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Design and Validity of Five Tier-Multiple Choice Test E-Instruments Using I-Spring Quiz Maker as an Assessment of Student Science Literacy in 21st Century Learning

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Abstract: The goal of 21st century learning is to provide students with conceptual knowledge and scientific literacy abilities. Creating a five-tier multiple choice e-instrument on the subject of work and energy and momentum and impulse. The purpose of this study was to determine the characteristics and validity of a five-tier multiple choice e-instrument using the i-Spring Quiz Maker as an assessment of scientific literacy and understanding of concepts for high school students in class X. The research carried out included the type of development research using the Plomp model. The research was carried out to the expert review stage (Validity). The object of the research is a five-tier multiple choice e-instrument using the i-Spring Quiz Maker. The source of content validity data was obtained from the results of expert validation by a Physics lecturer at the Faculty of Mathematics and Natural Sciences, UNP. Preliminary research conducted at this stage of research revealed that teachers were not familiar with the five-tier-multiple choice instrument in assessing students' conceptual understanding, especially on the matter of effort and energy and momentum and impulse. In the Development or Prototyping Phase, a five-level multiple choice electronic instrument is designed using the i-Spring Quiz Maker application. The results of the self-evaluation were obtained with very good criteria. The results of the instrument validity test are obtained as a whole with a high validity category.

Keywords: Concept understanding; Scientific literacy; Five-tier multiple choice e-instrument

Introduction

One of the skills that must be possessed in carrying out 21st century life is scientific literacy. Students who are literate in science will be better able to cultivate a caring and responsible attitude toward themselves, society, and the world (Fanata et al., 2017). In addition, scientific literacy can build a new generation that has scientific views and attitudes and can share knowledge and research results with the public (Arohman et al., 2016). Thus, scientific literacy skills play a role in preparing a generation that is able to solve challenges and problems in society in a scientific and accountable manner.

Concept understanding is the main foundation of scientific literacy competence (Shwartz et al., 2006). Conceptual understanding is the ability of students to explain a concept, apply a concept in many contexts, and obtain some implications from the existence of the concept (Duffin et al., 2000). Students' conceptual understanding is a mind that can integrate new knowledge into its existing understanding (Capriconia et al., 2022). The same thing was conveyed by Guswina that understanding the concept is the basis for solving problems for students in learning (Guswina et al., 2020). Therefore, understanding concepts is the main thing in improving students' scientific literacy competence to integrate their understanding in solving scientific problems.

Students who are able to understand concepts correctly and use these concepts to respond to natural events that occur in everyday life, students can be said to have high scientific literacy competence (Arief, 2015). In addition, PISA states that students can be said to have scientific literacy competence if they can evaluate and plan scientific studies, explain phenomena using

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science, and interpret data or evidence using science (Alti et al., 2021). Meanwhile, low scientific literacy competence occurs if students experience misconceptions or misconceptions that greatly affect the next concept (Mufit et al., 2019). Therefore, educators must know the understanding of concepts and identify misconceptions and assess students' scientific literacy so that science learning becomes quality and able to compete in the 21st century era.

Scientific literacy ability as a 21st century learning style requires a diagnostic test instrument that can assess scientific literacy and diagnose students' conceptual understanding of science learning. Diagnostic tests consist of various means such as descriptions, interviews, and multiple choice. There are several types of multiple-choice diagnostic tests, including: one-tier, two-tier, three-tier, four-tier and five-tier (Soeharto et al., 2019). A multiple choice question with only one right answer and three irrelevant choices is referred to as a single-level multiple choice question. A two-level multiple choice question is a multiple choice question where the prior answer has an additional level of confidence. A three-level multiple choice question combines a level of confidence with the justifications or opinions of the students to determine the response options. Four-tier multiple choice is a level three multiple choice because it gives pupils more confidence to explain their choices. Meanwhile, by using subjective judgments or student conclusions when offering responses, five-level multiple choice becomes a four-level multiple choice (Dirman et al., 2022).

Based on a preliminary study conducted on 5 physics teachers in class X from 5 high schools in Solok Regency, teachers had difficulties in assessing conceptual understanding and identifying misconceptions found in students . Misconceptions in physics learning will affect students in understanding the next material concept and also in solving physics problems (Ilahi et al., 2021). Concept understanding is closely related to students' scientific literacy. Concept understanding is low, so scientific literacy is also low. Therefore, we need a diagnostic test with a five-tier multiple choice test format so that teachers can identify misconceptions and assess students' scientific literacy. The electronic-based five-tier multiple choice test instrument can be accessed anywhere and anytime and can include features such as video, audio and pictures in the questions, using the iSpring Quiz Maker software, which can be used via students' smartphones. E-instruments are useful as an interesting assessment in measuring students' scientific literacy in 21st century learning.

Based on the findings of the teacher's problems in assessing students' conceptual understanding and scientific literacy skills, the researchers designed a five-level multiple-choice test e-instrument using the iSpring Quiz Maker as an assessment of students' scientific literacy in 21st century learning with materials of effort and energy and momentum and impulse. The purpose of this study is to produce a valid five-level multiple-choice test e-instrument through expert and practical review by users (teachers and students), as well as a reliable and valid construct through field testing so that it is suitable for use as an assessment tool.

Method

The type of research conducted is Design Research, which is one of the research models to develop and validate products so that they are feasible to use. The research development model used in this study is the Plomp model (T. Plomp, 2013). The development of the Plomp model consists of three stages, namely: (1) preliminary research, in the form of needs analysis, documentation and literature review stages; (2) the development or prototyping phase is the stage of designing a solution which includes the design, evaluation and revision of the prototype; (3) the assessment stage is testing the solution product on actual conditions in the field. The preliminary research stage is an activity of analyzing needs and finding solutions through literature review. The activity carried out was preliminary research to obtain valid data about teacher problems in assessing conceptual understanding and identifying student misconceptions in face-to-face learning.

Preliminary research was conducted on educators using interview guides and document analysis to find out how teachers assess concept understanding and identify misconceptions in students. The prototype stage aims to design an e-instrument prototype, evaluate the prototype and revise it, which is done repeatedly to produce a quality product. The instruments at this stage are self-evaluation sheets, expert review validation sheets, and one-to-one and small group practicality sheets. At this stage the product is designed, then formative evaluation is carried out starting from self-evaluation by the researchers themselves. Furthermore, the prototype was validated through a team of experts (expert review) by 3 lecturers majoring in physics, who are experts in the fields of physics material, physics learning and physics learning media. The last is the assessment stage to determine the effectiveness of the e-instrument prototype, after being declared valid by experts and practical by students at the development stage. At this stage, a field test was conducted to measure construct validity, reliability, differentiating power and the level of difficulty of the e-instrument as well as analysis of the results of students' understanding of the concept using the five-tier multiple choice test e-instrument. However, this research is limited to the development stage, namely to expert review.

Data analysis in the preliminary stage (Preliminary Research) used teacher interview guidelines and an analysis sheet of assessment documents used by teachers as instruments in the study. The findings are processed and analyzed quantitatively and qualitatively. Interview respondents consisted of 5 physics teachers in class X from 5 high schools in Solok Regency.

Self-evaluation data analysis is an assessment of the incompleteness and errors of the initial prototype carried out by the researchers themselves by examining in detail the instruments that have been made and adapted to the theories that have been put forward by previous experts. Then the results of the completeness evaluation are stated using the percentage technique as equation 1:

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

Using a Likert scale, expert review validation data analysis. The Likert scale is used to assess a person's or group's attitudes, opinions, and perceptions of social phenomena. The Likert scale has a score range of 1 to 5, with 1 denoting the lowest score and 5 denoting the highest score (Sutiyono, 2015). Questionnaires that have been validated by the validator will be analyzed. The results of the analysis of the e-instruments are then used to revise the e-instruments that have been developed. The V-Aiken equation is needed to determine the value of the content validity coefficient based on the results of assessments from experts, as many as n people against a statement (Aiken, 1985). The Aiken formula used is as equation 2:

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

After obtaining the rater agreement index, the category of the index value is decided. The results of category decisions are based on the V Aiken's index with the provision that if the value of V Aiken's is small equal to 0.4 then it is in the low category, if the value of V Aiken's is between 0.4 to 0.8 then it is in the medium category, and if the value of V Aiken's greater than 0.8 then it is in the high category.

Result and Discussion

The following describes the results of the preliminary research and development/prototyping phases which include document analysis, interviews, journal article reviews, designing a five-tier multiple choice e-instrument, self-evaluation and expert review and related discussions preliminary research and development.

Preliminary Research

At the preliminary research stage in the form of document analysis, the instrument for assessing students' conceptual understanding was carried out by the teacher. the instrument for assessing the level of students' conceptual understanding can be done using multiple choice tests which include: one-tier, two-tier, three-tier, four-tier, and five -tier. The use of multiple choice type used in assessing student understanding by 5 grade X teachers in Solok Regency can be seen in table 1.

Table 1. The Use of Multilevel Multiple Choice in 5 Schools in Solok District

Multiple Choice Type	Total	%
One Tier	5	100
Two Tier	4	80
Three Tier	1	20
Four Tier	1	20
Five Tier	0	0

Based on a documentary examination of five physics professors in class X at Solok Regency, it is known that every teacher uses the One Tier-Multiple Choice Test to evaluate students' conceptual comprehension with a percentage of 100%. Only 4 out of 5 teachers employ multiple choice in the form of a two-tier multiple choice test to gauge the degree of student mastery of physics subjects with a percentage of 80%. Only one out of every five teachers uses multiple choice tests, such as the Three Tier and Five Tier Multiple Choice Tests, to gauge their students' conceptual comprehension, at a rate of 20%.However, in the Five Tier-Multiple Choice Test multiple choice questions, the teacher has never used this instrument in assessing understanding of physics concepts and is not familiar with the Five Tier-Multiple Choice Test multiple choice form.

The application of graded multiple choice among class X physics teachers is still not very familiar. Teachers are more familiar with one-level and two-level multiple choice. Thus, the information obtained by the teacher after conducting an assessment with the existing instruments is only limited to right or wrong answers. Meanwhile, according to the expert, five-level multiple choice provides more information about students' understanding of concepts such as the source of the concepts students get, the answers or conclusions that students have and also the causes of misconceptions.

In the journal review activity, journal analysis was carried out on the Five Tier-Multiple Choice Test instrument on physics material. The following table shows the misconceptions about high school physics material reviewed in journals that were found using a five-level multiple choice test.

Table 2. Five-Tier Diagnostic Tests on High School Physics

Misconception Material	Class	Reference	Fifth Level
Vector Concept	X	Qonita et al. (2020)	Drawing and Conclusions
Circular Motion	X	Ramadhani et al. (2021)	Drawing and Conclusions
Newton's Law	X	Rosita et al. (2020)	Answer Source
Simple Harmonic Vibration	X	Putri et al. (2021)	Drawing and Conclusions
Elasticity	XI	Salsabila et al. (2020)	Drawing and Conclusions
Static Fluid	XI	Inggit et al. (2021)	Answer Source
Heat transfer	XI	Anam et al. (2019)	Drawing and Conclusions
Kinetic Theory of Gas	XI	Fajriyyah et al. (2020)	Drawing and Conclusions
Sound wave	XI	Lailiyah et al. (2020)	Drawing and Conclusions
Waves and Optical Instruments	XI	Putra et al. (2020)	Answer Source

From Table 2 there are 10 journals in identifying students' conceptual misconceptions using a five-level multiple-choice diagnostic test that was just distributed to physics material for grade 10 and grade 11. The use of the fifth level in grade five tiered multiple-choice diagnostic test there are two types of instruments, namely students provide explanations with pictures or provide conclusions on the concepts they have and students mention the source of the concepts obtained. Explanations by providing an overview or providing conclusions are more often used than determining the source of the concepts obtained by students. Additional uses for providing drawings and inferences are found in the concepts of vectors, circular motion, vibration, elasticity, heat transfer, the kinetic theory of gases, and sound waves.

Prototyping Phases: Prototype Design Results

The prototype is created by taking into consideration the findings of earlier research, specifically in the form of needs analysis. review of the literature and documentation. This study used the iSpring Quiz Maker as a prototype to create a product in the form of a five-tier multiple choice test e-instrument to assess student science literacy in 21st century learning. The activities carried out at the prototype design stage include:

– *Make a question grid*

The five-tier multiple choice instrument lattice on the work and energy and momentum and impulse material is designed, containing basic competencies, indicators of competency achievement, question indicators, question numbers and cognitive levels. The grid of questions on the five-tier multiple choice instrument on the subject matter of work and energy and momentum and impulse can be seen in Figure 1.

– *Modify the four-tier multiple choice instrument*

The five-tier multiple choice instrument on the matter of work and energy and momentum and impulse was developed from instruments developed by other researchers. Based on the existing instruments, modifications were made to adjust and improve the instrument to make it better and easier to understand. Modifications are made to tier-1 and tier-3. The modification process is carried out on the suitability of the language, the intent and purpose of the question and the appearance of the image on the question.

– *Designing five-tier questions*

After making modifications to tier-1 and tier-3, a five-tier question was designed on work and energy and momentum and impulse material. Questions at level five (five-tier), contain questions that can be used to confirm student answers. The questions presented at level five (five-tier) can be in the form of questions in the order of pictures, equations and conclusions to strengthen students' understanding of concepts in answering questions on work and energy and momentum and impulse material.

– *Designing a five -tier multiple choice e-instrument*

The researcher created a five-tier multiple choice e-instrument on the topic of work and energy, momentum, and impulse after completing the modification process and the five-tier question design. To ensure that students are interested in using five-tier multiple choice instruments on the subject of effort and energy as well as momentum and impulses that are developed, the design is carried out in accordance with the needs of the students, specifically from the perspectives of construction, content, appearance, and language used. Figure 2 illustrates the layout of the five-tier multiple choice e-instrument on the topics of work, energy, momentum, and impulse.

WRITING GRAPHIC OF EVEN SEMESTER PROBLEMS

Education Unit : High School
Subject : PHYSICS (Work and Energy)
Class : X MIPA

Time Allocation : 75 MINUTES
Number of Questions : 10 MULTIPLE CHOICE
Author : 1. HENDRA MUSFA DIRMAN

Core Competency : Understanding, applying, and analyzing factual, conceptual, procedural, and meta-cognitive knowledge based on curiosity about science, technology, art, culture, and humanities with insight into humanity, nationality, statehood, and civilization related to the causes of phenomena and events , as well as applying procedural knowledge in specific fields of study according to their talents and interests to solve problems

	Basic competencies	Material Scope	Cognitive realm	Science Literacy Indicator	Question Indicator	Question Number
1	3.9 Analyzing the concepts of energy, work (work), business relations (work) and energy changes, the law of the conservation of energy, and its application in daily events	Work and Energy	C2	Explain phenomena / scientific data	1. Given a video about a person pushing a car that broke down on the road, students can explain the right concepts related to business.	1
			C1	Explain phenomena / scientific data	2. Given the concept of motion on a Roller Coaster, students are able to determine the characteristics of potential energy on a Roller Coaster	2
			C3	Interpret/analyze data and scientific evidence	3. Given a table of observations about the magnitude of the force, the mass of the object and the coefficient of friction, students are able to analyze the greatest effort	3
			C5	Evaluating/designing	4. Given the Phet experiment video,	4

Figure 1. The grid of questions on the five-tier multiple choice instrument

Figure 2. Design of tier-1 questions using I sring Quiz maker on the android display

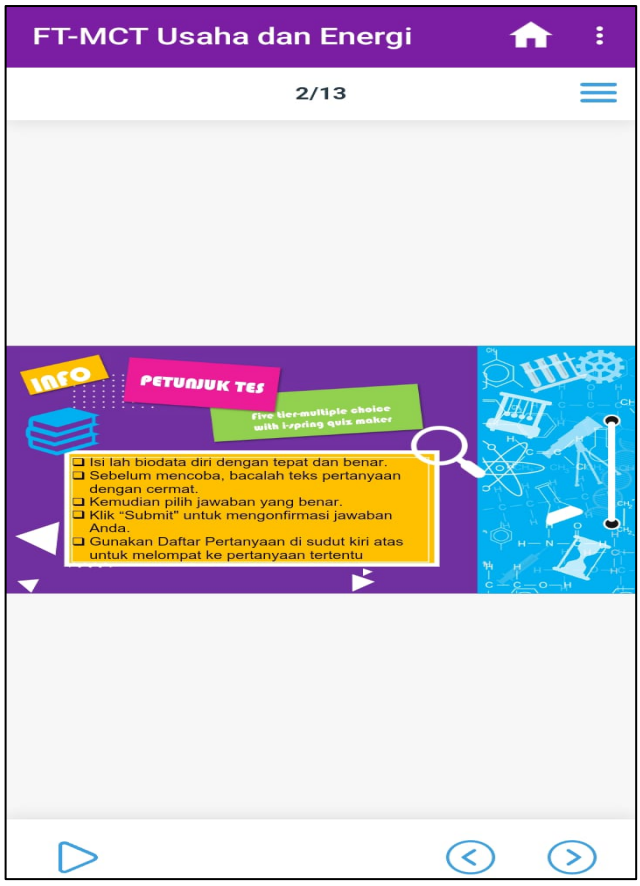

Figure 3. The design of the question instructions using the i-sring Quiz maker on the android display

– *Prepare instructions for working on questions*

Instructions for working on questions are guidelines that are used as procedures in answering questions. This work guide is very important for students because it tells students what to do and what students should not do while working on the problem. The instructions for working on the questions can be seen in Figure 3.

Self-Evaluation Results

Self-evaluation is an activity to check the completeness, feasibility and errors of the initial prototype of the researcher which is carried out by the researcher himself. This self-valuation stage is carried out before the product is submitted to the experts appointed as validators. At this stage the researcher reads, checks for completeness, corrects errors and adds if there are parts that are felt to be lacking. This self-evaluation format is in the form of a checklist (√). The results obtained at this stage are as follows: (1) The five-level multiple-choice electronic instrument contains instructions for working on questions, five-level multiple choice, answer keys, assessment guidelines and results interpretation assessment guidelines as well as applications used in distributing questions to students. (2) The display of five-level multiple choice instruments on the subject of work and energy and momentum and impulse is made interesting. (3) The questions that have been corrected in terms of language, letter type, and punctuation. (4) The grid's question indicators already make use of operational verbs. (5) The instrument's overly repetitive usage of writing fonts has been fixed. (6) The e-display, instrument's image, sound, and video all have colour schemes that are already striking and distinct.

Expert Review

The development stage of the expert review section was carried out by validating the five-tier multiple choice test e-instrument using the iSpring Quiz Maker as an Assessment of Student Science Literacy in 21st Century Learning by 5 physics lecturers. The validated aspects include five components, namely construction validity, content validity, display validity, language validity, and application or software usage validity, with an assessment instrument component containing several indicators.

– *Construction validity aspect*

The application questions have tier-3 justifications for answers, tier-2 and tier-4 levels of confidence in the answers, and tier-5 confirmation of answers. These make up the construct validity component (tier-5), 2) The application's test questions can detect conceptions Students, 3) The application's test questions can assess indications of scientific literacy proficiency, The reason options (tier-3) offered can shed light on the reasons behind students' misconceptions, and the questions on (tier-5) are related to the prior question. Reason distractors (tier-3) are rational and homogeneous with questions (tier-1). Table 3 displays the average result for each indicator in each construct validity question.

Table 3. The Average Value of Each Construct Validity Indicator on Each Question

Work and Energy		Momentum and Impulse	
Value of V aiken	Category Validity	Value of V aiken	Category Validity
0.83		0.85	
0.83		0.85	
083		0.83	
0.82		0.85	
0.83		0.84	
0.83	High	0.84	High
0.82		0.83	
0.83		0.82	
0.83		0.82	
0.83		0.82	
0.829	High	0.835	High

Based on Table 3, it is clear that all items are considered valid for the aspect of construct validity for work and energy matter because their values range from 0.82 to 0.83. All items are considered genuine as the momentum and impulse material values range from 0.82 to 0.85. The evaluation of the e-viability instrument has an average score of 0.829 and a high validity category for work and energy materials, and a score of 0.835 and a high category for momentum and impulse materials. Based on the results of the analysis of the degree of construct validity, it can be concluded that the ability of class X students in science can be evaluated using a five-level multiple-choice e-instrument on the topics of work and energy, momentum, and impulse.

– *Content validity aspect*

The content validity component consists of 1) The suitability of the questions in the application with learning indicators, 2) The suitability of the questions in the application with the concept, 3) The suitability of the questions asked with the material studied in SMA/MA, 4) The suitability of the material being asked with the composition (urgency, relevance, continuity, high daily usability), 5) Appropriateness/accuracy of the questions with each scientific literacy indicator, 6) Detractors (tier 1 and tier 3) functioning, 7) Homogeneous and logical answer choices, 8) Questions (tier-1) only has one correct answer, 9) The reason (tier-3) has only one correct answer, 10) The references used are appropriate and adequate. The average value of each indicator in each of the content validity questions can be seen in Table 4.

Table 4. The Average Value of Each Content Validity Indicator on Each Question

Work and Energy		Momentum and Impulse	
Value of V aiken	Category Validity	Value of V aiken	Category Validity
0.88		0.88	
0.88		0.90	
0.86		0.89	
0.88		0.89	
0.89		0.87	
0.89	High	0.88	High
0.86		0.88	
0.89		0.89	
0.88		0.90	
0.87		0.90	
0.879	High	0.888	High

Based on Table 4, it can be seen that for the content validity aspect of the work and energy material, values ranged from 0.86 to 0.89 so that all items were declared valid. Meanwhile, on momentum and impulse materials, values ranged from 0.87 to 0.90 so that all items were declared valid. The assessment obtained on the content validity aspect has an average of 0.879 with a high validity category on the work and energy material and has an average of 0.888 with a high category on the momentum and impulse material. Based on the results of the analysis of the level of content validity, it can be stated that the content of the five-tier multiple choice on the material of effort and energy, momentum and impulse in terms of content is appropriate to be used to assess the scientific literacy of class X students.

– *Aspects of display validity*

The display validity component consists of 1) The font, size and space used in the application are appropriate, 2) The test application developed is equipped with clear question instructions, 3) Pictures, videos and the like are clear and functional, 4) Pictures, videos and the like in accordance with the problems presented, 5) Pictures, videos and the like are interesting and the color composition is appropriate, 6) The main questions (tier-1), reasons (tier-3) and confirmation of answers (tier-5) are clearly formulated, 7) The main points the question does not give clues to the correct answer, 8) The subject matter does not contain double negative statements, 9) The sentences used do not cause multiple interpretations, 10) The length of the answer choices is relatively the same, 11) The answer choices presented are homogeneous and logical, 12) The answer choices does not contain the statement "all answers above are correct" or "all answers above are incorrect", 13) The item does not depend on the answer to the previous question. The average value of each indicator on each question of the validity of the display can be seen in Table 5.

Table 5. The Average Value of Each Display Validity Indicator on Each Question

Work and Energy		Momentum and Impulse	
Value of V aiken	Category Validity	Value of V aiken	Category Validity
0.89		0.88	
0.89		0.88	
0.88		0.91	
0.88		0.89	
0.89		0.91	
0.89	High	0.92	High
0.88		0.88	
0.88		0.87	
0.88		0.88	
0.88		0.90	
0.885	High	0.892	High

Based on Table 5, it can be seen that for the aspect of display validity on the work and energy materials, values ranged from 0.88 to 0.89 so that all items were declared valid. Meanwhile, on the momentum and impulse materials, values ranged from 0.87 to 0.92 so that all items were declared valid. The assessment obtained on the aspect of content feasibility has an average of 0.885 with a high validity category on the work and energy material and has an average of 0.892 with a high category on the momentum and impulse material. Based on the results of the analysis of the display level, it can be stated that the contents of the five-tier multiple choice on the material of effort and energy, momentum and impulse in terms of construct feasibility are feasible to be used to assess the scientific literacy of class X students.

– *Aspects of language validity*

The language used must be comprehensible, conform to Indonesian language rules, not be localised, and not offend someone because of their nationality, race, or religion. These four criteria make up the language validity component. Table 6 displays the average result for each indication in each of the linguistic validity questions.

Based on Table 6 above, it is clear that all items were deemed genuine for the language validity feature in the area of work and energy because values ranged from 0.93 to 0.95. All items were deemed genuine because the values for momentum and impulse materials ranged from 0.90 to 0.95. The assessment of the content's viability has an average score of 0.936 for the labour and energy material and a score of 0.927 for the momentum and impulse material, both with high validity categories. Based on the findings of the language level analysis, it can be concluded that the material covered in the five-tier multiple choice exam on effort and energy, momentum, and impulse in terms of construct feasibility is suitable for use in evaluating class X students' scientific literacy.

Table 6. The Average Value of Each Languange Validity Indicator on Each Question

Work and Energy		Momentum and Impulse	
Value of V aiken	Category Validity	Value of V aiken	Category Validity
0.95		0.93	
0.94		0.93	
0.93		0.95	
0.94		0.93	
0.93		0.91	
0.94	High	0.95	High
0.94		0.93	
0.93		0.90	
0.94		0.91	
0.95		0.93	
0.936	High	0.927	High

– *Aspects of application/software usage validity*

The validity component of using the application consists of 1) Appropriateness of the application title in providing an overview of the application, 2) Clarity of application usage guidelines, 3) Appropriate use of buttons in applications, 4) Consistency of layout proportions (layout of text, images and videos), 5) Clarity and the completeness of filling in the biodata of the test takers, 6) The suitability of the text, images and videos used in the question material, 7) Confirmation of exiting the application that is used communicatively,. The average value of each indicator on each question of the feasibility of using the application can be seen in Table 7.

Table 7. The Average Value of Eachusing the Application Validity Indicator on Each Question

Work and Energy		Momentum and Impulse	
Value of V aiken	Category Validity	Value of V aiken	Category Validity
0.91		0.91	
0.91		0.91	
0.91		0.91	
0.91		0.91	
0.91		0.91	
0.91	High	0.91	High
0.91		0.91	
0.91		0.91	
0.91		0.91	
0.91		0.91	
0.910	High	0.910	High

Based on Table 7 above, it can be seen that for the feasibility aspect of using the application on business and energy materials, a value of 0.91 is obtained so that all items are declared valid in the application used. Meanwhile, the momentum and impulse material obtained a value of 0.91 so that all items were declared valid in the application used. Based on the results of the analysis of the level of use, it can be stated that the contents of the five-tier multiple choice on the material of effort and energy, momentum and impulse in terms of the feasibility of using the application are suitable to be used to assess the scientific literacy of class X students.

Conclusion

Based on preliminary research through document analysis on 5 schools in Solok district, teachers are constrained in analyzing scientific literacy and students' level of conceptual understanding. First, students experience misconceptions in some material on physical quantities related to the concepts of work and energy and momentum and impulse. The five-tier multiple choice instrument is a test instrument consisting of five levels as follows: The first a variety of answer options, Second, the degree of confidence in selecting the right response, Third, a variety of first-level justifications for selecting the right response, Forth, the degree of confidence in selecting the right justification at the third level, and fifth, confirmation of answers in the form of illustrations, deductions, equations, and other forms. The five-tier multiple-choice test was developed to evaluate high school/MA students in class X's conceptual grasp of the work and energy, momentum, and impulse material. The results of content validation by experts show that the five-tier multiple choice instrument on the material of work and energy and momentum and impulse has a high validity value. The characteristics of the validity of this product are valid in the aspects of construction, content, appearance, language and use of this product application.

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