Development of Physics Teaching Materials with a Scientific Approach Loaded with Character Values in Fluid Material for Class XI IPA SMA

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Abstract *- The purpose of this study is to design and develop physics teaching materials with a scientific approach that contain character values in fluid material for class XI science students, to find out the character values extracted from fluid materials, and to determine the results of the feasibility test of the teaching materials developed. This research uses the ADDIE development model. Religious, curiosity, discipline, social care, peace-loving, hardworking, independent, creative, caring for the natural environment, tolerance, responsibility, communicative, and honest are the character values extracted from the fluid aspects added to the teaching materials. The validity and practicality tests were conducted using a questionnaire instrument and analyzed using a Likert scale. The validity test was assessed by two material and media validators. Meanwhile, the practicality test was assessed by students of class X IPA SMA N 4 Kupang City, who were grouped into two, namely the small group test and the large group test. The results of the validity test of the material and media validators, respectively, obtained a percentage of 85.76% and 88.19% with very valid criteria. And the results of the practicality test based on the assessment of student responses to the developed teaching materials, namely the small group trial with a percentage of 88.03% and the large group test with a percentage of 89.17%, both of which included very practical criteria.*

Keywords*: Teaching Materials; Scientific Approach; Character Values*

INTRODUCTION

The need for character education in Indonesia is currently very urgent and must be addressed immediately. This is due to the moral degradation and character of Indonesian citizens, which are currently weakening, as we know from the news in newspapers and television, which has become a hot topic of discussion, namely the phenomenon of moral degradation in various fields in various forms. For example, brawls between students; violence against children; domestic violence; corruption in various government agencies; plagiarism in a number of universities; honest children in exams being attacked by classmates; the habit of cheating in exams; and others (Elfindri et al., 2012). This cannot be allowed to continue because it can damage the character and dignity of the nation. The dignity of a nation will be seen in the character that radiated from his life. A good nation will have good character too. To overcome this, the government made various efforts. One way is through education.

Through the Ministry of Education and Culture, the government organizes a national education system that is expected to achieve educational goals by establishing a design that is in line with national education and is useful as a guide for the learning process in Indonesia, known as the curriculum. Accor-

According to Sanjaya (2008), the curriculum is an effort to help students develop according to the desired results. The current curriculum is the 2013 curriculum. In the 2013 curriculum, the Ministry of National Education is oriented towards developing student character. The character values implemented in the 2013 curriculum

are religious, honest, tolerant, disciplined, hard-working, independent, democratic, curious, national spirit, love of the motherland, respect for achievement, friendly and communicative, love of peace, love of reading, environmental care, social care, and responsibility (Depdiknas, 2003). These values must be implemented in schools through subjects, extracurricular activities, and devices that support learning. In addition to learning subjects and tools, the 2013 Curriculum also designs a program to form a whole, intelligent, fair, and civilized person with character. The program is designed systematically, logically, and according to needs so that it can be used as a reference for teachers and students in building character. Examples include the various models, strategies, and approaches implemented. One of the approaches applied in the learning process as part of the implementation of the 2013 curriculum that can shape student character is the scientific approach. Through this scientific approach, students are trained to behave scientifically, such as by observing, asking questions, gathering information, reasoning, and communicating their learning (Rahma et al., 2016).

Physics is one of the subjects that can integrate character values while also using a scientific approach to demand students behave scientifically as part of character development efforts (Yulkifli, 2019). Through the concept of material physics, we can carefully explore character values, which can be assisted through a scientific approach; for example, the concept of fluid matter. We can apply the integration of character values with the help of a scientific approach directly in the process of learning the physics of the concept of fluid matter. However, this is very rarely done by educators in schools and is difficult for students to understand. As a result, assistance, such as learning tools, such as teaching materials, is required (Tirmayasari et al., 2019. Character of students for a more dignified nation's civilization in the future, so that the moral degradation that occurs can be overcome.

However, teaching materials so far have not paid attention to character cultivation. In other words, there are physics teaching materials that use a scientific approach without containing character values, or vice versa. This can be seen from the fact that students generally still use textbooks and printed teaching materials sold in the market as learning resources, while physics teaching materials with an integrated scientific approach to character values compiled by the teachers themselves do not yet exist (Wulandari et al., 2021). This is also in line with the results of observations made by researchers on April 18, 2022, at SMAN N 4 Kupang. Similarly to previous studies, no scientific approach was used in the research conducted by Kusjuriansah and Yulianto (2019) regarding the development of character-complemented, standards-based physics teaching materials based on Newton's law of gravity.as well as research conducted by Lestari, W. M., et al. (2018) regarding a physics teaching book with a scientific approach based on light waves material for the eleventh grade students at SMA Negeri 5 Lubuklinggau, which uses a scientific approach without loading character values.

Based on this, the researcher is interested in conducting research with the title "Development of Physics Teaching Materials Using a Scientific Approach with Character Values in Fluid Materials for Class XI of the IPA High School". The purpose of this research is to design and develop scientific-based teaching modules that integrate character values into fluid material and explore the character values

contained in fluid material by conducting due diligence so that the developed teaching modules can be used to support students' character development efforts. for the sake of a more dignified and characterful nation

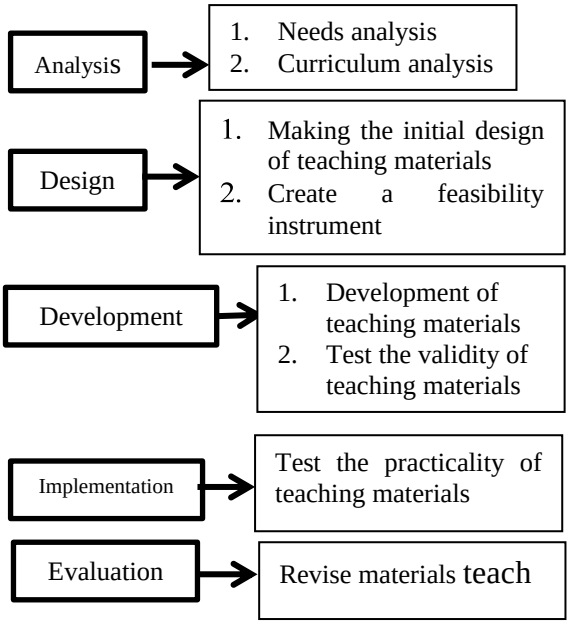

Figure 1. The Development stage of The ADDIE Model Teaching Materials

and civilization in the future.

RESEARCH METHODS

The type of research used in this research is research and development (R&D). The purpose of the research is to produce a product by testing the feasibility of the product and evaluating it. The end product of this research is a physics learning module with a scientific approach and contains character values in fluid material for class XI IPA students. This research refers to the ADDIE research and development model.

According to Robert Maribe Branch (2009) in (Sugiyono, 2018) this development concept has five stages as shown in the following figure.

With subject individual research two validators each for material and media validation and students as respondents to the practicality test of teaching materials. The data in this study are in the form of qualitative data and quantitative data. Qualitative data were obtained from the validator's responses or suggestions on the teaching materials being developed. Meanwhile, quantitative data from the results of the validation sheet analysis and student responses.

Data collection techniques were carried out using interview techniques to obtain initial research data and giving questionnaires to material validators, media and students to determine the validity and practicality of the product as well as a reference in evaluating the product. The instrument in this study was in the form of a questionnaire or validation questionnaire by the validator and a questionnaire or product practicality questionnaire for students.

This research questionnaire uses a Likert scale with twigs 1-4. The alternative scores for each validator's answers and student responses based on the Likert scale are shown in table 1 below

Table 1. Score of Alternative Answers

Alternative Answer	Score
Very good/strongly agree	4
OK / Agree	3
Less / Disagree	2
Strongly less/Strongly disagree	1

(*Source: Sugiyono, 2012*)

The data obtained is then analyzed for the validity and practicality of the materials developed

Teaching Material Validity

The score that has been obtained based on the validator's assessment, the average validity of each aspect of the assessment can be calculated using the formula:

$$\textbf{Average} = \frac{\sum \boldsymbol{score}}{\boldsymbol{Number\ of\ statements}}$$

Based on the average score obtained, then the feasibility of teaching materials is

determined based on ideal assessment criteria. According to Mardapi (2008), the criteria for converting ideal score criteria are shown in Table 2.

Table 2. Conversion of scoring criteria scores

intervals	Criteria
$\bar{x} > Mi + 1{,}5\ (SBi)$	Very Worth it
$\text{Mi} < \bar{x} < Mi + 1{,}5(SBi)$	Worthy
$Mi - 1{,}5(SBi) < \bar{x} < Mi$	Not feasible
$\bar{x} < Mi - 1{,}5(SBi)$	Very unworthy

(*Source: Mardapi, 2008*)

The percentage of validity can be calculated using the formula. The percentage results obtained are converted into validity criteria of teaching materials as in Table 3 based on (Akbar, 2017).

Table 3. Percentage of Teaching Materials Validity Criteria

Category	Score range	Validity Level
Very good	81.26%-100%	Very Valid
good	62.6%-81.25%	Valid
Not enough	43.76%-62.5%%	Less Valid
Very less	25%-43.75%	Invalid

Practicality of Teaching Materials

Calculation of the practicality percentage of learning devices also uses the previous equation with the practical criteria of learning devices as follows.

Table 4. Percentage of Teaching Material Practicality Criteria

Practical % interval	Category
81%-100%	Very practical
61%-80%	practical
41%-60%	Practical enough
21%-40%	Less Practical
0%-20%	Not practical

RESULTS AND DISCUSSION

In the analysis stage, a field study was carried out, namely an interview with one of the physics teachers in class XI IPA at SMA Negeri 4 Kupang City. The results of the interviews revealed that the learning activities carried out in the 2021/2022 academic year are online and face-to-face learning is limited. During online learning, physics learning is carried out in WhatsApp and Google Classroom groups, where students are not very actively involved in online learning resulting in a lack of interaction between teachers and students during learning. Meanwhile, the limited face-to-face learning process is also not very conducive which causes everything related to learning to be limited.

This has an influence on students both positive and negative influences. One of the things that has a positive impact is developing the attitude of independence of students, especially in terms of learning. Meanwhile, the negative impact isthe character of students during online learning during the Covid-19 pandemic and post-pandemic tended to decline. This can be seen from the behavior of students since online and face-to-face learning such as cheating, disrespect for classmates who are still in the learning process, being late, skipping school, and so on. Meanwhile, efforts to improve and develop character in this school are only carried out through school intracurricular and extracurricular activities, such as Scouting activities, arts, sports and social activities.

As long as online and face-to-face learning are limited, the method/approach that is often used by teachers in the learning process is the conventional method (lectures and discussions).As well as how to motivate students to behave in characterhave not applied it as an effort to develop character educationlikeduring learning takes place, especially physics learning, teachers rarely even have never linked the material being studied with the character values contained in the material to students.

The teaching materials used are printed teaching materials for the 2013 curriculum which are available in the school libraryhowever, it is not based on a scientific approach and its contents only contain descriptions of material, exercises, evaluation questions, pictures or illustrations, and experiments that exist in teaching materials in general without containing a fragment of character values that can be extracted from physics material to assist students in efforts to improve and character development. SoThe purpose or orientation of the 2013 curriculum, namely character development, has not been fully implemented.

Based on this,there needs to be an effort to improve the character education of students, especially by using teaching materials as media in learning. In this case, teaching materials based on a scientific approach and containing character values need to be developed to assist students in improving and developing character. In addition to developing character, this teaching material also helps students understand physics material, especially fluids. And of course this teaching material can be used during the online and face-to-face learning process and can be used individually by students in their respective homes via cellphones and laptops.

At the design stage, the thing to do is to make the initial design Teaching materials in draft form contain an overview of teaching materials such as their appearance, font size, type of text, flow, and content. This teaching material was made with Microsoft Word 2010, Corel Draw, Microsoft Office Power Point, and Paint. In addition, instrument creation and validation are handled by the instrument validator. Validation by the instrument validator aims to obtain comments and suggestions about the due diligence instrument so that instrument revisions can be carried out before being given to the validator or respondent. In instrument validation, there are four aspects of assessment: the clarity of the questionnaire, the suitability of the content, the validity of the content, and the language. The results of each aspect's assessment are summarized in the questionnaire's clarity aspect, which received an average of 3.7. For the suitability aspect of the contents of the questionnaire, an average of 3.5 was obtained. Meanwhile, for the aspect of content validity, the average is 4, and the language aspect gets an average of 3.5, with the criteria for each aspect being very feasible. In general, the validator's comments and suggestions are about double fragments and the use of words that have different meanings and meanings that must be avoided; being consistent in writing statements; being in accordance with the correct EYD; and correcting some unclear questionnaire statements, such as their links.

Table 6. Results of Instrument Validator Analysis

Aspect	Average	Criteria
Questionnaire clarity	3.7	Very Worth it
Suitability of the contents of the questionnaire	3.5	Very Worth it
Content validity	4	Very Worth it
Language	3.5	Very Worth it
Total Average	**3.7**	**Very Worth it**

At the development stage, there are also two things that are done, namely the manufacture of teaching materials and the validation of teaching material products. The making of this teaching material is in accordance with the initial design in the draft. The main characteristics of the teaching materials developed are based on a scientific approach and contain character values. This teaching material is in PDF format. In general, this teaching material is

divided into three sections: the introduction, the table of contents, the list of figures and tables, the introduction (containing identification and instructions for using the teaching materials), and concept maps.

The content section consists of an introduction that contains apperceptions or descriptions to open students' insights about fluid material in general. This teaching material also consists of two chapters, namely static and dynamic fluids. In each chapter, there are learning activities based on a scientific approach that are presented in detail and systematically arranged, starting from observing, asking questions, gathering information, reasoning, and communicating. In addition, there are examples of questions and their discussion, practice questions, and experimental activities that are marked with the phrase "let's experiment", independent assignments, and the integration of character values that can be explored from the material presented and contained in information gathering activities. Integrated character values such as religiousness, curiosity, discipline, social concern, love of peace, hard work, independence, creativity, care for the natural environment, tolerance, democratic, communicative, honest. The integrated character values are selected based on the context of the fluid material. The integration of character values in the developed teaching materials is contained in the content "Roots (I Have Character)". Apart from that, there are other things like physics figures and physics information. And the last part of the teaching material is equipped with a summary, evaluation questions, glossary, bibliography, author information, and a back cover. Display a scientific approach and integration of character values in teaching materials, as shown in the following figure.

After the teaching materials are developed, validity tests are then carried out.

Figure 2. Observing activities

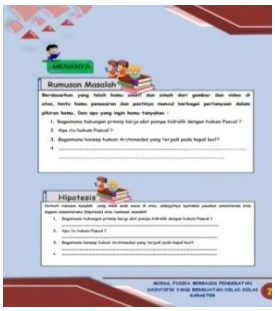

Figure 3. Asking activity

Figure 4. Information gathering activities

Figure 5. Reasoning

Figure 6. Communication

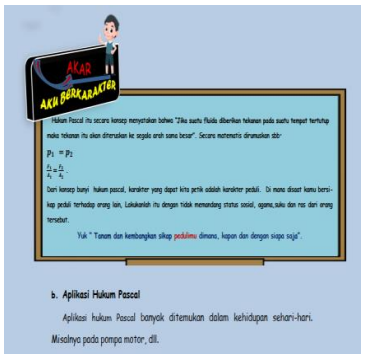

Figure 7. character integration

Validity test

In the validity test, there are two things that need to be validated by the validator, namely material and media validation. In material validation there are 4 aspects of assessment namelyaspects of content feasibility, presentation aspects, language aspects and aspects of scientific approach and character values. Material validation was carried out by 2 validators who work as lecturers and physics teachers.

The results of the material validation are presented in the following Table 5. Based on the table above, it is known that the teaching materials developed are very feasible or very valid to use with an average value obtained from the validation results of 2 validators, namely 3.43 with a validity percentage of 85.76%. There are 5 (five) basic assessor aspects which are translated into 12 indicators.

In the process of validating teaching materials, revisions were made several times based on the validator's suggestions and comments. In the feasibility aspect of the content, they get input about writing the correct formula symbols as wellexamples of questions and practice questions that should be contextual, in accordance with facts in everyday life. In the aspect of presentation, it is suggested to improve the appearance of the concept map and the character integration content box. For language aspects, input is given to improve sentence structures and incorrect words in typing. ease of language to be understood or communicative and the language used does not cause misconceptions. Meanwhile, in the aspect of the scientific approach and character values, getting advice and input regarding the contents of each scientific approach, such as in asking activities, there must be problem formulation and hypotheses as well as on the component of character values, namely the suitability of the relationship between fluid material and character values that are excavated.

Table 5. Results of Material Validator Analysis

Aspect	Average		% Validity		Criteria	
	V1	V2	V1	V2	V1	V2
Content eligibility	3.54	3.38	88.46%	84.62%	SL	SL
Presentation aspect	3.70	3.50	92.5%	87.50%	SL	SL
Language Aspect	3.00	3.38	75%	84.38%	Worthy	SL
Aspect PS & NNK	3.40	3.40	85%	85%	SL	
Average Number	**3.43**		**85.76%**		**Very Worth it**	

- *SL = Very Eligible*
- *PS = Scientific Approach*
- *NNK= Character Value*

Meanwhile, in media validation, the aspects that were evaluated were graphic feasibility aspects consisting of 3 indicators such as teaching material size, teaching material cover design and teaching material content design. Media validation was carried out by 2 lecturers. The media validation results are presented in Table 6.

In this aspect the validator assesses the size and type of letters used as well as the suitability of the layout of the illustrations/images for each subject matter.

Table 6. Results of Media Validator Analysis

Aspect	Average		% Validity		Criteria	
Graphic Feasibility	**V1**	**V2**	**V1**	**V2**	**V1**	**V2**
	3.33	3.72	83.33%	93.06%	SL	SL
Total	**3.53**		**88.19%**		**Very Worth it**	

In this aspect, the validator suggests changing the fontor backgrounds that have the same light intensity (bright-light, dark-

dark) this results in the legibility of letters that are less clear in conveying information and changes in font size, pictures and tables. Based on the validation results of media experts, it is known that this teaching material is included in the very feasible / very valid criteria.

After the teaching materials have been validated and revised and declared very good to use, these teaching materials are tested on students Kupang City 4 Public High School. This trial phase is what is done at the implementation stage. The tryout was carried out in 2 stages, namely a small group tryout on 10 students and a large group tryout on 30 students. This trial was conducted to determine the practicality of teaching materials. The practicality of teaching materials is assessed from three aspects of assessment, namely aspects of interest, convenience and benefits which are translated into 19-point statements.

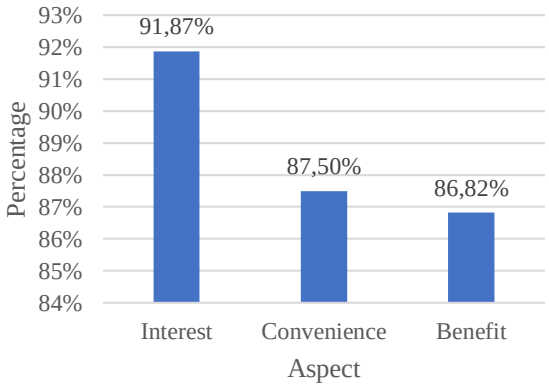

Figure 8. Practicality of Teaching Materials for Small Group Trials

The results of the small group trials indicated that the teaching materials developed were very practical. The test results can be seen in the following Figure 8. Meanwhile, the results of the large group trial of the 3 aspects of the assessment can be seen in the following Figure 9.

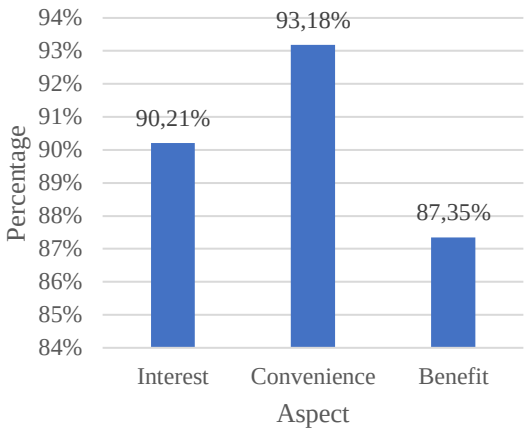

Figure 9. Percentage of Practicality of Teaching Materials for Large Group Trials

At this stage, comments or responses were obtained from participants regarding the practicality of teaching materials in terms of the advantages and disadvantages of teaching materials. The advantages of teaching materials are: students state that the teaching materials developed are unique, interesting and can help learn fluid material and encourage them to always have good character towards their surroundings wherever and whenever. While the weakness is that the number of pages of teaching material is quite a lot, it makes it boring to read and understand the existing material, so it is suggested that this teaching material be briefly summarized.

The evaluation stage in this study was carried out at each stage of developing teaching materials. After teaching materials physics with a scientific approach that contains character values has been validated and tested on small groups and large groups, and made revisions based on suggestions or comments from the validator, so this teaching material is feasible to use.

CONCLUSION

Based on the result of research and development, it can be concluded that the research and development of instructional materials in the form of this module is

adapted from the ADDIE development model. According to Robert Maribe Branch (2009) in (Sugiyono, 2018) this developer model be composed of 5 stages, namely the analysis stage which consists of needs and curriculum analysis, the design stage is the development of the initial design of teaching materials and the manufacture of instrument s the development stage is the development of teaching materials and validation of materials and media, the implementation stage which consists of small group trials and large group trials, and the last stage is evaluation, namely analyzing the advantages and disadvantages of instructional material based on the comments and suggestions of students. Character values integrated from the concept of fluid material to be added to teaching materials developed in accordance with the 2013 curriculum are religious, tolerant, honest, curious, disciplined, peace loving, hardworking, independent, creative, communicative/friendly, caring for the environment, social care, and responsibility (Mutia et al., 2019). This integration is based on the context of fluid matter. And the results of the feasibility test on the validation of physics instructional materials based on a scientific approach that contains character values in fluid materials for class XI IPA that have been developed are an average of 3.43 with a percentage of 85.76% with very feasible criteria for material validators and validators. media is 3.53 with a percentage of 88.19% with very decent criteria. The results of the practicality test of physics teaching materials based on a scientific approach that contains character values in fluid materials for class XI Science in the small group trial obtained an average of 3.52 with a percentage of 88.03% and the large group test obtained an average of 3.57 with a percentage of 89.17 % with each criterion very practical criteria.

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