Development of a Minimum Competency Assessment (AKM) Based on a Computer Based Test (CBT) to Measure Scientific Literacy and Numeracy Abilities

Anggun Wulandari✉, Sudarmin Sudarmin, Bambang Subali, Sigit Saptono

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Universitas Negeri Semarang, Indonesia

Abstract

The Minimum Competency Assessment (AKM) is a measure of literacy and numeracy achievements, which is used to map the quality of education in Indonesia against international standards. To achieve the demands of the 21st century, one important aspect is assessment. Computer Based Testing (CBT) can be used as a solution for conducting digital assessments. This research aims to determine the quality and feasibility of the AKM instrument for scientific literacy and numeracy. This research method is R&D with the ADDIE type. This research sample used a purposive sampling technique with a sample of 100 students. Expert Validation is carried out by 5 validators. The results of the research show that the development of CBT-based A K M to measure scientific literacy and numeracy skills has very good quality with the average result obtained for scientific literacy being 4.66 and numeration obtaining an average validation score of 4.77. with the "very good" category. The results of the analysis of scientific literacy question types for the average multiple choice question type were 4.8, complex multiple choice 4.7, matching 4.7, description 4.9, and short essay 4.8 with statements of very good/valid quality. Meanwhile, the results of the analysis of numeracy question types for multiple choice question types averaged 4.6, complex multiple choice 4.4, matching 4.6, description 4.7, and short essay 4.7 with a statement that the quality of the five question types was very good/ valid. The feasibility of the AKM Scientific Literacy and Numeracy Instrument was obtained from the validity analysis of the 25 items. The results of the analysis using SPSS show that the number of valid questions is 21 questions in the Eligible category.

How to Cite

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✉ Correspondence Author:
E-mail: anggunwlndr@students.unnes.ac.id

INTRODUCTION

The Minimum Competency Assessment (AKM) is part of the UN. AKM is used as a measuring tool to measure the cognitive ability of students where the aspect measured is the ability of science literacy and numeracy literacy. AKM measures fundamental competencies that need to be learned by all students regardless of specialization. Therefore, all students will receive questions that can measure the same competency. The AKM set by the government is one part of the government's target to prepare students to face the 21st century, namely having Critical thinking skills, Creativity, Communication skills, and Collaboratively (Andiani, 2020).

Apart from that, students are required to be able to build understanding, work together, solve problems, work and utilize ICT (Information and Communication Technology), and be able to build creativity (Riordan & Rosas, 2002). According to Rosnaedi (2021), to achieve 21st-century learning goals, one of the important aspects is assessment. Assessment and learning cannot be separated, they are integrated. The quality of good learning can be seen from the quality of the assessment, and vice versa, the quality of the assessment can show the quality of the learning.

Literacy and numeracy skills are the most important part of AKM. These two abilities are important because literacy and numeracy skills are fundamental competencies needed by students regardless of their profession and future aspirations. Apart from that, literacy and numeracy skills are also related to making wise decisions in students' lives. The Minimum Competency Assessment planned for 2021 refers to the skills needs of the 21 century, the character to be achieved in the 2013 curriculum, and high-order thinking skills (HOTS) through literacy (Hidayatulloh et al., 2020).

The problems presented by AKM are in various contexts that students are expected to be able to solve using their reading and numeracy literacy competencies. AKM is intended to measure competency in depth, not just mastery of content. This is also relevant to scientific literacy assessments which not only measure aspects of student knowledge but emphasize scientific competence. According to Black & Wiliam, (2010) define assessment as activities carried out by teachers and students to obtain information that can be used to change the teaching and learning process. This is confirmed in Wiliam's journal that assessment is something effective, that has quite large potential in improving learning (Wiliam, 2011).

Scientific Literacy and Numeracy abilities are important factors for a country's progress in living life in the era of globalization. This literacy ability must also be balanced with developing competencies which include critical thinking/problem-solving skills, creativity, communication, and collaboration. Both are useful in supporting sustainable development (Udompong & Wongmanich, 2014. Winata (2021) states that these two abilities are important because literacy and numeracy skills are fundamental competencies needed by students regardless of their profession and future aspirations. In addition, the ability literacy and numeracy are also related to making wise decisions in students' lives.

According to Asyhari (2017), scientific literacy is defined as the ability to use knowledge possessed scientifically, identify a problem, and draw scientific conclusions to make decisions in everyday life. According to the Organization for Economic Co-operation and Development (OECD), since 2000, the first time Indonesia became a PISA participant, students' scientific literacy abilities have never achieved above-average results (OECD, 2019). Improving students' literacy skills, innovative and literacy-oriented learning in the form of reasoning, not just memorizing, needs to be applied to every subject.

Scientific literacy and numeracy skills are designed to encourage the implementation of innovative learning that is oriented towards developing reasoning abilities, not focusing on memorization. The development of computer technology has also had a significant influence on developments in the field of education. One of them is providing convenience in the test field. The presence of a computer-based examination system often known as Computer Based Testing (CBT) can be used as a solution for conducting digital assessments.

Science is one of the subjects at the junior high school level. Science subjects are one aspect that is the main assessment in the learning process to determine students' abilities. This is in line with the opinion of Sudarmin (2015) who stated that science learning was developed as an integrative science subject and not as disciplinary education. Science education is applied-oriented, developing thinking abilities, learning abilities, curiosity, and developing caring and responsible attitudes towards the social and natural environment. This happens because the learning process at school is a determining component of success in achieving competency (Nabilah, 2020). The application of scientific literacy in science learning can be developed from problems, events, and

issues that develop in the surrounding environment. So, students can apply their knowledge and provide solutions in solving a problem (Ardianto, 2016).

Setiawan, et al (2017) stated that there are other factors such as potential, regional characteristics, social culture of the community, and the diversity of Indonesian students. These factors will certainly influence aspects of students' learning and scientific literacy abilities. This is in line with the opinion of Sudarmin (2014) who stated that the low level of scientific literacy and quality of education in Indonesia is thought to be caused by a lack of attention to the socio-cultural environment as a source of learning. Therefore, it is necessary to innovate in the field of education, one of which is assessment using AKM-based CBT.

Computer-based assessment has become an assessment standard in various countries and has become an interesting topic in the field of education (Walter, 2006). The interesting thing about computer-based assessments can be seen in design, animation, and other media. Apart from that, computer-based assessment can make it easier for teachers to create random questions in a short time. For score reporting, students can see directly the results obtained, making it easier for teachers to correct answers (Rendik & Nur, 2014). In 2015, the government began to introduce the Computer-Based National Examination (UNBK), namely a system for implementing National Examination assessments using computers as the test medium (Kusaeri, et al. 2018). In this era of rapidly developing technological advances, most students are more interested in learning and evaluation activities that utilize this technology, for example by using Quiziz. , Kahoot and Wondershare Quiz Creator compared with traditional evaluation tools in the form of sheets of paper (Ayuningtyas, et al. 2023)

Next to analyze the quality of SMP Science AKM using a Computer Based Test (CBT) and produce a viable Computer Based Test (CBT) AKM instrument. The benefit of this research is to produce a CBT-based research instrument that teachers can use to measure students' scientific literacy and numeracy abilities.

METHOD

Research Design and Procedures

The research method used is research and development (R&D). The development steps in this research adapt the ADDIE model. The development stages include *Analysis, Design, Develop-ment or Production, Implementation or Delivery, and Evaluations*. The ADDIE model developed can be seen in Figure 1.

Figure 1. Stages of the ADDIE Development Model

Data collection techniques in this research are questionnaires, interviews, test questions, and documentation. The data sources and subjects in this research are students and validators. This research used a sample of 100 class VIII students at SMP IT Bina Amal and MTsN Semarang and 5 validators with 2 validators being UNNES lecturers while 3 validators were science teachers with Masters qualifications.

Data collection uses research instruments which include validation instruments, student questionnaires, and test sheets consisting of Science Literacy and Numeracy questions. The scientific literacy and numeracy questions consist of 5 types of questions, namely multiple choice, complex multiple-choice, description, matching, and short essay. The first data collection technique is a validation sheet by experts to see the appropriateness of testing the before-used student. The data collection technique used in this research is by using test instruments. The test is used to measure students' numeracy literacy skills by looking at the validity and reliability, level of difficulty, and differentiating power of the test. The next data collection technique is document analysis. The documents analyzed are student test results. Through documents, researchers can measure students' numeracy and literacy abilities.

Data analysis technique

This research data analysis technique includes instrument analysis CBT-based AKM to measure scientific literacy and numeracy skills with validity test, reliability, level difficulty, And Power differentiator. Test appropriateness AKM Instruments by Expert with V-Aiken. A questionnaire test was carried out to determine students'

responses to the CBT-based AKM Instrument to measure scientific literacy and numeracy skills. Calculations to determine product suitability are obtained from assessments given by several experts (expert judgment) which are then processed using the V-Aikens formula. The scores obtained are then analyzed using the formula:

$$\text{Eligibility} V = \frac{\Sigma s}{[n(c-1)]}$$

Information:
S = r -Io
N = number of validators
C = highest assessment number
Io = lowest assessment number
r = number given by the assessor

Table 1. AKM Eligibility Criteria

Range	Category
V≥4.20	Very good
3.40≤V<4.20	Good
2.60≤V<3.40	Pretty good
1.80≤V<2.60	Not good
V≤1.80	Not good

Reliability

Media reliability data was obtained after testing the validity of the test into the moment. Reliability analysis techniques can be calculated using the *alpha formula* as follows:

$$r_{11} = \left(\frac{k}{k-1}\right)\left[1 - \frac{\sum \sigma_b^2}{\sigma_t^2}\right]$$

Information:
r_{11}: Media reliability
K: The number of questions
σ_b^2 : Number of variant items
σ_t^2 : Total variance

In the calculations, the SPSS version 20 program was used to calculate the *Cronbach's Alpha value, and* then to determine the reliability category, which can be seen in Table 2.

A test can be said to be reliable if the reliability coefficient is more than 0.40 or at least within the medium criteria. However, if the reliability value is low, the researcher will revise the test.

Table 2. Test Reliability Criteria

Cronbach's Alpha Value	Criteria
0.80 – 1	Very high
0.60 – 0.80	Tall
0.40 – 0.60	Currently
0.20 – 0.40	Low

RESULT AND DISCUSSION

Results

Development research *(Research and Development)* has been carried out using the ADDIE *(Analyze, Design, Development, Implementation,* and *Evaluation) procedure.* The resulting product is a prototype of the AKM instrument for science iteration and numeracy. Based on data collection and research carried out at MTsN Semarang and SMP IT Bina Amal, research results were obtained in the form of initial stages and final stage research results. The AKM science literacy and numeracy instruments were analyzed based on the researcher's findings through initial observations as follows.

Researchers carry out needs analysis activities that aim to analyze problems. The first analysis is curriculum analysis by conducting interviews with 2 junior high school teachers and 1 MtsN teacher adjusted to the curriculum used in schools. Curriculum analysis was carried out using the interview method. According to the results of the interview, SMP IT Bina Amal Semarang and MTsN Semarang use a curriculum that is adapted to the learning guidelines that apply to the Merdeka Curriculum for classes VII and the 2013 Curriculum for classes VIII and IX. From the results of the interview activities in the needs analysis, the researcher prepared the final product in the form of "AKM Questions to Measure Students' Scientific Literacy and Numeracy Abilities".

Researchers design Literacy and Numeracy questions by writing AKM question items. The initial step taken by the researcher is determining the behavior to be measured and formulating the material that will be used as the basis for questions (stimuli) in a certain context according to the desired behavior. The application used is *Wondershare Quiz Creator* (WQC). Researchers use this application because it is *user-friendly*, there is no

need to use difficult programming languages, and there is time management, *feedback,* and randomization of questions.

scientific literacy questions and 12 numeracy questions each. The materials used in this research are motion, force, and simple planes. Researchers used the *Wondershare Quiz Creator* (WQC) application to create questions. WQC is a piece of *software* that can be used to create questions, quizzes, or tests online (Haida, 2017). The use of this *software is very user friendly* or familiar and very easy to use so there is no need for a complicated programming language (Jayanta, 2013). This is supported by Haida (2017) who states that WQC is a type of software that is used to create various types of questions with different levels of difficulty and in flash format.

The *Prototype Display images* of the AKM Scientific Literacy and Numeracy Instrument can be seen in Figure 2, Figure 3, Figure 4, and Figure 5.
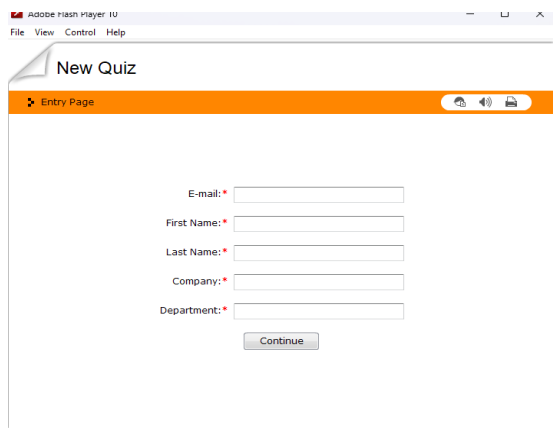

Figure 2. *Wondershare Quiz Creator's* initial display

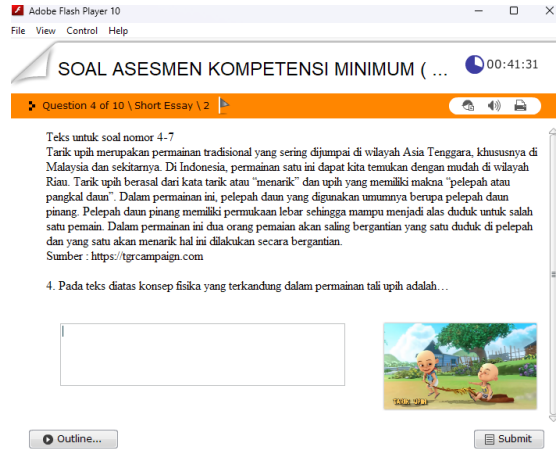**Figure 3.** Display of Working Instructions
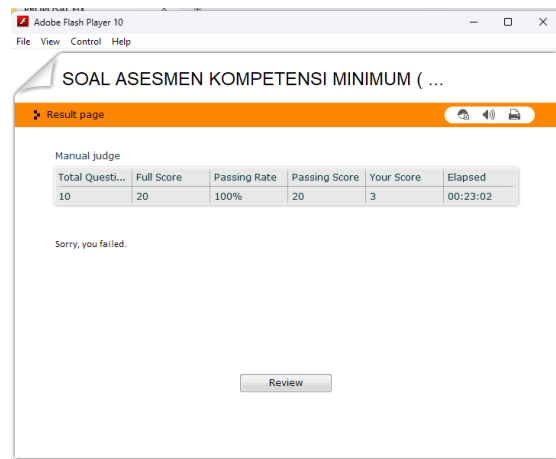

Figure 4 . Example of AKM questions

Figure 5. Final Score Display

In the initial menu display, there is a student identity that must be filled in before working on the AKM questions on scientific literacy and numeracy. After students fill in the *e-mail column*, first name, last name, class, and school of origin, students can then click *continue.*

After clicking *continue*, the next display is instructions for working on the questions. Before working on the questions, students are expected to read and understand them first. If you understand, you can then click on the section that says *Continue*.

The display in Figure 4 is a question about AKM science literacy and numeracy. In multiple-choice questions, there will be answer options A, B, and C. In complex multiple-choice questions, the answer option is the tick option, for short and clear questions you write the answer in the column provided, and then for matching questions, you have to match the correct answer. The step that must be taken is to click on the correct answer, then select submit, then the next question

will appear, and so on.

If students have finished working on the AKM scientific literacy and numeracy questions, the final score can be seen immediately. To see the work on the questions, click *review.*

Next, product trials for AKM instrument development to measure scientific literacy and numeracy have been validated and improved according to the validator's suggestions for improvement. The researcher prepared AKM questions which had been created based on the grid in the science literacy and numeracy question product. Researchers carried out implementation on 100 students consisting of 60 class VIII students at MTsN Semarang and 40 class VIII students at SMP IT Bina Amal Semarang. The first data collection was carried out at MTsN Semarang on November 23 2023 offline or face to face by distributing Science Literacy and Numeracy questions that had been prepared for students. Where the first data collection was tested in class VIII H with a total of 30 students.

The researcher started by sharing questions about scientific literacy and numeracy. Each student completes the questions individually then the AKM scientific literacy and numeracy questions are collected on the table. The second data collection was carried out on November 27, 2023. The AKM instrument trial was carried out in class VIII I with a total of 30 students. The final data collection was at SMP IT Binal Amal Semarang with a total of 40 students. Data collection was carried out on the date. Then, after the students had completed the AKM questions, the researcher distributed student response questionnaires regarding the scientific literacy and numeracy questions that had been worked on and the students filled in the questionnaires that had been provided.

The evaluation carried out by researchers consisted of two stages, namely formative evaluation and summative evaluation. Obtaining data from the summative evaluation is used to revise the quality of the AKM Science Literacy and Numeracy Instrument product, in addition to that, the results of the summative evaluation are used to determine the influence of the AKM Science Literacy and Numeracy Questions product on students' work results. The average validation results of scientific literacy and numeracy instruments for each type of question can be seen in Figure 6.
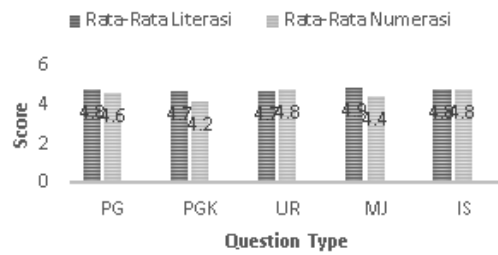

Figure 6. Results of Question Type Analysis

Based on the results of the expert validation analysis, it can be seen in Figure 6 that the five types of questions in science literacy received a score of > 4.20 with a valid or very good quality statement. This means that these five types of questions are declared valid for use. T types of numeracy questions can be seen and all five types of questions created are valid for use. The overall average validation results for each aspect can be seen in Figure 7.
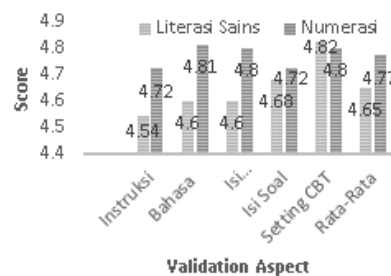

Figure 7. Expert Validation Chart

Based on Figure 7, the results of the expert validation above show that the average value for each aspect of the Science Literacy Instrument is 4, 66 with the statement "very worthy" to be used. While the overall average for aspects of the Numerical Instrument with an average of 4, 77 with the statement "very worthy". The result of member validation not only measures the product by giving a Value score, but the validator also explains his opinion in the column provided. The suggestions given by the validator are used by researchers in revising the product in the form of Science Literacy and Numeracy questions.

Results of Statistical Analysis of Question Items Using SPSS. Statistical analysis of the questions was carried out to determine the quality and improvement of each question item that was tested on 100 students. If the calculated R-value> R Table then the data is valid, whereas otherwise, the data is invalid. To find out whether

Table 3. Validity Test Results of Question Items

R Calculate (SPSS Output)	Decision-Making Criteria (R Table)	Information
0.133	0.1946	Invalid
0.183	0.1946	Invalid
0.072	0.1946	Tidak Valid
0.337	0.1946	Valid
0.505	0.1946	Valid
0.285	0.1946	Valid
0.505	0.1946	Valid
0.436	0.1946	Valid
0.245	0.1946	Valid
0.318	0.1946	Valid
0.338	0.1946	Valid
0.502	0.1946	Valid
0.417	0.1946	Valid
0.271	0.1946	Valid
0.287	0.1946	Valid
0.361	0.1946	Valid
0.153	0.1946	Tidak Valid
0.221	0.1946	Valid
0.355	0.1946	Valid
0.361	0.1946	Valid
0.395	0.1946	Valid
0.465	0.1946	Valid
0.353	0.1946	Valid
0.423	0.1946	Valid
0.506	0.1946	Valid

the question items are valid or not, see Table 3.

Data from the analysis of the percentage of questions are briefly summarized in Table 4.

Table 4 . Percentage of Valid and Invalid Question Items

Valid Question Item Categories	Percentage
Question items are valid	84%
The question item is invalid	16 %

According to Table 3. Results of analysis of validity trials on 25 scientific literacy and numeracy questions, data on questions number 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 11, 12, 13, 14, 15, 16, 18. 19, 20, 21, 22, 23, 24, 25 are valid because r calculated is greater than r table. Meanwhile, questions number 1, 2, 3, and 17 are invalid because the calculated r is smaller than the table r. Furthermore, to find out the reliability of an instrument, it can be seen from the SPSS output by looking at *Cronbach's Alpha value.* The following results of the analysis of the reliability test questions can be seen in Table 5.

Table 5. Results of Analysis of Reliability Test Items

Case Processing Summary			
		N	%
Cases	Valid	100	100.0
	Excluded	0	.0
	Total	100	100.0

a. Listwise deletion based on all variables in the procedure.

Reliability Statistics	
Cronbach's Alpha	N of Items
.689	25

According to the reliability analysis obtained above, a Cronbach's alpha figure of 0.692

was obtained, so this figure is greater than the minimum Cronbach's alpha of 0.6. Reliability testing determines whether the product is reliable or suitable for use. Whether an item is reliable or not is related to the validity of the question item, meaning that the low validity of the question item will affect the interpretation index of the question item's reliability (Ulfah et al., 2020). Therefore, it can be concluded that the 21 Scientific Literacy and Numeracy questions are reliable and have high reliability. The results of the reliability test will be used as the final product in the form of "AKM Test Instrument for Measuring Students' Scientific Literacy and Numeracy Abilities".

Discussion

Research into the development of a minimum completion assessment (AKM) based on *a computer-based test* (CBT) to measure scientific literacy and numeracy abilities has produced a set of questions containing CBT-based aspects of scientific literacy and numeracy. The types of questions developed consist of multiple-choice questions, complex multiple-choice questions, matching, short answers, and descriptions. The resulting prototype can measure scientific literacy and numeracy skills. The application used in this research is *Wondershare Quiz Creator* (WQC). Based on the results of the student response questionnaire, the level of practicality of using this application is very practical, because it is *user-friendly*.

The scientific literacy question instrument was developed in such a way with a different number of questions For every scientific literacy and numeracy competency. Many current issues, phenomena/problems need to be understood and associated with the concepts of simple motion forces and planes studied by the student. Scientific literacy is related to a person's way of thinking in analyzing and connecting things with Various scientific facts will have an impact on internal decision-making abilities to finish problems related to natural phenomena and their impact on human activities (Takda, 2023).

Apart from that, based on research by Astuti, (2023), it is known that many students still have difficulties in relating and using the concepts studied with phenomena that occur in life daily. Harianto's (2023) research results also show that students master it more easily scientific literacy abilities in the aspects of designing and evaluating scientific investigations which are compared to explain phenomena scientifically and interpret scientific data and evidence. Thus, the scientific literacy instruments in this research were developed with the competence to explain scientific phenomena much more than interpreting scientific data and evidence and evaluating and designing investigations scientific.

Researchers carry out formative evaluations by validating the products that have been created with experts or validators. Product validation is carried out by researchers before the development product is implemented for students. Product validation aims to obtain the validity and quality of the CBT-based AKM instrument to measure scientific literacy and numeracy abilities.

Product validity includes the overall assessment of the AKM Scientific Literacy and Numeracy instruments. The results of the expert validation analysis for the scientific literacy question type for the multiple choice question type obtained an average of 4.8 with a valid/very good quality statement. The complex multiple choice question type got an average score of 4.7 with a valid/very good quality statement, the matching question type got a validation average of 4.7, the description question type with an average of 4.9, the short answer question type with an average -an average of 4.8 means the quality statement for the matching, test and short form questions is valid/very good.

The results of the analysis of the numeracy question type for the multiple choice question type were with an average of 4.6 and the quality statement was valid/very good. Complex multiple choice question type with an average of 4.4 and a valid/very good quality statement, matching question type with an average of 4.6 and a valid/very good quality statement, description question type with an average of 4.7 and a statement valid/very good quality, short answer type questions with an average of 4.7 and valid/very good quality statements. Based on this data, the average analysis result for the literacy question type is higher than the numeracy question type. Based on the results of expert validation analysis of scientific literacy material for the instruction aspect, an average of 4.54 was obtained, the language aspect was obtained an average of 4.61, the question context aspect was obtained an average of 4.60, the question content aspect was 4.67, the CBT setting aspect obtained an average of 4.82. The overall average aspect is 4.66 in the very good category. So it can be said that the quality of the AKM Science Literacy instrument produced is very good and very suitable for use.

Meanwhile, the average value of the validation analysis results for the numeration questions in the instruction aspect has obtained an average of 4.72, the language aspect obtained an avera-

ge of 4.81, the question context aspect obtained an average of 4.80, the question content aspect obtained an average of 4.72, the CBT setting aspect obtained an average of 4.80 and the overall average of the aspects was 4.77 with the category very good and very suitable for use. So it can be said that the quality of the AKM Numeracy instrument produced is very good and suitable for use. This research produces scientific literacy and numeracy instruments that are valid and reliable. Thus, this instrument is a good instrument and suitable for use. As Arifin (2016) said, the preparation of a test should be adjusted to the principles and procedures for preparing test instruments. Similar research has also been carried out by I'anatul (2023) regarding the development of a scientific literacy-based assessment instrument using Quizizz to measure HOTS in science learning that the instrument meets feasibility in terms of material, construction, and language. This is the opinion of Aprianti (2022) who states that the development of numeracy literacy instruments produces valid and reliable instruments.

Next, the researchers carried out a summative evaluation by working on scientific literacy and numeracy questions as well as filling out student response questionnaires that had been completed. Researchers conducted a summative evaluation after product trials. From the results of the summative evaluation, researchers obtained the quality of the questions based on the results of students' work and then analyzed them using SPSS. A good test can certainly provide an accurate picture of student learning outcomes. In other words, a good test must be of high quality. Results of Statistical Analysis of Question Items Using SPSS. Statistical analysis of the questions was carried out to determine the quality and improvement of each question item that was tested on 100 students. If the calculated R-value> R Table then the data is valid, whereas otherwise, the data is invalid. R Table for 100 respondents with a significance level of 0.05 obtained an R Table value of 0.1946.

The results of the validity analysis using SPSS for the 25 Scientific Literacy and Numeracy questions showed that there were 21 valid questions while 4 questions were invalid. Valid questions are numbers 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16, 18, 19, 20, 21, 22, 23, 24, 25, while the questions invalid numbers 1, 2, 3 and 17. So of the 25 questions, 86% of the questions are valid and 16% of the questions are invalid. Furthermore, to find out the reliability of an instrument, it can be seen from the SPSS output by looking at *Cronbach's Alpha value*. According to the reliability

analysis obtained above, a Cronbach's alpha figure of 0.692 was obtained, so this figure is greater than the minimum Cronbach's alpha of 0.6. Reliability testing determines whether the product is reliable or suitable for use. It can be concluded that the 21 Scientific Literacy and Numeracy questions are reliable and have high reliability. This means that the scientific literacy-based assessment instrument that has been developed has a high level of reliability, that is, whenever this assessment instrument is tested on students, it will give relatively the same results.

The reliability technique for question items can be analyzed using the reliability coefficient formula with reliable criteria if r > r table (Sari et al., 2022). The results obtained were 0.636 which has a high level of reliability with the description "reliable". The results of the reliability test will be used as the final product in the form of "AKM Test Instrument for Measuring Students' Scientific Literacy and Numeracy Abilities".

The advantage of the product being developed is that there has been no development of the AKM instrument using the *Wondershare Quiz Creator* (WQC) application. Based on the research results, it can be said that the use of the WQC application is declared capable of being used as an AKM-based assessment. Able to measure students' scientific literacy and numeracy abilities. Apart from easy operation, making instruments using this application is also very easy. The types of questions that can be created with this application are very complex compared to other applications such as Quiziz, Edomo, Kahoot, and others. Apart from that, the questions developed in this research can make students interested and encourage them to solve the questions because they are in the context of the area around the students. The questions developed can be used as a stimulus for critical thinking, this is by Mahpi's research. A., Karim, & Hidayanto, T. (2023).

CONCLUSION

The conclusions in this development research are: The quality of the science literacy and numeracy AKM instruments based on the 5 validators obtained an average score for science literacy of 4.66 in the "very good" category. Meanwhile, for enumeration instruments. The feasibility of the science literacy and numeracy AKM instrument was obtained from the results of the validity analysis of the 25 scientific literacy and numeracy questions. The results of the analysis using SPSS show that the number of valid questions is 21 questions while there are 4 invalid

questions.

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