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Research Article

THE INFLUENCE OF SCIENTIFIC ATTITUDE, ACTIVE LEARNING, AND FRIENDLY CHARACTER ON SCIENCE LEARNING OUTCOMES IN JUNIOR HIGH SCHOOL STUDENTS

Mohamad Ilhami[1], Siti Amanah[1,*], Sophia Rahmawati[1], Priyanto[1], Ade Kumalasari[1], Erisa Kurniati[1], Suci Hayati, Duano Sapta Nusantara[1]

[1] Institute for Research and Community Service University of Jambi, Universitas Jambi, Jambi, Indonesia
Corresponding author email: siti.amanah@unja.ac.id

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Abstract
This research investigates the combined influence of scientific attitude, active learning, and friendly character on the science learning outcomes of junior high school students in Jambi City. It explores how these factors contribute to student's academic performance and social development in science education. A mixed-methods approach was used, integrating quantitative data from questionnaires with qualitative insights from interviews. The sample consisted of junior high school students in Jambi City. Data analysis was performed using multiple regression tests with SPSS to examine the relationship between the variables. The results indicate that scientific attitude, active learning, and friendly character significantly and positively affect students' science learning outcomes. Active learning enhanced students' engagement and critical thinking skills, while a strong scientific attitude improved their curiosity and problem-solving abilities. Students with well-developed, friendly character traits also demonstrated better social interactions, leading to more effective collaboration in group-based learning activities. Despite these positive outcomes, the study highlights the challenge of translating scientific concepts into real-world applications, which requires greater emphasis on contextual learning and motivation. This study offers a fresh perspective by integrating social-emotional traits such as friendly character into analyzing science learning outcomes, an area often overlooked in previous research. It provides actionable insights into how fostering active learning and positive social interactions can create a more engaging and effective science learning environment.

Keywords: Active Learning, Attitude, Friendly Character, Science Learning

INTRODUCTION

Education is a real effort to develop students' potential through the teaching and learning process. Education is a planned effort that aims to shape the personality and mindset of individuals in order to create an intelligent and characterful society (Hermino, & Arifin, 2020; Tanti et al., 2020;

Birhan et al., 2021; Habiburrohman et al., 2024). According to Rukiyati, Sutarini, & Priyoyuwono (2014), education aims to make students good, intelligent, and competitive individuals. In addition, education is also a process for individuals to acquire knowledge, skills, and habits that support their lives (Biesta, 2020; Lövdén et al., 2020). The success of education can be measured by the effectiveness of teachers in delivering material that facilitates students in achieving the expected competencies (Ngereja, Hussein, & Andersen, 2020; Lauermann & ten Hagen, 2021; Ummah & Yohamintin, 2025). In the formal education system in Indonesia, levels of education include Elementary School, Junior High School, Senior High School, and College. One of the core subjects taught from elementary to junior high school is Natural Sciences. Science subjects aim to introduce students to the world of science, understand natural phenomena, and apply scientific knowledge in everyday life (Tanti et al., 2020; Zidny et al., 2020; Dewi et al., 2021). Science is a combination of scientific products, scientific processes, and scientific attitudes that need to be mastered by students (Irwanto, 2020; Tinapay et al., 2021; Rini et al., 2024).

Research shows that aspects of attitude and psychomotor assessment in science learning are often ignored, so students become less active and unmotivated to learn (Abdurrahmansyah et al., 2022; Tujyinama & Ntivuguruzwa, 2023; Karuku, 2023; Fatoni & Subando, 2024). This has an impact on low student learning outcomes. A positive attitude towards science can encourage students to act more scientifically and be open to developments in science and technology (Owens et al., 2020; Sahin, D., & Yilmaz, 2020; Wu et al., 2021; Hermanto, Ardianto, & Permanasari., 2025). A Positive attitude toward science increases students' interest in learning and encourages active involvement in learning. However, many students have difficulty understanding science material in practice because the learning method is less contextual and meaningful. This causes low student activity and interest in learning. Student inactivity during the learning process hinders the achievement of learning objectives (Ismaeel & Al Mulhim, 2021; Tika et al., 2021; Svensson et al., 2021; Karina, Oktariani, & Hong, 2024). In contrast, active students show higher enthusiasm, are directly involved in learning activities, and participate actively (Cents-Boonstra et al., 2021; Dewaele & Li, 2021; Fitriazmi, Wahyuni, & Aliweh, 2024).

In addition to activeness, friendly character is an important aspect that needs to be developed in character education. Friendly character includes empathy, openness, and the ability to work together (Burmansah et al., 2020; Suciu, Meliț, & Mărginean, 2021; Aizinsh et al., 2023; Fauz, Aldila, & Hakhumyan, 2024). Students with friendly character tend to be more likely to establish good communication, respect the opinions of others, and contribute positively to group learning (García-Moya, Brooks, & Moreno, 2020; Lukman et al., 2021; Retnani et al., 2024). This character also helps increase student participation in learning activities and creates a conducive learning atmosphere (Cayubit, 2022; Luo et al., 2022; Manlapig, 2024; Sirait & Ratti, 2024). Previous studies have discussed the importance of positive attitudes towards science, friendly character, and student activeness in supporting the success of science learning. Astalini et al., (2023) found that positive attitudes toward science are closely related to student learning achievement. Astalini et al., (2024) highlighted the importance of friendly character in improving social interaction and cooperation in the classroom. Virtanen, Niemi, & Nevgi (2017) emphasized the importance of active learning in building students' critical and creative thinking skills.

Various studies have discussed attitudes toward science, friendly character, and learning activity, research that specifically examines the relationship between these three aspects in the context of science learning at the junior high school level is still limited, especially in schools in Jambi City. Most studies focus more on students' cognitive aspects, while affective elements such as attitudes and character are often neglected. This affective aspect is essential in encouraging students' active involvement in the learning process. Therefore, this study aims to analyze the influence of attitudes toward science, friendly character, and learning activity on student learning outcomes at Junior high school in Jambi City. This study is expected to contribute to developing more effective learning strategies to improve positive attitudes toward science, strengthen friendly character, and encourage students' activeness in the science learning process.

RESEARCH METHOD

This study uses the mixed methods method. Mix Methods is a method of collecting and analyzing data that combines quantitative and qualitative approaches in several phases of research (Hermawan, 2019). This study is also a regression analysis that investigates the functional relationship between several variables. Multiple regression analysis is used to determine whether or not there is an

influence of two or more independent variables (X) on the dependent variable (Y). The study was conducted at Junior high school 14 Jambi City and Junior high school 16 Jambi City. The population in this study consisted of 136 students at Junior high school 14 Jambi City and 136 students at Junior high school 16 Jambi City, with a total population of 272 students.

The data collection technique was carried out using a questionnaire and interview sheets. Science Attitude Questionnaire, Adopted from the research of Astalini & Kurniawan, consists of 56 statement items with a Cronbach Alpha of 0.842, so this questionnaire is categorized as reliable and suitable for use. The learning Activeness Questionnaire was Adapted from the research of Emosda & Anggraini, to measure the level of student activeness during the learning process. The friendly Character Questionnaire, adapted from the research of Anita & Setyowati, has been adjusted to the context of this study. This instrument aims to measure the extent to which students show friendly attitudes, such as openness, empathy, and the ability to work with friends and teachers. Interviews Interviews are used to strengthen quantitative data. Interviews are conducted with a previously prepared instrument guide and equipped with aids such as a voice recorder (tape recorder), pictures, brochures, and other materials that support the smooth running of the interview process.

Categoty	Interval				
	Social implications of science and Interest in a career in science	Adoption of scientific attitudes and Attitudes towards science investigations	Interest in increasing time spent studying science	Active learning	Students' friendly character
Very Not Good	9.0 – 16.2	7.0 – 12.6	8.0 – 14.4	25.0 – 45.0	24.0 – 36.0
Not Good	16.3 – 23.4	12.7 – 18.2	14.5 – 20.8	45.1 – 65.0	36.1 – 48.0
Enough	23.5 – 30.6	18.3 – 23.8	20.9 – 27.2	65.1 – 85.0	48.1 – 60.0
Good	30.7 – 37.8	23.9 – 29.4	27.3 – 33.6	85.1 – 105.0	60.1 – 72.0
Very Good	37.9 – 45.0	29.5 – 35.0	33.7 – 40.0	105.1 – 125.0	72.1 – 84.0

Data were analyzed using SPSS software with multiple regression tests. This analysis aims to determine the effect of friendly character (X1) and learning activity (X2) on students' attitudes towards science (Y). The stages of analysis used include the t-test (Partial Test), which is used to determine whether or not each independent variable has a partial effect on the dependent variable. A simple regression test was conducted to determine whether or not there is a simultaneous (together) effect of the independent variables on the dependent variable, with a Significance Level or confidence level of 95% ($\alpha = 0.05$).

RESULTS AND DISCUSSION

The results of this study are presented in the form of tables and descriptions for each variable studied, namely the social implications of science, adoption of scientific attitudes, interest in a career in science, interest in increasing time studying science, attitudes towards science investigations, learning activity, and friendly character of students.

Social Implications of Science

In the social implications of science for junior high school students, we can see the results from the distributed questionnaire, with results such as Table 2.

Table 2. Social implications of science

Classification			Mean	Min	Max	%
Range	Respond	Total				
9.0 – 16.2	Not very good	0				0.0
16.3 – 23.4	Not good	50				18.4
23.5 – 30.6	Enough	190	27	19	34	69.9
30.7 – 37.8	Good	32				11.8
37.9 – 45.0	Very good	0				0.0
TOTAL		272				100

Based on Table 1, the average value of social implications of science is 27, with a minimum score of 19 and a maximum of 34. Most students (69.9%) are in the sufficient category, indicating that students' understanding of the social impact of science is still in the moderate stage. In this indicator, students stated they did not understand the impact of learning science in everyday life. Several students admitted that they had not linked the knowledge learned in class with real societal situations, such as protecting the environment or using technology wisely. *"I don't know how science can help everyday life, other than in lessons." and "There is rarely an explanation of how this science lesson can be applied outside of school."*

Adoption of scientific attitudes

The results of the questionnaire that has been distributed regarding the adoption of scientific attitudes are as Table 3.

Table 3. Adoption of students' scientific attitudes

Classification			Mean	Min	Max	%
Range	Respond	Total				
7.0 – 12.6	Not very good	0				0.0
12.7 – 18.2	Not good	56				20.6
18.3 – 23.8	Enough	160	21	14	29	58.8
23.9 – 29.4	Good	56				20.6
29.5 – 35.0	Very good	0				0.0
TOTAL		272				100

Based on Table 3, the average value is 21, with a minimum score of 14 and a maximum of 29. Most students (58.8%) are in the sufficient category in applying scientific attitudes, indicating that students still need to be encouraged to be more active in applying scientific attitudes during the science learning process. Students stated that they did not like science lessons, so they rarely applied scientific attitudes such as high curiosity or openness to evidence when conducting experiments. *"I don't really like experiments in the laboratory because they are often confusing." and "Sometimes I just follow instructions without really understanding the process."*

Interest in a career in science

The results of the questionnaire that has been distributed about interest in a career in science are shown in Table 4.

Table 4. Interest in a career in science

Classification			Mean	Min	Max	%
Range	Respond	Total				
9.0 – 16.2	Not very good	0				0.0
16.3 – 23.4	Not good	50				18.4
23.5 – 30.6	Enough	190	27	17	38	69.9
30.7 – 37.8	Good	32				11.8
37.9 – 45.0	Very good	0				0.0
TOTAL		272				100

Based on the data in Table 4, the average value is 27, with a minimum score of 17 and a maximum of 38. Most students (69.9%) are in the sufficient category, indicating that students' interest in pursuing a career in science still needs to be improved. Students said they did not enjoy conducting experiments or investigations in science lessons. Many of them felt that experiments were too complicated or tedious. *"Doing experiments is boring, especially if the tools are difficult to use." and "I prefer to learn theory rather than conducting experiments."*

Interest in increasing time studying science

The results of the questionnaire distribution on interest in increasing time studying science can be seen in Table 5.

Table 5. Interest in Increasing Time Studying Science

Classification			Mean	Min	Max	%
Range	Respond	Total				
8.0 – 14.4	Not very good	0				0.0
14.5 – 20.8	Not good	30				11.0
20.9 – 27.2	Enough	190	23	13	35	69.8
27.3 – 33.6	Good	48				17.7
33.7 – 40.0	Very good	4				1.5
TOTAL		272				100

Based on the data in Table 5, the average value is 23, with a minimum score of 13 and a maximum of 35. Most students (69.8%) are in the sufficient category, indicating that they have not fully utilized their free time to deepen their science knowledge. Only a few students showed interest in a career in science. Most students stated that they were not interested in a profession related to science in the future. *"I don't plan to be a scientist or work in science." and "I am more interested in a career in the social or economic fields."*

Attitudes toward science investigations

The results of the questionnaire that has been distributed regarding attitudes towards science investigations are as show Table 6.

Table 6. Attitudes toward science investigations

Classification			Mean	Min	Max	%
Range	Respond	Total				
7.0 – 12.6	Not very good	0				0.0
12.7 – 18.2	Not good	56				20.6
18.3 – 23.8	Enough	160	21	14	29	58.8
23.9 – 29.4	Good	56				20.6
29.5 – 35.0	Very good	0				0.0
TOTAL		272				100

Based on the data in Table 6, the average value is 22.56, the median is 23, and the mode is 23, with a minimum score of 14 and a maximum of 31. Most students (55.1%) are in the sufficient category, indicating that students' attitudes towards science investigations still need to be improved. Students admitted they prefer to spend their free time on other activities rather than studying science. They tend to use their time for hobbies or social activities. *"I prefer playing or watching videos rather than studying science." and "If it's not for the exam, I rarely study science at home."*

Descriptive data from the results of the study of learning activity

Table 7. Learning Activity Students in science learning

Classification			Mean	Min	Max	%
Range	Respond	Total				
25.0 – 45.0	Not very good	0				0.0
45.1 – 65.0	Not good	2				0.7
65.1 – 85.0	Enough	10	84	57	104	3.7
85.1 – 105.0	Good	132				48.5
105.1 – 125.0	Very good	128				47.1
TOTAL		2				100

From the research results that have been obtained, it can be seen in Table 7 that the results above show that learning activity is more dominant in the good category, where from a total of 272 students, there are 132 students with a percentage of 48.5% in the good category. For the very not good category, 0%. In the not good category, there are 2 students or 0.7%. And in the enough category there

are 10 students or 3.7%, and for the very good category 128 students with a percentage of 47.1%. Then the average value is 84, maximum value 104, and minimum value 57. This shows that students are good at carrying out active teaching and learning activities. Students who are active in science learning state that they enjoy learning and are involved in class discussions. However, some students admit they often feel bored or sleepy during learning. “I like learning science because there are many interesting things that I learn.” and “Sometimes I am lazy to join science class because the material feels difficult.”

Descriptive data from the results of the study of students’ Friendly character

Table 8. Friendly Character in Science learning

Classification			Mean	Min	Max	%
Range	Respond	Total				
24.0 – 36.0	Not very good	0				0.0
36.1 – 48.0	Not good	5				1.7
48.1 – 60.0	Enough	22	70	57	104	8.1
60.1 – 72.0	Good	147				54.1
72.1 – 84.0	Very good	98				36.0
TOTAL		2				100

Based on the data in Table 7, the results show that students' friendly character is more dominant in the Good category, with a total of 147 students (54.1%). There are 98 students (36.0%) in the Very Good category, There are 22 students (8.1%) in the enough category, while only 5 students (1.7%) are included in the Not Good category. There are no students in the Not Good category. The average value obtained is 70. The minimum score is 57, while the maximum score reaches 104. Some students show good, friendly characters, such as helping friends with difficulties and maintaining good relationships with classmates. However, some students are still individualistic or less concerned about their social environment. *“I always try to help friends who have difficulty learning.” and “Sometimes I feel more comfortable studying alone than working with friends.”*

These results indicate that most students have shown relatively good friendly characters, such as behaving in a friendly manner, being sociable, and caring about the friends around them. However, efforts are still needed to improve this friendly character so that more students fall into the good and very good categories.

Table 8. Results of the influence of friendly character and active learning on students' science attitudes in science lessons

Variabel	Unstandardized Coefficients		Standardized Coefficients	t	sig.
	B	Std. Error	Beta		
1 (Constant)	12.227	3.151		4.328	.000
Friendly Character	.102	.144	.182	1.027	.012
Active Learning	.108	.164	.191	1.024	.016

From table 8, it can be seen the results of a multiple regression test found that the regression equation is Y = 12.228 + 0.115X1 + 0.108X2. The contribution of friendly characters and students' learning activity to students’ science attitudes in science lessons can be seen in table 9.

Table 9. Contribution of friendly characters and students’ learning activity to students’ science attitudes in science lessons

Model	R	R square	Adjust R Square	Std. Error of the Estimate
1	.807	.651	.672	2.418

The results of multiple regression analysis show that the coefficient of determination is (R2) 0.651. This means that the contribution of friendly character and learning activity to students' attitudes in Science Lessons is 65.1%, while other variables influence the remaining 34.9%. The regression analysis reveals a significant positive relationship between students' attitudes, friendly character traits, and active learning with their performance in science learning, as indicated by a significance value of less than 0.05. Science is an essential field that encompasses concepts, facts, theories, principles, hypotheses, and models developed from human curiosity (Nurâ et al., 2023; Fatimah, 2024; Sofyan & Tlali, 2024). The fundamental concepts of science learning are widely applied in daily life. According to Iwuanyanwu (2020), learning science equips students with essential problem-solving skills for real-world situations.

Scientific analysis plays a crucial role in helping students solve real-life problems (Dare et al., 2021; Yolviansyah et al, 2023). When students replicate experiments, it reflects their interest in scientific inquiry. Honesty is a vital principle in science experiments; students should not manipulate data. Syahrial, Asrial, Kurniawan, Pratama, and Perdana (2019) argue that scientific attitudes foster students' critical and creative thinking skills. Science learning emphasizes direct experiences and integrates science, environment, technology, and society (Belbase et al., 2022; Yusipa, 2024; Sunia, 2024). Motivation is a key factor in encouraging students to invest time in learning science, while interest in learning can significantly impact students' futures (Godwin & Kirn, 2020; Kurniawan, 2024; Pustika, 2024; Somantri, 2024). Students interested in science are more likely to pursue careers in science-related fields.

As mentioned in the introduction, students' attitudes toward science learning can be categorized as either positive or negative. A positive attitude can enhance students' interest in science (Makransky, Petersen, & Klingenberg, 2020), whereas a negative attitude may result in disinterest in both the subject and the teacher (Guido, 2013; Mardiana, Mickovska-Raleva, & Zakari, 2024; Sahban, Igbokwe, & Nakazwe, 2024). Students with a positive attitude toward science are more active and enthusiastic during lessons. Active learning is demonstrated through student engagement in answering questions, completing tasks, and participating in discussions. Winarso (2016) states that active learning includes listening to the teacher's explanations, engaging in discussions, and reporting tasks. Active students are generally more confident in expressing their opinions. Teachers can encourage active learning by asking thought-provoking questions (Coulter & Onufer, 2022; Maulia et al., 2023; Ghunaimat & Alawneh, 2024; Halimah et al., 2024). Motivated students are resilient when facing challenges (Trigueros et al., 2020; Chumburidze et al., 2023; Fitriani, Triandafillidis, & Thao, 2023; Fakhroni, & Puotier, 2023). In science learning, students often prefer hands-on experiments because practical activities make concepts easier to understand. These direct experiences improve comprehension and retention.

A friendly character is an essential component of students' social development. Friendly students demonstrate empathy, help their peers, and maintain good relationships with others. Desnita, Usmeldi, & Hidayat (2023) emphasizes that friendly behavior often manifests in caring for others and the surrounding environment. Boudlaie, Nik, and Kenarroodi (2020) highlight that a friendly character reflects students' ability to interact harmoniously with their environment. Students with friendly characteristics find it easier to collaborate in groups, share ideas, and support peers in need. These traits include care for others, mutual respect, and a desire to maintain positive relationships (Sökmen, 2021; Fernando & Yusnan, 2022; Sirait et al., 2023; Habibi, Jiyane, & Özşen, 2024). Developing a friendly character enhances students' learning experiences, increases motivation, and fosters a conducive classroom environment (Chan-Anteza, 2020; David et al., 2024; Mardiati et al., 2024; Saputra et al., 2024). Individualistic or indifferent behavior can be addressed through group activities and project-based tasks that emphasize teamwork. Assigning group tasks teaches students to collaborate and support each other in achieving shared goals (Hussein, 2020; Maymunah, Ramorola, & Shobowale, 2023; Hanoum et al., 2024).

The novelty of this research lies in its focus on the friendly character variable and its combined influence with active learning and scientific attitude on students' science learning outcomes. While previous studies primarily emphasized cognitive aspects, this study highlights the often-overlooked importance of social and emotional factors such as friendly character on academic success. This research bridges the gap by demonstrating how social interactions and emotional connections can enhance student engagement and performance in science learning. The findings of this study offer several important implications for educational practice, curriculum design, and policy. Curriculum Design: Incorporating activities that promote friendly character traits and active learning can create a

more collaborative and engaging learning environment, fostering both academic and social development. Teacher Strategies: Teachers should prioritize cooperative learning activities, group discussions, and collaborative projects to cultivate students' social skills and friendly character while reinforcing active learning behaviors. Policy Implications: Schools should develop character education programs focusing on empathy, collaboration, and social skills to enhance students' overall academic performance. Character education initiatives can indirectly improve learning outcomes in science by promoting teamwork and mutual respect.

This study has several limitations that should be acknowledged: Scope of Data: The study is limited to a specific sample size and location, which may not fully represent diverse student populations. Future studies should explore a broader demographic to ensure generalizability. Cross-Sectional Design: This research provides a snapshot of the relationship between variables at a specific time. A longitudinal study could offer deeper insights into how students' attitudes, friendly character, and active learning evolve and influence learning outcomes over time. Subjective Measures: Data on students' attitudes and character were collected through self-reported questionnaires, which may introduce bias. Future research could incorporate observational methods or teacher assessments to provide a more objective evaluation.

Based on the findings and limitations, several recommendations are proposed: Developing Character Education Programs: Schools should design and implement programs that focus on fostering social and emotional skills, particularly emphasizing the development of a friendly character and teamwork in science learning contexts. Teacher Training and Workshops: Educational institutions should provide teachers with training on cooperative learning strategies, character-building activities, and ways to encourage active learning in science classrooms. Longitudinal Studies: Future research should conduct longitudinal studies to assess how social and emotional factors influence long-term learning outcomes. These studies could also explore the role of different variables, such as family support or peer influence, on students' science learning. Integration of Technology: The use of technology-based interventions (e.g., digital collaborative tools) can enhance active learning and provide new avenues for promoting friendly interactions and social engagement in the classroom.

CONCLUSION

This study concludes that scientific attitude, active learning, and a friendly character significantly contribute to improving science learning outcomes. A friendly character fosters positive social interactions, which enhance collaboration and create a supportive classroom environment conducive to group-based learning. Active learning promotes deeper student engagement and intrinsic motivation, while a strong scientific attitude encourages students to approach learning tasks with critical thinking, curiosity, and creativity. These factors collectively enhance students' academic performance and overall learning experience. The findings emphasize the importance of integrating character education and active learning strategies into science curricula to optimize learning outcomes. Teachers should focus on designing interactive, student-centered learning environments that encourage collaboration, critical thinking, and real-world problem-solving. Given that many students still face challenges in applying scientific concepts to real-life situations, future research should explore the implementation of contextual learning strategies, such as project-based and experiential learning approaches. Additionally, teacher training programs should prioritize fostering scientific attitudes and active learning practices to further support students' holistic development and academic success.

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AUTHOR CONTRIBUTIONS

Author 1-2 creates articles and creates instruments and is responsible for research, author 3-4 Analyzes research data that has been collected, author 5-8 assists in research data analysis, instrument validation and input research data.

CONFLICTS OF INTEREST

The author(s) declare no conflict of interest.

USE OF ARTIFICIAL INTELLIGENCE (AI)-ASSISTED TECHNOLOGY

The authors declare that no artificial intelligence (AI) tools were used in the generation, analysis, or writing of this manuscript. All aspects of the research, including data collection, interpretation, and manuscript preparation, were carried out entirely by the authors without the assistance of AI-based technologies.

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