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Students' mathematics learning attitudes and behaviors: A case study of boarding school alumni in higher education

Prima Cristi Crismono [1]*, Siti Lailatul Maghfiroh [2], Harapandi Dahri [3], Mahnawawe Yakoh [4]

[1] Mathematics Education Department, Jember Islamic University, East Java, Indonesia
[2] Communication Studies Department, Jember Islamic University, East Java, Indonesia
[3] Research Center and Jawi Study and the Book of Turath, Kolej Universiti Perguruan Ugama Seri Begawan (Kupu SB), Brunei Darussalam
[4] Tadika Raudhatul Ahtfan, Pattani, Thailand

* Correspondence: primacrismono@gmail.com

Abstract

Islamic boarding school (*pesantren*) education emphasizes moral discipline, obedience, and religious devotion, shaping students' character from an early age. However, when pesantren graduates enter university, particularly in subjects like mathematics that require analytical thinking and problem-solving, they often face adaptation challenges. While pesantren instills strong ethical values, it generally lacks learning strategies that develop higher-order cognitive skills. This study investigates how pesantren education influences university students' learning attitudes and behaviors in mathematics courses, focusing on learning motivation, active engagement, and time management. The research uses a quantitative approach with a descriptive correlational design. The sample consists of 132 students from pesantren backgrounds enrolled at the Islamic University of Jember, selected through purposive sampling. Data were collected using a Likert-scale questionnaire and analyzed through Pearson correlation, ANOVA, and linear regression. Findings reveal that pesantren education has only a limited effect on students' academic attitudes in mathematics, especially in motivation and engagement. Although it supports character development, pesantren education does not sufficiently equip students with the analytical skills required for university-level learning. The study recommends integrating more analytical and interactive teaching methods into pesantren curricula to help students adapt and succeed academically.

Keywords: academic adaptation; higher education; learning attitudes; learning behaviors; mathematics; pesantren education

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Introduction

Pesantren education plays a significant role in shaping the character and behavior of students. As a traditional Islamic educational institution, pesantren not only provides religious knowledge but also instills strong moral values, discipline, and obedience (Husin et al., 2022; Latifah, 2020; Yunitasari, 2020). These values are often applied by students in various aspects of their lives, including within the academic environment at the university level (Cardozo, 2021; Islamic, 2024). Students with a pesantren educational background bring the habits and values they learned during their pesantren experience into campus life. One area of interest is how pesantren education influences learning attitudes and behaviors, particularly in subjects often seen as challenging, such as mathematics. Mathematics requires a specific learning approach, including logical thinking, problem-solving skills, and group collaboration (Sukarsono, 2019; Iqbal, 2023; Egara & Mosimege, 2024; Yerizon et al., 2024).

In pesantren, education often emphasizes rote learning, discipline, and a high degree of respect for teachers (*ustadz/ustadzah*). These attitudes can affect how students learn and interact in mathematics classes at the university level. Students with a pesantren background tend to have strong discipline and adherence to rules (Rahayu, 2019; Muhajir, 2020; Qodir, 2020; Bagaskorowati, 2023). This discipline can contribute positively to completing mathematics assignments on time and attending classes consistently. Additionally, the respect taught in pesantren makes students more appreciative of their lecturers, which may be reflected in behaviors such as actively asking questions and seeking further clarification when they do not understand the material. Pesantren education also involves group study and mutual cooperation activities, which can enhance collaborative skills in solving mathematics tasks together. The perseverance and resilience cultivated in pesantren can support students in overcoming challenges in learning mathematics (Cahyono, 2019; Guo et al., 2021; Pambudi, 2023b; Yasin et al., 2020).

Pesantren education is characterized by its emphasis on memorization (*hafalan*), moral conduct (*adab*), and deep respect for teachers (ustadz or ustadzah). Unlike modern formal education, which often prioritizes critical thinking, creativity, and interactive learning, pesantren focuses more on discipline, obedience, and religious devotion. This fundamental difference in educational philosophy can significantly influence students' academic behaviors and their ability to adapt to university learning environments, particularly in analytical subjects like mathematics (Boyle, 2006; Hakim, 2023; Winata et al., 2021).

Despite many advantages, there are also some challenges faced by students with a pesantren background in learning mathematics. Transitioning from the rote-learning-based teaching methods in pesantren to more analytical and logical teaching methods at the university can be a particular challenge (Handayani, 2022; Nurdiani, 2020). Some students from pesantren backgrounds may feel reluctant or shy to ask questions or actively participate in class discussions, which can affect their understanding of the material (Maghfiroh et al., 2024). Additionally, some students may feel uncomfortable working in groups with members of the opposite gender, which can impact group dynamics in completing mathematics tasks (Crismono et al., 2025).

Although pesantren education contributes significantly to shaping students' character and behavior, there is a gap in understanding how the rote-learning and discipline-based methods in pesantren can adapt or integrate with the approach needed in university-level mathematics learning, which requires logical analysis, problem-solving, and active collaboration (Priharvian et al., 2023; Zubaidi et al., 2017). Students from a pesantren background, who are accustomed to discipline and high respect for teachers, may face challenges in adapting to analytical evaluation methods and inter-gender interaction within study groups at university. This gap highlights the need to identify effective and inclusive learning strategies to help pesantren students achieve optimal academic success in university mathematics courses (Handayani, 2022; Zulhannan & Musyarrofah, 2024). Students' attitudes toward mathematics encompassing cognitive, affective, and behavioral dimensions have been shown to significantly influence their academic engagement and performance, highlighting the importance of instructional strategies that foster positive perceptions and motivation in mathematics learning (Hwang & Son, 2021; Karjanto & Acelajado, 2022; Pizon & Ytoc, 2022).

Previous studies have shown that pesantren education plays an essential role in shaping students' moral character and discipline (Husin et al., 2022; Latifah, 2020). However, its influence on academic learning particularly in subjects that demand analytical thinking such as mathematics is still limited and inconsistent. Research by Cardozo (2021) and Yunitasari (2020) indicates that while pesantren graduates demonstrate strong discipline and respect for teachers, they often struggle with interactive and analysis-based learning approaches required in university settings. Moreover, existing studies have not fully explored how pesantren-based values align or fail to align with modern academic demands, especially in quantitative subjects like mathematics.

This study addresses that gap by examining the extent to which pesantren education affects students' attitudes and behaviors in university mathematics courses, focusing on motivation, engagement, and time management. The novelty of this research lies in its specific focus on mathematics a subject rarely studied in this context and in its quantitative correlational approach that captures measurable impacts.

The aim of this study is to analyze the relationship between pesantren education and students' attitudes and behaviors toward learning mathematics at the University of Islam Jember, with the goal of informing more adaptive and inclusive teaching strategies for students from pesantren backgrounds.

By analyzing the relationship between pesantren educational backgrounds and learning attitudes in mathematics courses, this study not only evaluates the impact of value-based education on exact sciences but also expands the understanding of the academic adaptation processes experienced by students from pesantren backgrounds in higher education. The findings are expected to serve as a foundation for curriculum designers and educators to develop more inclusive and adaptive teaching approaches that accommodate diverse educational backgrounds.

Methods

This study employed a quantitative approach with a descriptive correlational method to assess the influence of pesantren education on university students' attitudes and behaviors in learning mathematics. This approach allows for measuring the extent to which pesantren education impacts various aspects of learning attitudes and behaviors (Creswell, 2019; Crismono, 2024). The population in this study consists of university students with a pesantren educational background, specifically those studying at the University of Islam Jember or similar Islamic universities. The sample size was determined using purposive sampling technique by considering the duration of education in Islamic boarding schools, which is between 1–5 years and 6–10 years. This technique is used to obtain subjects that are relevant to the research objectives.

Table 1. Demographic distribution of respondents based on gender and duration of pesantren education

Category	Sub-Category	Number of Respondents	Percentage (%)
Gender	Male	58	43.9%
	Female	74	56.1%
Duration of Pesantren Education	1–5 years	77	58.3%
	6–10 years	55	41.7%
Total		132	100%

Data were collected through a questionnaire that assessed attitude indicators (discipline, active involvement, and respect toward lecturers) and learning behaviors (study regularity, time management, and collaboration). The questionnaire uses a 5-point Likert scale to measure the intensity of each indicator (Crismono, 2023). In addition, structured interviews may be conducted to gain deeper insights into students' experiences with pesantren education. Before use, the questionnaire is tested for validity and reliability. Content validity is conducted with the assistance of experts, while reliability is tested using Cronbach's Alpha.

Data were analyzed using various statistical techniques with the assistance of SPSS (Statistical Package for the Social Sciences) version 30.0.0. Descriptive analysis was conducted to summarize sample characteristics and the distribution of attitude and behavior variables. Pearson or Spearman correlation tests were applied to examine the relationship between the duration of pesantren education and learning attitude or behavior indicators, depending on the data's normality. ANOVA (Analysis of Variance) was employed to determine whether significant differences existed in attitudes and behaviors across groups with different durations of pesantren education. Linear regression analysis was used to assess the extent to which pesantren education predicted variations in student attitudes and behaviors. Additionally, factor analysis was conducted to identify clusters of related attitude variables and explore their underlying structure in the context of pesantren education (Macaskill et al., 1990).

The questionnaire used in this study was developed by the researchers and written in Bahasa Indonesia to ensure cultural and linguistic appropriateness for the respondents. It was a self-constructed instrument, designed specifically for this study based on theoretical frameworks related to learning attitudes and behaviors in higher education. The instrument used

in this study was the Student Mathematics Learning Attitude and Behavior Scale for Pesantren Backgrounds (SMLABS-PB), which was independently developed by the researchers. It was designed based on theoretical frameworks of academic attitudes and learning behaviors, specifically tailored for students with a pesantren educational background. The scale was constructed in Bahasa Indonesia to align with the cultural and linguistic context of the respondents.The questionnaire consisted of two main dimensions: (1) learning attitudes, which included indicators such as discipline, active involvement, and respect toward lecturers, and (2) learning behaviors, which covered study regularity, time management, and group collaboration. In total, the instrument comprised 24 items, evenly distributed across the six indicators, with each indicator represented by 4 items. All items were measured using a 5-point Likert scale, ranging from 1 ("strongly disagree") to 5 ("strongly agree").

The instrument's content validity was established through expert judgment involving educational researchers and practitioners familiar with pesantren-based education and student learning psychology. Revisions were made based on their feedback to improve clarity, relevance, and alignment with the research objectives. To test the internal consistency of the questionnaire, a Cronbach's Alpha reliability analysis was conducted, resulting in a coefficient of 0.82, which indicated a high level of reliability. This suggests that the items consistently measured the intended constructs across respondents.

Results

Relationship between pesantren education and students' learning attitudes and behaviors in mathematics courses

Based on the Pearson Correlation Test results between the Pesantren Education variable and various attitude and learning behavior variables, a very weak correlation is observed between the two sets of variables. For the Discipline variable, a correlation value of -0.073 indicates a weak negative relationship, suggesting that the length of time spent in pesantren education does not necessarily correlate with an increase in academic discipline. Meanwhile, the Active Engagement variable has an extremely weak correlation with a value of 0.023, indicating that the influence of pesantren education on active participation in learning is also minimal.

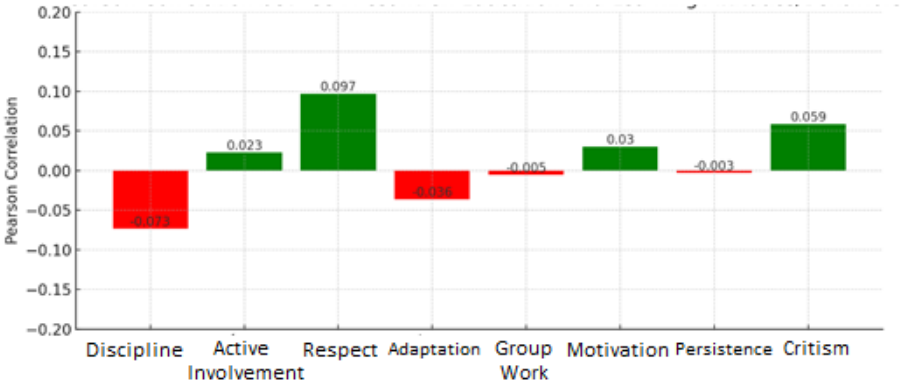

Figure 1. Pearson correlation between pesantren education and learning attitudes/behaviors

The questionnaire used in this study was developed independently by the researchers and written in Bahasa Indonesia to align with the cultural and linguistic context of the respondents. It aimed to measure students' attitudes and learning behaviors in mathematics courses, especially among those from pesantren backgrounds. The instrument consisted of 24 items, organized under six key indicators, with each indicator represented by four items.

1. Respect Toward Lecturers measured the degree of appreciation and obedience students showed to their instructors, including behaviors such as listening attentively, following instructions, and valuing lecturer feedback.
2. Adaptability referred to students' ability to adjust to academic challenges, changes in teaching styles, or collaborative learning environments in university mathematics classes.
3. Group Collaboration assessed students' willingness and comfort in working with peers, including teamwork during assignments and communication in mixed-gender groups.
4. Learning Motivation captured internal drivers of engagement such as interest in mathematics, confidence in problem-solving, and the desire to achieve academic success.
5. Persistence and Endurance evaluated students' resilience in facing academic difficulties, including their tendency to continue working through challenges without giving up.
6. Attitude Toward Criticism measured how students responded to academic feedback and corrections, whether from lecturers or peers, and their openness to self-improvement.

Each item was rated using a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree"). The instrument's content validity was confirmed through expert evaluation, and its reliability was measured using Cronbach's Alpha, yielding a value of 0.82, which indicates high internal consistency across the items.

Overall, the preliminary conclusion from this analysis suggests that the duration of pesantren education does not have a strong influence on students' attitudes and learning behaviors in university mathematics courses. The correlations found are largely very weak, in both positive and negative directions, indicating that pesantren education is not a primary factor influencing academic attitudes and behaviors in this context.

The practical implications of these weak correlations between pesantren education and various attitude and behavior variables indicate that pesantren education does not significantly impact aspects such as discipline, active engagement, or learning motivation in higher education. Practically, this implies that pesantren education is not a dominant factor shaping students' academic behaviors. The weak correlations also suggest that other factors, such as the campus environment, teaching methods, intrinsic motivation, or even family background, may play a more significant role in determining learning attitudes.

Therefore, if the goal of educational interventions is to improve academic behaviors, relying solely on pesantren education as an instrument may not be effective. This weak correlation also reflects the possible diversity of experiences in pesantren, which may lead to varied impacts on students. Additionally, for a more comprehensive understanding, further analysis considering other variables, such as social support or high school experiences, may be necessary. Overall, these correlation results suggest a broader approach is needed to understand and influence students' learning attitudes and behaviors.

The duration of pesantren education significantly affects students' mathematics learning attitudes at the university level

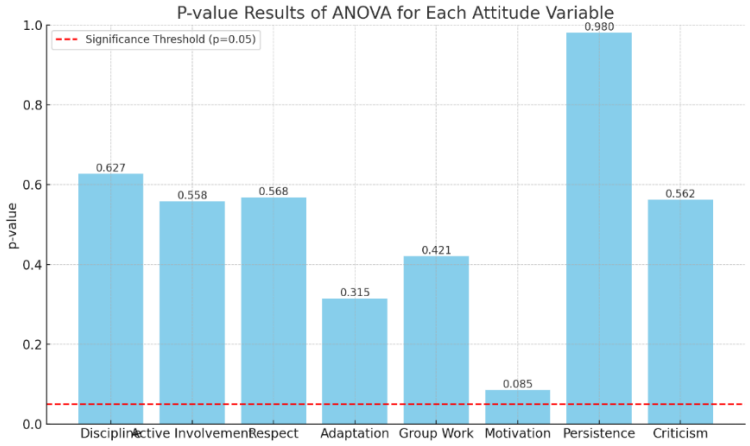

Figure 2. P-value result of ANOVA for each attitude variable

The ANOVA test results conducted to evaluate differences in mathematics learning attitudes based on the duration of pesantren education indicate no significant differences among the groups in most learning attitude variables. For the Discipline variable, the F-value of 0.58 with a p-value of 0.627 suggests no significant difference. Similarly, variables such as Active Engagement (F = 0.69, p = 0.558), Respect Toward Lecturers (F = 0.68, p = 0.568), Adaptability (F = 1.20, p = 0.315), Group Collaboration (F = 0.95, p = 0.421), Persistence and Endurance (F = 0.06, p = 0.980), and Attitude Towards Criticism (F = 0.69, p = 0.562) also show no significant differences among student groups based on the length of pesantren education.

However, for the Learning Motivation variable, the results show an F-value of 2.28 with a p-value of 0.085, which is close to the significance threshold. Nevertheless, this p-value is still above the typical significance threshold (0.05), so it cannot be conclusively determined that there is a significant difference. To conclude a strong difference, a lower p-value (below 0.05) would be required. Overall, these results suggest that the duration of pesantren education may not play a major role in differentiating students' mathematics learning attitudes at university.

Pesantren education has a predictive influence on students' learning attitudes in mathematics courses

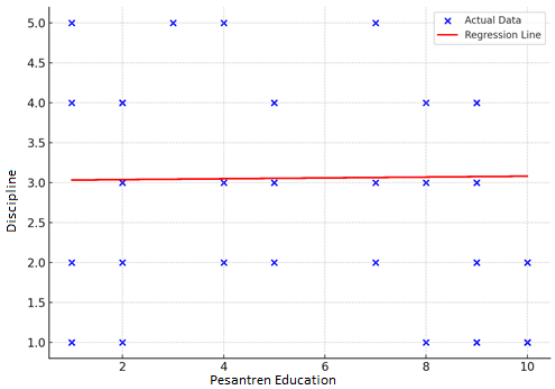

Figure 3. Linier regression: Pesantren education vs disipline

The linear regression analysis conducted to measure the influence of pesantren education as an independent variable on various learning attitudes of students as dependent variables shows that the impact of pesantren education is very weak. The R-squared (R^2) values obtained are mostly negative or close to zero, indicating that pesantren education does not significantly explain the variation in students' learning attitudes. For the Discipline variable, an R^2 value of -0.087 suggests that the regression model has poor predictive power. The same holds for Active Engagement (R^2 = -0.083), Adaptability (R^2 = -0.005), Group Collaboration (R^2 = -0.010), Learning Motivation (R^2 = -0.181), Persistence and Endurance (R^2 = -0.079), and Attitude Towards Criticism (R^2 = -0.133). Meanwhile, Respect Toward Lecturers has an R^2 value of 0.014, which, though positive, remains very weak and insignificant.

Overall, these low and negative R^2 values indicate that pesantren education is not a primary factor influencing students' attitudes toward learning mathematics in this context. Other factors beyond pesantren education are likely more relevant in affecting students' learning attitudes and behaviors.

Students' learning attitudes are structured based on interrelated factors influenced by pesantren education

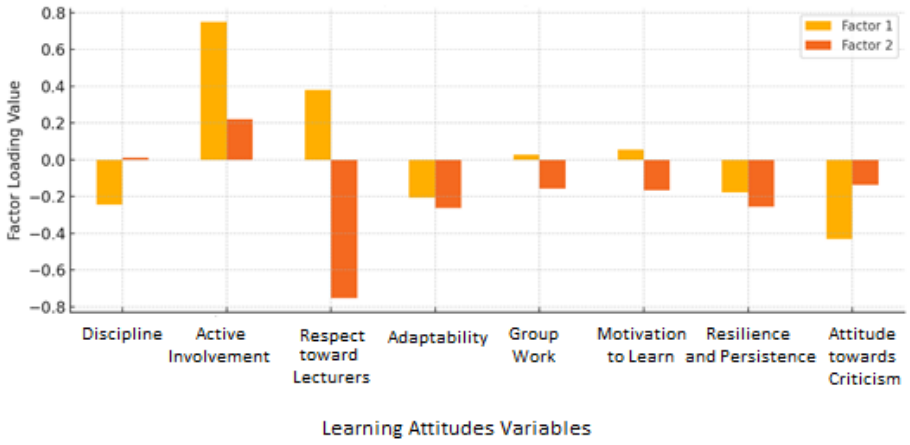

Figure 4. Factor loading for learning attitudes variables

The factor analysis identifies two primary factors that influence students' learning attitude variables. Factor loadings indicate the strength of each variable's correlation with these factors. Factor 1 shows a high correlation with Active Engagement (0.748) and Respect Toward Lecturers (0.379), suggesting that this factor may reflect a proactive learning attitude, such as students' active participation in the learning process. Conversely, Factor 2 shows a relatively strong negative correlation with Respect Toward Lecturers (-0.753) and Adaptability (-0.263). This negative correlation suggests that Factor 2 may be associated with respect for authority or hierarchy, where respect toward lecturers inversely relates to this factor.

Additionally, the variable Active Engagement has the strongest correlation with Factor 1, reinforcing the idea that this factor is related to proactive engagement attitudes. Meanwhile, Respect Toward Lecturers stands out by having a high correlation with both factors, though the

direction of these correlations differs. This factor analysis helps group related learning attitudes, providing a clearer understanding of the structure underlying relationships among variables in the context of students' learning attitudes.

Patterns of academic behavior among pesantren students can be grouped based on their learning attitudes

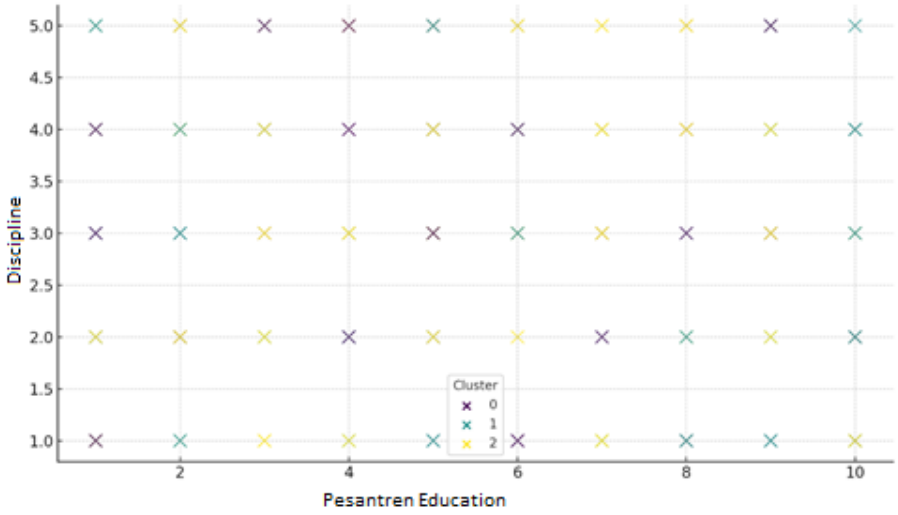

Figure 5. Cluster analysis of learning attitudes based on pesantren education

The cluster analysis reveals groupings of students based on similarities in their learning attitudes, influenced by pesantren education and discipline-related variables. Each cluster is formed based on distinct attitude patterns, such as levels of discipline, active engagement, respect toward lecturers, and other variables that reflect learning attitudes. In this interpretation, each cluster represents a group of students with different characteristics regarding the duration of pesantren education and learning attitudes. For example, one cluster may consist of students with longer pesantren education and higher discipline levels, while another cluster may include students with stronger active engagement but with varied pesantren education backgrounds.

By comparing these clusters, it is possible to observe any specific patterns that indicate pesantren education's influence on certain learning attitudes, such as discipline or learning motivation. If a particular cluster shows a clear relationship between the duration of pesantren education and more positive learning attitudes, this could indicate that pesantren education plays a role in shaping students' academic behavior. However, if no consistent pattern is found across clusters, other factors outside pesantren education may be more influential in shaping learning attitudes. This cluster analysis provides a clearer view of how pesantren education and learning attitudes are interrelated and opens opportunities for further research on the impact of religious education on students' academic behavior in higher education.

Pesantren education significantly influences students' learning motivation and discipline through direct or indirect paths

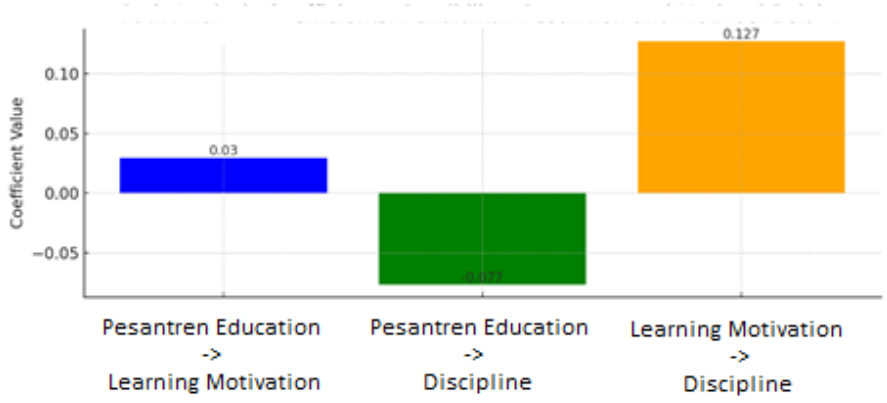

Figure 6. Path analysis coefficients: Pesantren education and learning motivation

The results of the path analysis reveal two regression models that explore the influence of pesantren education on learning motivation and discipline. Model 1, which measures the impact of pesantren education on learning motivation, yields an R^2 value of 0.001, indicating that pesantren education explains only 0.1% of the variation in learning motivation—a very low value. The coefficient for pesantren education is 0.0296 with a p-value of 0.659, suggesting that the influence of pesantren education on learning motivation is not statistically significant.

Model 2, which measures the influence of both pesantren education and learning motivation on discipline, shows an R^2 value of 0.022, meaning that pesantren education and learning motivation together explain only 2.2% of the variation in discipline, which is also low. The coefficient for pesantren education in relation to discipline is -0.0767 with a p-value of 0.251, indicating that pesantren education does not have a significant impact on discipline. However, learning motivation has a coefficient of 0.1273 with a p-value of 0.057, which is close to the threshold of significance. This suggests that learning motivation may have a slight influence on discipline, albeit not fully significant.

Overall, pesantren education does not have a direct, significant influence on either learning motivation or discipline. However, learning motivation shows a potential, albeit weak, indirect influence on discipline, though this effect is not yet entirely significant.

Relationship between pesantren education and academic attitudes in non-normal data

The Spearman Correlation Test is used to assess the strength and direction of relationships between two ordinal variables or data that do not meet normality assumptions. This test serves as an alternative to Pearson Correlation and is more suitable for non-normally distributed data. In this analysis, the Spearman Correlation Test is used to measure the relationship between Pesantren Education and various other variables, including discipline, active engagement, respect toward lecturers, adaptability, group collaboration, learning motivation, persistence and endurance, and attitude towards criticism.

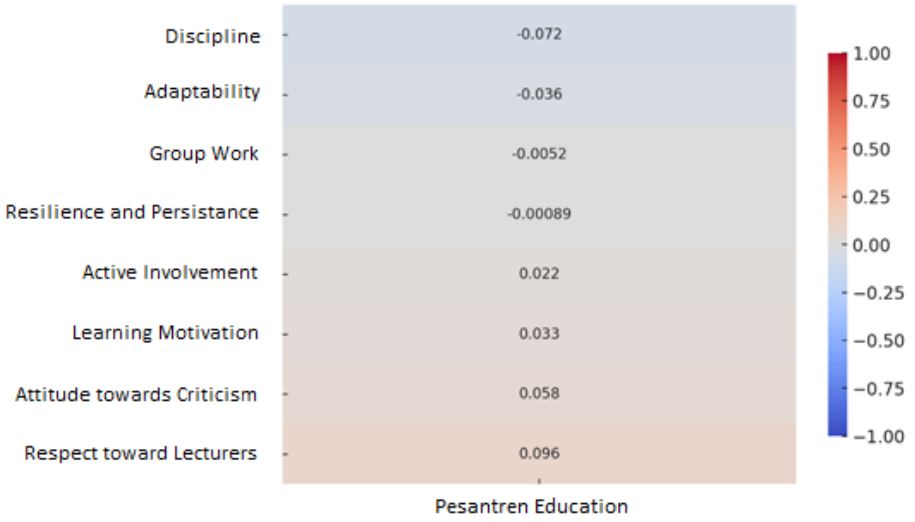

Figure 7. Spearman correlation between pesantren education and other variables

The results show very weak correlations across all variables, in both positive and negative directions. The correlation between Pesantren Education and Discipline is -0.072, indicating a very weak negative correlation. The correlation with Active Engagement is 0.022, showing a very weak positive correlation, and similarly, Respect Toward Lecturers has a correlation value of 0.096, which, although higher than other variables, remains weak. Adaptability shows a very weak negative correlation of -0.036, as does Group Collaboration with -0.005. Learning Motivation has a very weak positive correlation of 0.033, Persistence and Endurance shows -0.001, and Attitude Towards Criticism has a weak positive correlation of 0.058.

Overall, there is no significant correlation between Pesantren Education and any of the other variables, with the correlations found being very weak in various directions. The highest correlation is between Pesantren Education and Respect Toward Lecturers at 0.096, though this remains weak and not significant.

Students' learning motivation significantly differs based on the duration of pesantren education

The t-test is a statistical method used to compare the means between two groups to determine if there is a significant difference between them. There are two commonly used types of t-tests: the Independent Sample T-Test and the Paired Sample T-Test. The Independent Sample T-Test is applied when comparing the means of two unrelated groups, such as students from pesantren backgrounds and those without. In contrast, the Paired Sample T-Test compares the means of two measurements on the same group, such as before and after a specific intervention.

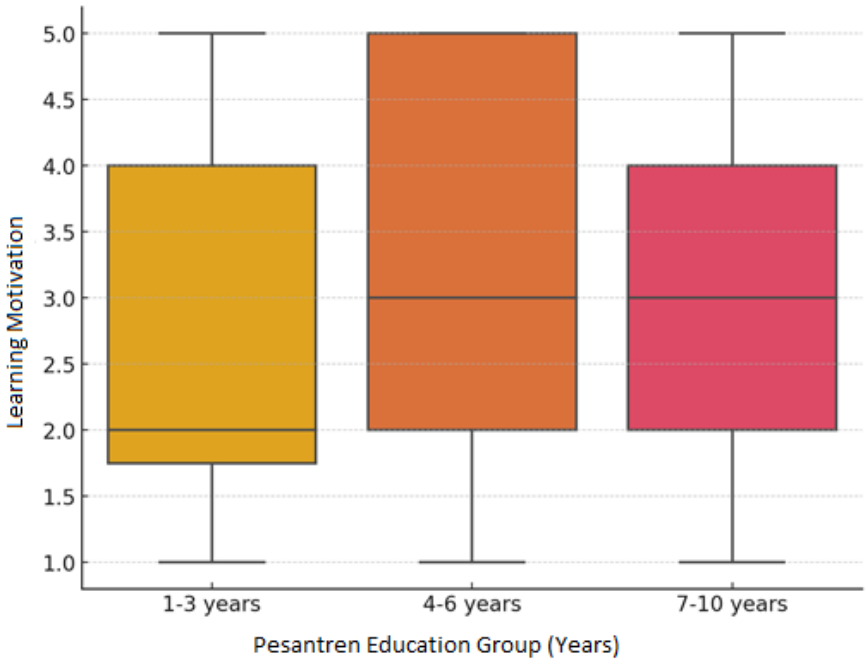

Figure 8. Learning motivation based on legth of pesantren education

In this context, to assess whether there is a difference in learning motivation between two groups with different durations of pesantren education (1–5 years and 6–10 years), an Independent Sample T-Test was conducted. The test results show a t-statistic value of 0.326 with a p-value of 0.745. Since this p-value is significantly higher than the general significance threshold (0.05), it indicates no significant difference in the average learning motivation between the 1–5 year group and the 6–10 year group of pesantren education. Thus, the duration of pesantren education (within these two ranges) does not significantly affect individual learning motivation levels within this group.

Discussion

Pearson correlation analysis shows that the duration of pesantren education has a very weak correlation with learning attitudes, such as discipline, active engagement, and motivation, suggesting that pesantren education does not play a significant role in shaping academic attitudes, particularly in mathematics courses at the university level. This finding reinforces that pesantren education emphasizes moral and ethical values over specific academic skills relevant in a university setting. Other studies support this result, such as the research by Husin et al. (2022), which shows that pesantren education is effective in forming students' morals and ethics but does not focus on the academic learning skills required at university. Similarly, Latifah (2020) states that although pesantren instills discipline and obedience, these values do not necessarily support academic skills such as critical or analytical thinking, which are important in mathematics. Likewise, Cardozo (2021) found that students from pesantren backgrounds have strong moral discipline but often struggle to adapt to analysis-based learning methods at

university. Yunitasari (2020) adds that although pesantren instills strong discipline, this does not significantly impact learning skills that require complex analysis and problem-solving.

ANOVA results show no significant differences in mathematics learning attitudes based on the duration of pesantren education, indicating that the length of time spent in pesantren is not a major factor in shaping academic attitudes like discipline and active engagement. This implies that the duration of pesantren education is not a determining factor in forming students' academic attitudes, and additional approaches are needed to support their academic adaptation in university. Qodir (2020) supports this finding, stating that pesantren education focuses more on moral and ethical character building rather than academic learning methods. Bagaskorowati (2023) also found that although extended pesantren education can enhance moral character, it does not significantly impact academic adaptation or learning skills at the university level. Rahayu (2019) adds that the rote-based and discipline-oriented learning system in pesantren is less effective in developing analytical skills and dynamic learning attitudes needed in higher education. Handayani (2022) also noted that the duration of pesantren education does not correlate with improved academic attitudes, particularly in fields requiring critical thinking like mathematics.

Linear regression analysis shows that pesantren education has a very weak influence on predicting students' learning attitudes at the university level, with low or even negative R-squared values. This confirms that pesantren education is not a primary factor influencing academic attitudes such as discipline and active engagement, which are more affected by the academic environment or individual student characteristics. Research by Fadhilah et al. (2018) supports this finding, showing that religious-based educational experiences do not necessarily influence motivation or learning attitudes at university, especially in analytical study areas. Yusup et al. (2021) also revealed that character education in pesantren is less effective in developing the critical and analytical thinking skills needed in higher education, consistent with the weak correlations shown by regression analysis. Guo et al. (2021) adds that while pesantren education can enhance moral discipline, this does not always correlate with better academic achievement, indicating that forming academic attitudes requires a different approach. Furthermore, Pambudi et al. (2023) noted that a background in rote-based and discipline-oriented pesantren education is less relevant in forming academic attitudes like motivation and discipline in more complex learning environments, such as mathematics.

Factor analysis shows that the first factor is closely related to active engagement and respect toward lecturers, while the second factor shows a negative correlation with respect toward lecturers. This suggests that traditional pesantren values may support respect for authority but are less relevant to the need for active engagement in university classrooms. Bagaskorowati (2023) highlights that pesantren education cultivates respect for authority, but this attitude does not always support the active engagement needed in university settings. Husin et al. (2022) also found that pesantren builds respect toward teachers, but limitations in active engagement pose challenges in adapting to more interactive academic environments. Sukarsono (2019) notes that pesantren values emphasize respect and discipline, which are beneficial in interactions with lecturers but insufficient to support active participation in the learning process. Latifah (2020) adds that although pesantren strengthens respect, the skills to interact actively

are not well developed, especially in learning environments that require discussion and collaboration.

Cluster analysis reveals that the learning attitudes of students with pesantren backgrounds vary, but no consistent pattern indicates the influence of pesantren education on academic attitudes at university. This indicates that although pesantren backgrounds may shape basic character, this does not always directly impact academic behavior in a university context. Yasin et al. (2020) found that pesantren education produces variations in students' learning attitudes, suggesting that other factors, such as the academic environment, have a more significant influence on academic attitudes. Kudinov et al. (2020) found that while pesantren education provides a solid foundation of values, each individual's academic response varies according to personal needs and goals. Zulhannan (2024) highlights that the pesantren environment helps shape basic discipline, but academic attitude patterns at university are still influenced by teaching methods and academic interactions. Rahayu (2019) states that pesantren education focused on rote learning does not always create uniform academic attitudes, especially in courses requiring problem-solving skills and active collaboration.

Path analysis shows that pesantren education does not have a significant influence on learning motivation and discipline, although learning motivation has a slight influence on discipline. This finding confirms that the influence of pesantren education on motivation and learning discipline is very limited in a university environment that requires academic independence. Cahyono, (2019) and Hamdanah & Crismono (2024) supports this result, stating that academic motivation and discipline are more influenced by the university learning environment than by a religious education background. Handayani (2022) found that pesantren education focuses on moral attitudes, but academic motivation requires further adaptation in the campus environment. Guo et al. (2021) shows that learning motivation is more influenced by the educational environment and teaching approach, reinforcing the finding that a pesantren background does not significantly correlate with academic motivation in higher education. Latifah (2020) adds that the focus of pesantren education on ethical values may be less relevant for forming the academic motivation needed in university studies.

Spearman correlation analysis shows that pesantren education does not have a strong correlation with variables like active engagement or time management, indicating that pesantren values do not always align with the skills needed for university-level learning. Rahayu (2019) states that although pesantren emphasizes discipline, this does not always support time management or academic engagement skills that are essential in university settings. Acar (2014) adds that traditional value-based education does not always support adaptive learning behavior in an analytical environment like university. Yunitasari (2020) also shows that pesantren discipline values are not directly related to time management and engagement skills required at university. Meanwhile, Nurdiani (2020) found that students' learning behavior is more influenced by the academic needs at university than by the discipline values from pesantren education.

The T-test results indicate no significant difference in learning motivation between students with different durations of pesantren education, suggesting that learning motivation is more influenced by individual needs at university than by the duration of pesantren education.

Pambudi (2023a) states that learning motivation is influenced by individual goals and needs, rather than the length of previous education, consistent with the finding that pesantren duration has no significant impact. Egara & Mosimege (2024) also noted that learning motivation is more related to university learning approaches than the rote learning methods in pesantren. Fatonah et al. (2023) found that learning motivation is driven more by individual academic needs, reinforcing the result that pesantren education duration does not impact learning motivation. Additionally, Yusup et al. (2021) supports the view that motivation in learning is more influenced by academic challenges than by the length of pesantren education.

This analysis reveals several interesting contradictions with previous research findings. First, although pesantren education emphasizes high discipline, as noted by Latifah (2020) and Husin et al. (2022), this does not correlate with good time management skills at university, especially in an academic context that requires independence. Furthermore, although pesantren students have respect for lecturers, the analysis shows that this does not encourage active classroom participation. This contradicts findings by (Bagaskorowati, 2023) and Qodir (2020), who suggest that respect for authority can increase academic participation. Another contradiction lies in the influence of pesantren education duration on learning motivation. Although it might be expected that longer pesantren education would strengthen motivational values, the results indicate that learning motivation at university is more influenced by internal factors and individual adaptation, consistent with (Fatonah et al., 2023).

Another noteworthy finding is that pesantren education does not fully prepare students for the analytical skills required in university, especially in mathematics learning. Husin et al. (2022) and Latifah (2020) emphasize that the discipline and persistence values developed in pesantren seem more suitable for rote learning than for analytical problem-solving. Although moral values and respect for authority are well established, their impact on academic achievement is not significant. Furthermore, pesantren students' adaptation to discussion-based learning methods in university remains limited, consistent with findings by Handayani (2022), who mentions the need for more interactive learning approaches in pesantren to better prepare students for academic environments that demand participative and analytical skills.

These findings highlight the importance of gaining a deeper understanding of the learning characteristics of pesantren-background students, particularly in mathematics learning contexts that demand analytical thinking and active engagement. Thus, this study offers valuable empirical insights into mathematics education by examining how pesantren values intersect with the academic demands of higher education. The implications of this research can inform the development of more context-sensitive and responsive instructional strategies to support students from various educational backgrounds.

Conclusion

The pesantren education had a limited influence on students' attitudes and learning behaviors in mathematics courses that require analytical skills and academic independence. While pesantren education was effective in shaping moral character and discipline, these values did not significantly correlate with essential college-level learning competencies such as time

management, active engagement, and self-regulation. The findings suggest that pesantren-based instruction, which tends to emphasize obedience and rote memorization, may not adequately prepare students for the demands of university-level mathematics learning. However, this study was not without limitations. First, the sample was limited to one institution the Islamic University of Jember which may affect the generalizability of the results to pesantren students in other universities or regions. Second, the study relied exclusively on self-reported questionnaire data, which may be subject to bias or limited introspective accuracy. Third, the gender distribution and other demographic details of the respondents were not analyzed in depth, which could have provided more nuanced insights into how different student groups experience the transition from pesantren to university learning. For future research, it is recommended that pesantren integrate more analytical and interactive learning strategies to better support academic adaptation. Moreover, future studies should examine the role of external factors such as the university learning environment, teaching methods, and peer support. A qualitative approach is also encouraged to explore in greater depth the adaptation challenges faced by pesantren students, especially in contexts that demand active participation, critical thinking, and collaborative learning.

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Conflicts of Interest

The authors declare no conflict of interest regarding the publication of this manuscript. In addition, the authors have completed the ethical issues, including plagiarism, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies.

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Author Contributions

Prima Cristi Crismono: Conceptualization, writing original draft, methodology, formal analysis, editing, investigation and visualization; **Siti Lailatul Maghfiroh:** Supervision, validation, formal analysis, Writing review & editing, visualization; **Harapandi Dahri:** Supervision, validation, formal analysis, and visualization; Writing–review & editing, and visualization. **Mahnawawe Yakoh:** Writing–review & editing

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