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Validity and Practicality of the Minimum Competency Assessment Instrument (AKM) for Reading Literacy and Numeracy Literacy of High School Students

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ABSTRACT

This study was motivated by the fact that teachers do not yet have a deep understanding of AKM reading and numeracy literacy, rarely use digital media, and the instruments used do not yet cover all competency indicators and socio-cultural contexts. The purpose of this study is to produce AKM instruments that are theoretically and practically valid, empirically valid, and reliable. The research method used is R&D with the ADDIE model. Validity data was obtained from the validation results of three expert lecturers, practicality data was obtained from teachers and students, and limited test data was obtained from 25 students at SMAN 13 Padang. The data collection techniques in this study used validity, practicality, and AKM instrument item instruments. This AKM instrument has been validated and declared valid with an average score of 0.95. The results of the practicality test by teachers and students had an average score of 89.94% with a very strong category. All test items were declared empirically valid and reliable. The reliability of the AKM instrument was 0.913 with a very high category. Thus, it can be concluded that the AKM instrument can be used to measure students' reading literacy and numeracy literacy. This study only developed instruments for temperature and heat material, so it needs to be developed for other physics material to be more complete. The trial was also limited to one school, so it is recommended to be expanded to three schools with low, medium, and high levels for better results.

Keywords: Instrument, Minimum Competency Assessment (AKM), Reading Literacy, Numeracy Literacy

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I. INTRODUCTION

National Assessment (AN) is an evaluation that replaces the National Examination (UN) conducted annually by the government. The results of this national evaluation are viewed by the Ministry of Education as a means to evaluate the performance of educational institutions and the quality of education they provide [1] . The purpose of this replacement is to encourage the advancement of education in Indonesia [2] . The Minimum Competency Assessment (AKM), Character Survey, and Learning Environment Survey are the three components of the National Assessment used to map the quality of education in Indonesia. AKM assesses the basic competencies needed by students to grow as individuals and contribute to society [3] . AKM measures two basic competencies, namely reading literacy and numeracy literacy [4] . Therefore, AKM is very important because it can help improve the quality of education and equal access to education.

Reading literacy and numeracy literacy are minimum competencies that students must acquire in order to function in society. Reading literacy is the ability to understand, apply, evaluate, and consider various texts to solve problems and improve one's ability to make positive contributions to society [5] . The ability to use mathematical ideas, methods, facts, and resources to solve problems in various real-world situations is known as numeracy literacy [6] . Therefore, AKM reading and numeracy literacy instruments can solve problems with various contexts in physics.

Based on the results of an observation questionnaire obtained from four physics teachers at SMAN 13 Padang, it was found that in conducting learning evaluations, teachers used test and non-test instruments, but

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teachers did not yet have a deep understanding of AKM reading literacy and numeracy literacy assessment, and teachers did not yet use AKM assessment instruments that covered all aspects of AKM. In teaching, teachers often use media, both print and visual media. Teachers rarely use digital media, so this study developed AKM questions using digital media, namely Wizer.me. Analysis of the questions on temperature and heat used by teachers showed that they did not cover all competency indicators in AKM, the number of items for each indicator was uneven, and the context used did not include socio-cultural contexts.

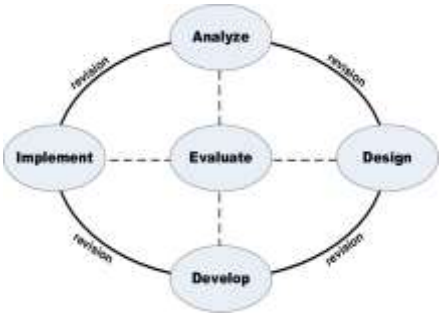
Possible reasons for the inadequacy of the AKM instruments include dense material that tends to test mastery of the material rather than reasoning skills [7] , teachers' complaints about repetitive, unvaried, and non-AKM-based teaching materials, the limitation of contexts relevant to students' daily lives [8] , and the lack of reference sources for AKM numeracy questions, which can reduce students' skills [9] . In addition, the low level of understanding of AKM instrument development is the main reason why AKM instruments are still inadequate.

Research conducted by Aulia et al [9] proves that AKM numeracy instruments are valid and practical, but their scope is still limited to numeracy literacy only. Similarly, research by Sanjaya & Derlina [10] produced good literacy and numeracy instruments in a socio-cultural context in mechanics material, but did not cover other contexts or reading literacy. These drawbacks suggest that a more thorough AKM tool is still required, one that employs a range of sociocultural, scientific, and personal settings and assesses reading and numeracy literacy. In order to meet these objectives, this work focuses on creating an AKM instrument with a wider perspective on temperature and heat material.

Based on the background of the problem described above, it is necessary to create an AKM instrument to measure students' reading and numeracy literacy in temperature and heat material. Thus, the purpose of this study is to produce an AKM instrument that is suitable for measuring students' reading and numeracy literacy. The suitability of the AKM instrument is determined based on the results of the instrument's validity and reliability tests.

II. METHOD

This research was conducted using the ADDIE development model as a guide. Branch [11] states that the ADDIE paradigm is divided into five stages: *analysis*, design, *development*, *implementation*, and *evaluation*. The following figure illustrates the five steps of the ADDIE model development process.



Figu. 1. ADDIE Model Stages [11]

The *analysis* stage is carried out in two stages. Performance analysis is the first step, which is used to categorize and identify issues with the assessment tools already in use in schools. Then, by creating AKM tools for reading and numeracy literacy, remedies are found. The second step is needs analysis, which identifies the evaluation tools that students require in order to raise learning quality and student performance.

The *design* stage involves an inventory of tasks aimed at identifying the tasks that must be carried out to achieve the objectives by selecting the type of assessment instruments to be used, then designing a draft of the AKM instruments consisting of learning objectives, an outline, instructions for use, instructions for completion, and designing questions based on the outline. Next, a testing strategy is designed to determine the feasibility of the instruments that have been developed.

The *development* stage includes: 1) creating the AKM instrument. 2) conducting a validation test. 3) revising the product according to the validator's suggestions. 4) conducting a practicality test. Validation tests are conducted to determine the suitability of the AKM instrument. Validation tests are conducted by physics lecturers from the Faculty of Mathematics and Natural Sciences, University of North Sumatra, who have experience in the field of physics. Criticism and suggestions from experts are used as material to improve the AKM instrument so that it becomes a valid product. Products that have been tested for validity are then tested for practicality in the field.

During the *implementation* stage, a limited trial was conducted with 25 students from class XII FL 1 at SMAN 13 Padang to determine the empirical validity and reliability of the test items. The AKM instrument is acceptable for use in reading and numeracy literacy assessments because validity ensures that the instrument can measure the right competencies and reliability ensures that the measurement results are reliable and consistent.

Finally, the *evaluation* stage was carried out to evaluate the developed product. There were two phases to the evaluation: formative and summative. With the goal of reducing errors, the formative evaluation was conducted at every stage, including analysis, design creation, and implementation. In the meantime, the summative assessment evaluated the final result. Determining the instrument's quality was the goal of the evaluation phase.

The data obtained from the validators is analyzed using the validity index proposed by Aiken's V because this method is able to provide a quantitative measure of the level of agreement between assessors on the relevance of the items to the indicators being measured. Thus, Aiken's V not only shows the suitability of the instrument's content but also represents the consistency of assessments between experts, so that the validation results are more objective and accountable [12] .

Based on the evaluation results of three lecturers with extensive knowledge on a particular topic, the content validity coefficient was calculated using the Aiken's V formula. The following is the Aiken's V formula used:

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

$$s = r - l_0$$

Explanation:
V = Validity index
l_0 = Lowest validity rating (in this case = 1)
c = Highest validity score (in this case = 5)
r = Score given by validator
n = Number of validators
s = Total sum of all validator scores

The criteria used in determining the validity of the AKM instrument can be seen in the following table.

Table 1. Product Validity Criteria

Interval	Category
0.88	Not valid
≥ 0.88	Valid

(Source: Ref[12])

The practicality data obtained was analyzed using the following formula:

$$\text{nilai akhir} = \frac{\text{jumlah skor}}{\text{skor maksimum}} \times 100\% \qquad (2)$$

The scores given by teachers and students were calculated based on these instructions, and the final results were matched with the Likert scale table.

Table 2. Product Practicality Criteria

No	Percentage	Category
1	0	Very weak

No	Percentage	Category
2	21-40	Weak
3	41-60	Moderate
4	61-80	Strong
5	81-100	Very strong

(Source: Ref [13])

After being tested for theoretical validity, the AKM instrument will also be tested for empirical validity. Student answers are analyzed using the *product moment* correlation formula:

$$r_{xy} = \frac{N\sum XY-(\sum X)(\sum Y)}{\sqrt{(N\sum X^2-(\sum X)^2)(N\sum Y^2)-(\sum Y)^2)}} \quad (3)$$

Explanation:

r_{xy} = correlation coefficient between variables X and Y

N = Number of respondents

X = Item score

Y = Question score

The AKM instrument, which has been empirically validated, shows that of the items analyzed, 27 items meet the validity criteria with a value of $r_{count} > r_{table}$, so the AKM instrument is suitable for use.

Table 3. Meaning of the product moment correlation coefficient

Correlation coefficient	Meaning
0.80-1.000	Very strong
0.60–0.799	Strong
0.40–0.599	Moderate
0.20–0.399	Low
0.00–0.199	Very low

(Source: Ref [14]

The reliability test in this study was conducted using the Cronbach Alpha formula:

$$r_{11} = \left(\frac{n}{n-1}\right)\left(1 - \frac{\sum s_i^2}{\sum s_t^2}\right) \quad (4)$$

Explanation:

r_{11} = Reliability coefficient

n = Number of items

s_i^2 = Total variance of scores from each item

s_t^2 = Total variance

To find the variance using the equation:

$$s_i^2 = \frac{\sum x^2 - \frac{(\sum s^2)_i}{n}}{n} \quad (5)$$

An instrument can be considered reliable if $r_{count} > r_{table}$, while the reliability criteria for the instrument itself can be seen in the following table.

Table 4. Instrument reliability criteria

Correlation coefficient	Correlation
$0.90 < r \leq 1.00$	Very high
$0.70 < r \leq 0.90$	High
$0.40 < r \leq 0.70$	Moderate
$r < 0.20$	Very low

(Source: Ref [15])

III. RESULTS AND DISCUSSION

This study began by distributing analysis questionnaires to physics teachers to assess the implementation of learning and observe the instruments used by teachers. It was found that teachers did not have a deep understanding of the AKM instruments, and the instruments used by teachers did not cover all competencies in the AKM. Next, an instrument grid was designed and developed into instrument items. The resulting AKM instrument consisted of 27 questions.

The instruments that had been created were validated by three expert lecturers with a total of 45 assessment options consisting of three components, namely content feasibility, construct feasibility, and language feasibility, which had a validity value ranging from 0.83 to 1.0 for each item. Based on the validation test results from the three validators, the average score of the AKM instrument was categorized as valid. According to Aiken[12] , a score range of >0.88 is considered valid. The results of the AKM instrument validation can be seen in the following table.

Table 5. AKM instrument validation results

Validated Components	Value	Category
Content Validity	0.96	Valid
Construct validity	0.94	Valid
Language validity	0.96	Valid
Average	0.95	Valid

The results of the analysis of the AKM reading and numeracy literacy instruments on temperature and heat are valid for each of the three components: content validity, construct validity, and language validity. Thus, this AKM instrument is suitable for use in field trials. This indicates that experts have a strong agreement on the relevance of the items to the competency indicators being measured. The consistency of the assessment strengthens inter-rater reliability, so that the instrument is not only assessed as substantively appropriate, but also valid. In line with Ibrahim [21] , a valid instrument will provide valid data for educational decision making.

Practicality tests should take into account both viewpoints to ensure that the instrument is both pedagogically appropriate and learner-friendly. Teachers evaluated the instrument's suitability in terms of efficiency, while students focused more on the instrument's ease of use and instruction clarity.

On the AKM instrument practicality sheet by teachers, there are three components that have been analyzed. For the ease of use component, 94.67%; the attractiveness component, 89.33%; and efficiency, 100%. Of all the components of the teacher's practicality assessment, they are in the very strong category. The average practicality score by teachers is 94.66%. Thus, the AKM reading literacy and numeracy literacy instruments are in the very strong category. The analysis of the average practicality of the AKM instrument by teachers can be seen below.

Table 6. Practicality scores of the AKM instrument by teachers

No	Assessment component	Practicality Score (%)	Description
1	Ease of use	94.67	Very strong
2	Attractiveness	89.33	Very strong
3	Efficiency	100	Very strong
Average		94.66	Very strong

On the AKM instrument practicality sheet, there are three components that have been analyzed. The attractiveness, efficiency, and ease of use components reached 84.67%, 81.2%, and 89.8%, respectively. These components are included in the very strong category of all student practicality assessment components. The average practicality score of students is 85.22%. As a result, the AKM reading and numeracy literacy instruments fall into the very strong category. The following table shows the analysis of the average practicality of the AKM instrument by students.

Table 7. Practicality scores of the AKM instrument by students

No	Assessment component	Practicality score (%)	Description
1	Ease of use	89.8	Very strong
2	Attractiveness	84.67	Very strong
3	Efficiency	81.2	Very strong
Average		85.22	Very strong

The validated AKM reading literacy and numeracy literacy instruments were then field tested. The AKM instrument trial aimed to determine the empirical validity and reliability of each item that had been created. A limited trial was conducted on a sample of 25 students in class XII FL 1 at SMAN 13 Padang.

An item is considered valid if $r_{count} > r_{table}$, for a sample of 25, a significance level of 5% based on the *product moment* correlation table $r_{table} = 0{,}396$. Empirical validity was tested by comparing the values $r_{count} > r_{table}$. The analysis showed that 27 items were valid with a moderate to strong interpretation, meaning that these items could be used. According to Sukardi[17] , these valid items can be used. Based on the overall results, the AKM instrument items were declared valid and can be used to measure students' reading literacy and numeracy literacy. The validity analysis results from the AKM instrument trial can be seen in the following table.

Table 8. Results of empirical validity analysis of items

Question No.	r_{tabel}	r_{hitung}	Criteria
1	0.396	0.528	Valid
2	0.396	0.450	Valid
3	0.396	0.426	Valid
4	0.396	0.413	Valid
5	0.396	0.447	Valid
6	0.396	0.502	Valid
7	0.396	0.480	Valid
8	0.396	0.513	Valid
9	0.396	0.439	Valid
10	0.396	0.641	Valid
11	0.396	0.513	Valid
12	0.396	0.406	Valid
13	0.396	0.696	Valid
14	0.396	0.521	Valid
15	0.396	0.467	Valid
16	0.396	0.747	Valid
17	0.396	0.788	Valid
18	0.396	0.506	Valid
19	0.396	0.705	Valid
20	0.396	0.760	Valid
21	0.396	0.711	Valid
22	0.396	0.690	Valid
23	0.396	0.746	Valid
24	0.396	0.632	Valid
25	0.396	0.526	Valid
26	0.396	0.606	Valid
27	0.396	0.482	Valid

Each valid item was then analyzed further to determine its reliability. The reliability calculation aimed to assess the consistency of the instrument. After analysis, the reliability of the AKM instrument was found to be

0.913, which is classified as very high, meaning that it can be used to measure reading literacy and numeracy literacy. A reliable instrument is considered suitable for use if it has sufficient to very high reliability criteria [18]. This indicates that the test instrument has high reliability, meaning that it will produce relatively comparable results when administered to students at different times. This is in accordance with Misda & Mukhlis [19] , who state that the results obtained are stable or consistent when an instrument is used repeatedly to measure the same object.

IV. CONCLUSION

Based on the results and discussion, it can be concluded that the AKM reading literacy and numeracy literacy instruments that were created are deemed feasible based on theoretical validity with an average validity value of 0.96 for the three validity components, namely content feasibility, construct feasibility, and language feasibility. Furthermore, its practicality has been tested with a very strong category with an average practicality score of 90% for teachers and students for the three components, namely ease of use, attractiveness, and efficiency. Finally, the instrument has been tested to be valid for 27 items and reliable with a reliability score of 0.913, which is classified as very high, so that the AKM instrument is feasible to be tested on a large scale.

The AKM instrument produced to measure digital-based reading and numeracy literacy skills uses wizer.me. In this study, the instrument was only developed for temperature and heat material. Future researchers can develop AKM instruments for other physics material to produce a more comprehensive instrument for measuring students' reading and numeracy literacy skills. In addition, this study is still in a small-scale trial with one school, so other researchers can test this AKM instrument on a large scale using three schools with low, medium, and high levels to obtain maximum results.

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