences which have many characteristics, such as scientific argumentation, are understood and taught in schools [12].

The importance of providing students with scientific arguments raises new innovations that 18 carried out by each institution to prepare future students who are critical and able to compete. The ultimate goal of this research is to determine the effect of ethnoscience-oriented android-based learning media on the problem-solving ability and scientific argumentation ability of students. Ethnoscience-oriented android-based learning media is an effort to improve the quality of learning as well as to equip students with higher-order thinking skills and attitudes of students who care about the environment.

EXPERIMENTAL DESIGN

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This research is development research using th 19 D development model developed by Thiagarajan [13]. The subject of the limited trial was conducted on 135 students of class VIII in one of the junior high schools on the island of Lombok, with details of 68 male students and 67 female students. This study uses 4 experimental classes.

The scientific argumentation ability test instrument used is a reasoned multiple-choice test that refers to the indicators developed by Erduran [14], namely: claim, ground, warrant, support, qualifier, and rebuttal. Feasibility data collection techniques in the form of syllabus validation sheets, lesson plans, android media, and evaluation instruments. The practicality of learning was obtained from the learning implementation sheet, teacher and student response questionnaires related to learning using ethnoscience-based android media. Effectiveness data in the form of scientific argumentation ability test results were tested on students using multiple-choice instruments with reasons. Data analysis to determine the feasibility and practicality was obtained from Aiken's V, then the data analysis of the effectiveness of the ethnoscience-integrated android media was carried out using the N-gain test according to Hake [15].

RESULT AND DISCUSSION

The final model of the development stage is an ethnoscience-integrated android media as a source of learning media that can be accessed and shared by teachers and students as support in learning activities. The ethnoscience-integrated android media product is packaged in the form of an application. The components of the Android media feature consist of the home menu, instructions for use, learning materials, schedules, quizzes, animations, inquiry activities, summaries, references, and media developer profiles. The Android media feature components developed have specifications by combining elements of images, audio, video, and learning animations without the need to use internet access.

This e-learning media is developed based on the flowchart that has been made. The flowchart is structured as an illustration to simplify the process of making ethnoscience-integrated android media; At this stage, supporting materials such as hosting and domains are collected, images, background creation, videos, sound effects, button icons, and learning animations related to the content of atomic structures and electron configurations. At this stage, an instrument of scientific argumentation ability was also made, and a validation instrument was used to assess the product being developed.

Based on the e-learning media flowchart, the results presented in the previous design stage, the next stage is to produce a product in two stages, namely expert appraisal and developmental testing. Expert assessment is an assessment of expert lecturers followed by revision, while the development test is a test of the results of development. Testing the results of development in development testing was carried out by limited group trials and broad group trials and testing the effectiveness of ethnoscience-based android media to improve students' problem-solving abilities. Some examples of ethnoscience-integrated android media displays are presented in Figure 1.

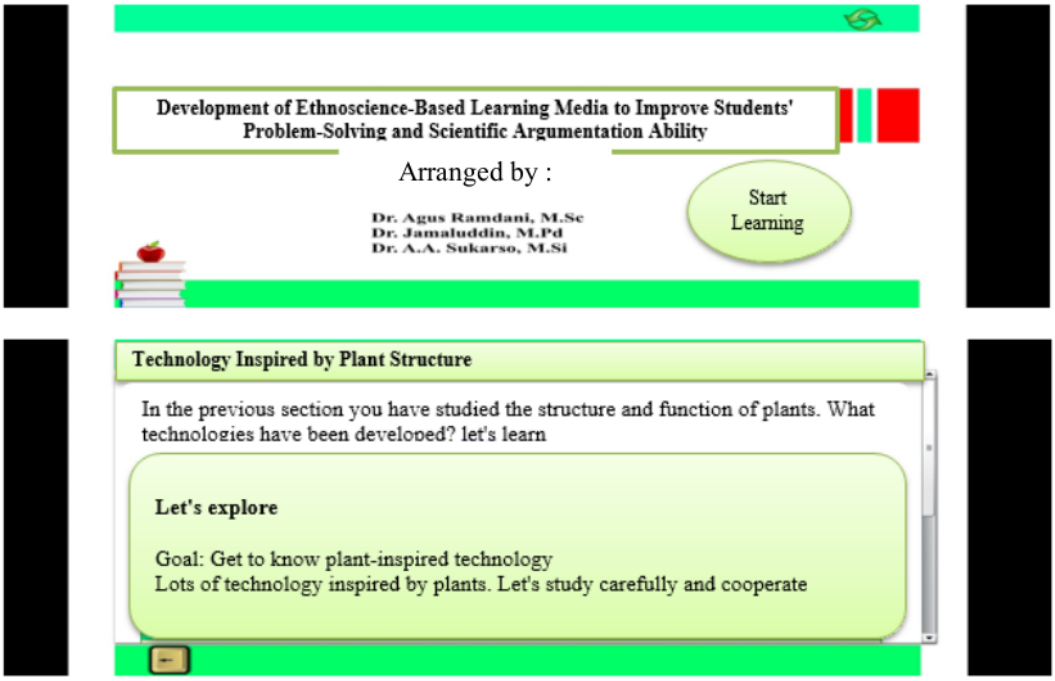

FIGURE 1. Display of ethnoscience-integrated android-based learning media

This study aims to produce an ethnoscience-integrated android learning media that is feasible, practical, and adequate to improve students' scientific argumentation skills. The validation of the developed product is carried out by three experts who are competent in their fields. The learning products assessed were syllabus, lesson plans, android media, and evaluation instruments. The expert validation results obtained are listed in Table 1.

TABLE 1. Expert Validation Results

Validator	Syllabus (%)	Lesson Plan (%)	Android media (%)	Instrument of scientific argumentation ability (%)
I	91.6	92.8	89.6	89.5
II	88.8	91.0	90.0	85.4
III	83.3	82.1	75.8	79.1
Average	87.9	88.6	85.1	84.6

Based on Table 1, it can be seen that the average percentage of syllabus eligibility is 87.9% with very feasible criteria, the average percentage of lesson plan eligibility is 88.6% with very feasible criteria, the average percentage of android media eligibility is 85.1% with criteria very feasible, and the average percentage of the feasibility of the scientific argumentation ability instrument is 84.6% with very feasible criteria. In line with research by Lin dan Parson [16]; Yustiqvar, et al [17], a product that has been developed that obtains the appropriate criteria from an expert validator can be used as a trial in the learning process.

The results of the practicality test were obtained based on the data collected by the researchers in the form of observations of the implementation of learning by observers, questionnaire data on teacher and student responses to the use of ethnoscience integrated android media in learning.

Learning Implementation Data

The observations on the implementation of the learning process carried out by the observer using a learning implementation questionnaire are listed in Table 2.

TABLE 2. Observation of learning data

No.	Meeting	Average value (%)	Category
1	I	75	Practical
2	II	82	Very Practical
3	III	80	Very Practical
4	IV	78	Practical
Average (%)		**78.7**	**Practical**

Table 2 shows that the average implementation of the learning process in the limited trial is 78.7% with the practical category.

Questionnaire data on teacher and student responses to the use of e-learning media

The results of teacher and student responses to ethnoscience integrated android media in learning are listed in Table 3 and Table 4.

TABLE 3. The percentage of student responses

Respondents	The attractiveness of e-learning media	Ease of Use	The role of e-learning media in the learning process	Average
Students	83%	80%	75%	79.3%
Criteria	Very practical	Practical	Practical	Practical

TABLE 4. The percentage of teacher responses

Respondents	Content Quality and Purpose	Quality of Learning and Instructional	Average
Teacher	82%	84%	83%
Criteria	Very practical	Very Practical	Very Practical

Based on Tables 3 and 4, the average percentage of teacher and student responses in all aspects of learning has efficient criteria, so it can be concluded that the ethnoscience-integrated android media in learning is in the practical category.

N-Gain results to analyze students' scientific argumentation skills

Based on the analysis results that have been carried out, the overall students' scientific argumentation skills scores were obtained as listed in Table 5.

TABLE 5. Students' scientific argumentation skills N-Gain Test Results

Class	Average		Average N-Gain (%)	N-Gain criteria
	Pre-Test	Post-test		
Experiment 1	21	71	61	Moderate
Experiment 2	29	73	69	Moderate
Experiment 3	28	75	70	High
Experiment 4	25	70	65	Moderate
Average			**66.25**	**Moderate**

Table 5 shows that the N-gain value of the four classes obtained an average value for increasing the scientific argumentation ability of students with high criteria. Hadisaputra [3, 19] explains that computer media in the learning process can improve students' thinking skills.

The main purpose of this research and development is to produce ethnoscience-integrated android media to improve students' scientific argumentation skills. This media can be a solution for learning during the pandemic and new normal. This is done as an effort to provide an alternative learning system that can be applied by teachers during a pandemic, which is useful for improving students' ICT skills and for delivering abstract and microscopic chemistry material that is difficult to explain in more detail. by student and teacher textbooks [19].

This android media can be used independently. The products developed are android media, lesson plans, syllabus, practice questions, and concept understanding instruments. The lesson plans and syllabus were developed by researchers which aim to serve as a guide for teachers in carrying out learning. Then the developed android media is equipped with instructions for use to guide students in carrying out learning. The developed android media is also designed as well as possible so that students are interested in participating in learning. Some students think that using e-learning media is fun [4]. Yilmaz [20] also stated that student satisfaction and motivation affect learning outcomes.

Android media is given an overview of learning design so that students are not confused in using the media. The existence of practice questions also supports android media. The practice questions are given five repetitions, using a random system. In the first work process, the arrangement of the questions will be different from the second, third, and so on. The development of questions in the media aims to train students' scientific argumentation skills against the concepts being studied.

Gouveia [21] describes media as multimedia and internet technology to improve the quality of learning by facilitating access to resources and services as a guide in information exchange and collaboration. The ethnoscience-integrated android media presents new opportunities for educators and students to enrich their teaching-learning experiences through a virtual environment that supports, not only conveying but also exploring and applying information and promotion of new knowledge. Learning using ethnoscience-integrated android media uses a guided inquiry learning model.

Kauchak & Eggen [22] explained that the application of the guided inquiry model in the learning process includes five activities or learning phases. Based on these phases, the third phase is the exploration phase. This phase can apply learning that emphasizes the interaction between educators and students or students with students. Based on this opinion, the guided inquiry model is applied as a supplement to help facilitate students in learning and accessing information.

The development of ethnoscience integrated android media is used as a source of learning media that can be accessed and used simultaneously by teachers and students in learning. The results of ethnoscience-integrated android media products that have been developed are then packaged in the form of applications.

To complete the expert validation test, a media practicality test was carried out which was measured based on the responses of students and teachers; and the application of media in learning. The results of the analysis of student responses to the android learning media show that the media has a good level of practicality both in terms of attractiveness, ease of use, and benefits in the learning process. Media appeal is important because the selection of quality images will make students happy and enthusiastic in learning activities [19, 23]. Likewise, the teacher's

response as a user shows that from the two aspects assessed, namely the quality of content and objectives; and the quality of learning and learning, the media has a very good level of practicality.

The results of the analysis of N-gain show that ethnoscience-integrated android media can improve students' scientific argumentation skills. This is evidenced by the results of the N-Gain test obtaining a score with moderate improvement criteria. These findings indicate that the ethnoscience-integrated android learning media can help students improve their scientific argumentation skills. These results are in line with research by Wijaya et al [24] who found that the use of learning multimedia significantly increased students' thinking skills. The same thing was also reported by Chairunnisa, et al [25] who proved that learning media can improve students' scientific abilities.

Android media integrated with a guided inquiry model presents learning material with a more attractive and informative appearance. It aims to facilitate and increase students' learning motivation. The inquiry process carried out in groups causes interaction between students which allows them to exchange ideas and express opinions with each other through research or scientific work procedures before they find answers so as to train students' thinking skills [4].

The argumentation ability of students can be increased through scientific inquiry activities because in practice students are trained to conclude valid research results based on the evidence obtained through the investigations carried out [26]. Argumentation is a systematic exploration of a theoretical confirmation through the coordination of evidence that describes the results of empirical observations or experimental results about natural phenomena [27].

The ADI (Argument-Driven Inquiry) learning model is designed for scientific inquiry purposes in an effort to develop arguments and support explanations of research questions. Learners are directed to design and carry out their own investigations, collect and analyze data, communicate and justify their ideas with one another during interactive argumentation sessions, write investigative reports, document their work, and engage in peer-review [28].

Through the combination of all these activities, students become more skilled in arguing and understanding important concepts as part of the learning process that has been carried out. By being involved in the argumentation process, students can also master concepts better because knowledge of the content of the topics discussed is needed by students to build arguments [29].

The activities "Let's Think" and "Let's Read" present phenomena that occur in everyday life and are closely related to material content and questions that allow students to contribute to conveying hypotheses orally or in writing in the column formulating hypotheses. Meanwhile, in the conclusion-making phase, students are facilitated to contribute to concluding the results of the investigation in writing or orally through presentations.

This is supported by Lu, et al [30] who states that a claim can be interpreted as an opinion or hypothesis on an event or phenomenon that needs to be proven through investigation and statements in the form of opinions or conclusions obtained based on the results of the investigation.

In the orientation and hypothesis phases, students are given the responsibility to express individual claims in the form of statements of approval "yes" or "agree" and rejection in the form of "no" or "disagree" from questions in the "Let's Think" activity. Examples of questions in the "Let's Think" activity that trigger student claims are as follows:

“In the previous section, you have seen that plants have xylem tissue that functions to transport water and minerals from the soil to the leaves for use in photosynthesis. Have you ever seen a coconut tree or other tall tree? Have you ever thought about how water and minerals that are below the soil surface can rise to the leaves through the xylem?”

From these questions, students were very enthusiastic and confident in expressing their claims without exception. However, the claims put forward by each individual do not vary because students tend to present arguments that have been agreed upon in the group. This is supported by Zohar, et al [31] that in all class discussions, the argument presented by a student is usually an agreed argument developed by the group during small class group work.

In the conclusion-making phase, students are given the responsibility to submit claims in the form of conclusions based on the results of the investigation of the problems/questions faced in oral and written form in groups. That is, the claims put forward by students in this phase must be accompanied by scientific evidence. Students must first collect data through literature review or experimentation, analyze the data obtained, and interpret the data. Examples of questions that trigger student claims.

In this phase, students can express a claim, but it is not optimal because to express a claim it is necessary to have a correlation between evidence and reasoning, so teacher guidance is needed. Smith & Timar (2010) also stated that students have problems connecting data to support their arguments. Niaz, et al. (2002) concluded that if students are given the opportunity to argue and discuss their ideas, their level of understanding of the details of the investigation increases.

Stanford, et al. [34] that claims put forward by students are more guided by instructors than students build claims individually and with the help of their peers. Instructors count as helpful in constructing an argument if they

contribute to one of the components of the argument. It was found that in 2009, 72% of arguments were built jointly between students and instructors, and 20% presented students individually or in collaboration with the help of their friends. In 2010, there was an increase in the number of students arguing, namely 32% of arguments were developed by individual students and 17% were developed jointly by several students during class discussions.

Based on the explanation above, in the claim indicator there is the highest increase due to the fact that most students can express a claim but at a lower cognitive level (predicting/mentioning), it is not based on the results of an investigation that requires a correlation between evidence and reason (analyzes and interprets data).

CONCLUSION

The feasibility of the ethnoscience-integrated android media based on the results of expert validation obtained an average percentage of eligibility of 85.1% with a very feasible category. The practicality of android media based on teacher responses is 84% with efficient criteria, student responses of 78.6% with practical criteria, and 83% of learning implementation with efficient criteria so that the developed android media is practically used in learning. Based on the results of the N-Gain test, it was concluded that the ethnoscience-integrated android media increased the ability of scientific argumentation and students with moderate improvement criteria.

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