



Development of Scientific Argumentation Test Instruments for Students on the Classification of Living Creatures in Junior High School

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Abstract

Development of Scientific Argumentation Test Instruments for Students on the Classification of Living Creatures in Junior High School. Encouraging students to think and act like scientists is an important basis of the scientific approach to learning. Both students and scientists need arguments. This study uses a research and development (R&D) approach concerning the ADDIE model. The validation stage has been carried out by experts—linguists, material experts, and media experts—as well as one-on-one trials, small groups, and teacher practice. It can be concluded that the results of the expert validation as a whole.

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INTRODUCTION

An important foundation of a scientific approach to learning is to encourage students to think and act like scientists. Argumentation is an important practice for a scientist as well as for students (Suraya et al., 2019). Argumentation is a central activity in classroom investigations, namely when students use evidence and reasons to support their claims or convince others. Students need a deep understanding of content and the nature of argumentation to be able to make quality arguments (Riwayani et al., 2019). Therefore, argumentation makes students not only focus on what they know about the content but also on how to know and why they believe what they know. As part of science, including science, learning argumentation requires assessment instruments. However, the availability of argumentation assessment instruments is still very limited. Therefore, for science learning with relevant subject matter, it is necessary to develop argumentation assessment instruments (Wardani et al., 2016).

Biology is a branch of Natural Science (IPA) that specifically studies living things (Satriani & Hardiyanti, 2020). In Biology lessons, grouping living things based on differences and similarities in their characteristics is also called classification (Made Suastikarani, 2019). The classification of living things is one of the learning chapters for class VII junior high school (SMP) students (Leyli et al., 2020). So far, learning in science subjects regarding the classification of living things has often been done with lectures. This is not effective in constructing students' knowledge and has not been able to stimulate their argumentation skills. Classification material for living things can provide uncertainty in learning, such as microscopic organisms, namely bacteria or protists, are often difficult to classify because they are difficult to see and often have wide genetic variations, and distinguishing between different

species can be difficult. This is especially true for organisms that have wide phenotypic variation or organisms that evolve rapidly. Students must be aware of the uncertainty in classifying living things because they must work with their classmates to create reliable scientific explanations. So that in this material, arguments are needed.

Argumentation is a structural element of scientific language, which is a strategy for resolving questions, problems, and disputes using arguments. Argumentation in science education plays a role in building students' knowledge based on the beliefs and reasons they have. Science learning itself requires students to have the ability to argue to find concepts or solve problems. Through argumentation skills, students have a foundation for critical and logical thinking in solving problems scientifically and in stages because students' arguments must be equipped with supporting scientific data and evidence. There are indicators of scientific argumentation, namely: 1) Claim or position question 2) Data (evidence) 3) Warrant or guarantee (J) 4) Backing or supporter (P) 5) Model Qualifier or statement of modalities (M) 6) Rebuttal or knowledge or rebuttal. One of the novelties of this study is the instrument used to support scientific arguments on the topic of the classification of living things. In addition, this study uses digital technology, which can help students learn to use digital technology and can support 21st-century skills.

Based on the previous explanation regarding the importance of students having 21st-century skills, students' difficulties in understanding the topic of classification of living things, and limited study time, the researcher feels it is very necessary to conduct research entitled "Development of Scientific Argumentation Instruments for Students on the Topic of Classification of Living Things in Junior High Schools / MTs". This material is very contextual to extraordinary conditions and situations like this because it will explore students' abilities in building argumentation skills and constructing their understanding independently regarding the classification of living things. There has been no research to develop argumentation instruments on the classification of living things and investigate students' argumentation abilities on this topic (Sarira et al., 2019). For this reason, this research aims to develop a valid and reliable scientific argumentation test on the classification of living things and investigate students' scientific argumentation skills. This instrument was developed to support argumentation-based assessment and support teachers implementing new ways of assessment that make students' reasoning visible by including evidence and reasons for answers or decisions made.

METHODS

This research is a research and development (Research and Development), the development of Scratch-based E-Modules was carried out using the ADDIE development model (Analysis, Design, Develop, Implementation, Evaluation) by Dick Walter and Lou Carey (2005) who said that ADDIE development is a very systematic instructional development model. Starting from the initial stage of development to product dissemination by carrying out a continuous improvement process until the quality standards of the products developed are achieved, namely (effective, efficient, and quality) (Musaddat et al., 2021). Then the subjects of this study were teachers and students.

The analysis stage carried out includes core competency analysis, basic competency analysis, and determination of scientific argumentation indicators related to invertebrate topics. The Design stage carried out was to design the test instrument grid. The Development stage carried out was to develop test instruments based on the grid and compile an assessment rubric. The Implementation stage carried out was to test the test instrument on students. The Evaluation stage carried out was to assess the suitability and accuracy of the Analyze, Design,

Development, and Implementation stages and calculate the validity and reliability of the test instrument.

Development of research instruments, validation, and trials using Richardson 20 Kuder analysis using Anates V4 and questionnaire analysis with Alpha Croanbach analysis using SPSS 23. The results of data analysis are used as the basis for developing test instruments. Assessment of the development of this product is carried out with formative and summative assessments by experts, students, and teachers. The results of the analysis are used as the basis for revising the resulting prototype (product prototype) which is evaluated based on effectiveness and practicality using field simulations and attitude questionnaires are also distributed to determine changes in the use of scientific argumentation test instrument development programs on the material of classification of living things.

RESULTS AND DISCUSSION

Development of scientific argumentation test instruments. The final product of this research is a test instrument based on scientific argumentation on the theme of classification of living things for class VII students at SMPN 2 Singingi junior high school. The test instrument used in this research is scientific literacy-based essay questions. In the development of ADDIE, there are several stages, namely: analysis stage, design stage, development stage, and evaluation stage. The author must go through these stages so that the scientific argumentation test instrument on the material for the classification of living things for class VII students is valid and practical. The following are the stages that the author has gone through:

1. Analysis Stage

The initial stage of developing a scientific argumentation test instrument is a needs analysis. Product needs analysis is developed by linking it to real conditions in the field according to needs. Learning needs analysis is a stage to find a product in the form of a scientific argumentation test instrument needed by teachers and students on the material on the classification of living things in the surrounding environment for class VII students of SMPN 2 Singingi. One study, such as Sudarmo (2018), showed that class XI students of SMAN 1 Jember have high scientific argumentation skills. In addition, Sudarmo et al. (2018) found that class XI students of SMA X have a moderate level of scientific argumentation. Other studies also mention that arguments are an important part of a scientist's work, it is considered an important component of the science learning process. There are three reasons why argumentation is very important in education: (1) scientists use argumentation to develop and improve their knowledge; (2) society uses argumentation in scientific debates; and (3) students need argumentation to strengthen their understanding of concepts in a good way (scientific, logical, and pragmatic). In addition, student concept representation can be seen to determine the challenges faced by students. The ability to describe ideas will greatly help students in arguing scientifically in solving problems (Bahri, 2012).

2. Design Stage (Designing)

The test instrument design process, before the researcher begins to develop the test instrument design, the researcher first understands how to develop it from several references regarding making test instruments. Suggestions from supervisors and teachers are very helpful for researchers who are still beginners in developing teaching materials. Before the validation process, the researcher also asked for input from several friends and several teachers regarding the test instruments being developed. The following is a form of preparing a scientific argumentation test instrument that the researcher wants to make, namely as follows.

Table 1. Format for Preparing Scientific Argumentation Test Instruments

No.	Element Test Instrument	Description Instrument Test
1	Cover Front	Page front containing title, class, identity student, education logos, and name of the author.
2	Instruction General	Contains instructions for students to use test scientific argumentation.
3	Instruction Workmanship Questions	Containing instruction method processing questions by students as well as time processing.
4	Material	Thematic material classification themes creatures living in class VII.
5	Literacy Learning Science	Which hook material learning with argumentation ability scientific which owned student so that student capable answer question based on proof real which there is in the environment surroundings.
6	Task Individual	The test was given after learning the theme classification of creature life.
7	Cover Rear	As cover behind.

1. Stage Development (Development)

The test instrument was developed into a description of 15 questions, with the following details:

- Five questions on the subtheme 1 Humans and the environment.
- Five questions on the subtheme 2 Environmental changes.
- Five questions on the subtheme Environmental conservation efforts.

The test instrument used includes cognitive domains C1 to C5, namely knowledge (C1), understanding (C2), application (C3), analysis (C4), and evaluation (C5).

2. Stage Implementation (Application)

The test instrument is validated first before use. The validation carried out is language, media, and material validation carried out by a team of experts. Then try it out for students of SMP N 2 Singingi class V II as many as 10 people in the one-to-test one, and 8 people in the small group testing stage. Then students are given a questionnaire to answer and become analysis researchers, which is an instrument test That needs revision or Not.

On study, This instrument Was used from the questionnaire. Two questionnaires Which used in the study This is a questionnaire for evaluating validity and practicality. Description questionnaire evaluation validity instrument test and practicality instrument test as follows:

a. Results test Validation test instrument

The validation assessment questionnaire in this study consisted of 35 questions arranged on a *Likert scale* with answer categories 5, 4, 3, 2, and 1 with the criteria respectively very good, good, quite good, not good, and No Good. Based on results from evaluation expert material Which has analyzed forknow validity instrumenttest literacy science. As for results validation Which has been analyzed as follows:

Table 2. Results Analysis Validation Expert Media/Design

Aspect Which rated	Indicator Value Assessment	Category Score
Aspects of material feasibility	The questions are by the classification of material creature life	4 Very good
	Question and answer boundaries are clear	3 Pretty good
	The content of the material is by the classification of creature life	3 Enough good
	The content of the material is appropriate to the type of school or grade level	4 Good
	Formulation of the question or question sentence	4 Good

Based on the results of the expert assessment, the material has been analyzed to determine the validity of the instrument test scientific argumentation. As for results validation Which has been analyzed as follows.

Table 3. Results Analysis Validation Expert Media/Design

Aspect Which rated	Indicator Value Assessment	Category Score
Design	Quality paper Which used	4 Good
	Presentation covers, list fill and instrument test	4 Good
	Appearance size and form question	4 Good
	Suitability design instrument test with characteristics material	4 Good
	Quality of interior design form book simple and interesting	4 Good
	Consistency appearance design	4 Good
	Type And size letter used	4 Good
	Efficiency question and picture	4 Good
	Order presentation	4 Good
	Results print and binding	4 Good
Total	44	Good

Based on the overall assessment of the validity of the ability test instrument argumentation scientific given by the three experts namely language experts, material experts, and media experts on argumentation test instruments scientific on theme classification creature life for class VII students of SM N 2 Singingi. Recapitulation of the overall results of the validity assessment from three experts can seen in Table:

Table 4. Results Response Team Expert

No.	Validator	The Score Obtained	Average	Category
1	Design	44	4	Very Good
2	Language	56	4.3	Very Good
3	Contents/ Material	52	4.7	Very Good
	Total	152	4.3	Very Good

Based on the table above, an average of 4.3 is obtained, which falls into the x category > 3.4 with the information being very good or can be said to be valid. Therefore, it is an argumentation test instrument scientific on theme classification creature life for class VII students of SMP N 2 Singingi stated valid from the validity of the language. Based on the table above, material analysis obtained an average of 4.7 which included category $x > 3.4$ with very good information or can be said to be valid. Therefore, it is an argumentation test instrument scientific material classification creature life For Class VII is declared valid in terms of validity material. Based on the table above, media or design analysis is obtained on average 4 who went inside category $x > 3,4$ with information very Good or can be said valid.

b. Results Test Practicality Teacher and Student

1) Test Practicality Teacher

The practicality test of teaching materials was carried out with Mrs. Nanih, S. Pd. elementary school. As a class VII teacher at SMP N 2 Singingi on the teacher's practicality sheet there are 11 questions to become a teacher's guide to assessing argumentation test instruments which was developed. The following are the results of the teacher's response after using argumentation test instruments on theme classification creature life for class VII students. The aspects provided through the teacher response sheet were categorized as very practical. Results recap Teacher can see on evaluation questionnaire open as follows:

Table 5. Results Response Team Expert

Code Teacher	Qty. Score	Category
Guardian class	52	Very practical
Average	4.7	Very Practical
Results	94, 55%	Very Practical

Based on the results teacher practicality questionnaire which is obtained, it can be concluded that the teacher's response towards contextual-based companion book teaching materials is very practical with a percentage of 94.55% so the material taught can be used in the process of learning.

2) Test Practicality student

Based on the questionnaire given to students in this one-to-one test and small group test showed very positive results on the scientific literacy test instrument. Student results on one-to-one tests and tests group small can seen on the evaluation questionnaire as follows:

3. Stage Evaluation (Evaluation)

Argumentation test instruments scientific on the theme of classification creature life is evaluated in stages validation of media experts, language experts, and material experts. The analysis stage carried out is by the curriculum applicable. Evaluation of validity in argumentation test instruments carried out by conducting evaluations expert team. The expert

team's evaluation was carried out by three experts, namely design experts, language experts, and material experts. Evaluation result team expert form questionnaire becomes standard benchmark is instrument test Which developed valid or No. The following are the results of revisions from experts after receiving input and suggestions, being revised or repaired by suggestions and input from experts, described in detail in the Table below:

Table 6. Revision from Experts Validation

No.	Validation	Before revision (expert advice)	After revision (results revision)
1.	Expert Language	<ol style="list-style-type: none"> 1. Understand effective usage. 2. Understand usage of sentence sign read, and method typing. 3. Numbering 	<ol style="list-style-type: none"> 1. Use sentence-effective language Which standard by PUEBI Already repaired 2. Use sign read and method typing Already repaired 3. Numbering Already repaired
2.	Expert material	<ol style="list-style-type: none"> 1. Take note of effective sentences in the making question 2. <i>Typo</i> (there is an error writing in a sentence) 3. Answer limits must be customized with question 	<ol style="list-style-type: none"> 1. The effectiveness of the sentence 2. Used has been repaired Repair letter <i>Typo</i> or writing error already repaired 3. The answer is limited and customized with question
3.	Expert media	<ol style="list-style-type: none"> 1. The picture on the cover front the quality not enough 2. Background color consistency written (dark vs bright). 3. Quality of picture used (dark vs bright). 	<ol style="list-style-type: none"> 1. Picture on the cover front moment in print the quality Already repaired 2. Use a color background on instruments test has been repaired in accordance suggestion 3. Using quality pictures on question instrument tests has repaired by suggestion

Trial of the argumentation test instrument scientific the teaching process is carried out using the question and answer method, assignments, and discussions about material about our vertebrate friends in the argumentation test instrument scientific. Based on the results of the research conclusions, the argumentation test instrument used scientifically is valid and practical for use in the process study.

CONCLUSION

Based on the results of research and development (R&D), the argumentation test instrument on material classification creature life for class VII students" produces material products teaching in the form of test instruments that are valid and practical to use. This research has gone through the validation stage by experts consisting of language experts, material experts, and media experts as well as one-to-one trials, trials small groups, as well as teacher practicality tests. It can be concluded that the overall results of expert validation are valid, so it is suitable to be tested in one-to-one trials and small-group trials. Results practicality

Teacher And student give response very Good to Instrument test argumentation scientific Which developed so that stated very practical for used.

Study This is study development, so that suggests the need for utilization of the products produced. The product resulting from this research is expected to become a reference Teacher class VII in activity learning.

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