
Development of Android-Based Biology Learning Media *Plant Tissue-App* to Train High School Students' Scientific Argumentation Skills

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Abstract. Student centered learning is important to be implemented to improve and develop students' critical thinking and argumentation skills, so that students become active in learning. The importance of thinking in thinking competence in order to compete in the world of technology industry and towards the era of society 5.0 so that in the future Indonesia will become a developed country and human resources can compete internationally. However, in fact, there are still many students who do not like discussion activities with presentations in front of the class. This causes students' argumentation skills to be low and need to be improved. This is influenced by one of the learning media used by teachers still using textbooks. This study aims to produce a product in the form of biology learning media based on the android plant tissue app application that is suitable for use to train high school students' scientific argumentation skills. This study is a research and development (R&D) study with the ADDIE model. Data collection was carried out using a Likert scale assessment instrument which was analyzed descriptively qualitatively and quantitatively. The results of this study are the feasibility of media experts by 98% (very feasible), material experts by 74% (feasible), from Biology teachers (81%), and responses from students by 86% (very feasible). These results indicate that the developed media is suitable for use in training high school students' scientific argumentation skills on the focus of plant tissue material.

Keywords: android mobile, learning media, plant tissue, scientific argumentation,

Introduction

Data from *the Program for International Student Assessment* (PISA) shows that Indonesia ranks 69th out of 79 countries in the science ability category (OECD, 2019). These data show that the level of students' abilities in science is quite low, including scientific argumentation abilities. This is because scientific argumentation is part of science learning that can be trained in the science process in the classroom (Astutik, 2019). Scientific argumentation activities are important to develop and apply in learning activities because argumentation can encourage the development of scientific knowledge, as well as strengthen students' understanding of concepts (Dwyer et al., 2010). Scientific argumentation activities can help determine the level of understanding and ability of students in combining and integrating a concept in material (Faiqoh et al., 2018). Therefore, scientific argumentation activities need to be realized in teaching and learning

activities where it is hoped that students will have good communication skills. So that competence in the 21st century can be realized (Siregar & Pakpahan, 2020) . Students are expected to be able to explain scientifically related natural phenomena which are then used to solve a problem and be able to understand the various new discoveries they make (Probosari et al., 2016) .

Argumentation is an important foundation for students to learn how to think, act and communicate like scientists in practical science learning activities (Probosari et al., 2016). Scientific argumentation has an important role in learning activities, thinking processes, scientific reasoning, and understanding concepts. The ability to make scientific arguments is used by individuals to analyze information about a problem or conflict, then the results will be analyzed and discussed with other people, therefore it is important to apply scientific arguments in science learning to train critical thinking (Imaniar et al., 2020). This is in line with Minister of Education and Culture Regulation No. 81A of 2013, where in discussion or communication activities, students are expected to be able to convey the results of observations with conclusions originating from the results of the analysis in writing, orally, or using other supporting media. Discussion or communication activities require good scientific argumentation skills and must always be improved. According to (Muslim, 2012). Students' low scientific argumentation skills will have an impact on low learning outcomes, while students with low skills are less able to compete in the increasingly advanced realities of life and do not rule out the possibility of losing good job opportunities (Sampson et al., 2011). The problems encountered by students cannot be resolved effectively, which results in students having difficulty in facing challenges in an increasingly complex life (Witri & Effendi-Hasibuan, 2020).

Based on observations made, it shows that argumentation-based learning at SMAN 5 Semarang is still rarely implemented. Students' ability to argue has not been trained due to educators' lack of knowledge regarding effective learning models and media related to argumentation skills (Riwayani et al., 2019). From the results of a survey via *G-form* which was distributed to 46 students of class 23 out of 46 respondents were still confused because students only looked for answers via the internet without understanding the material. The results of the interview show that the material in biology learning that is still difficult for students to understand and less interesting is plant tissue. This is because in plant tissue material, students are required to study the concepts of the structure and function of plant tissue, which use many foreign names. On the other hand, what causes students to lack mastery of plant tissue material is limited lesson time, resulting in minimal time for teachers to deliver the material and lack of time for students to discuss. Discussions are sometimes carried out via Moodle but without teacher supervision, which results in students tending to get bored and unenthusiastic

This less than optimal and less efficient discussion activity via Moodle shows that *smartphone use* is less than optimal and tends to be misused . It is hoped that the use of *smartphones* among students can be used as a learning tool and can also be used by teachers to divert students' attention in the process of teaching and learning activities and avoid misconceptions (Haq, 2017). The existence of misconceptions in learning will affect other subjects and subsequent levels because they can indirectly root in students incorrect learning concepts (Wilantika et al., 2018). Therefore, appropriate learning media are needed to help facilitate the delivery of material and reduce the occurrence of misconceptions. Currently, there are many *online learning platforms* that can be accessed for free, but this has not been matched by educators' ability to maximize the use of these media (Tauhidah et al., 2021). Educators are one of the supporting factors for successful learning in schools, while the rapid development of technology requires teachers to continue to develop skills in operating various online learning media that have been developed (Tauhidah & Prayitno, 2020).

Based on the problems that have been described and the needs that exist in the field, the author provides a solution in the form of biology learning media plant tissue-app which means an application for studying plant tissue. plant tissue-app is a type of *mobile learning* that utilizes innovative handheld technology (*handphone*) containing plant tissue material, where this material is still difficult to understand and is considered less interesting by students. With the Android-based learning media "*Plant Tissue-App*" it is hoped that it can help simplify the learning process. This research aims to determine students' needs for products and the feasibility of application bebrabis Biology learning media to train high school students' scientific argumentation skills.

Methods

This research uses the research and development (R&D) research method, while the model used in this research is ADDIE (Branch, 2009) which aims to design a learning system (Mulyatiningsih, 2011). The ADDIE development procedure includes 5 stages, namely analyze, design, develop, implementation, and evaluation. This research uses the ADDIE model because it has systematic stages that only reach the assessment stage without any product deployment stage. The research was conducted at SMAN 5 Semarang. This research involved 1 media expert lecturer, 1 material expert lecturer, 1 biology teacher at SMAN 5 Semarang, and 30 students of Senior high school 5 Semarang.

Table 1. Details of Product Development Stages

No.	Step	Collecting Technique- and Data	Data Type	Analysis
1.	<i>Analysis</i>	Interview (Teacher and student)	Qualitative	Descriptive
		Observation	Qualitative	Descriptive
2.	<i>Design</i>	Product Design	Qualitative	Descriptive
3.	<i>Development</i>	Documentation (source material used)	Qualitative	Descriptive
		Realization of the design process	Qualitative	Descriptive
		Validation Questionnaire	quantitative	Descriptive statistics
4.	<i>Implementation</i>	Small Scale Test Questionnaire	Quantitative	Descriptive statistics
5.	<i>Evaluation</i>	Revision of small-scale test questionnaire results	Qualitative	Descriptive

The data analysis technique used in this research is descriptive analysis of data from interviews, student needs analysis questionnaire results, and results from expert validation. The percentage value of the data from the validation questionnaire results will be analyzed by dividing the total score obtained by the highest score multiplied by 100%. After the percentage results are obtained, they will be adjusted to the eligibility category grouping shown in the following Table 2.

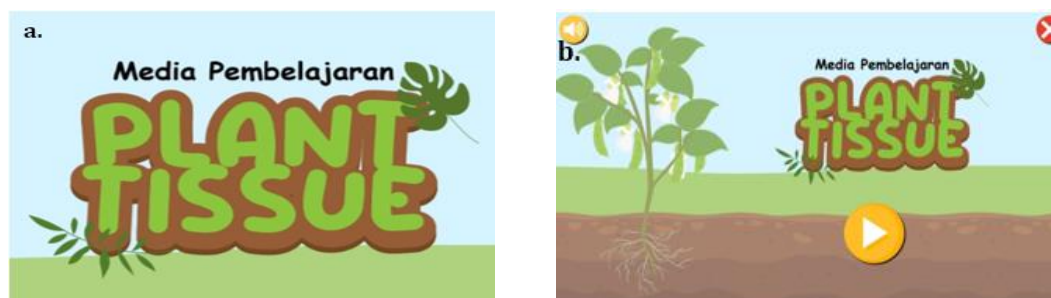
Table 2. Learning Media Eligibility Criteria

No.	Assessment Eligibility (%)	Criteria
1	81 - 100	Very Worth It
2	61 - 80	Worthy
3	41 - 60	Decent Enough
4	21- 40	Not feasible
5	0- 20	Totally Not Worth It

(Source: Ernawati, 2017)

Results and Discussion

The product needs analysis step for students was carried out by distributing a questionnaire to class and the discussion or question and answer process. However, the discussion process cannot run smoothly because in learning activities students and teachers do not maximize the function of smartphones and structured discussions have never been implemented so that students' ability to argue still needs to be trained. The development results of the initial product that the researchers developed based on needs at school are as follows.



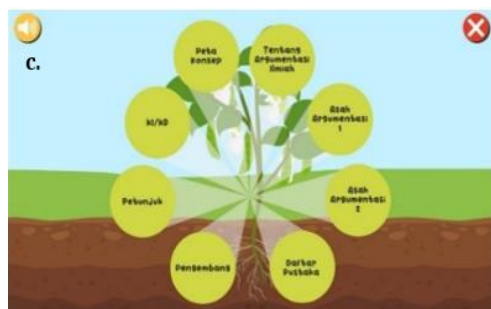


Figure 1. Opening Part a) Icon display, b) *Splash Screen display* c) Menu display d) Introductory display e) Identity display

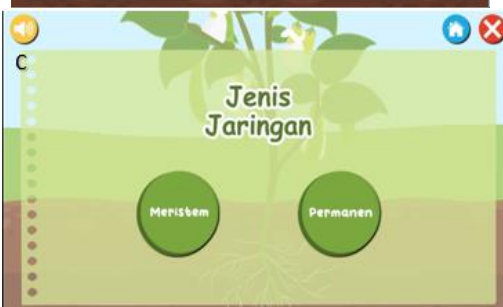
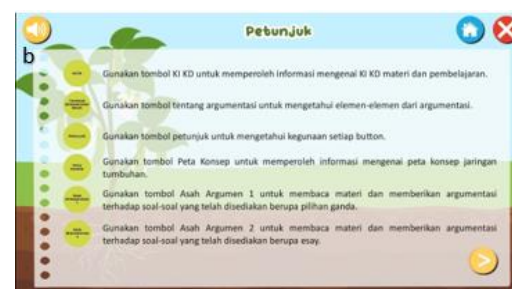




Figure 2. Contents section a) KI KD display b) Instructions display c) argumentation sharpening material menu 1 d) summary of argumentation sharpening material 1 e) data and claims f) *Backing* (Supporting) g) *Rebuttal* (rejection) h) argumentation sharpening exercise 2 i) summary of argumentation sharpening material 2 j) appearance of the argumentation sharpening menu 2



Figure 3. Closing Part a) Developer Profile Display b) Bibliography List Display

The appropriateness of the material is measured using a validation questionnaire containing 11 indicators with 3 assessment aspects, namely the appropriateness aspect of the content, the linguistic aspect, and the scientific argumentation aspect. The following are the results of the material validation assessment of the learning media developed.

Table 3. Validation Results by Material Experts

No	Aspect	Percentage of Assesment	Appropriateness
1.	Appropriateness	73	Worthy
2.	Language	68	Worthy
3.	Scientific Argumentation	80	Worthy
Total		74	Worthy

Based on Table 3 it can be seen that the assessment of material suitability by the validator is 74%. This shows that the material in the application has a category that is suitable for use with revisions according to input. Table 3 shows that the appropriateness aspect of the content received a score of 72%. This is because of the 8 assessment items there are 4 items that received adequate marks (score 3). The assessment items are the presentation of images, the attractiveness of the presentation of the material, the literature references used. The final result of the content feasibility aspect assessment was 73% with the appropriate category. According to the validator, the image presentation was less detailed and the bibliography still needed to be added. This was because the bibliography was an important element in finding relevant sources or what is usually called literacy skills. According to Subarjo, (2020) currently information literacy skills need to be trained in students to keep up with the pace of development of science and technology (IPTEK). The abundance of information requires people to have good information literacy skills making mobile phone users and the general public confused in sorting and filtering relevant information and news sources (Saraswati et al., 2021). One of the benefits of literacy is that it can help find news sources quickly and are credible or relevant Yusuf et al., (2023). With literacy skills, it is hoped that students will be able to filter or sort and examine what information is currently viral and the truth of the news.

In the linguistic aspect, it got the lowest percentage, namely 68% in the appropriate category. This is because the indicators for making it easier for students to understand the message, spelling accuracy and grammatical accuracy get a low score, namely 60% in the quite decent category. According to the validator, there are several sentences that have an incorrect SPOK arrangement. This is supported by research from Munirah & Hardian (2021). The application of sentence structure in Indonesian must be applied in formal education environments. This is due to the position and function of Indonesian as a language of instruction in the world of education. The correct structure of Indonesian sentences aims to help students develop the ability to communicate various concepts, both orally and in writing.

In the aspect of scientific argumentation, it received the highest percentage, namely 80% with the appropriate category. According to the validator, the data presented is up to date and is equipped with backing (support) from several research articles. However, the claim element still needs to be improved to deceive students. This assessment shows that the application developed is suitable for use to train high school students' scientific argumentation skills. Supported by a menu of functional scientific argumentation elements. This feature meets the criteria for aspects of scientific argumentation that have been determined by (Sampson & Gleim, 2009), namely sentence, data, rebuttal, and backing. The following are the results of the media expert validation assessment:

Table 4. Validation Results by Media Experts

No	Aspect	Percentage of Assesment	Appropriateness
1.	Appearance	92	Very Worth It
2.	Presentation	100	Very Worth It
3.	Software	100	Very Worth It
4.	Benefit	100	Very Worth It
Total		98	Very Worth It

Based on Table 4, it can be seen that the media validation results obtained a result of 98% with the category very suitable for use without revision. based on Table 4. According to the validator, the appearance and layout aspects still do not maximize the empty parts, so there are still many pictures and explanations whose layout is less strategic, thus giving the impact of a lack of focus in reading the material. Therefore, strategic layout placement also needs to be considered, this is supported by Fari'ah (2020) who states that the consistency of the shape and location of images also influences the comfort of using the application, namely when examining the information contained in the learning media. The initial display or layout is useful for providing an initial overview of what is in the application, and users can estimate what is presented by the program being displayed. The elements of color and image selection still need to be improved. According to Julianto (2020) colors can evoke certain emotions which increase a person's level of focus and have an overall impact on the information conveyed, so the choice of colors used in learning media also needs to be considered in order to provide maximum benefits.

The appearance aspect, software aspect, and benefits aspect each received a percentage of 100%, which means that the Android-based learning media application "Plant Tissue App" developed is very suitable for use as a learning media. According to (Ernawati, 2017), android application software is said to be good if the programs in the software are able to operate smoothly, do not hang, crash or even stop during operation. The level of application efficiency is also assessed by how far the application can be used and can continue to run even if an error occurs in the operation (error tolerance).

Apart from media and material expert validation tests, the *Plant Tissue App learning media* was also assessed by Biology teachers with the aim of knowing the teacher's response regarding the suitability of the media being developed. The suitability of the media was assessed by biology teacher at SMAN 5 Semarang. The following are the results of the assessment from the Biology teacher:

Table 5. Validation Results by Biology Teachers

No.	Aspect	Percentage of Assesment	Appropriateness
1.	Learning	86	Very Worth It
2.	Media	80	Worthy
3.	Material	77	Worthy
Total		81	Worthy

Based on the results of the teacher's responses in Table 5, a score of 81% was obtained, this shows that the media is suitable and can be used without revision because it received a fairly good response.

Data related to the feasibility of the android-based Biology learning media *Plant Tissue App* was analyzed using descriptive analysis based on the results of the validation percentage by media expert validators, material experts, and assessments by biology teachers, so it can be seen that the *Plant Tissue App* learning media received the very suitable category for use after being carried out. some revisions of the validator input. Score of 98% was obtained from media experts in the category very suitable for use, 74%

from material experts in the category suitable for use, and 81% from Biology teachers in the category very suitable for use. After validation testing is carried out by experts, the next step is to test the media on students.

Biology teacher gives notes that the picture presented is lacking provide a detailed explanation. However, it has enough to help students to analyze the questions. Role Images in the learning process are an aspect which is quite important in use learning media help students understand the material, such as which has been explained by Thanthirige et al. (2016) that one of the functions of the image is function compensatory that can provide context for understand texts and help weak students in reading to organize information in the text and can recall it. This matter very important in accommodating students who weak and slow in receiving and understanding the content lessons presented with text or presented verbally, because students can see it verbally directly and relate to the subject matter. The validation results by expert validators can be seen in the following in Figure 4.

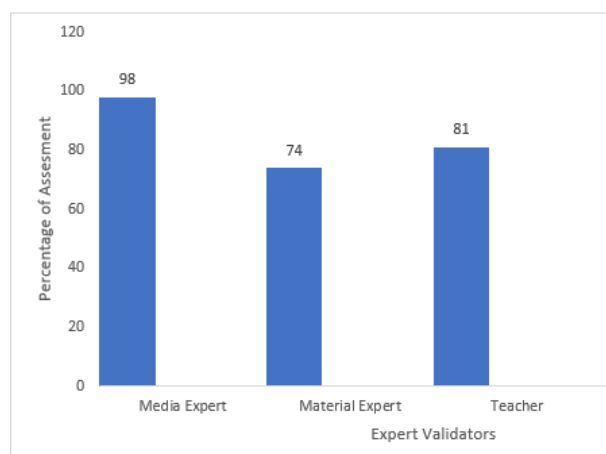


Figure 4. Graph of Media Assessment Recapitulation Results by Validators

Process furthermore after media revised in accordance with input and suggestions from expert validators, namely carried out field test. The field test carried out was a small scale test with 10 students of class XI MIPA 5 at SMAN 5 Semarang. Researchers distributed questionnaires using the *Google Form application* so that students could access the assessment instruments via the Google form link. Data obtained from small-scale tests are as follows.

Table 6. Small Scale Test Results

No.	Aspect	Scale Test (%)	Appropriateness
1.	Media	87	Very Worth It
2.	Benefit	86	Very Worth It
Total		86	Very Worth It

Results recapitulation response student to android-based learning media plant tissue app based on table 6 above, obtained results as big as 86% which show category very worthy. Category very worthy This obtained after researcher do revision on images in the media. The final percentage results show that the Android-based application media

plant tissue app is suitable for use as an independent learning resource on plant tissue material. Small-scale testing is the final stage of developing this learning media.

The deficiency of the product being developed is the user or students have not been able to access. The application in Playstore can only be accessed digitally via the link <https://tinyurl.com/4stvp7f> with size 17.8 mb. In addition, the application can only be installed on Android-based smartphones only. In terms of users iOS (iPhone operating system) cannot be installed the application.

Conclusion

From the results and discussions that have been carried out, conclusions can be drawn, namely the design of the plant tissue app android application as a learning medium that trains scientific argumentation skills, containing menus consisting of: introduction, about scientific argumentation, hone argumentation 1 which contains elements of scientific argumentation, namely: data, claim, rebuttal (rejection), and backing (support), hone argumentation 2 which contains: argumentative essay questions, concept maps, KI and KD, Instructions, Bibliography, and Developer. The android-based plant tissue app learning media has been validated by material experts, media experts and biology teachers, and has received responses from students. The feasibility obtained from media experts was 98% (very feasible), material experts were 74% (adequate), from biology teachers (81%), and student responses were 86% (very feasible).

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