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Item Analysis of Minimum Competency Assessment (AKM) Information Text Literacy Level 5 Biology Based on Pisa Framework Review

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Abstract

Ideal condition of education field occurs when students' science and reading literacy fulfill the average international standards such as PISA and TIMSS. According to the 2018 OECD report, Indonesian students' science and reading literacy are at the lowest rank. Improvement of the assessment system from student evaluation using UN items to National Assessment using Minimum Competency Assessment (AKM) items has been attempted by the government, which can be accessed through the PUSMENJAR and PUSMENDIK web pages. Analysis of AKM simulation items is needed in an effort to review the feasibility of items and students' abilities in information text literacy. The purpose of the study was to analyze the characteristics of AKM items tested based on the review of the domains of science and reading literacy PISA qualitatively, to analyze the characteristics of AKM items tested in measuring student learning outcomes related to the literacy of information text on biology subject quantitatively, and to analyze students' abilities related to the literacy of information text based on the results of the AKM simulation test which was tested quantitatively. Type of research used is mixed method research with the research design is concurrent embedded design. The research respondents were 75 students of class X at SMA Islam Sultan Agung 1, SMA Kesatrian 2, SMA Teuku Umar, SMA Negeri 10 Semarang, and SMA Negeri 12 Semarang. Research instruments were 15 items of AKM level 5 biology simulation items with supporting data for student and teacher response questionnaires. For the quantitative analysis, the validity was estimated with the fulfillment of the criteria, includes MNSQ, ZSTD, and Pt Measure Corr outfit values. Determination of the item difficulty level and student ability level categories were based on the logit value obtained from the standard deviation. The qualitative analysis includes document study using the AKM simulation items along with the science and reading literacy framework PISA 2018. The results showed that the AKM simulation items tested had reached the entire domain of science and reading literacy PISA, but the items did not contain low and moderate aspects of the cognitive demands domain. Based on the item characteristic analysis using MINISTEP, for the item validity that S1, S2, S3 and S4 are categorized as valid, S5, S6, S7, S8, S9, S10, S11, S14, and S15 are categorized as valid with revisions, and S13 are categorized as discarded item. AKM simulation items tested had a test reliability of 0,81 with a good category. There are 2 items in the very difficult category, 4 items in the difficult category, 6 items in the medium category, and 3 items in the easy category. Person characteristic analysis in the form of the ability level of 75 students as respondents which had high ability to solve AKM simulation items for all types of item tested.

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INTRODUCTION

Asesmen Kompetensi Minimum (AKM) or Minimum Competency Assessment is a competency assessment in the form of 5 types of item, there are multiple choice, complex multiple choice, matching, short answer, and essay (Kemendikbud, 2020). According to Tohir (2019), AKM, which refers to international level practices such as the Program for International Student Assessment (PISA) and Trends in International Mathematics and Science Study (TIMSS), has been designed to produce information that triggers improvements in the quality of teaching and learning. In this case, it can improve outcomes of students learning. According to the type of literacy, AKM is divided into two, there are reading literacy and mathematical literacy. There are three domains contained in the AKM items, namely content, context, and process. The content contained in AKM reading literacy includes informational texts and fictional texts (Kemendikbud, 2020).

PISA is a triennial survey conducted by The Organization for Economic Co-operation and Development (OECD) (Stoet & Geary, 2020). The PISA assessment includes how well adolescents aged 15 years can apply certain skills in real-world situations (Jerrim et al., 2020). Each country that has joined as a PISA country partner must be able to complete the established procedures (Agustin, 2018). The implementation of PISA includes assessment of achievement in various academic domains and student attitudes (Stoet & Geary, 2020). There are three areas that PISA measures, namely reading performance, science performance, and mathematics performance (Kemendikbud, 2020). The domains of PISA science performance include knowledge, competence, context, and attitudes (Topilova & Kimsanova, 2021). The domains of PISA reading performance include cognitive processes, texts, and scenarios (Kemendikbud, 2020). PISA defines reading comprehension as an activity of understanding, using, reflecting on and engaging in the reading process. Involvement in these activities is able to motivate students in interpreting text construction, with the result that students have an interest or pleasure in reading (OECD in Rogiers et al., 2020). PISA assessment parameters are the extent to which students have acquired the key knowledge and skills necessary to fully participate in social and economic life (Agustin, 2018). The application of AKM as a national assessment in Indonesia is accompanied by the hope that students will be able to develop their knowledge and capacity until they can actively participate in the social environment (OECD in Rogiers et al., 2020).

The purpose of this study was to analyze the characteristics of the AKM items tested based on the review of PISA science and reading literacy domains qualitatively, to analyze the characteristics of the AKM items tested in measuring student learning outcomes related to information text literacy on biology subject quantitatively, and to analyze students' abilities related to information text literacy based on the results of the tested AKM simulation test quantitatively.

RESEARCH METHOD

The research method used is concurrent embedded design in mixed method research. The research was carried out in five high schools in Semarang city, including SMA Islam Sultan Agung 1, SMA Kesatrian 2, SMA Teuku Umar, SMA Negeri 10 Semarang, and SMA Negeri 12 Semarang in January- March 2022. The research population was science class students from the research location school. The sampling technique used is simple random sampling. The research sample was in the form of class X students who were randomly selected with the number of students was 75 students.

This research is divided into three stages, there are preparation stage, implementation stage and final stage. The preparation stage includes problem formulation, literature study, report generation, and instrument selection. The implementation stage includes determining the sample, retrieving data, and collecting data. The final stage includes data analysis based on a review of the PISA domain, results and discussions, and conclusions. Research instruments at the preparation stage are AKM simulation items grids, questionnaire indicators for student and teacher responses, item validation instruments, and questionnaire validation instruments. The research instrument at the implementation stage are AKM

simulation items sheets, student response questionnaires, and teacher response questionnaires. All instruments at the implementation stage have been previously validated using a validation instrument. In the final stage, research data was obtained in the form of answers to the results of instruments at the implementation stage which had been tested at the school where the research was carried out, both quantitative analyzed data and qualitative analyzed data.

Data were analyzed both qualitatively and quantitatively with a total of 75 samples of student answers collected. Qualitative analysis includes document study using the AKM simulation test instrument as well as the PISA 2018 science and reading literacy framework. The analyzed aspects include AKM simulation items' review based on the domains of PISA science and reading literacy profiles. These two aspects are described by domain of each literacy profile and grouped based on indicators of each domain. Quantitative analysis of research data using Rasch 1PL Item Response Theory (IRT) model assisted by the MINISTEP application to determine item validity, item reliability, item difficulty level, and student ability level. Proof of validity is based on the fulfillment of criteria including MNSQ, ZSTD, and Pt Measure Corrofit values. Determination of the category of item difficulty level and student ability level is based on the logit value. The final analysis stage is to analyze the supporting data in the form of student and teacher response questionnaires quantitatively in the form of a percentage of the answers comparison obtained with the maximum total score.

RESULTS AND DISCUSSION

PISA Science and Reading Literacy Domain Review in AKM Level 5 Biology Simulation Items

Qualitative analysis includes reviewing the AKM level 5 biology simulation items based on PISA science and reading literacy. The review of test instrument based on PISA science literacy includes four domains, there are knowledge domain, competence domain, context domain, and cognitive demand domain (Amanda, 2019). The review of test instrument based on PISA reading literacy includes three domains, there are there are cognitive process domain, text domain, and scenario domain (Kemendikbud, 2020). Based on the PISA science literacy review, the percentages of knowledge, competence, context and cognitive demand domains are 44,4%, 28,86%, 33,3%, and 11,1% respectively. The knowledge domain is the most domain that appears in the items instrument. Based on the PISA reading literacy review, the percentages of cognitive process domains, texts, and scenarios are 39,95%, 53,3%, and 24,95% respectively. The text domain is the most domain that appears in the items instrument.

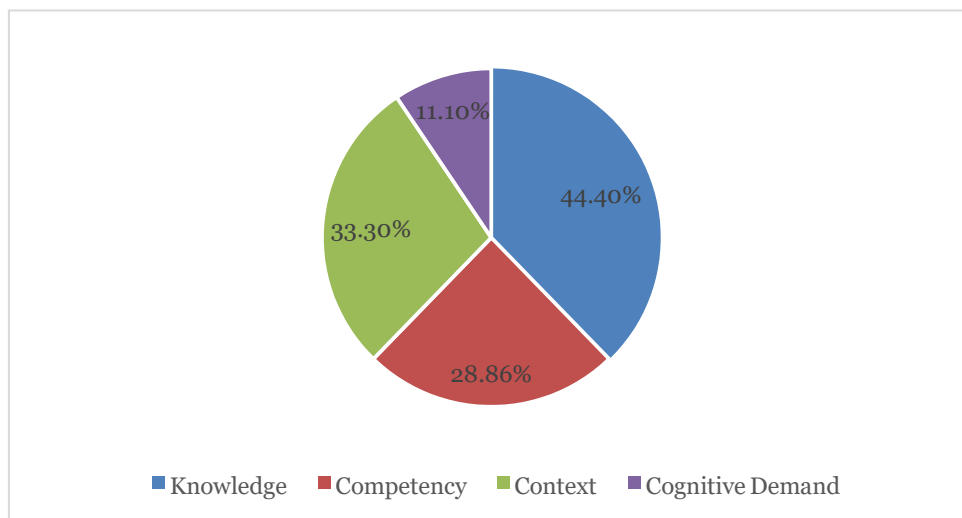


Figure 1 Percentage of Science Literacy Domain in AKM Level 5 Biology Simulation Items

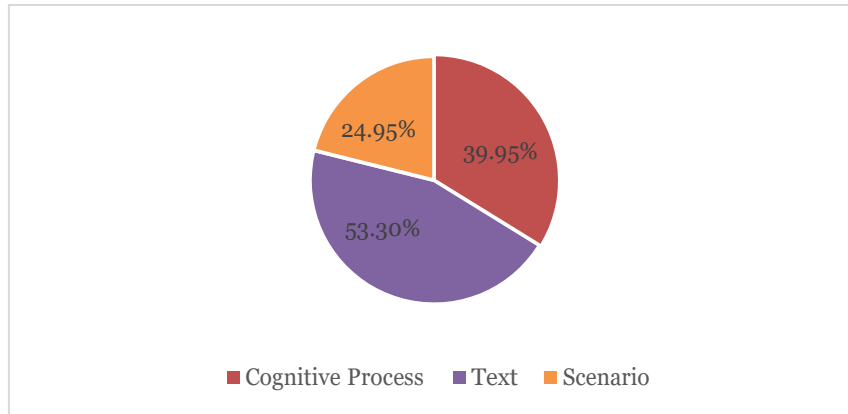


Figure 2 Percentage of Reading Literacy Domain in AKM Level 5 Biology Simulation Items

The review of the AKM simulation items based on the emergence of aspects in the PISA science and reading literacy domain was presented in the form of a percentage in a bar chart. Description of aspects in each domain is abbreviated in the attached codes in the table 1 and 2.

Table 1 PISA Science Literacy Framework

Domain	Code	Aspect	Code
Competency	A.1	Explaining Phenomena Scientifically	A.1.1
		Evaluating and Designing Scientific Research	A.1.2
		Interpreting Data and Evidence Scientifically	A.1.3
Scientific Knowledge	A.2	Content Knowledge	A.2.1
		Procedural Knowledge	A.2.2
		Epistemic Knowledge	A.2.3
Context	A.3	Personal	A.3.1
		Local/National	A.3.2
		Global	A.3.3
Cognitive Demand (Attitude)	A.4	Low	A.4.1
		Medium	A.4.2
		High	A.4.3

Table 2 PISA Reading Literacy Framework

Domain	Code	Aspect	Code
Cognitive Process	B.1	Searching for information	B.1.1
		Evaluation and Reflection	B.1.2
Text	B.2	Source	B.2.1
		Organization and Navigation	B.2.2
		Format	B.2.3
		Type	B.2.4
Scenario	B.3	Personal	B.3.1
		Public/Global	B.3.2
		Education	B.3.3
		Job	B.3.4

The emergence of aspects of the PISA science and reading literacy domain on the items instrument is described in the form of percentages. Description of each percentage generated based on the appearance of aspects on the AKM simulation items instrument can both be seen and be reviewed in the bar charts listed in figure 3 and 4.

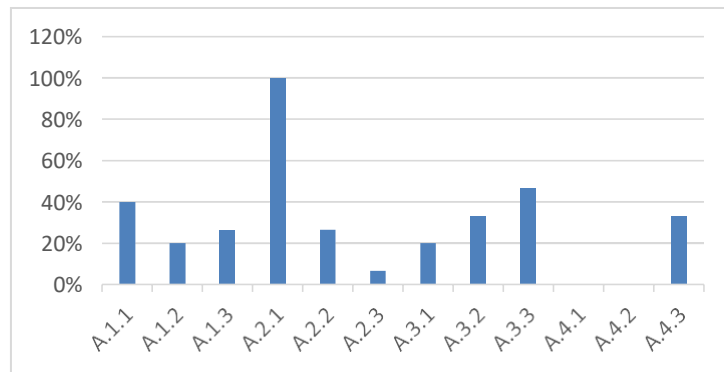


Figure 3 Science Literacy Profile of AKM Level 5 Biology Simulation Items

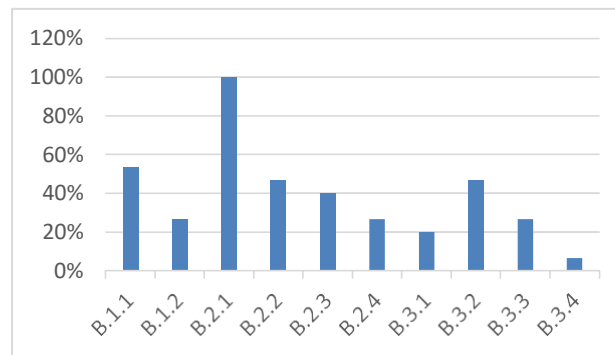


Figure 4 Reading Literacy Profile of AKM Level 5 Biology Simulation Items

The review of the test instruments tested based on the emergence of aspects in the science literacy domain showed that the most aspects that appeared in the items was content knowledge aspect (A.2.1) of knowledge domain, while the least aspects were low (A.4.1) and moderate (A.4.2) of cognitive demands (attitudes) domain. The review of the test instruments tested based on the appearance of aspects in the reading literacy domain showed that the most aspects that appeared in the items was source aspect (B.2.1) of text domain, while the least aspect was work aspect (B.3.4) of scenario domain. This indicates that the AKM level 5 biology simulation items did not contain cognitive demands domains at low and moderate levels, and the test instruments had not contained many situations that support the achievement of work tasks in the future.

Item Validity and Reliability

According to Boone et al. (2014), item validity was determined by qualify for the Mean Square (MNSQ) outfit value of $0,5 < MNSQ < 1,5$, the Z-standard outfit value (ZSTD) of $-2 < ZSTD < 2$, and the Point Measure Correlation (Pt Measure Corr) value of $0,4 < Pt Measure Corr < 0,85$.

Table 3 Validity of AKM Level 5 Biology Simulation Items

Item Number	Item Type	Outfit		PT Measure Corr	Categories
		MNSQ	ZSTD		
S1	Multiple Choice	1	0,02	0,5	Valid
S2	Complex Multiple Choice	0,84	-0,91	0,51	Valid
S3	Multiple Choice	1	0,04	0,43	Valid
S4	Complex Multiple Choice	0,98	-0,04	0,67	Valid
S5	Multiple Choice	1	0,1	0,31	Valid with revision
S6	Essay	0,99	0,09	0,14	Valid with revision

S7	Multiple Choice	1	0,22	0,17	Valid with revision
S8	Multiple Choice	1	0,17	0,21	Valid with revision
S9	Essay	0,82	-1,19	0,31	Valid with revision
S10	Essay	1,14	0,43	0,15	Valid with revision
S11	Multiple Choice	1,43	1,32	0,15	Valid with revision
S13	Essay	0,73	-2,19	0,51	Not valid
S14	Essay	1,18	0,63	0,29	Valid with revision
S15	Essay	1,11	0,71	0,33	Valid with revision

Proof of item validity resulted in 4 items categorized as valid, 9 items categorized as valid with revisions, and 1 item categorized as not valid. There are possibilities that underlie the reasons why the 9 items are categorized as valid with revisions, including different interpretations and responses inconsistencies that result in inaccurate modeling. In addition, large research samples tend to increase ZSTD value which affects the results of item validity (Tornabene et al., 2018). The S13 item included in the not valid category was caused by several factors, including the ZSTD outfit value of -2,19 which exceeds the applicable ZSTD outfit interval and the possibility of inconsistency of responses between students. Another assumption states that it is not necessary to have a good ZSTD value for the item validity. Wibisono in Yuliadinda et al. (2019) explained that if the items meet more than one criterion, then the items do not need to be removed. At the same case, editorial changes are enough. Furthermore, the test instrument was made by Pusat Asesmen dan Pembelajaran (2020) and has been published on the official website of the Kementerian Pendidikan dan Kebudayaan in 2021 with the result that the test instrument has met the item validity requirements.

Based on test reliability estimation, the test instrument obtained item reliability value of 0,81 with a good category using the Rasch model measurement reference mentioned by Boone et al. (2014). Good measurement occurs when the measurement is able to show a high level of reliability (Fitri, 2017). The high reliability is obtained from a constant variable with a consistent score. Tornabene et al. (2018) states that the sample is sufficient to support the item difficulty value and item fit value when the results of data analysis are obtained with a high Rasch item reliability value.

Tabel 4 Reliability of AKM Level 5 Biology Simulation Items

Item Type	Item Reliability	Categories
Multiple Choice	0,67	Fair
Complex Multiple Choice	0,84	Good
Essay	0,92	Excellent
Average	0,81	Good

Item Difficulty Level

Item difficulty level is the level of ability to answer students' items to find out whether the items tested are quite easy or difficult (Fatimah & Alfath, 2019). In Rasch modeling, item difficulty level is

categorized based on the logit measure value and the standard deviation (SD) logit item (Kurli et al., 2021). Standard deviation of the multiple choice, complex multiple choice, and essay are 0,9, 2,4, and 1,24 respectively.

Table 5 Difficulty Level of AKM Level 5 Biology Simulation Items

Item Number	Item Type	Total Score	Total Count	Measure	Categories
S1	Multiple Choice	61	75	1,17	Very Difficult
S2	Complex Multiple Choice	205	75	-0,28	Normal
S3	Multiple Choice	64	75	0,80	Difficult
S4	Complex Multiple Choice	177	75	1,54	Difficult
S5	Multiple Choice	69	75	0,01	Normal
S6	Essay	215	75	-0,85	Normal
S7	Multiple Choice	73	75	-1,21	Easy
S8	Multiple Choice	72	75	-0,78	Normal
S9	Essay	171	75	1,95	Very Difficult
S10	Essay	220	75	-1,64	Easy
S11	Complex Multiple Choice	215	75	-1,26	Normal
S12	Complex Multiple Choice	225	75	-5,02	Easy
S13	Essay	188	75	1,07	Difficult
S14	Essay	215	75	-0,85	Normal
S15	Essay	201	75	0,32	Difficult

Analysis of item difficulty level resulted in 2 items (S1 and S9) categorized as very difficult, 4 items (S3, S4, S13, and S15) categorized as difficult, 6 items (S2, S5, S6, S8, S11, and S14) categorized as normal, and 3 items (S7, S10, S12) categorized as easy. Item type with normal or medium difficulty dominates the entire category on the AKM level 5 biology simulation items. According to Fatimah & Alfath (2019), a good item has a difficulty level that is not too difficult and not too easy. The accuracy of the measurement accompanied by objective results can be obtained from the interaction between the subject and the test item which is described through the measurement of the response item (Yulianto & Widodo, 2020). Based on the research, 2 items categorized as very difficult, 4 items categorized as difficult, 6 items categorized as normal, and 3 items categorized as easy. There are items of each category so that the items are proven to be adequate in terms of measuring students' abilities. Items with difficult categories do not always mean that the items are good in testing students' abilities. This is because when the item has the highest level of difficulty, the discriminatory power will be low (Fatimah & Alfath, 2019). Moreover, Dewi et al., (2019) stated that an item is said to fail in measuring students' abilities if the item has poor difficulty level or discriminatory power. Inadequate targeting of item difficulty for students' ability levels is reflected by the selection of an instrument with a small distribution of items difficulty level categorized as difficult and easy (Davidson, 2009).

Student Ability Level

Students' ability level is determined based on respondent's logit value and standard deviation (SD) value of each type of items. The standard deviation of multiple choice, complex multiple choice, and essay items are 0,72, 1,12, and 0,86 respectively. The starting point for determining student abilities can be determined from the average value of logit person (Boone et al., 2014). The average value of logit person on multiple choice, complex multiple choice, and essay items are 2,38, 2,66, and 2,93 respectively.

Table 6 Student Ability Level

Item Type	Person Number	Logit Value (<i>Measure</i>)	Ability
Multiple Choice	1-39	3,07	High
	40-75	1,62	High
	1-17	4,39	High
Complex Multiple Choice	18-55	2,65	High
	56-75	1,18	High
	1-4	5,28	High
Essay	5-22	3,80	High
	23-59	2,70	High
	60-75	1,89	High

The results of students' ability on the type of multiple choice items show that all students get logit value greater than 0,72. The results of students' ability on the type of complex multiple choice items show that all students get logit value greater than 1,12. The results of student's ability on the type of essay items indicate that all students get a logit value greater than 0,86. In sum, 75 students as research respondents are categorized as having high abilities.

The role of the teacher in facilitating more effective learning process can be achieved with various activities, one of them is analyzing students' ability (Kurniawan & Andriyani, 2018). Student's Ability Level (person) is obtained from the person measure output value in the Ministep application. Measure column in the person measure outfit represents students's ability level in the logit unit (Risdianto et al., 2021). Classification of person ability level is determined based on logit value, standard deviation (SD), and the average of person's logit value. Log odds unit shows students' ability and item difficulty level. High and low ability of students are influenced by several factors, including students' interest in reading and writing, and whether or not participation of each students. Students' ability is relatively high in this research. This was strengthened by the acquisition of the score of the student response questionnaire, for 37 students obtained intervals score 81,81-100 and 38 students obtained intervals score 61,36-79,54. Both intervals score are classified as very high and high criteria.

Analysis of Student and Teacher Response Questionnaire

This study uses a response questionnaire involving students and teachers as respondents. Collecting student response questionnaire data aims to determine the extent to which students are able solve AKM simulation items level 5 information text literacy on biology subject, while teacher response questionnaire data collection aims to determine teacher responses regarding the feasibility of AKM simulation items tested based on a review of the PISA characteristic domains.

Table 7 Analysis of Student and Teacher Response Questionnaire Data

Type of Questionnaire Response	Respondent	Frequency	Score Interval (%)	Categories
Student response questionnaire	R1-R37	37	81,81-100	Very High
	R38-R75	38	61,36-79,54	High
Teacher response questionnaire	R1-R3	3	86,5-100	Very High
	R4-R5	2	75-76,9	High

Table 7 shows the results of the analysis of 75 students response questionnaire data. Based on the student's ability level to understand information text literacy, 37 respondents were categorized as very high and 38 respondents were categorized as high. This shows that the majority of students have high informational text literacy skills, in this case there is possible of the use of AKM items as an assessment instrument to be implemented in the future. Likewise, the results of response questionnaire data analysis of

5 teachers showed that based on the teacher's responses regarding the feasibility of the items instrument, 3 respondents were categorized as very high and 2 respondents were categorized as high. This shows that 5 respondents as biology teachers at the research location schools thought that the AKM level 5 biology simulation items were feasible to use, so as the use of AKM items as an assessment instrument was very possible to be implemented in the future.

The collection of student response questionnaire data aims to determine the extent of the ability or feasibility of an item or person in achieving a learning goal. General problems in the learning system can be revealed through analyzing student responses of learning, until there are solutions founded for these problems (Firmansyah, 2021). Student responses can be measured using a response questionnaire by paying attention to the number of positive or negative responses to each component of the questionnaire (Imelda & Anzelina, 2019).

Students' interest and motivation in good category indicate that students are motivated in terms of learning that will improve science and reading performance. This results in students trying to get maximum learning outcomes (Santini, 2014). On the other hand, low science and reading performance can be caused by students' interest in reading and writing as well as unequal participation of each students, that caused knowledge gap (Fadillah et al., 2021).

CONCLUSION

The review of items based on PISA science and reading literacy profiles concluded that the AKM level 5 Biology simulation items had reached the entire domain of PISA science and reading literacy, but the items did not contain low and moderate aspects of the cognitive demands domain. Items characteristics analysis includes proving item validity, estimating item reliability, and item difficulty level. Proving item validity resulted in varying levels of validity which were affected by the outfit values of MNSQ, ZSTD and Pt Measure Corr generated by each item. The test instrument had a test reliability of 0.81 with a good category. In the aspect of the item difficulty level, there are 2 items in the very difficult category, 4 items in the difficult category, 6 items in the medium category, and 3 items in the easy category. Person characteristics analysis in the form of the ability level of 75 students who have high abilities in solving AKM simulation items. Suggestions regarding better AKM simulation items in the future include equalizing the percentage of aspects appearing in the test instrument as well as adjusting the text of the items to the level of students in terms of content, context and process.

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