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Validating Test of Science-Related Attitudes (TOSRA) For Elementary Students In Mataram, Indonesia

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Abstract— The Test of Science-Related Attitudes (TOSRA) was initially developed in Australia by Barry J. Fraser in 1977 for high school students. This research aims to modify and validate the TOSRA used for 5th-grade elementary school students in Mataram, Indonesia. A survey model with a Likert scale questionnaire was used in the research and a purposive sampling strategy was used to recruit 318 students from 3 different elementary schools in Mataram. There were 4 of 7 indicators of TOSRA used in this research: attitude to scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, and leisure interest in science. From each indicator, 5 of the 10 statements on TOSRA are taken, so a total of 20 statements were presented in the questionnaire. Each item of the question was analyzed for its validity and reliability overall. The results showed that all question items are valid and reliable so this modified TOSRA can measure the science-related attitudes of 5th-grade elementary school students in Mataram, Indonesia.

Keywords—elementary student, science-related attitudes, TOSRA
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1. Introduction

The Test of Science-Related Attitudes (TOSRA) was initially developed in Australia by Barry J. Fraser in 1977 and 1978. TOSRA is designed to measure seven distinct science-related attitudes among secondary school students. It measures attitudes towards science regarding social implications, normality of scientists, attitude towards scientific inquiry, adoption of scientific attitudes, and enjoyment of science lessons. Over time, TOSRA has been used in various studies to investigate the attitudes of elementary school students toward science. Here is how TOSRA has evolved. Cross-cultural validation: A study conducted in the United States investigated the cross-cultural validity of TOSRA when used with American high school students. The results of the study revealed that the seven subscales of TOSRA were, in general, highly reliable. However, the discriminant validity of each of these scales was found to be generally low [1] (Khalili, 1987). Psychometric properties: Several studies have investigated the psychometric properties of TOSRA. A study conducted in Spain analyzed the psychometric properties of TOSRA, such as its construct validity, its discriminant and concurrent validity, and its reliability.

The evidence presented suggested that TOSRA, in its Spanish-adapted version, has adequate construct validity regarding its theoretical referents, as well as good indexes of reliability [2] (Navarro, et.al., 2016). Use in research: TOSRA has been used in various studies to investigate the attitudes of elementary school students toward science. For example, a study used an adapted version of TOSRA to measure students' attitudes towards science in Spain. The results showed that the TOSRA is a valid instrument for measuring elementary students' attitudes towards science [2] (Navarro, et.al., 2016). Another study used TOSRA to investigate the effects of integrative STEM instruction on elementary students' attitudes toward science. The study found that students participating in the integrative STEM project reported significantly more favorable attitudes toward science than students from traditional classrooms [3] (Ali, et. al., 2013).

Translation and validation: TOSRA has been translated and validated in different languages and cultural contexts. For example, a study conducted in Pakistan explored the psychometric properties of an Urdu translation of TOSRA. The results showed that TOSRA-Urdu has sufficient validity and reliability for subsequent research on Urdu-speaking people [4] (Khatoon, 2021). Another study conducted in Korea used TOSRA to investigate the attitudes of Korean elementary school students toward science [5] (Fraser & Lee, 2015). Overall, TOSRA has become a reliable and valid instrument for measuring elementary students' attitudes toward science. It has been used in various studies and has been translated and validated in different languages and cultural contexts.

Several previous research have been conducted outside of Indonesia. How about the research that used TOSRA in Indonesia? One study conducted in Aceh, Indonesia, explored elementary and secondary students' attitudes toward science learning based on gender and grade level of schools using TOSRA [6] (Nurfina, et. al., 2022). This study espoused five scales of TOSRA that are bonded to the exploration. The selected scales are the social implications of science, the normality of scientists, enjoyment of

science lessons, leisure interest in science, and interest in a career in science. Each scale consisted of 5 item number statements, so the total number of statements in the TOSRA questionnaire was 25 statements. Students were asked to indicate whether they strongly agree (SA), agree (A), undecided or neutral (N), disagree (DA), or strongly disagree (SD) with each statement of the instrument by using the Likert scale.

Another study aimed to develop high school students' attitudes toward chemistry learning through culturally responsive transformative teaching (CRTT) in Banten, Indonesia, and used TOSRA as one of the data collection instruments [7] (Najid, et. al., 2021). The data were anatomized through the original coding of the TOSRA instrument which consists of social implications of science, normality of scientists, attitude to the inquiry, adoption of scientific attitudes, enjoyment of science lessons, leisure interest in science, and career interest in science. A study conducted in Muaro Jambi district compared high school students' attitudes towards science subjects through three indicators, namely the social implications of science, attitudes towards investigation, and career interests in the field of science sourced from TOSRA [8] (Budiarti, et. al., 2020). Last, a study also conducted in Jambi, Indonesia, aimed to assess the relationship between student perceptions of teacher interpersonal behavior and student attitudes towards science in primary school using TOSRA [9] (Nasution, 2012). The study found that the questionnaires are relatively reliable for Indonesian primary students.

Based on the description above, before use to certain levels of school students, the TOSRA must be adapted and modified to suit language, cultural differences, validation, and interpretation to ensure that the instrument measures attitudes toward science validly and reliably across students. This research aims to adapt and modify TOSRA which was originally for measuring high school students' attitudes toward science to be suitable for measuring grade 5 elementary school students' attitudes toward science in Mataram, Indonesia.

2. Method

The Test of Science-Related Attitudes (TOSRA) has been used in various studies to investigate the attitudes of elementary school students toward science. However, before using the TOSRA, it is important to validate the instrument to ensure its reliability and validity, and this research just does that. Here are some steps to validate The TOSRA for elementary school students in this research:

1. Expert review: Experts in science education can review the test to ensure that it measures what it is intended to measure. The experts involved in this research were Professors of the Science Education Doctoral Program, Postgraduate, Mataram University, Indonesia, namely Prof. Joni, Prof. Wahab, and Dr. Gunawan.
2. Pilot testing: The test can be pilot-tested with a small group of students to identify any issues with the instrument, such as confusing or ambiguous questions. This test was carried out on 10 students of 5th grade elementary school and adjustments were made after receiving feedback on the modified TOSRA question instrument.
3. Field tests: The test can be administered to a larger group of students to gather data on its reliability and validity. This test was conducted on 318 5th-grade elementary students with modified TOSRA question instruments. A survey model with a Likert scale questionnaire was used in the research and a purposive sampling strategy was used to recruit 318 students from 3 different elementary schools in Mataram.
4. Statistical analysis: Statistical analysis can be used to determine if the test is reliable and valid and if it is measuring what it is intended to measure. The calculation of the validity of each item question and the reliability of the modified TOSRA instrument were analyzed using Microsoft Excel and IBM SPSS Statistic 27.

This research used 4 of 7 indicators of TOSRA, which are: attitude to scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, and leisure interest in science. From each indicator, 5 of 10 statements on TOSRA are taken, translated, and modified to Bahasa Indonesia, so that a total of 20 statements were presented in the questionnaire. Each statement in the modified TOSRA questionnaire consists of 11 positive statements and 9 negative statements with 4 attitude choices: “strongly agree”, “agree”, “disagree”, and “strongly disagree”. For a positive statement, the choice of “strongly agree” is worth 4 points, the choice of “agree” is worth 3 points, the choice of “disagree” is worth 2 points, and the choice of “strongly disagree” is worth 1 point. For a negative statement, the choice of “strongly agree” is worth 1 point, the choice of “agree” is worth 2 points, the choice of “disagree” is worth 3 points, and the choice of “strongly disagree” is worth 4 points. All students' answer choice has been given points and all data has been entered into Mc—Excel for further analysis of its validity and reliability. Validating a test of science-related attitudes for elementary students involves a comprehensive testing and analysis process to ensure that it is a reliable and valid instrument for measuring elementary students' attitudes toward science.

3. Result and Discussion

Four of the seven indicators of TOSRA which were adapted in this research are attitude to scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, and leisure interest in science. Another three indicators were not taken (social implications of science, normality of scientists, and career interest in science) because the researchers believe that these three indicators are less relevant to elementary school level students. These three things may be relevant when this test is intended for students at a higher level. From each indicator, 5 of 10 statements on TOSRA are taken, translated, and modified to Bahasa Indonesia, so that a total of 20 statements were presented in the modified TOSRA questionnaire. Indicators of TOSRA and several questions/statements in Bahasa Indonesia are presented in the following table 1.

For each question/statement in the modified TOSRA questionnaire, students were given 4 attitude choices: “strongly agree”, “agree”, “disagree”, and “strongly disagree”. In this case, it is also different from TOSRA which has 5 answer choices: “strongly agree”, “agree”, “not sure”, “disagree”, and “strongly disagree”.

Table 1. Indicators of TOSRA and number of item questions/statements in Bahasa Indonesia in the modified TOSRA questionnaire

No.	Indicators of TOSRA	Number of Questions / Statements (in Bahasa Indonesia)
1	Attitude to scientific inquiry	1, 2, 3, 4, 5
2	Adoption of scientific attitudes	6, 7, 8, 9, 10
3	Enjoyment of science lessons	11, 12, 13, 14, 15
4	Leisure interest in science	16, 17, 18, 19, 20

The answer choice of "not sure" was removed to prevent the emergence of undecided answers by students. Twenty questions/statements in the modified TOSRA questionnaire consist of 11 positive statements and 9 negative statements with the distribution presented in the following table 2.

Table 2. The distribution of positive and negative statements in the modified TOSRA questionnaire

Indicators of TOSRA	Question Item Number	Kind of Statement	
		Positive	Negative
Attitude to scientific inquiry	1	√	
	2		√
	3		√
	4	√	
	5		√
Adoption of scientific attitudes	6	√	
	7	√	
	8		√
	9	√	
	10		√
Enjoyment of science lessons	11	√	
	12	√	
	13	√	
	14		√
	15		√
Leisure interest in science	16	√	
	17		√
	18		√
	19	√	
	20	√	

Twenty question items of modified TOSRA that were used in this research, were arranged sequentially for each indicator and its statement. The statement for the first indicator was presented from number 1 to 5, the statement for the second indicator was presented from number 6 to 10, the statement for the third indicator was presented from number 11 to 15, and so was the statement for the fourth indicator was presented from number 16 to 20. This part of the modified TOSRA is also the difference from TOSRA. In TOSRA, each statement from each indicator was presented one by one in turn. This was done to make students at the grade 5 of elementary school level more focused in determining their attitude choices for each indicator. After going through expert review, pilot testing, and large-scale field tests, these 20 questions are presented in the following table.

Table 3. Questions / Statement of adapted and modified TOSRA in Bahasa Indonesia

No.	Questions / Statement (in Bahasa Indonesia)
1	Saya lebih memilih langsung melakukan percobaan IPA daripada hanya membacanya.
2	Saya lebih memilih mengikuti pendapat orang lain daripada melakukan percobaan untuk mencari tahu sendiri.
3	Saya lebih suka mencari tahu tentang berbagai hal tentang IPA dengan bertanya kepada ahlinya daripada melakukan percobaan.
4	Saya lebih memilih memecahkan masalah IPA dengan melakukan percobaan sendiri daripada langsung diberi tahu jawabannya.
5	Saya lebih memilih bertanya pada guru daripada mencoba mencari tahu sendiri dengan melakukan percobaan.
6	Saya senang membaca tentang hal-hal yang belum saya ketahui sebelumnya.
7	Saya tertarik untuk mengetahui tentang dunia tempat kita tinggal.
8	Saya menganggap bahwa mencari tahu tentang hal baru itu **tidak** penting.
9	Saya suka mendengarkan pendapat orang yang berbeda dengan pendapat saya.

10	Saya **tidak** mau mengubah pendapat saya ketika ada bukti yang menunjukkan bahwa pendapat saya salah.
11	Pelajaran IPA adalah pelajaran yang menyenangkan.
12	Sekolah harus menambah jam pelajaran IPA di setiap minggu.
13	Saya sangat senang mengikuti pelajaran IPA.
14	Materi yang ada dalam pelajaran IPA **tidak** menarik.
15	Pelajaran IPA di sekolah membuatku **bosan**.
16	Saya ingin mengikuti ekstrakulikuler sains di sekolah.
17	Saya merasa **bosan** ketika menonton program TV mengenai pengetahuan IPA di rumah.
18	Saya **tidak** suka membaca buku tentang IPA selama liburan saya.
19	Saya ingin melakukan percobaan IPA di rumah.
20	Saya ingin diberikan buku IPA sebagai hadiah.

The data analysis results of the validity and reliability calculation of each item question/statement above are presented in the following table.

Table 4. The validity and reliability results of adapted and modified TOSRA

Indicators of TOSRA	Question Item Number	r-result	r-tabel of N=318	Validity Decisions	Reliability
Attitude to scientific inquiry	1	0.34161	0.1103	valid	0.7135 (reliable)
	2	0.25961	0.1103	valid	
	3	0.19675	0.1103	valid	
	4	0.40385	0.1103	valid	
	5	0.23899	0.1103	valid	
Adoption of scientific attitudes	6	0.36164	0.1103	valid	
	7	0.28547	0.1103	valid	
	8	0.33987	0.1103	valid	
	9	0.11235	0.1103	valid	
	10	0.17227	0.1103	valid	
Enjoyment of science lessons	11	0.58357	0.1103	valid	
	12	0.51085	0.1103	valid	
	13	0.56694	0.1103	valid	
	14	0.55133	0.1103	valid	
	15	0.55706	0.1103	valid	
Leisure interest in science	16	0.37152	0.1103	valid	
	17	0.44905	0.1103	valid	
	18	0.50806	0.1103	valid	
	19	0.53789	0.1103	valid	
	20	0.56145	0.1103	valid	

Validity assesses how accurate the measuring instrument used is, while reliability assesses how consistent the measuring instrument is. Validity is an essential aspect of research studies. The importance of validity in research can be summarized as follows: 1. Ensures accuracy and consistency: Validity ensures that the research instrument used in the study is accurate and consistent in measuring what it is intended to measure. 2. Provides evidence of research quality: Validity provides evidence of the quality of research in various fields, including science education. 3. Helps in designing and conducting studies: Validity is important for designing and conducting studies, as it ensures that the study's findings accurately reflect what is being studied. 4. Helps in understanding published research: Validity is important for understanding the merits of published research, as it ensures that the study's findings are accurate and reliable. From the data analysis, all the statements in the modified TOSRA questionnaire are valid. It means that this “new instrument” can measure what should be measured and consistent for measuring science-related attitudes of 5th-grade elementary students in Mataram.

Validity refers to the extent to which a study measures what it is intended to measure. It ensures that the research instrument used in the study is accurate in measuring what it is intended to measure. It provides evidence of the quality of research in various fields, including science education. Validity helps in designing and conducting studies, as it ensures that the study's findings accurately reflect what is being studied. Lastly, validity can be established through content validity, construct validity, criterion validity, internal validity, and external validity. Overall, reliability and validity are both important considerations in science education research, as they ensure that the findings are consistent, reliable, and accurate. While reliability focuses on consistency and stability, validity focuses on accuracy and whether the study measures what it is intended to measure.

Reliability and validity are two important concepts in research studies, and they are often used together to ensure the quality of research. Reliability refers to the consistency and stability of research findings over time and across different conditions. It ensures that the research instrument used in the study is consistent in measuring what it is intended to measure. It provides evidence of the quality of research in various fields, including science education. Reliability helps in designing and conducting studies, as it ensures that the study's findings are consistent and reliable. Lastly, reliability can be established through psychometric testing, ensuring internal validity, and assessing external validity. From the data analysis, all the statements in the modified TOSRA questionnaire are reliable. The value of reliability also showed that the reliability of this new instrument is in a high-reliability

category. Moreover, these results also show that 5th-grade elementary school students with an age range of 10 years can provide assessments of positive and negative statements well.

Several studies have been conducted to validate instruments that measure elementary students' attitudes toward science. A study conducted in China developed and validated an instrument to measure upper-level Chinese elementary students' attitudes towards science. The instrument development was performed through expert review, small-scale pilot tests and student interviews, large-scale field tests, and validation. Factor analysis and Rasch analysis handed reliability and validity confirmation. The final instrument consisted of four dimensions: enjoyment of science learning, self-efficacy in science learning, the value of science learning, and intention to learn and do science [10] [11] (Guo, et. al., 2021, 2022). Another study validated the Test of Science-Related Attitudes (TOSRA) for elementary students in Spain. The study used an adapted version of the TOSRA to measure students' attitudes towards science. The results showed that the TOSRA is a valid instrument for measuring elementary students' attitudes towards science. The study concluded that integrative STEM instruction can improve students' attitudes toward science [1] (Khalili, 1987). A study conducted in Turkey used the Science and Technology Course Attitude Scale to measure the attitudes of elementary school students toward science. The results showed that elementary school students have positive attitudes toward science. Female students, students from urban schools, and students who want to pursue science-related jobs in the future had significantly higher scores than their counterparts. Moreover, the scores differed significantly as the students' families' income and their education level increased [12] (Çibir & Özden, 2017). A study conducted in Spain investigated the attitudes towards science and views of the nature of science among elementary school students in terms of gender, cultural background, and grade level variables. The study used the Nature of Science Instrument (NOSI) and an adaptation of the Test of Science Related Attitudes scale (TOSRA) to gather data. The results showed that boys had better attitudes towards science than girls but more naïve views of the empirical nature of science. Second-generation Spanish students with European heritage reported significantly better attitudes toward science than Spanish students and Spanish students of gypsy ethnicity. Third graders had more positive attitudes toward science than fifth and sixth graders and more informed views of the tentative nature of science [13] (Toma, et. al., 2019). Overall, validating instruments that measure elementary students' attitudes toward science involves a comprehensive testing and analysis process to ensure that they are reliable and valid instruments for measuring elementary students' attitudes toward science.

The Test of Science-Related Attitudes (TOSRA) has been adapted for use in different languages and cultural contexts. A study conducted in Pakistan explored the psychometric properties of an Urdu translation of TOSRA. The results showed that TOSRA-Urdu has sufficient validity and reliability to be used in subsequent research on Urdu-speaking people [4] (Khatoon, 2021). Further, a study conducted in Spain analyzed the psychometric properties of TOSRA, such as its construct validity, its discriminant and concurrent validity, and its reliability. The evidence presented suggested that TOSRA, in its Spanish-adapted version, has adequate construct validity regarding its theoretical referents, as well as good indexes of reliability [2] (Navarro, et. al., 2016). Furthermore, a study conducted in Korea used TOSRA to investigate the attitudes of Korean elementary school students toward science [5] (Fraser & Lee, 2015). The adaptation of TOSRA for use in different languages and cultural contexts involves a rigorous process of translation and validation to ensure that the instrument measures attitudes towards science validly and reliably across different populations. The process involves expert review, pilot testing, large-scale field tests, factor analysis, Rasch analysis, and statistical analysis to ensure the reliability and validity of the instrument. Overall, the adaptation of TOSRA for use in different languages and cultural contexts has allowed researchers to investigate the attitudes of elementary school students toward science more comprehensively.

Adapting the Test of Science-Related Attitudes (TOSRA) for use in different languages can present some challenges. Here are some of the challenges: 1. Translation: Translating TOSRA into another language requires careful consideration of the meaning of each question and the cultural context in which it will be used. The translation must be accurate and culturally appropriate to ensure that the instrument is measuring attitudes toward science validly and reliably. 2. Cultural differences: Cultural differences can affect the way that students respond to TOSRA questions. For example, some questions may be more relevant to students from certain cultural backgrounds than others. Adapting TOSRA for use in different languages requires careful consideration of these cultural differences to ensure that the instrument is measuring attitudes toward science validly and reliably across different populations. 3. Validation: Validating TOSRA in a different language requires a rigorous process of testing and analysis to ensure that the instrument is measuring attitudes toward science validly and reliably. This process involves expert review, pilot testing, large-scale field tests, factor analysis, Rasch analysis, and statistical analysis to ensure the reliability and validity of the instrument. 4. Interpretation: Interpreting the results of TOSRA in a different language requires careful consideration of the cultural context in which it was used. The results may not be directly comparable to results obtained using TOSRA in another language or cultural context. Overall, adapting TOSRA for use in different languages requires careful consideration of the translation, cultural differences, validation, and interpretation to ensure that the instrument is measuring attitudes toward science validly and reliably across different populations.

4. Conclusion

This research has adapted and modified the TOSRA that was used for 5th-grade elementary school students in Mataram, Indonesia. The data analysis showed that all the items of the modified TOSRA are valid and reliable. That result confirmed that this “new instrument” of TOSRA can measure the science-related attitudes of 5th-grade students in Mataram, Indonesia. For further research, researchers can adapt and modify TOSRA on the 7 (all) indicators, considering that this research used only 4 of the 7 science-related attitude indicators in TOSRA that were adapted and modified as developed by Barry J. Fraser (1987). Researchers can give some notes for using TOSRA in further research. First, TOSRA relies on self-reporting, which may not always accurately reflect students' attitudes toward science. Students may not be honest in their responses or may not fully understand the questions being asked. Second, while TOSRA is a reliable and valid instrument in some studies, its reliability and

validity may vary depending on the context in which it is used. Researchers should carefully consider the reliability and validity of TOSRA in their specific context before using it in their research. Last, TOSRA has been used in a variety of contexts, but its generalizability to other contexts may be limited. Researchers should be cautious when generalizing findings from TOSRA to other contexts. Overall, TOSRA is a useful tool for science education research. It has some limitations, including its limited scope, limited cultural relevance, reliance on self-reporting, limited reliability and validity, and limited generalizability. Researchers should carefully consider these limitations when using TOSRA in their research.

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6. Author Contributions

First author: writing research articles. Second and third authors: review and direct the substance of the article. Fourth, and fifth author: checking the draft research article. All authors have read and agreed to the published version of the manuscript.

7. Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this paper.

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Appendix 1. TOSRA in Bahasa

No.	Questions / Statement (in Bahasa Indonesia)
1	Saya lebih memilih langsung melakukan percobaan IPA daripada hanya membacanya.
2	Saya lebih memilih mengikuti pendapat orang lain daripada melakukan percobaan untuk mencari tahu sendiri.
3	Saya lebih suka mencari tahu tentang berbagai hal tentang IPA dengan bertanya kepada ahlinya daripada melakukan percobaan.
4	Saya lebih memilih memecahkan masalah IPA dengan melakukan percobaan sendiri daripada langsung diberi tahu jawabannya.
5	Saya lebih memilih bertanya pada guru daripada mencoba mencari tahu sendiri dengan melakukan percobaan.
6	Saya senang membaca tentang hal-hal yang belum saya ketahui sebelumnya.
7	Saya tertarik untuk mengetahui tentang dunia tempat kita tinggal.
8	Saya menganggap bahwa mencari tahu tentang hal baru itu **tidak** penting.
9	Saya suka mendengarkan pendapat orang yang berbeda dengan pendapat saya.
10	Saya **tidak** mau mengubah pendapat saya ketika ada bukti yang menunjukkan bahwa pendapat saya salah.
11	Pelajaran IPA adalah pelajaran yang menyenangkan.
12	Sekolah harus menambah jam pelajaran IPA di setiap minggu.
13	Saya sangat senang mengikuti pelajaran IPA.
14	Materi yang ada dalam pelajaran IPA **tidak** menarik.
15	Pelajaran IPA di sekolah membuatku **bosan**.
16	Saya ingin mengikuti ekstrakulikuler sains di sekolah.
17	Saya merasa **bosan** ketika menonton program TV mengenai pengetahuan IPA di rumah.
18	Saya **tidak** suka membaca buku tentang IPA selama liburan saya.
19	Saya ingin melakukan percobaan IPA di rumah.
20	Saya ingin diberikan buku IPA sebagai hadiah.
No.	**Questions / Statement (in Bahasa Indonesia)**
1	Saya lebih memilih langsung melakukan percobaan IPA daripada hanya membacanya.
2	Saya lebih memilih mengikuti pendapat orang lain daripada melakukan percobaan untuk mencari tahu sendiri.
3	Saya lebih suka mencari tahu tentang berbagai hal tentang IPA dengan bertanya kepada ahlinya daripada melakukan percobaan.
4	Saya lebih memilih memecahkan masalah IPA dengan melakukan percobaan sendiri daripada langsung diberi tahu jawabannya.
5	Saya lebih memilih bertanya pada guru daripada mencoba mencari tahu sendiri dengan melakukan percobaan.
6	Saya senang membaca tentang hal-hal yang belum saya ketahui sebelumnya.
7	Saya tertarik untuk mengetahui tentang dunia tempat kita tinggal.
8	Saya menganggap bahwa mencari tahu tentang hal baru itu **tidak** penting.
9	Saya suka mendengarkan pendapat orang yang berbeda dengan pendapat saya.
10	Saya **tidak** mau mengubah pendapat saya ketika ada bukti yang menunjukkan bahwa pendapat saya salah.
11	Pelajaran IPA adalah pelajaran yang menyenangkan.
12	Sekolah harus menambah jam pelajaran IPA di setiap minggu.
13	Saya sangat senang mengikuti pelajaran IPA.
14	Materi yang ada dalam pelajaran IPA **tidak** menarik.
15	Pelajaran IPA di sekolah membuatku **bosan**.
16	Saya ingin mengikuti ekstrakulikuler sains di sekolah.
17	Saya merasa **bosan** ketika menonton program TV mengenai pengetahuan IPA di rumah.
18	Saya **tidak** suka membaca buku tentang IPA selama liburan saya.
19	Saya ingin melakukan percobaan IPA di rumah.
20	Saya ingin diberikan buku IPA sebagai hadiah.