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Profile of Elementary Student's Science-Related Attitudes In Mataram, Indonesia

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Abstract — This research is a continuation of previous research by the authors. The modified TOSRA (Test of Science-Related Attitudes), originally developed by Barry J. Fraser in 1987 for secondary high school students, has been validated in the previous research to be suitable for elementary school students in Mataram. This research aims to obtain an initial profile of science-related attitudes of grade 5 elementary school students in Mataram generally, based on gender and based on the school. This research aims to identify students' science-related attitudes in four indicators: attitude to scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science. This descriptive ex post facto study explores the science-related attitudes of 318 students from 3 elementary schools in Mataram, Indonesia. The results revealed that there is a difference in indicator attitude to scientific inquiry. Still, there is no difference in the adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science between the students in these schools, and no significant differences in results based on gender overall.

Keywords: Elementary Student, Science-related Attitudes, TOSRA

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1. Introduction

The history of students' science-related attitudes in science education has been a topic of interest numerous times. Moreover, the importance of science education is increasing all over the world. One of the main objectives of science education is to make scientifically literate students or citizens rather than scientists [1]. Many studies reveal that students' negative or positive feelings about science are related to their attitudes toward science [1, 2, 3]. To understand and measure students' attitudes toward science, researchers have developed numerous instruments. Studies have discovered that students' positive attitudes toward science begin to reduce from 5th grade to the upper grades, and this scene affects their achievements in science and their understanding of scientific concepts [1]. Elementary science, the other subject teachers, the school curriculum, and the environment play major roles in influencing students' attitudes toward science [1]. Attitude, as an affective domain of learning, is an element affecting the learning outputs of students in science courses. Scientific attitudes of students direct their interest in lessons and simultaneously affect their long-term success in courses [2]. The importance of performing attitude studies emerges in obtaining positive outputs on scientific attitude. Individuals with positive scientific attitudes are more willing to identify and solve the problems in their surroundings [3]. At the student level, gender, socioeconomic status, and teacher-student relationship were significantly associated with attitudes toward science. Male students, who have better socioeconomic status and perceive better teacher-student relationships, adopt more positive attitudes toward science [4]. Overall, the history of students' science-related attitudes in science education has been a topic of interest for many years, and studies have shown that students' attitudes toward science can have a significant impact on their academic achievement and future career success.

Science-related attitude in education refers to the attitudes, beliefs, and values that students hold towards science and its related fields. It encompasses their interest in science, their perception of its relevance to their lives, their confidence in their ability to learn and apply scientific concepts, and their appreciation of the scientific method. Research has shown that positive science-related attitudes are associated with better academic achievement, increased motivation to learn, and greater interest in pursuing science-related careers [5,6]. Teachers play a crucial role in shaping students' science-related attitudes through their teaching methods, classroom environment, and personal attitudes toward science [7]. Therefore, educators need to foster a positive and engaging learning environment that promotes curiosity, critical thinking, and scientific inquiry.

Various studies explore the effects of science-related attitudes on elementary school students. The effect of science classes based on Havruta learning on the logical thinking and science-related attitude of elementary students. The study found that the experimental group, which took science lessons based on question-centered Havruta learning, showed higher improvement in logical thinking and science-related attitude compared to the comparative group, which took teacher-driven lessons using a

teacher's guidebook [8]. The effects of extracurricular science club activities on science-related attitudes of female elementary school students. The study found that meaningful changes have been observed in science-related attitudes of the experimental group, whereas the control group reveals no meaningful changes. Science-related attitudes have been analyzed in three categories: cognition, interests, and scientific attitude [9]. The experimental group shows significant changes in all of the three orders, while the control group shows no change in any order [10].

between students' science-related attitudes and intellectual, sensual, imaginational, psychomotor, and emotional overexcitability in order. Last, according to multiple regression analysis, factors affecting science-related attitudes were intellectual overexcitability and love among the types of parents' rearing attitudes perceived by students in order. The results of this study show how different types of students succeed or struggle within S&T education, which is essential for teachers to differentiate their instruction and guidance. Differentiation held at supporting language and the integration of science into the system, while facilitating a heterogeneity of learning activities and assessments that shift beyond written tasks, could support achieving the most optimal learning conditions for each student [11].

The most common factors influencing science-related attitudes in elementary school students include (1) Gender. Males tend to have better attitudes towards science than females [4, 12]. (2) Socioeconomic status. Students with higher socioeconomic status tend to have more positive attitudes towards science. (3) Teacher-student relationship. A better relationship between students and their teachers can lead to more positive attitudes towards science [4]. (4) School curriculum and environment. The science curriculum, teaching methods, and classroom environment can significantly influence students' attitudes toward science [1]. (5) Cultural background. Students' cultural background can also impact their attitudes towards science. (6) Grade level. As students progress through elementary school, their attitudes towards science may change, with younger students potentially having more positive attitudes [12]. (7) Teaching methods. Using inquiry-based teaching methods can positively impact students' attitudes toward science and their science literacy skills [4]. These factors can shape students' attitudes toward science and influence their interest in and engagement with science-related learning experiences. By understanding these factors, educators can develop strategies to foster positive science-related attitudes and improve students' academic achievement in science.

2. Methodology

This research is ex post facto research with a quantitative descriptive and comparative descriptive approach. Ex post facto research is a type of research design that is used in education research to study the relationship between variables that cannot be manipulated [13]. Ex post facto research is to examine cause and effect relationships that are not manipulated or treated by the researcher, but the researcher only records data from activities that have already occurred. Ex post facto research is a useful tool for exploring relationships between variables and generating hypotheses for future education research [13, 14, 15]. The sample of this research is 318 students from 3 schools in Mataram City, which were selected using a purposive sampling technique, as shown in the following chart.

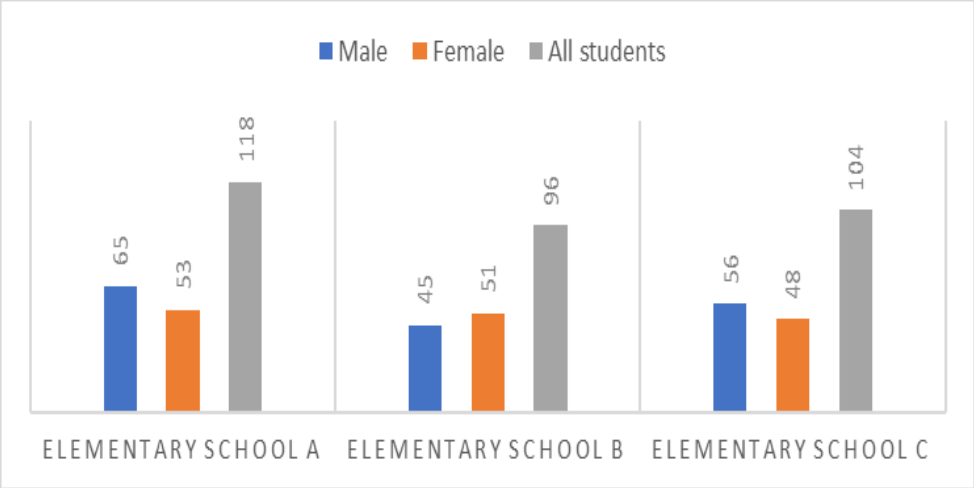

Fig. 1. Chart of the distribution of the sample based on school and gender

The science-related attitude instrument measured in this research refers to the indicator of TOSRA (Test of Science Related Attitude) which has been modified and validated in the previous research by Rahmatiah, et. al. (2023), namely attitude to scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science. Quantitative descriptive analysis is used to describe students' science-related attitude values, while comparative descriptive analysis is used to describe school and gender differences in students' science-related attitudes. Descriptive statistics were applied to describe students' science-related attitudes. After fulfilling the assumption tests, i.e., normality ($p > 0.05$) and homogeneity ($p > 0.05$), t-test and one-way ANOVA were employed. The t-test was applied to determine whether any significant relationship existed among students' science-related attitudes based on gender, while Anova was applied to determine whether any significant relationship existed among students' science-related attitudes in the three different schools. A deeper analysis of each indicator of TOSRA, since it was not fulfilling the assumption tests, i.e., normality ($p > 0.05$), Mann-Whitney and Kruskal Wallis test were employed to

analyze any significant relationship existed among each indicator of students' science-related attitudes based on different school and gender. The data analysis was assisted by IBM SPSS Statistics 27 software.

3. Results and Discussion

After collecting all data from all sample schools, inputting data to SPSS software was done, and analyzing data started by checking the normality of the data. The result of the normality test for the total score of science-related attitude in each school is presented in the following table.

Table 1. The normality test result of students' science-related attitude scores in each school

	School	Sig.
Science related attitudes	Elementary School A	.121
	Elementary School B	.341
	Elementary School C	.876

The data of science-related attitude scores in each school is in a normal distribution because the Sig in each school is more than 0,05, so Anova can be used for the next analysis.

Table 2. The result of Anova

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	57.634	2	28.817	.703	.496
Within Groups	12912.014	315	40.991		
Total	12969.648	317			

Based on the table above, the result of Sig is 0,496. It's more than 0,05, so it can be concluded that there is no difference in science-related attitudes between the students in Elementary Schools A, B, and C. A more detailed review of students' science-related attitudes score in each indicator of TOSRA that was used in this research is presented in the following table.

Table 3. The normality test result of students' science-related attitude score in each indicator of TOSRA

Indicator of TOSRA	School	Sig.
Attitude to scientific inquiry	Elementary School A	.004
	Elementary School B	.010
	Elementary School C	.007
Adoption of scientific attitudes	Elementary School A	.000
	Elementary School B	.003
	Elementary School C	.000
Enjoyment of science lessons	Elementary School A	.002
	Elementary School B	.023
	Elementary School C	.004
Leisure's interest in science	Elementary School A	.019
	Elementary School B	.102
	Elementary School C	.007

The SPSS software result showed that the data of each indicator of TOSRA in each school is not in a normal distribution. Consequently, for further analysis, we used non-parametric analysis that is the Kruskal-Wallis test. The results of the Kruskal Wallis test are presented in the following table.

Table 4. The result of the Kruskal Wallis test

	Attitude to Scientific Inquiry	Adoption of scientific attitudes	Enjoyment of science lessons	Leisure's interest in science
Kruskal-Wallis H	11.298	1.055	2.939	2.204
df	2	2	2	2
Asymp. Sig.	.004	.590	.230	.332

Based on the table above, the result of Asymp. Sig for the first indicator: attitude to scientific inquiry is 0,004, it's less than 0,05, so it can be concluded that there is a difference in attitude to scientific inquiry between the students in these schools. Meanwhile, the result of Asymp. Sig for the next three indicators: adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science are 0,590, 0,230, and 0,332. It's all more than 0,05, so it can be concluded that there is no difference in the indicator: adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science between the students in these schools. The chart below presents a graph of the student's mean scores differences in each indicator from TOSRA in each school.

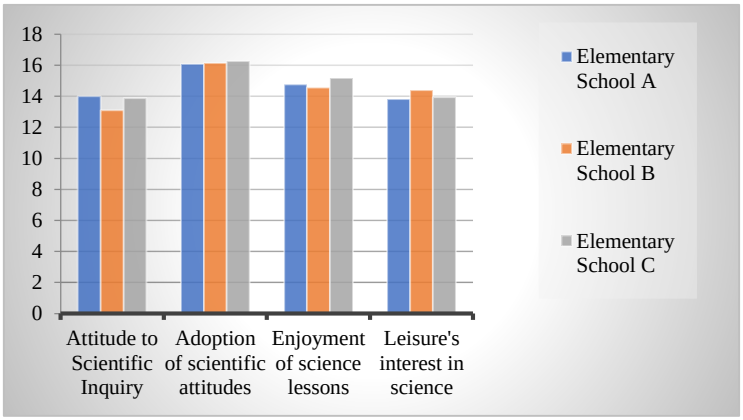

Fig. 2. Chart of mean scores of students' science-related attitude per indicator of TOSRA based on school

Based on the chart above, there does not appear any significant difference in the mean score of students per indicator of TOSRA based on the school. Only for the first indicator, there is little difference in attitude to scientific inquiry among the students in these schools. Meanwhile, in the chart of the next three indicators: adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science, it can be said that there is no significant difference.

Next, data analysis was carried out based on gender. The result of the normality test for the total score of students' science-related attitudes based on gender is presented in the following table.

Table 5. The normality test result of students' science-related attitude scores based on gender

	Gender	Sig.
Science related attitude	Male	.271
	Female	.623

The data score of students' science-related attitudes between male and female students is in a normal distribution, 0,271 and 0,623 are > 0,05, so the t-test can be used for the next analysis.

Table 6. The result of the T-test

t-test for Equality of Means	Mean Difference	Sig. (2-tailed)
Science related attitude	Equal variances assumed	226
	Equal variances not assumed	.223

Based on the table above, the result of Sig is 0,226, which is more than 0,05, so it can be concluded that there is no difference in science-related attitudes between male and female students. A more detailed review of students' science-related attitudes score in each indicator of TOSRA that was used in this research is presented in the following table.

Table 7. The normality test result of students' science-related attitude score in each indicator of TOSRA based on gender

	Gender	Sig.
Attitude to scientific inquiry	Male	.011
	Female	.001
Adoption of scientific attitudes	Male	.000
	Female	.000
Enjoyment of science lessons	Male	.001
	Female	.009
Leisure interest in science	Male	.004
	Female	.044

The SPSS software result showed that the data of each indicator of TOSRA based on gender are not in a normal distribution. Consequently, for further analysis, we used non-parametric analysis that is the Mann-Whitney test. The results of the Whitney test are presented in the following table.

Table 8. The results of the Whitney test

	Attitude to scientific inquiry	Adoption of scientific attitudes	Enjoyment of science lessons	Leisure interest in science
Mann-Whitney U	12403.500	11705.000	12418.000	11252.500
Wilcoxon W	24031.500	25566.000	24046.000	25113.500
Z	-.262	-1.127	-.244	-1.676
Asymp. Sig. (2-tailed)	.793	.260	.808	.094

Based on the table above, the result of Asymp. Sign for all the indicator of TOSRA are 0,973; 0,260; 0,808; and 0,094. It's all more than 0,05, so it can be concluded that there is no difference in the indicator: attitude to scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science between male and female students in these three schools. The chart below presents a graph of the student's mean score differences in each indicator from TOSRA based on gender.

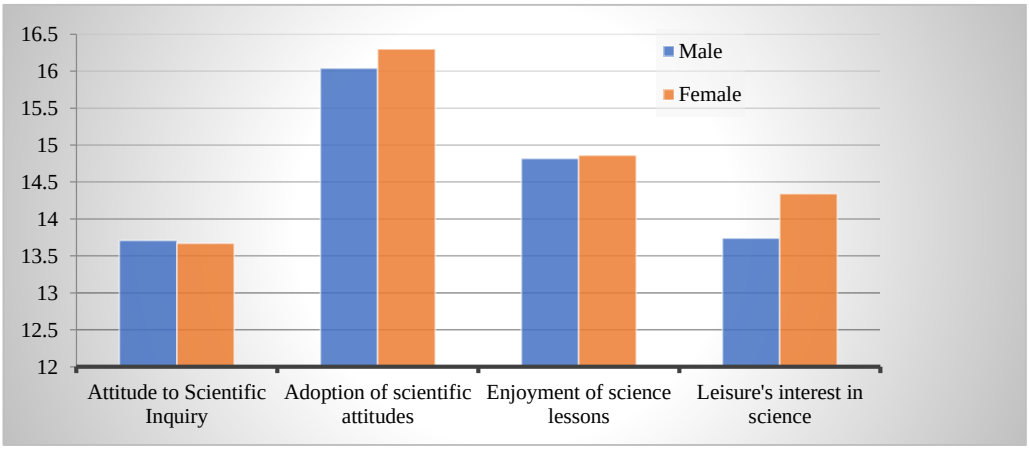

Fig. 3. Chart of mean score per each indicator of TOSRA based on gender

Based on the chart above, there does not appear any significant difference in the mean score of students per indicator of TOSRA based on gender. Only for the last indicator, there is little difference in leisure interest in science between the male and female students. Meanwhile, in the chart of the next three indicators: attitude to scientific inquiry, adoption of scientific attitudes, and enjoyment of science lessons, it can be said that there is no significant difference between the male and female students. These results implied that male and female students, basically have the same level of science-related attitudes without any interventions or treatments that researchers have given to them. These results can be a good reason for researchers to use these students in the three schools as samples for further research to be given intervention or treatment whose effects will be studied later.

That science classes in elementary schools should seek to enable students to engage in scientific thinking, encourage them to perform work on basic sciences, and positively develop their attitudes toward science classes with a positive educational atmosphere [2]. Studies related to both the healthy construction of classroom environments and attitudes have a long history [12, 16]. That attitudes toward science are effective factors in attaining the goals of science education. In addition, they described that these factors affect student motivation or encouragement. The scientific attitudes of students also direct their interest in lessons and simultaneously affect their long-term success in courses [16]. Attitude, as an affective domain of learning, is an element affecting the learning outputs of students in science courses. Consequently, the importance of performing attitude studies emerges about carrying positive labors on scientific attitude. Individuals with scientific attitudes have curious and argumentative characteristics; thus, they do not fall prey to prepossessions or pontifical belief systems. Individuals with positive scientific attitudes are more willing to identify and break the problems in their surroundings, as well as being willing to search for solutions. In addition, while scientific attitudes may help an individual to be successful, they also support his or her continual enhancement by affecting his or her thinking [17]. In this research, the effect of a different variable on attitude was interrogated by concentrating on the relationship between scientific attitudes and intellectual risk-taking behaviors of elementary school students. Theoretical ground while an individuality attitude cannot continually be observed precisely, it mostly directs affection, aversion, and the ideas of individuality. scientific attitudes in four categories attitudes toward school science, attitudes toward science careers, attitudes toward science itself, and attitudes toward specific issues in science. This examination, indeed, emphasizes the significance of attitudes in terms of long-term learning and incuriosity toward science or deep understanding development [18].

Attitudes are divided into two, namely attitudes towards science and scientific attitudes [19]. Moreover, the scientific attitudes included within the environment of this study were expressed as a mixture of the will to know and understand, inquiring attitudes, data collection and sense-making, and judgment and explanation of conclusions. In this study, the connection between scientific attitudes and intellectual risk-taking behaviors of fourth-grade students in elementary schools in Turkey was questioned. A total of 184 students participated in the study, which was directed based on a survey model. For data gathering, the "Scientific Attitude Inventory" and the "Intellectual Risk-Taking and Perceptions About Its Predictors Scale in Science Education" were referred to. Descriptive statistical analyses and t-tests, ANOVA, simple linear regression, and multiple regression analyses were employed for the analysis of the data. As an aftereffect of this data analysis, it was observed that these elementary school students have scientific attitudes at the "not sure" status and have intellectual risk-taking behaviors at the "mostly correct" place. Gender was not observed to affect scientific attitude; however, it was effective in intellectual risk-taking behavior. In addition, the analysis results demonstrated that there is a meaningful difference between the intellectual risk-taking behaviors of students and the educational levels of their fathers. Also, when the interactions between other pairs of variables were interrogated, the variables of intellectual risk-taking, gender, educational degrees of the mother, and educational degrees of the father together had low-level but significant relations with the scientific attitudes of elementary school students. It was pointed out that teachers will contribute to students' acceptance of positive scientific attitudes by presenting the lives and studies of scientists, and it was implied that the effect of

changes in educational patterns in classroom surroundings be examined through experimental studies on the intellectual risk-taking behaviors of students. With the results earned from this study, further light can be exfoliated on what should be suited to support students' intellectualistic risk-taking behaviors.

Several former exploration studies have been conducted outside of Indonesia. How about the research's result about TOSRA in Indonesia? One study conducted in Aceh, Indonesia, explored students' attitudes toward science learning based on gender and grade level of schools using TOSRA [20]. The study found that female students reflect more positive attitudes toward science than male students do, and the data reflect the equivalency of students' attitudes toward science between primary and secondary schools. However, when primary school students enter secondary school, the maturity of students enjoy learning science less. This reality is valuable feedback for science teachers. The study supports scholars seeking ways to avoid the gender gap in learning activities and pedagogical implications are also discussed. Another study aimed to develop students' attitudes toward chemistry learning through culturally responsive transformative teaching (CRTT) in Banten, Indonesia, and used TOSRA as one of the data collection instruments [21]. The study found that students became engaged in chemistry learning through Banten cultural practices, and the learning model provided opportunities for students to develop their attitudes to scientific inquiry.

A study conducted in Muaro Jambi district compared 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. The research design used is quantitative with the type of survey research, and the research subjects were 1075 students. The study found that students at Junior High School 26 Muaro Jambi were dominant in the indicators of social implications with a good category. At the same time, Junior High School 6 Muaro Jambi was dominant in the social implication indicators with a sufficient category, and Junior High School 5 Muaro Jambi was dominant in the indicators of social implications with a sufficient category. Based on the one-way ANOVA test, it was found that there were differences in attitudes towards science subjects at Junior High School 26 Muaro Jambi, Junior High School 6 Muaro Jambi, and Junior High School 5 Muaro Jambi.

Eventually, a study conducted in Jambi, Indonesia, aimed to assess the relationship between student perceptions of teacher interpersonal behavior and student attitudes toward science in primary school using TOSRA [22]. The study found that the questionnaires are fairly reliable for Indonesian primary students, and the findings reveal that from the students' view, their teachers have relatively good leadership and understanding in the classroom, lower query, dissatisfaction, and admonishment toward students. Still, the students perceive to some extent unfavorable perceptions of their freedom and the teacher's strictness. Another analysis describes that there are significant differences between actual and ideal perceptions on the whole scale of QTI except for uncertainty. Likewise, between male and female perceptions, this study finds that there are significant differences in helping and strictness. Lastly, the multiple correlation analysis explains that there is a correlation between the scale of QTI and enjoyment towards science, in which uncertainty and admonishment scales significantly negatively affect students' attitudes toward science.

The profile of elementary students' science-related attitudes encompasses various aspects, including their scientific attitude, interest in science, perception of its applicability to their lives, confidence in their capability to learn and apply scientific concepts, and appreciation of the scientific method. Research has shown that positive science-related attitudes are associated with better academic achievement, increased motivation to learn, and greater interest in pursuing science-related careers.

Some specific aspects of elementary students' science-related attitudes that have been explored in studies include (1) Scientific attitude. This refers to the development of a habit of mind that involves asking questions, seeking explanations, and using evidence to make decisions. A study conducted in Islamic elementary schools found that an inquiry-oriented environmental science course helped develop scientific attitudes among preservice elementary teachers [23]. (2) Interest in science. A study on the effects of an app-based learning program on observing and recording living things found that students' interest in science increased after participating in the program [24]. (3) Perception of science's relevance. A study on the effects of extracurricular science club activities on science-related attitudes of female elementary school students found that the experimental group, which participated in the activities, showed a higher improvement in their perception of science's applicability compared to the control group [25]. (4) Confidence in learning scientific concepts. A study on the effects of Cornell-typed science journal writing on elementary students' science-related attitude found that the experimental group, which performed the journal writing, showed a higher improvement in scientific attitude, particularly in the subdomain of voluntariness [26]. (5) Appreciation of the scientific method. A study on the effects of an inquiry-oriented environmental science course on preservice elementary teachers' attitudes about science found that the experimental group, which took science lessons based on question-centered Havruta learning, showed higher improvement in their appreciation of the scientific method compared to the comparative group, which took teacher-driven lessons using a teacher's guidebook [27].

Teachers play a crucial role in shaping students' science-related attitudes through their teaching methods, classroom environment, and personal attitudes toward science [28]. Therefore, educators need to foster a positive and engaging learning environment that promotes curiosity, critical thinking, and scientific inquiry. Grounded on many search results, negative science-related attitudes in elementary school students can have a significant impact on their performance in science classes, and their future academic and career success.

Some of how science-related attitudes affect their performance are (1)—lower academic achievement. Students' negative attitudes towards science are related to their lower academic achievement in science courses [4, 26]. This can limit their opportunities for pursuing science-related careers in the future. (2) Dropped motivation to learn. Negative attitudes towards science can lead to decreased motivation to learn and engage in scientific inquiry [2]. This can limit students' curiosity and interest in science-related topics, which can further limit their opportunities for pursuing science-related careers. (3) Limited understanding of scientific concepts. Negative attitudes toward science can limit students' understanding of scientific concepts, which can affect their performance in science classes and limit their career options in the future [26, 29]. This can further limit

their openings for pursuing science-related careers and can have long-term counteraccusations for their profitable and social well-being. (4) Negative conceptions. Negative attitudes toward science can support negative stereotypes about scientists and science-related fields [29]. This can further limit students' interest in pursuing science-related careers and immortalize gender and cultural biases in the field.

Thus, educators must foster a positive and engaging learning environment that promotes curiosity, critical thinking, and scientific inquiry among elementary students. Teachers play a crucial part in shaping students' science-related attitudes through their tutoring styles, classroom environment, and personal attitudes toward science [2, 4]. By promoting positive attitudes towards science, educators can help students achieve academic success, develop a love for learning, and pursue fulfilling careers in science-related fields.

There are several examples of science-related activities that elementary school students can engage in outside of school: (1) Watching science-related television shows. Many television shows, such as "SciGirls," "NOVA," and "The Magic School Bus," provide engaging and educational content for young children. (2) Reading science-related books. Reading age-appropriate science books can help spark children's curiosity and provide them with a solid foundation in scientific concepts. (3) Attending science-related events. Many communities host science festivals, museum exhibits, and workshops that are suitable for young children [30]. (4) Participating in science clubs. Extracurricular science clubs can provide students with opportunities to engage in hands-on activities, learn new scientific concepts, and develop their problem-solving skills [31]. (5) Engaging in backyard science. Simple activities, such as observing plants and animals, collecting rocks, or conducting experiments with common household items, can help students develop a deeper understanding of the natural world [32]. (6) Participating in citizen science projects. Students can contribute to real-world scientific research by participating in citizen science projects, such as monitoring local wildlife populations or helping to collect data for scientific studies [33]. (7) Do something with nature. Positive adventures in mathematics and science learning for students to support their understanding of the conceptions of mathematics and science itself, one of which is through the preface and preservation of the natural environment [34]. (8) Using mobile apps for science learning. Many mobile apps, such as "Science365" or "Star Walk," can provide engaging and educational science content for young children [35]. By engaging in these activities, elementary school students can develop a strong foundation in scientific concepts and foster a lifelong interest in science.

Parents and caregivers can encourage elementary school students to engage in science-related activities outside of school in the following ways: (1) Provide access to science-related resources. Parents can provide access to science-related resources, such as books, magazines, and educational television shows, to help spark children's curiosity and interest in science [30]. (2) Encourage hands-on activities. Parents can encourage children to engage in hands-on science-related activities, such as conducting experiments, building models, or exploring nature [33]. (3) Attend science-related events. Parents can take children to science-related events, such as science fairs, museum exhibits, and planetarium shows, to provide them with opportunities to learn about science in a fun and engaging way [30]. (4) Participate in citizen science projects. Parents and children can participate in citizen science projects, such as monitoring local wildlife populations or collecting data for scientific studies, to contribute to real-world scientific research [35]. (5) Talk about science-related topics. Parents can engage children in conversations about science-related topics, such as the natural world, space, or technology, to help them develop a deeper understanding of scientific concepts [36]. (6) Encourage participation in science clubs. Parents can encourage children to participate in extracurricular science clubs, which can provide opportunities for hands-on learning and engagement with science-related topics [31]. By encouraging children to engage in science-related activities outside of school, parents and caregivers can help foster a love for learning and a lifelong interest in science.

4. Conclusion

This research has revealed that generally and naturally, there are no significant differences in science-related attitudes between male and female students in the three different schools in Mataram, which were used as this research sample. These results can be a reference that students at these three schools are suitable as research locations regarding measuring students' science-related attitudes after being given certain treatments. However, what is noted in this research is first, the TOSRA that is used in this research has limited generalizability to other contexts. Readers should be careful when generalizing TOSRA findings to other contexts. Second, the TOSRA instrument used to measure students' science-related attitudes in this research only consists of 4 indicators, namely: attitude to scientific inquiry, adoption of scientific attitudes, enjoyment of science lessons, and leisure interests in science.

Researchers recommend that if there are readers who wish to conduct similar research can measure students' science-related attitudes for more than these 4 indicators or adjust them again to their research needs. However, TOSRA has become a widely adopted, adapted, and modified instrument in many studies regarding the measurement of science-related attitude variables throughout the world. But, the most critical point is whatever type of instrument is used to measure students' science-related attitudes, the most important is how to develop students' science-related attitudes. Especially since elementary school age because the perceptions or attitudes that are instilled in students from an early age like elementary school age seem to be carried out until they grow up. Therefore, it is also necessary to carry out learning processes and learning innovations that will be able to change, develop, and increase students' positive science-related attitudes which will be useful in their future lives.

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