



Design And Validity Of An E-Assessment Four Tier Multiple Choice To Assess Science Literacy Skills Of Students

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ABSTRACT

The low level of science literacy in sound and light waves is a problem in education, especially in physics learning. The low science literacy is caused by students' low understanding of concepts. Assessment instruments that specifically assess students' science literacy skills on the concept of sound and light waves are not widely available. This study aims to develop a valid four-level multiple choice e-assessment to assess students' science literacy skills on the concept of sound and light waves. This research is a development/design (R&D) research using the Plomp model. The developed e-assessment was validated by five experts. The data collection instruments used were interview sheets, self-evaluation sheets, and validation sheets. The results of the validity analysis showed that the e-assessment was in the valid category in terms of construction feasibility aspects, content feasibility aspects, display feasibility aspects, and language feasibility aspects. From the validity results with an average value of 0.94, it shows that the four-level multiple choice assessment to assess science literacy skills is declared valid and suitable for use.

Keywords: E-Assessment, Four-tier Multiple Choice, Literasi Sains.



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I. INTRODUCTION

The quality of education in Indonesia has not been fully optimized, this is due to the low science literacy skills of students. Where, science literacy has a very important role in facing 21st century learning challenges [1]. Literacy is also a requirement that must be mastered by individuals or students in their lives so that they can become responsible individuals for the problems that surround them. Science literacy is the most important thing that needs to be considered in the world of education [2]. Furthermore, science literacy skills have an important contribution to preparing the next generation to solve challenges and problems in society.

Concept understanding is the most important thing that students must have. Understanding concepts is a key element of students' scientific literacy abilities. [3]. Conceptual understanding is the understanding of concepts that are accepted and in accordance with the actual scientific form [4]. Concept understanding is the ability of students to link concepts that are already known with the material they will learn so that they can solve problems in learning [5]. Understanding this concept is also the initial ability of students that must be obtained to master a certain concept so that students will be even better in solving problems [6]. It can be concluded that concept understanding is a basic ability that must be possessed by students to improve their science literacy skills by linking concepts that are already owned so that they can solve problems scientifically.

Students who have a correct understanding of concepts will have good science literacy competencies so that they can face the challenges of the times. Individuals who have good science literacy competencies will be able to address the challenges of the 21st century because they are literate in science that utilizes information about events that occur in life associated with concepts [7]. Students who have a correct understanding of the concept, then the student also has good science literacy competencies [8]. In addition, science literacy competence is a person's ability to understand, communicate, and apply concepts in real life and use them in problem solving [9]. Meanwhile, students who have low science literacy skills will have misconceptions that will have an impact on the concepts in the next material. The thing that causes misconceptions in students is due

to the wrong initial concept of students [5]. To produce qualified individuals who are able to compete in the 21st century, Educators must understand concepts, identify misconceptions, and assess students science skills.

However, science literacy is still a problem in the world of education in Indonesia. According to the results of the PISA (Program for International Student Assessment) survey from 2000 to 2018 placed Indonesia as one of the countries with low science literacy skills. The average science literacy score in OECD countries in 2012 was 500, while Indonesia only reached a score of 382 ranked 64th out of 65 participating countries. In 2015, the average international score for science literacy was 493, while Indonesia scored 403 and ranked 62 out of 70 participating countries. Likewise, the PISA results for Indonesian students in 2018 are also still at a fairly low level, namely the score obtained of 396 while the average OECD country is 500, Indonesia is ranked 74th out of 79 countries. Based on this data, it shows that from year to year, Indonesia is always ranked low. The inability of students in science literacy will have a negative impact on their future in the world of work competition. Science literacy is a top priority in improving the quality of education because it plays an important role in the development of technology and science [10].

Based on observations made to 2 teachers from one of the state senior high schools in Payakumbuh that the assessment questions developed in learning have not included aspects of science literacy. The questions developed refer to certain quantities that require remembering which emphasizes the memorization of students [11]. One of the causes of students' low science literacy is because they are not used to solving questions or tests based on science literacy [12]. Teachers also have not maximally use the electronic media in distance learning, especially in assessing science literacy skills. Electronic assessments to evaluate students' science literacy skills are not yet available. Therefore, a diagnostic test with a four-tier multiple choice format is needed so that teachers can identify concept understanding and assess students' science literacy. Assessments that use electronic media make assessments more interesting, more accessible and easier to understand [3]. E-Assessment four-tier multiple choice uses iSpring Quiz Maker software that can be used through students' smartphones. Electronic assessment is an effort to integrate technology in the assessment process, which is in accordance with the characteristics of 21st century learning.

The problem of teachers in assessing students' science literature skills, the researcher designs e-assessment four-tier multiple choice using iSpring Quiz Maker as the assessment of students' science literature in the 21st century learning with sound and light waves material. The research aims to design a valid assessment of four-tier multiple choice through expert review and practical by users (students), also reliable and valid questions after field test so that it is feasible to use as an assessment instrument.

II. METHOD

The type of research conducted is Design Research which is used to develop and validate products so that they are suitable for use. The research conducted was designed based on the Plomp development model. Plomp model development has three stages, namely: (1) preliminary research, at this stage a needs analysis and literature review are carried out, (2) prototyping phase, at this stage design, product design, evaluation and revision are carried out, (3) assessment phase, at this stage field trials are carried out to get questions that are valid and suitable for use. The preliminary stage of the researcher analyzes the needs and provides solutions by conducting a literature review stage. For needs analysis to get the problems experienced by teachers in assessing science literacy skills in physics learning.

This needs analysis was carried out through interviews with physics teachers to find out how the implementation of the assessment of students' science literacy skills. At the prototype phase, designing e-assessment four-tier multiple choice, evaluating and revising it until the resulting product is of high quality. At this phase using self-assessment sheets, validation sheets by experts, and one to one and small group practicality sheets. This prototype phase is product design, then formative evaluation is evaluated by the researcher himself. Then the product will be validated by three expert lecturers majoring in physics who are experts in the field of physics learning and physics learning media and two physics teachers in one of the senior high schools in Payakumbuh. The last phase is field trials to determine the feasibility of the product after being validated by experts. At this phase of the field trial to assess the validity of content construction, reliability, differentiability, and difficulty of the e-assessment four-tier multiple choice and analysis of the results of students' science literacy skills. However, in this study researchers limited it to the formative evaluation stage, namely validation by experts.

In this preliminary research phase, the research instrument used was an interview guide. Interviews were conducted with 3 teachers in one of the senior high schools in Payakumbuh. The results of these interviews will be processed and analyzed qualitatively. Data analysis conducted on self-evaluation is an assessment of the

incompleteness and errors of the initial prototype by the researcher himself in detail the product that has been made and adjusted to the theory of the experts in the past. Then the assessment results are expressed using a percentage technique as follows:

$$\% = \frac{\text{score obtained}}{\text{max score}} \times 100\% \quad (1)$$

After revising the e-assessment four-tier multiple choice to be developed, the e-assessment was validated by experts. Data analysis of e-assessment four-tier multiple choice validity was conducted with the V-Aiken formula. Product validity is conducted on four aspects, namely aspects of content feasibility, construction feasibility aspects, language feasibility aspects and display aspects. The validity assessment questionnaire used was prepared based on a Likert scale. The Likert scale has a score range from 1 to 5, score 1 indicates strongly disagree criteria and score 5 indicates strongly agree criteria. The data obtained from the validity test results were analyzed using the Aiken's formula which is used as follows:

$$V = \frac{\sum s}{n(c - 1)} \quad (2)$$

$$S = r - lo \quad (3)$$

Information:

- V = rater deal index
- lo = the lowest validity rating score (in the case 1)
- c = the highest validity rating score (in the case 5)
- r = number given by an appraiser
- n = number of raters

After obtaining the agreement index on the validity assessment, the interpretation of the results of the V Aikens formula is between 0 and 1 [13].

Table 1. Categorization Based on Aiken's V. Index

Aikens V-Index	Category
$V < 0,8$	Invalid
$V > 0,8$	Valid

When the V Aikens index is less than 0.8, the e-assessment four-tier multiple choice is categorized as invalid, so an improvement is needed. As for the Aikens V index value greater than 0.8, it has a valid category, so the e-assessment four-tier multiple choice can proceed to the practicality phase.

III. RESULTS AND DISCUSSION

Results

Based on the research that has been carried out, the research results of the preliminary research phase and the development phase are identified, which include needs analysis, designing e-assessment four-tier multiple choice, self-evaluation and expert review.

Needs analysis

In the preliminary research phase, an initial study was conducted in the forms of teacher and material analysis. The initial study of teachers was to conduct interviews to find out 4 indicators, namely, the physics learning process at school, identification of science literacy skills of students by teachers, identification of the existence of diagnostic tests with electronic assessment to assess students' science literacy skills, and teacher knowledge about electronic assessment. The initial study of the material was carried out by analyzing students' science literacy skills on sound and light waves through a literature study of articles on science literacy skills on sound and light waves.

First, an initial study in the form of an analysis of teachers was conducted through interviews. Interviews were conducted with two teachers in one of the senior high schools in Payakumbuh. The two teachers are

eleventh grade physics teachers in one of the senior high schools in Payakumbuh. The results of interviews with the two teachers were: (1) teachers rarely assess students' science literacy skills, (2) the unavailability of electronic assessments to assess students' science literacy skills, (3) less knowledge of teachers about applications for electronic assessments. Based on the results of the analysis of teachers, an e-assessment is needed to help teachers assess students' science literacy skills in physics learning on sound and light waves.

Second, an initial study in the form of an analysis of the material was carried out by analyzing articles on students' science literacy skills on sound and light waves. The articles analyzed were articles that revealed the science literacy skills of sound and light waves, with the intention of knowing the science literacy skills on sound and light waves. The results obtained from the analysis of articles on sound and light waves, it is known that students' science literacy skills are still relatively low. The percentage of students' science literacy skills is 27.94% [14], and 31,58% [15]. Based on the problems of science literacy that occur, it is necessary to develop a four-tier multiple choice e-assessment on the material of sound waves and light to assess the science literacy skills of high school students or islamic high schools.

Based on the analysis of the preliminary research, the results of the preliminary research were: (1) teachers rarely assessed students' science literacy skills, (2) there was no electronic assessment to assess students' science literacy skills, (3) teachers' lack of knowledge about the application for electronic assessment, and (4) students' science literacy skills were poor: (1) teachers rarely assess students' science literacy skills, (2) the unavailability of electronic assessments to assess students' science literacy skills, (3) lack of teacher knowledge about applications for electronic assessments, (4) students' science literacy skills on sound and light waves are still low. Based on the problems obtained in the preliminary research, it is necessary to develop an e-assessment that can help teachers to assess students' science literacy skills in sound and light waves. One solution that can be done is to develop e-assessment four-tier multiple choice on sound and light waves to assess the science literacy skills of high school students or islamic high schools.

Prototype phase: Prototype Design Results

The results obtained at this prototype stage are in the form of product prototype design, self-evaluation, and expert review. The design or design of the product prototype is in the form of a four-tier multiple choice E-assessment using the iSpring Quiz Maker application which can be accessed via students' smartphones online. This prototype design is also equipped with a question grid, answer key and scoring guidelines. The E-assessment prototype is designed based on the question grid and the sound and light waves material that students learn at school can be seen in Figure 1.

KISI-KISI SOAL LITERASI SAINS MATERI GELOMBANG BUNYI DAN CAHAYA

Satuan Pendidikan	: SMA/MA	Alokasi Waktu	: 60 menit
Mata Pelajaran	: Fisika	Jumlah Soal	: 15 pilihan ganda
Kelas	: XI MIPA		

Kompetensi Dasar	Indikator	Indikator Literasi Sains	Indikator Soal	Tingkat Kognitif	Nomor Soal
3.10 Menerapkan konsep dan prinsip gelombang bunyi dan cahaya dalam teknologi	3.10.1. Menganalisis karakteristik dan cepat rambat gelombang bunyi	Menjelaskan fenomena secara ilmiah	Diberikan sebuah video tentang gajah dan kalelawar, siswa mampu menjelaskan karakteristik gelombang bunyi yang dapat didengar oleh makhluk hidup dengan benar	C3	1
		Menjelaskan fenomena secara ilmiah	Diberikan sebuah fenomena pesawat yang dapat memecahkan kaca jendela, siswa dapat menjelaskan dengan konsep yang berkaitan dengan frekuensi bunyi dengan benar	C4	2
		Menginterpretasi data dan bukti secara ilmiah	Diberikan sebuah data hasil percobaan, siswa dapat menganalisis hubungan frekuensi bunyi dengan panjang gelombang dengan benar	C4	3
	3.10.2. Menganalisis fenomena dawai dan pipa organa suatu benda pada kehidupan sehari-hari.	Menjelaskan fenomena secara ilmiah	Diberikan sebuah video percobaan dawai pada gitar, siswa dapat menentukan frekuensi dawai dengan pada gitar dengan benar	C4	4
		Mengevaluasi dan mendesain	Diberikan sebuah narasi percobaan pipa organa dengan gelas, siswa mampu membuat rumusan masalah yang dapat digunakan dalam percobaan pipa organa dengan benar	C4	5
		Menjelaskan fenomena secara ilmiah	Diberikan sebuah narasi yang berkaitan dengan perbedaan bunyi pada lubang seruling, siswa mampu menganalisis frekuensi pada alat musik dengan tepat	C5	6
		Menginterpretasi data dan bukti	Diberikan sebuah video percobaan dan data hasil percobaan tentang pipa organa terbuka, siswa mampu menyimpulkan	C4	7

Figure 1. Question grid for assessment of four tier multiple choices

This E-Assessment is a development of essay questions modified into one tier multiple choice. One tier multiple choice questions are developed into four-tier multiple choice. After modifying tier-1 and tier-3, the design was developed to ensure that students are more interested in using the developed four-tier multiple-choice assessment on the subject of sound and light waves, especially in terms of construction, content, appearance and

language used. Fig 2 (a) illustrates the layout of the four-level multiple-choice e-assessment on the topic of sound and light waves. After designing the e-assessment in iSpring Quiz Maker, a guide was created as a procedure for answering questions. The work guide is so important to the students as it tells the students what to do and what not to do when working on the problems. For instructions on how to do the questions, please refer to Fig 2 (b).

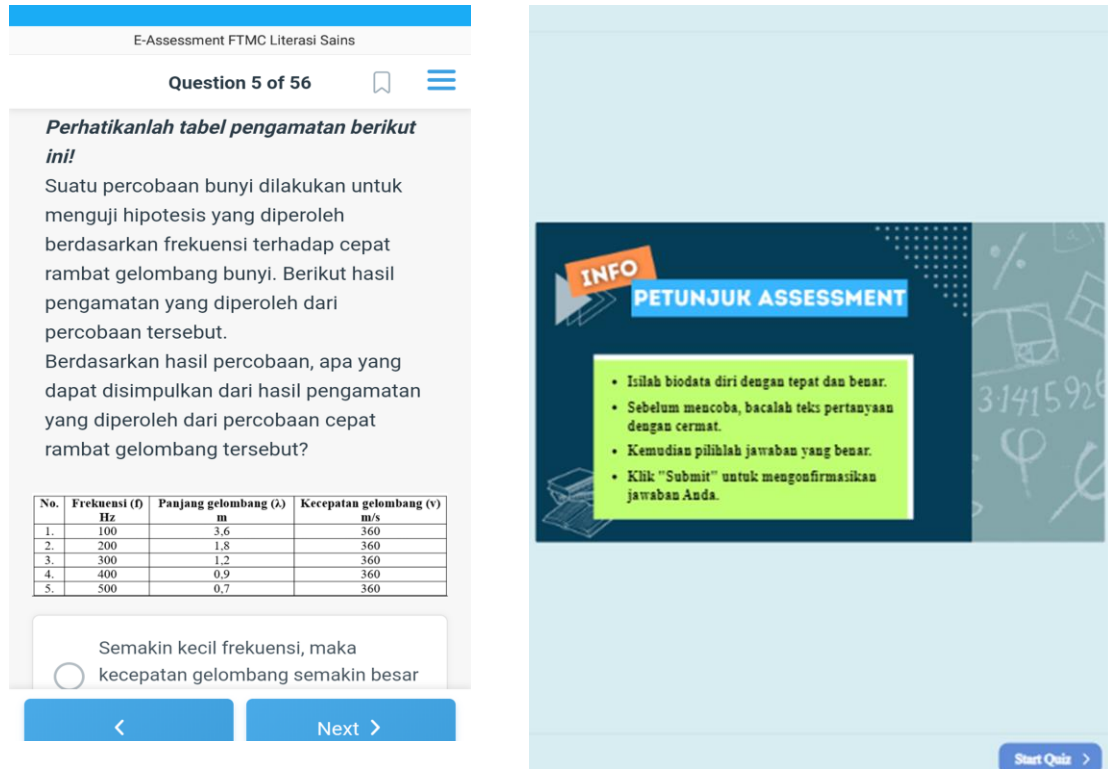


Fig 2. (a) The design of tier-1 questions using iSpring Quiz Maker on android display (b) The design of question instructions using iSpring Quiz Maker on android display

Formative Evaluation Results: Self-Evaluation Results

After the e-assessment prototype is designed, formative evaluation is then conducted which consists of two phases, namely self-evaluation and expert review. Self-evaluation is an assessment conducted by the researchers to assess the completeness and appropriateness of the e-assessment four-tier multiple choice on sound and light wave's material developed by the researchers. At this self-evaluation phase, it is carried out before the product is examined by the validator to be validated. At this step, the researcher reads, checks for completeness, revises errors and adds if there are missing parts. The indicators assessed in this self-evaluation are four aspects, namely: SE (e-assessment structure), IEC (feasibility of e-assessment content), B (language), T (display). This self-evaluation format provides a checklist on a score of 1 to 5. The results obtained at this stage are as below:

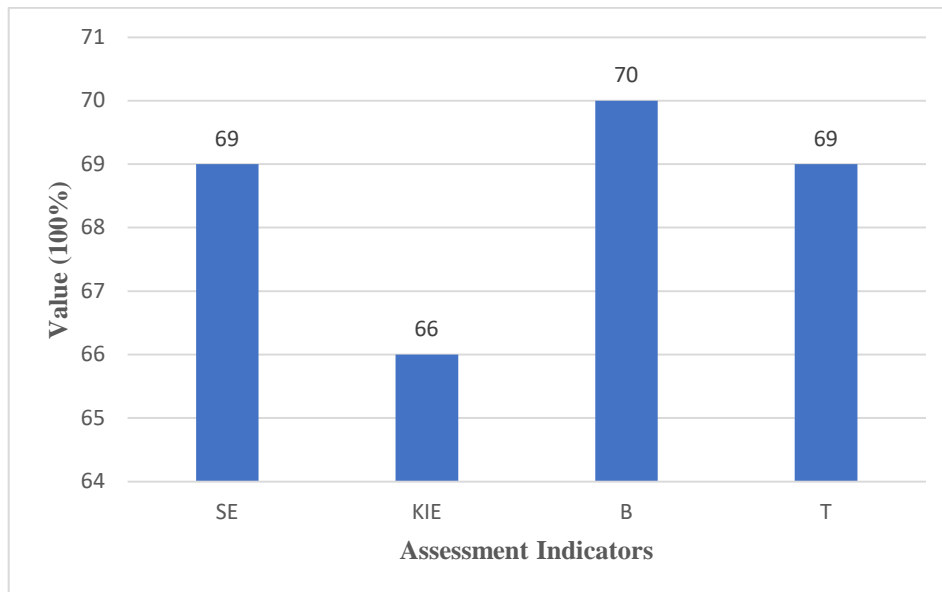


Figure 3. Results of Self Evaluation

Results of Content Validity Test by Expert (Expert Review)

Validation of the four-tier multiple choice e-assessment on sound and light waves was carried out by five experts consisting of three physics lecturers and two physics teachers. The results of this validation are used as guidelines for making revisions to the product and to determine the feasibility of the product that has been made. The product validation instrument consists of four aspects, namely construction aspects, content aspects, language aspects, and display aspects. Each aspect of the validation instrument consists of several indicators. The results of the validation carried out by the five validators in the form of feedback and input to be considered for revision can be seen in the table below.

Table 2. Validator Feedback

Validator	Feedback
Validator I	— Some questions are only pure physics such as questions no. 7, 12, 13, 14, and 15
	— Question 2 should be in the E-Assessment application.
Validator II	— Many questions have no context
	— Question indicators only lead to knowledge
Validator III	— There are questions such as learning outcomes that do not measure science literacy in question 12
	— One reading text/video can be made into more than one question
Validator IV	— The question is made implicit so that the answer can be analyzed from the phenomenon
	— Question 11 emphasizes the spectrum of light.
Validator V	— There are questions in the form of general learning outcomes such as question no. 12
	— For question 9, add more phenomena
	— There are questions in the form of learning outcomes that generally do not contain science literacy

Based on the assessment instrument used, the results of the validation assessment for the four aspects of the assessment can be analyzed. The data from the validity test results based on the assessment aspects were analyzed using Aiken's V formula on each question item. The assessment consists of four aspects with a total of 30 assessment indicators. The results of the validation assessment from the five validators are as below.

— *Aspects of Construction Eligibility*

The construction eligibility aspects contain indicators related to the characteristics of a four-level multiple choice test. The eligibility aspect of this e-assessment construction has 3 indicators which are; 1) Questions are complete with reasons and confidence levels of answers, 2) Test questions can assess science literacy skills, 3)

The reason options given can identify the understanding of students' concepts. The results of the analysis of the eligibility aspects of construction based on the question items can be seen in the table below.

Table 3. Results of Construction Feasibility Aspect Validation

Question Number	Aiken's V value	Validity Categories
1	0,95	
2	0,85	
3	0,92	
4	1,00	
5	0,98	
6	0,97	
7	0,88	
8	1,00	Valid
9	0,88	
10	0,95	
11	0,87	
12	0,80	
13	0,82	
14	0,88	
15	0,88	
Mean	0,91	Valid

Based on the table at the top, it can be seen that for the construction feasibility aspect, the values range from 0.80 to 1.00 so that all question items are valid. The assessment obtained on the construction feasibility aspect has an average of 0.91 with a valid category. Based on the results of the analysis of the construction feasibility level, it can be stated that the four-tier multiple choice e-assessment on sound and light wave's material in terms of construction feasibility is feasible to use to assess students' science literacy skills.

— *Aspects of Content Appropriateness*

The content feasibility aspect consists of 10 assessment indicators that have been filled in by the validator. The value given by the validator is used as a measure of the feasibility of the e-assessment content developed. The results of the validity analysis for the content feasibility aspect of the e-assessment four-tier multiple choice can be seen in the table below.

Table 4. Results of Content Appropriateness Aspect Validation

Question Number	Aiken's V value	Validity Categories
1	0,98	
2	0,91	
3	0,97	
4	0,99	
5	0,99	
6	0,98	
7	0,93	
8	0,97	Valid
9	0,93	
10	0,92	
11	0,94	
12	0,85	
13	0,86	
14	0,92	
15	0,92	
Mean	0,93	Valid

From the table above, the content eligibility aspect has a value ranging from 0.85 to 0.99 so that all question of items are confirmed as valid. The assessment of feasibility of content has an overall average of 0.93 with valid category. Based on the results of the analysis of the level of content feasibility, it can be stated that the

e-assessment four-tier multiple choice on sound and light wave's material in terms of content feasibility is feasible to use to assess students' science literacy skills.

— *Aspects of Display Feasibility*

The display feasibility aspect consists of 13 assessment indicators, each of which has been assessed by the validator. The value given by the validator is used as a measure for the feasibility of the e-assessment display developed. The results of the display feasibility analysis can be seen in the table below.

Table 5. Results of Display Feasibility Aspect Validation

Question Number	Aiken's V value	Validity Categories
1	0,99	
2	0,89	
3	0,99	
4	0,99	
5	0,99	
6	0,99	
7	0,95	
8	0,98	Valid
9	0,98	
10	0,93	
11	0,97	
12	0,93	
13	0,93	
14	0,93	
15	0,94	
Mean	0,96	Valid

According to the above table, the feasibility of display aspect has a value range of 0.89 to 0.99 so all question items are valid. The evaluation results obtained in the feasibility of display aspect have an average of 0.96 with valid category. The results of analysis of the feasibility of display can be stated that the e-assessment four-tier multiple choice on sound and light wave's material in terms of feasibility of display is feasible to use to assess the science literacy skills of students.

— *Aspects of Language Feasibility*

The language feasibility aspect contains indicators related to the use of language in e-assessment four-tier multiple choice on sound and light waves. The language feasibility aspect consists of 4 assessment indicators, each of which has been assessed by the validator. The results of the analysis of language feasibility aspects can be seen in the table below

Table 6. Results of Language Feasibility Aspect Validation

Question Number	Aiken's V value	Validity Categories
1	0,99	
2	0,89	
3	0,99	
4	0,99	
5	0,99	
6	0,99	
7	0,95	
8	0,99	Valid
9	0,99	
10	0,94	
11	0,99	
12	0,94	
13	0,93	
14	0,94	
15	0,93	
Mean	0,96	Valid

Based on the table at the top, it can be seen that for the language feasibility aspect, the values range from 0.89 to 0.99 so that all question items are declared valid. The assessment obtained on the aspect of language

feasibility has an average of 0.96 with a valid category. Based on the results of the analysis of the level of language feasibility, it can be stated that the e-assessment four-tier multiple choice on sound and light wave's material in terms of language feasibility is feasible to use to assess students' science literacy skills.

Based on the data from the validity analysis results for the four aspects of assessment on each item, the feasibility results graph for each aspect of assessment is obtained as follows.

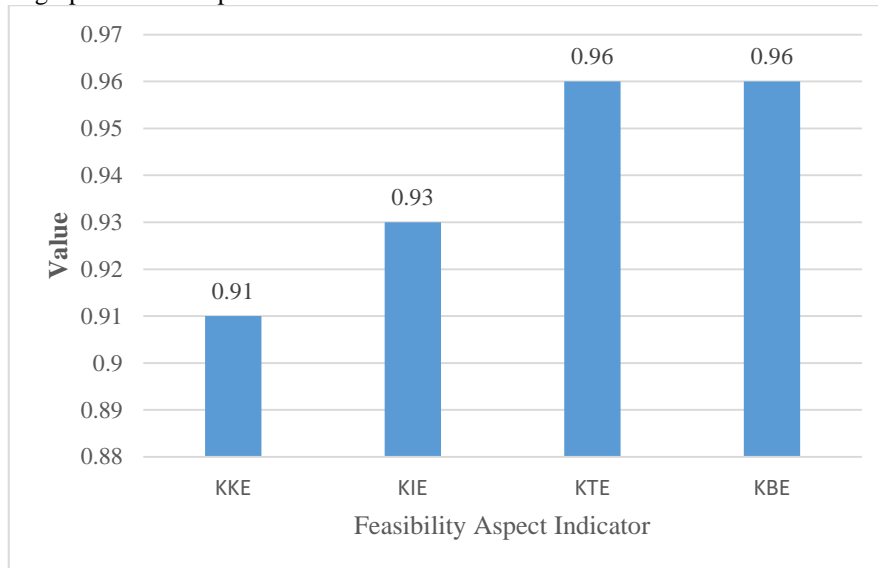


Figure 4. Average of Validation Results

Based on Figure 4, it can be explained that the average value of each component of the validation researcher on the four tier multiple choice e-assessment varies from 0.91 to 0.96 with an average value of all components of 0.94. From these results it can be stated that overall the e-assessment components are in the valid category. Thus, e-assessment four-tier multiple choice on sound and light waves material to assess students' science literacy skills is included in the valid category. The results of the validation of e-assessment four tier multiple choice are obtained from expert suggestions to be revised again. Suggestions given in the form of affirmation in the context of science literacy, sentence improvement, clarifying questions according to indicators, e-assessment display and there are questions that are only pure physics. The expert's suggestions were used to improve the feasibility of the e-assessment four tier multiple choice made.

From the validity results based on the assessment aspects obtained, the four-tier multiple choice e-assessment on sound and light waves material can be declared to meet the eligibility criteria for each assessment aspect consisting of construction aspects, content aspects, appearance aspects, and language aspects. Therefore, e-assessment four-tier multiple choice on sound and light waves can be used to assess students' science literacy skills.

Discussion

The e-assessment in this study was developed to assess students' science literacy skills. The e-assessment developed is in the form of four-tier multiple choice. This discussion will discuss the results of the research that has been carried out from each stage of the research. The following is the description of the discussion.

The results of the needs analysis and literature review that researchers conducted to obtain the results that the availability of assessments to assess science literacy skills, and four-tier multiple choice instruments to assess students' concept understanding. In preliminary research, there are several problems found, namely: (1) teachers are less familiar with four-tier multiple choice questions, (2) the unavailability of assessments to assess science literacy skills, (3) teachers have not maximally utilized electronic media in conducting assessments (4) students' science literacy skills are still low, and (4) the questions developed have not contained indicators of students' science literacy and are still rote. As for what causes low science literacy skills because they rarely do practicum activities, do not understand the terms in scientific investigations, and spend a lot of time memorizing learning materials [16].

Based on the results of product design, e-assessment needs to be self-evaluated as a form of evaluation from researchers personally related to the suitability of questions with science literacy indicators, completeness of questions in the form of scoring guidelines, work instructions, and appearance in the application. In the self-assessment, the language of the question sentence is also assessed, ensuring that the questions are free from the use of ambiguous sentences and sentences that cause multiple meanings of understanding by students.

After the self-assessment of the four-tier multiple choice E-Assessment by the researchers themselves, then the expert review was conducted. At this stage, the e-assessment was tested for feasibility in measuring students' science literacy skills by five experts, namely three lecturers in the physics department and two physics teachers at one of the senior high schools in Payakumbuh. There were four aspects assessed, namely construction aspects, content feasibility aspects, display aspects and language aspects. The results of validation are used as guidelines in revising e-assessment and determining the feasibility of e-assessment that has been made. Processing of validation results using the V Aikens formula.

The data from the validity test results based on the construction feasibility aspect by the five validators on average obtained a score of 0.91 or was in the valid category. This is because all questions have been equipped with reasons (tier-3) and the level of confidence of answers (tier-2 and tier-4), there are some questions that are less suitable for assessing science literacy skills, and the reason options can reveal students' concept understanding. The assessment questions are declared valid based on the feasibility of construction if the questions designed are able to assess each of the aspects that become instructional objectives [17].

The average content feasibility of validation results is 0.93 with a valid category. This is because all the questions loaded are in accordance with the learning indicators studied in senior high school, all questions already contain the composition of applicability in life, all the answers intended in each question are appropriate to be used as answers, the questions on the e-assessment presented are in accordance with the science literacy indicators to assess students' science literacy skills, and the questions on the e-assessment have one correct, homogeneous and logical answer. So that based on the results of content validation is categorized as very valid. E-assessment four tier multiple choice which is declared valid, if in the aspect of content feasibility has suitability with the indicators and subject matter that has been determined [18].

On the feasibility of display, the average validation result is 0.96 with a valid category. This is because the typeface, size, and spacing on the e-assessment used are correct, the test application is equipped with clear question instructions, images/video/types have clarity in function on the question and are attractive in color composition, questions, tier-1 and tier-3 have been clearly formulated, do not provide clues to the correct answer, do not contain double negative statements, multiple interpretations, questions have unequal answer choices, and answers do not depend on the previous question.

Language feasibility on average obtained a score of 0.96 with a valid category. This is because the questions in the e-assessment four tier multiple choice are in accordance with communicative language rules, do not use language that applies to the local area, and do not offend a person's personality, ethnicity, race and religion. Writing question sentences on e-assessment must pay attention to good and correct Indonesian language and EYD rules so that the questions developed are easily understood by students [19] and have met the characteristics of the language used [20].

Based on the results of the validation test from five validators, the validation results obtained on the e-assessment four-tier multiple choice are valid to be used to assess students' science literacy skills in terms of construction aspects, content aspects, appearance aspects, and language aspects. This is because the e-assessment four-tier multiple choice has fulfilled all aspects that are required in making questions. In developing e-assessment four tier multiple choice material sound and light waves, it takes a long time to complete the product until it is feasible to use to assess students' science literacy skills. This research is limited to only one topic of physics discussion, namely sound and light waves and application is limited to only fifteen questions. Therefore, it is necessary to develop e-assessment four tier multiple choice for other physics materials to assess students' science literacy skills in physics learning.

IV. CONCLUSION

E-assessment four-tier multiple choice on sound and light waves material is an assessment consisting of four levels as follows: 1) several answer choices, 2) the level of confidence in choosing the correct answer, 3) several choices of reasons for choosing the correct answer in the first level, 4) confidence in choosing the correct reason in the third level. The assessment of four-tier multiple choice developed is electronic-based using iSpring Quiz Maker media that can be accessed through smartphones with html format. The four-tier multiple choice e-assessment was made to assess the science literacy skills of eleventh grade students on sound and light waves.

The results of content validation by experts show that the e-assessment four-tier multiple choice on sound and light waves material is categorized as valid in terms of construction, content feasibility, display feasibility and language feasibility with an average value of 0.94. This shows that the e-assessment four-tier multiple choice developed is feasible to use to assess students' science literacy skills on sound and light waves. Therefore, further studies on the practicality and effectiveness of this e-assessment four-tier multiple choice are expected. E-assessment four-tier multiple choice can be developed on other physics materials to assess students' science literacy skills in physics learning. E-assessment four tier multiple choice can also be developed for the addition of the next tier.

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