



Development of Science Teaching Materials on Inquiry-Based Biotechnology Materials Using the Addie Model for Class IX Students of SMP Negeri 3 Taman

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Masih banyaknya pendidik yang menggunakan bahan ajar dari penerbit tanpa upaya merencanakan, menyiapkan, dan menyusunnya sendiri. Sehingga pembelajaran IPA dilapangan untuk peserta didik tidak terbiasa menggunakan daya nalarnya, tetapi justru terbiasa dengan cara menghafal yang terpaku pada buku sumber. Model pengembangan bahan ajar yang digunakan adalah yang berbasis inkuiri dengan model ADDIE. Instrumen data yang digunakan adalah lembar validasi/kuesioner dan tes tulis. Dari hasil data tersebut dianalisa secara kualitatif dan kuantitatif. Data yang digunakan berupa skor pada lembar validasi dan kuesioner dianalisa dan diolah dengan prosentase kemudian dikonversi dalam skala pencapaian. Bahan ajar yang dikembangkan kemudian divalidasi oleh ahli isi materi dengan hasil 96% dalam kategori sangat baik/ sangat layak Hasil validasi dari ahli desain adalah 89,2 % dalam kategori sangat baik/ sangat layak. Kemudian bahan ajar yang dikembangkan dilakukan uji coba perorangan dengan hasil 98,3 % dalam kategori sangat baik/sangat layak. Uji coba kelompok kecil 85,8 % dalam kategori sangat baik/sangat layak, uji coba lapangan dengan hasil 91,3 % sangat baik/ sangat layak. Berdasarkan hasil tersebut bahwa bahan ajar yang dikembangkan sangat layak untuk dipergunakan dalam proses pembelajaran IPA materi Bioteknologi untuk peserta didik kelas IX

Abstact

There are still many educators who use teaching materials from publishers without planning, preparing, and compiling them themselves. So that learning science in the field for students is not used to using their reasoning power, but instead they are used to memorizing which is fixated on source books. The teaching material development model used is inquiry-based with the ADDIE model. The data instruments used were validation sheets/questionnaires and written tests. The results of the data were analyzed qualitatively and quantitatively. The data used in the form of scores on validation sheets and questionnaires were analyzed and processed with percentages and then converted into achievement scales. The teaching materials developed were then validated by a content expert with a result of 96% in the very good/very feasible category. The validation results from the design expert were 89.2% in the very good/very feasible category. Then the teaching materials developed were tested individually with a result of 98.3% in the very good/very feasible category. Small group trials 85.8% in the very good/very feasible category, field trials with 91.3% very good/very feasible results. class IX students



INTRODUCTION

In the new normal era after the Covid -19 pandemic has changed the lives of Indonesian people. This pandemic has changed the behavior of individuals, families and communities. The pandemic has also had socio-economic and cultural impacts. The changes triggered by the pandemic are a new reality for most Indonesians. Currently, the implementation of education cannot be separated from the development of science and technology. This rapid development also has an impact on various aspects of life including the world of education (Carolina, Sutanto and Suseno, 2017). With the development of information and communication technology, the world of education also takes advantage of the results of technology in the learning process, this requires teachers to be able to take advantage of existing technology in classroom learning, for example the development of teaching materials.

Learning Natural Sciences (IPA) is a very important learning for students. The importance of learning science is because learning science is related to the environment of everyday life. For some students learning science is learning that is less interesting where this is due to conventional science learning. According to Gita, Annisa and Nanna (2018), one of the problems facing the world of education today is the weak implementation of the learning process applied by teachers. Where in the implementation of the learning process, students are only directed at the ability to memorize various information without any demands on students to understand and apply information in everyday life. The problems faced today come from the teacher, where in the learning process the teacher only requires students to memorize without any understanding and application in students' daily activities. It can be said that students are only able to memorize without applying Yuliati, Y. (2017)

The reality on the ground shows that there are still many educators who directly use teaching materials from publishers without planning, preparing and compiling them themselves. This can be seen in the results of an interview with a class IX Natural Sciences (IPA) teacher at SMP Negeri 3 Taman on November 19 2020 which stated that the teaching materials used by teachers and students in the learning process were only sourced from textbooks obtained from certain publishers. In addition, in the learning process teachers and students have never used other teaching materials such as modules. The package book contains data collection activities, learning materials, sample questions, and practice questions. However, the learning material is presented briefly and the dominant teacher uses the lecture method rather than the experiment so that students are less actively involved in the learning process. Pratiwi, S. N., Cari, C., & Aminah, N. S. (2019)

Teachers must develop teaching materials that can be used in the learning process, this is quite reasonable because, first, the available teaching materials do not meet the needs according to the demands of the curriculum, second, the available teaching materials are not in accordance with the target characteristics, both the physical environment, social, geographic, culture and characteristics of students Anggraeni, P., & Akbar, A. (2018). Third, there are demands for solving learning problems. Based on the results of observations made at SMP Negeri 3 Taman, the teacher's way of teaching still uses the lecture

method and the facilities and infrastructure owned by the school such as the internet network are not optimized. This can be seen in the underutilization of the internet as a source of learning. Nugraha, M. (2018)

Inquiry in science learning involves students in scientific investigations through real experiences while at the same time being given the opportunity to be able to act and work systematically in learning Siahaan, K. W. A., Lumbangaol, S. T., Marbun, J., Nainggolan, A. D., Ritonga, J. M., & Barus, D. P. (2021). The application of inquiry learning that requires a long time and more mature preparation can be overcome by applying inquiry abilities using appropriate teaching materials because existing teaching materials do not yet contain inquiry activities. According to Hermanto, Soetjipto and Hidayat (2016), students can learn to think by utilizing and using their brains optimally through inquiry activities.

One of the obstacles to applying inquiry in learning is that teaching materials or learning resources that facilitate inquiry-based learning are still limited. It is necessary to develop an inquiry-based teaching material that is used as a support for textbooks and as a supplement for teachers in carrying out variations on the learning process and delivery of material that is tailored to basic competencies centered on the potential, development, needs and interests of students. So far, biotechnology material is still a problem for class IX students because it is rarely practiced. Seeing these problems, it is necessary to solve problems by developing science teaching materials that can be easier, interesting, understandable, have a willingness to practice for students and more familiarize students with solving problems by doing a lot of practice questions in these teaching materials Apriliani, N. M. P. D., Wibawa, I. M. C., & Rati, N. W. (2019)

METHOD

The teaching material development model used is an inquiry-based model with the ADDIE model with the steps of analysis, design, development, implementation and evaluation Danks, S. (2011). The teaching materials developed were validated by content experts and design experts, individual trials were carried out, field trials to produce valid and practical teaching materials, while to produce effective teaching materials tests were conducted on students. The data instruments used were validation/questionnaires and written tests. From the results of the data analyzed qualitatively and quantitatively. The data used in the form of score sheets on validation and validation were analyzed and processed with percentages and then converted to a scale.

RESULT AND DISCUSSION

This research aims to develop inquiry-based teaching materials using the ADDIE model for science subjects for students in class IX at SMP Negeri 3 Taman, Sidoarjo in the learning process for both teachers and students. To find out if this device can be used as a reference in the learning process, the design product will be tested on students with a total of 50 students. The desired data in the questionnaire on the use of the product will ask how the content or material is presented, convenience, and the attractiveness of the product by students.

To find out the responses or responses of students to the design product with 3 stages, namely small group trials which are categorized as initial validation of 5 students, limited trials involving 15 students and large group trials involving students with a total 30 people. However, the instruments made will be tested for validity and reliability, so that the instruments to be used can be said to be valid and reliable. Validity is a test tool to determine the accuracy of a measuring instrument (questionnaire), whether the measuring instrument has measured what is meant, with high validity, the measuring instrument is said to have measured the actual thing (the variable in question, in this case knowledge early learners). The results of the validity test using the product moment correlation will be compared with r table $N = 50$ in the table with $\alpha = 0.05$, a value of 0.266 is obtained, the instrument test results are as follows:

Tabel 1. Instrument Validity Test Results

Item	R count	R tabel	Information
Item 1	0.645		Valid
Item 2	0.590		Valid
Item 3	0.850		Valid
Item 4	0.812		Valid
Item 5	0.650	0.266	Valid
Item 6	0.670		Valid
Item 7	0.590		Valid
Item 8	0.688		Valid
Item 9	0.719		Valid
Item 10	0.777		Valid
Item 11	0.774		Valid
Item 12	0.650		Valid
Item 13	0.677		Valid
Item 14	0.719		Valid
Item 15	0.766	0.266	Valid
Item 16	0.878		Valid
Item 17	0.578		Valid
Item 18	0.547		Valid
Item 19	0.595		Valid
Item 20	0.855		Valid

The results of testing the instruments in table above show that at a significant level of 5% a number of instruments used in this study obtained a correlation coefficient value greater than the Product Moment r -table value of 0.266. It can be said that the instruments in this study are valid or can measure the variables studied.

Tabel 2. Reliability Test Results

Variable	r	Information
Student Instruments	0.933	Reliability

The results of the reliability test in the table above show that the reliability coefficient value of the variable used, in the variables above is greater than the r-table value of 0.6. then the results of the respondents' answers can be relied upon in other words that if the same research is carried out at different times, the respondents will give the same answer.

Tabel 3. Instrument Validity Design

No.	Aspect	Item	Percentage	Percantege total
1	Title page	4	90%	
2	Instruction	4	90%	
3	Each Topic Page	4	80%	
4	Competency Framework, Indicators, and Time Allocation	5	92%	89,2%
5	Summary	8	90%	
6	Worksheet	8	92,5%	
7	Evaluation	4	90%	
	Total	37		

The validation results from the design expert validator from several aspects that will be assessed are aspects of the title page, instructions, pages for each subject, competency framework, indicators, and time allocation, material summaries, worksheets, and exercises/evaluations. Successively the title page aspect obtains a percentage of 90%, the instructions aspect obtains a percentage of 90%, the page aspect for each subject obtains a percentage of 80%, aspects of the competency framework, indicators and time allocation obtain a percentage of 92%, the material summary aspect obtains a percentage of 90 %, student worksheet aspects get a percentage of 92.5%, and training/evaluation aspects get a percentage of 90%. Overall, each aspect as a whole indicates that the results of the assessment can be used as a basis for testing in a limited group and all aspects of product design are said to be feasible significantly. The aspect obtained a total percentage of 89.2%, this also gives the conclusion that the product of developing inquiry-based teaching materials with the ADDIE model for science subjects for class IX students at SMP Negeri 3 Taman, Sidoarjo which is developed is feasible for trials in limited groups.

Tabel 4. Instrument Validity Material

No.	Aspect	Item	Percentage	Percentage total
1	Content Depth	10	96%	96%
	Total	10		

a description of the data that is categorized as the depth of the content of the learning material. The validation results from the material content expert validator got a percentage of 96%. Overall, each aspect as a whole indicates that the results of the assessment can be used as a basis for conducting trials in a limited group and all aspects of product design are said to be significantly feasible. This also concludes that the product of developing inquiry-based teaching materials with the ADDIE model for science subjects for class IX students at SMP Negeri 3 Taman, Sidoarjo which was developed is feasible for trials in limited groups.

Tabel 5. Percentage of Friends of Colleagues

No.	Aspect	Item	Percentage	Percentage total
1	Material Content Presentation	12	98,3%	98,3%
	Total	12		

description of the data that is categorized as material presentation. The validation results from peer validators for the presentation aspect of the material content got a percentage of 98.3%. From the aspect of presenting the content of the material, it indicates that the results of the assessment can be used as a basis for conducting trials in a limited group and all aspects of product design are said to be very significant feasible. This also concludes that the product of developing inquiry-based teaching materials with the ADDIE model for science subjects for class IX students at SMP Negeri 3 Taman, Sidoarjo which was developed is feasible for trials in limited groups.

Tabel 6. Percentage of Student Responses

No	Aspect	Item	Percentage	Percentage total
1	Material Content Display	12	80%	76,5%
2	Attractiveness	8	77,7%	
	Total	20		

From the aspect of student response which is categorized into 2 in-depth aspects of design which are categorized as aspects of display of material content, and aspects of attractiveness, it is found that the percentage is 80% for display of material content, 77.7% for attractiveness, this also gives the conclusion that the product of developing teaching materials based on inquiry with the ADDIE model for science subjects for class IX students at SMP Negeri 3 Taman, Sidoarjo which was developed to be feasible for trials in limited groups. It is also proven that the overall percentage gets a percentage of 76.5%.

Some small revisions are still revising about the appearance of the material content and the attractiveness of students to get more perfect results. For the results of the percentage of all aspects that get a percentage of 76.5%, the researcher needs some improvements to the product of teaching materials in terms of aspects of the appearance of the material content as a whole and the attractiveness the contents of the teaching materials regarding the types of uppercase letters and the color of the images as suggested by the learning design expert, after minor revisions are made, the teaching materials will be tried out in limited or moderate groups.

Tabel 7. Limited Group Percentage

No	Aspect	Item	Percentage	Percentage total
1	Material Content Display	12	85,8%	85,8%
2	Attractiveness	8	85,70%	
	Total	20		

From the aspect of student response which is categorized into 2 in-depth aspects of design which are categorized as aspects of display of material content, and aspects of attractiveness, it is found that the percentage of 91.1% for display of material content is 91.6% for attractiveness, this also gives the conclusion that material development products Inquiry-based teaching with the ADDIE model for science subjects for class IX students at SMP Negeri 3 Taman, Sidoarjo which was developed experienced a significant increase in student responses so that it can be said that the product developed is feasible for trials in this field group. that the overall percentage gets a percentage of 91.3%.

However, in field group tests involving other schools in the city, sub-district, district and province, field group trials will be carried out in the future at different times. This was done because of limited time and funds. However, even though the trials are only carried out in large groups, the teaching materials will be socialized and disseminated to be mass-produced and distributed to a group of teachers and students to serve as guidelines in the learning process of science subjects for students of class IX in junior high schools.

Tabel 8. Large Group Percentage

No	Aspect	Item	Percentage	Percentage total
1	Material Content Display	12	91,1%	91,3%
2	Attractiveness	8	91,6%	
	Total	20		

From the aspect of student response which is categorized into 2 in-depth aspects of design which are categorized as aspects of display of material content, and aspects of attractiveness, it is found that the percentage of 91.1% for display of material content is 91.6% for attractiveness, this also gives the conclusion that material development products Inquiry-based teaching with the ADDIE model for science subjects for class IX students at SMP Negeri 3 Taman, Sidoarjo which was developed experienced a significant increase in student responses so that it can be said that the product developed is feasible for trials in this field group. that the overall percentage gets a percentage of 91.3%. However, in field group tests involving other schools in the city, sub-district, district and province, field group trials will be carried out in the future at different times.

Based on these objectives, a teaching material must have certain components that are interrelated with one another. According to Talib, Mohamad, and Wahab (2015), there are three main stages that need to be passed to develop teaching materials, namely: 1.) Analysis of the needs of teaching materials; 2.) Develop maps of teaching materials; 3.) Make teaching materials based on the structure of each form of teaching materials.

From product development planned by researchers, validation tests carried out by validation design expert Dr. Drs, Achmad Noor Fatirul, ST, M.Pd. get the results of the assessment and feasibility is quite

significant, namely 89.2% and the advice given is that this product is feasible to continue to be tested. Referring to some suggestions from design experts that the shape of letters and fonts and the color of images are made diverse and striking to increase reading interest, this was all done by the researcher to revise it. Furthermore, the validation of material expert Prof. Ir. Pungky Slamet Wisnu Kusuma, M.Sc. also obtained a percentage of 96%, it was concluded that the product developed could be applied to limited group trials. The peer test conducted by Arif Budiono, S.Pd. M.Pd obtained a percentage of 98.3%, this also indicates that the product being developed is very feasible to be implemented in further trials. In the small group try out which is called initial validation to find out the response of students to 5 students getting a percentage of 76.5%. This trial is needed to initially determine the feasibility of the material being developed which is tested on different groups of research subjects in limited trials and large group trials.

In the limited trial conducted on 15 students, students received responses from students with a total percentage of 85.8%, this indicated progress from the feasibility trial of 5 students who received a percentage of 76.5% to 85.8 %. This means that the product can be tested in large batches. In the large group trial, the total percentage yield was 91.3%. This try-out was carried out in a large class, namely in the class that was used as the test subject, totaling 30 students. The progress of the limited group trial from 85.8% to 91.3% in the large group was a significant improvement. So that the product of developing inquiry-based teaching materials with the ADDIE model for science subjects for class IX students of SMP Negeri 3 Taman, Sidoarjo can be produced, socialized, and decoded so that they can be used by teachers and other students who share the same subject as a reference in learning process.

The researcher concludes that the product of developing inquiry-based teaching materials using the ADDIE model for science subjects for students of class IX at SMP Negeri 3 Taman, Sidoarjo has been developed and has been tested for its validity and the product can be used in implementing product designs for developing inquiry-based teaching materials by the ADDIE model for science subjects for class IX students at SMP Negeri 3 Taman, Sidoarjo.

Due to time and budget constraints in carrying out this research, the researchers did not conduct this research within the scope of a field trial. Field trials involve schools other than small group trials, limited trials and large group trials. Field group trials involving schools within the school environment in sub-districts, districts, cities or provinces require very large funds. Because in this study it was only enough to carry out in the form of large groups. However, the results of this study can be accounted for because all validation results show very significant results, so that this product can be reproduced to be used by teachers, students or other schools as a guide in developing the learning process. For field research, another time will be carried out to obtain funds to support the costs of conducting research so that this product can be generalized.

CONCLUSION

The development of Scientific teaching materials for Biotechnology class IX SMP Negeri 3 Taman based on the 2013 curriculum is proven to be used for learning activities, because the developed teaching materials are able to increase teacher creativity, improve the quality of learning and can be easier to understand, more effective, interesting and of high quality for participants class IX SMP Negeri 3 Taman. The teaching materials developed are very feasible to be used or applied in the learning process. It has been proven that the validation results carried out from the validation of design experts, material experts, colleagues and initial trials on students, have obtained very significant assessment gains, therefore the development of inquiry-based teaching materials with the ADDIE model for science subjects for class IX students at Taman Sidoarjo 3 Public Junior High School, it can be used as a guideline in the learning process and can be produced on a large scale to be distributed to teachers and students who are on the same level. At the same times it can be used as a reference for teachers in the learning process and also as complementary and enrichment teaching materials.

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