

A Holistic and Data-Informed Model of Positive Education, Psychological Well-Being, and Academic Achievement among Generation Z Students

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ABSTRACT

Recent discussions in higher education increasingly emphasize the need to balance academic achievement with students' psychological well-being, particularly among Generation Z students who often experience high academic pressure alongside psychosocial challenges. This study examines a holistic model integrating Positive Education and Psychological Well-Being to explain academic achievement among Generation Z students in Muhammadiyah and 'Aisyiyah higher education institutions in Riau Province. An explanatory sequential mixed-methods design was employed. Quantitative data were collected from 359 students using validated instruments measuring Positive Education (PERMA), Psychological Well-Being, and Academic Achievement. Data were analyzed using descriptive statistics, correlation analysis, mediation analysis with bootstrapping, and machine learning models (Random Forest and XGBoost) to identify predictive patterns. Qualitative data from semi-structured interviews with 30 students were used to enrich the interpretation of the quantitative findings. The results indicate significant positive relationships between Positive Education and Psychological Well-Being ($r = .52, p < .01$) and between Psychological Well-Being and Academic Achievement ($r = .55, p < .01$). Mediation analysis shows that Psychological Well-Being fully mediates the relationship between Positive Education and Academic Achievement ($\beta = .31, p < .01$). Machine learning results further support these findings, with XGBoost demonstrating the highest predictive performance ($R^2 = 0.66$) and identifying purpose in life, engagement, and meaning as the most influential predictors of academic achievement. These findings suggest that academic achievement among Generation Z students is closely linked to both the quality of educational environments and students' psychological resources. Integrating well-being-oriented educational practices with data-informed analytical approaches may provide a promising pathway for supporting sustainable student success in higher education.

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1. INTRODUCTION

In recent years, discussions in higher education have increasingly moved beyond a narrow focus on academic performance toward a more comprehensive understanding of student development. Academic achievement is no longer viewed solely as the result of cognitive ability or instructional quality (Blömeke et al., 2022), but as an outcome shaped by students' psychological, emotional, and social conditions (Turetsky et al., 2021). Rising concerns related to academic stress, disengagement, and declining persistence have encouraged educators and institutions to reconsider how learning environments can better support both academic outcomes and student well-being (Bakker & Mostert, 2024).

This shift is particularly relevant for Generation Z students, a cohort commonly associated with high levels of digital engagement, rapid access to information, and strong adaptability to technological change (Chardonens, 2025). At the same time, empirical evidence suggests that Generation Z students are also more vulnerable to psychological challenges such as anxiety, emotional fatigue, and academic pressure (Ningthoujam et al., 2021). These conditions may undermine concentration, motivation, and sustained engagement in learning, ultimately affecting academic achievement (Bustamante-Mora et al., 2025). As a result, Generation Z represents an important population for examining educational models that explicitly integrate academic and psychological dimensions of learning.

Positive Education and Psychological Well-Being are conceptually interconnected (Sarzhanova & Nurgabdeshev, 2025). Rooted in positive psychology, Positive Education integrates the cultivation of well-being with academic instruction by fostering positive emotions, engagement, supportive relationships, meaning, and accomplishment within the learning process (Kern & Wehmeyer, 2021; R. Wang & Zhang, 2025). Through these dimensions, Positive Education emphasizes the development of students' strengths, resilience, and sense of purpose, positioning well-being as a supportive foundation for effective learning rather than as a separate educational goal (Gill et al., 2021). Closely aligned with this perspective, Psychological Well-Being is understood as a multidimensional construct encompassing autonomy, personal growth, purpose in life, self-acceptance, environmental mastery, and positive relationships (Cilar Budler, 2025). Students with higher levels of psychological well-being tend to demonstrate stronger self-regulation, intrinsic motivation, and adaptive coping strategies, which play a critical role in responding to academic demands, managing stress, and persisting in challenging learning contexts (Rodríguez et al., 2022; Chaudhry et al., 2024). In this context, Positive Education functions not only as an instructional approach but also as a contextual mechanism that shapes students' psychological experiences by creating emotionally supportive, meaningful, and relational learning environments (Allison et al., 2021; Frazier & Doyle Fosco, 2023). Psychological Well-Being, in turn, enhances students' capacity to engage effectively with academic tasks by supporting motivation, focus, and academic resilience, thereby strengthening the impact of positive educational practices on learning outcomes through students' psychological functioning (F. Wang & Liu, 2022).

Although a growing body of research has examined the relationship between Positive Education and academic outcomes, as well as the association between psychological well-being and academic achievement, many existing studies address these constructs in isolation. Limited attention has been given to how Positive Education and Psychological Well-Being operate together within an integrated model, particularly in higher education settings. Moreover, research focusing specifically on Generation Z students remains relatively scarce, despite the distinctive academic and psychological challenges faced by this cohort.

Despite the expanding literature on Positive Education and Psychological Well-Being, several important gaps remain. First, existing studies often report positive associations between these constructs and academic outcomes, yet findings are frequently inconsistent regarding the strength and explanatory role of psychological well-being across different educational contexts. Second, many studies treat Positive Education and Psychological Well-Being as independent predictors of academic achievement, offering limited insight into how these constructs operate together within a single explanatory framework. As a result, the mediating role of Psychological Well-Being remains underexplored, particularly in higher education settings where academic pressure and psychosocial demands are increasingly complex.

Another limitation of prior research lies in its predominant reliance on traditional analytical approaches that emphasize linear relationships and isolated predictors of academic performance. Such approaches may overlook the complex and interrelated pathways through which educational environments and psychological factors jointly influence learning outcomes. There is a need for research that adopts a more holistic perspective, allowing for the examination of both direct and indirect relationships among key educational and psychological constructs.

Based on these considerations, the present study proposes a holistic model that integrates Positive Education and Psychological Well-Being in explaining academic achievement among Generation Z students in higher education. Psychological Well-Being is examined as a central mechanism through which positive educational practices are translated into academic outcomes. In addition to conventional statistical approaches, this study adopts a data-informed analytical perspective to capture patterns and relationships that may not be fully explained through linear analysis alone. The use of educational data analytics allows for a more nuanced examination of how multiple dimensions of well-being and positive education interact in shaping academic achievement.

By focusing on Generation Z students in Muhammadiyah and 'Aisyiyah higher education institutions in Riau Province, this study seeks to bridge educational theory with emerging analytical approaches in higher education research. While the primary emphasis remains on educational and psychological perspectives, the incorporation of machine learning-supported analysis serves as a complementary tool to strengthen empirical insights and predictive understanding. The findings are expected to contribute to the literature on well-being-oriented education by demonstrating how holistic educational models, supported by data-informed techniques, can promote sustainable academic achievement and student flourishing.

Based on the identified theoretical and empirical gaps, this study aims to examine a holistic model integrating Positive Education and Psychological Well-Being in explaining academic achievement among Generation Z students in higher education. Specifically, this study addresses the following research questions: (1) How are Positive Education and Psychological Well-Being associated with academic achievement among Generation Z students? (2) Does Psychological Well-Being mediate the relationship between Positive Education and academic achievement? (3) How can data-informed analytical modeling enhance understanding of the relative contribution of educational and psychological factors to academic achievement? The proposed conceptual model guiding this study is presented in Figure 1.

2. METHODS

2.1 Research Design

This study employed a cross-sectional explanatory sequential mixed-methods design to examine the integration of Positive Education and Psychological Well-Being and their influence on Academic Achievement among Generation Z students enrolled in Muhammadiyah and 'Aisyiyah higher education institutions in Riau Province. In line with the explanatory sequential approach, quantitative data were collected and analyzed in the first phase, and the results subsequently informed the selection of participants for the qualitative phase.

A mixed-methods approach was chosen to enhance complementarity and triangulation. Quantitative analysis enabled examination of generalizable relationships among variables, while qualitative inquiry provided contextual depth to interpret how students experience positive educational practices and psychological well-being within academic settings. In addition, machine learning techniques were incorporated to strengthen predictive modeling and explore data-driven patterns beyond conventional inferential analysis.

2.2 Participants and Sampling

The target population consisted of approximately 3,520 Generation Z students across Muhammadiyah and 'Aisyiyah higher education institutions in Riau Province. Using Slovin's formula

with a 5% margin of error, the minimum recommended sample size was 359 respondents. A simple random sampling technique was employed within the participating institutions to ensure proportional representation of eligible students. A total of 359 questionnaires were distributed, of which 349 were returned and deemed complete, resulting in a response rate of 97.21%. The final sample consisted of 349 students.

The inclusion criteria for this study were defined as actively enrolled undergraduate students who had completed at least their first semester (minimum semester 2). Participants were aged between 18 and 23 years, corresponding to the Generation Z classification with birth years ranging from 2003 to 2008. The mean age of participants was approximately 20.5 years ($SD=1.5$). Preliminary screening confirmed GPA values within the 0–4 scale and age eligibility. Missing data were minimal and handled through listwise deletion. Multicollinearity was assessed using Variance Inflation Factor (VIF) in SPSS, with all values within acceptable limits.

2.3 Instruments

Quantitative data were collected using standardized self-report measures on a 5-point Likert scale, specifically the 15-item PERMA Profiler to measure Positive Education and the 18-item Ryff's Psychological Well-Being Scale to assess well-being. Additionally, academic achievement was operationalized through participants' self-reported cumulative Grade Point Average (GPA) on a scale of 0 to 4. Construct validity was examined using Exploratory Factor Analysis (EFA) in SPSS. Factor loadings exceeded 0.50, and Average Variance Extracted (AVE) values were above 0.50 (≈ 0.72), indicating adequate convergent validity (Mat Roni & Djajadikerta, 2021). Discriminant validity was assessed using the Fornell–Larcker criterion. Internal consistency reliability was confirmed using Cronbach's alpha, with all constructs exceeding 0.70 as seen in table 1.

Table 1. Measurement Instruments and Psychometric Properties

Construct	Instrument	Items	Scale	α	AVE	Loading Range	Source
Positive Education	PERMA Profiler	15	5-point	0.86	0.72	≥ 0.50	(Chue et al., 2024)
Psychological Well-Being	Ryff Scale	18	5-point	0.87	0.72	≥ 0.50	(Blasco-Belled & Alsinet, 2022)
Academic Achievement	Cumulative GPA	–	0–4 scale	–	–	–	Self-reported

2.4 Quantitative Data Analysis

Statistical analyses were conducted using SPSS. Descriptive statistics, reliability testing, and inferential analyses were performed to examine relationships among variables. Mediation analysis was conducted using a bootstrapping procedure with a 95% confidence interval. Indirect effects were considered statistically significant when the confidence interval did not include zero, providing robust estimation without assuming normal distribution of indirect effects.

2.5 Machine Learning Analysis

Machine learning techniques were implemented using the Orange data mining platform to enhance predictive understanding. Academic Achievement was modeled as a function of Positive Education and Psychological Well-Being dimensions:

$$\hat{Y} = f(X_1, X_2, \dots, X_n) \quad (2)$$

where $\hat{Y}$ represents predicted academic achievement and X_i represents specific predictor dimensions. The dataset was divided into training (80%) and testing (20%) subsets. Random Forest and XGBoost

algorithms were implemented using predefined hyperparameters. Model performance was evaluated using R^2 , RMSE, MAE, and MSE as seen in the table 2 below.

Table 2. Machine Learning Model Configuration

Model	Training/Test Split	Hyperparameters	Evaluation Metrics
Random Forest	80% / 20%	n_estimators=100, max_depth=5	R^2 , RMSE, MAE, MSE
XGBoost	80% / 20%	learning_rate=0.1, max_depth=4	R^2 , RMSE, MAE, MSE

2.6 Qualitative Component

Following quantitative analysis, semi-structured interviews were conducted with a purposively selected subset of students representing varying levels of academic achievement and psychological well-being. Interviews were conducted to contextualize statistical findings and explore students' experiences with positive educational practices. Transcripts were analyzed thematically through manual coding by two independent researchers. Inter coder agreement was established prior to theme consolidation. Qualitative findings were used to triangulate and enrich interpretation of quantitative and predictive results.

2.7 Integration of Findings

Integration occurred at the interpretation stage through triangulation of statistical results, machine learning outputs, and qualitative themes. This approach strengthened methodological rigor by combining explanatory, predictive, and contextual perspectives in examining how Positive Education and Psychological Well-Being jointly influence academic achievement. The conceptual relationship can be summarized as figure below:



Figure 1. Conceptual Relationship

2.8 Ethical Considerations

Formal administrative approval was obtained from institutional academic authorities prior to data collection. All participants provided informed consent, and confidentiality was strictly maintained. Participation was voluntary, and data were anonymized prior to analysis.

3 FINDINGS AND DISCUSSION

3.1 Findings

3.1.1 Quantitative Data Analysis

Quantitative analysis was conducted using data from 349 Generation Z students enrolled in Muhammadiyah and 'Aisyiyah higher education institutions in Riau Province. Table 3 presents the descriptive statistics of the key study variables. Overall, mean scores across constructs were situated in the moderate to high range, with relatively low dispersion, indicating a generally consistent response pattern among participants.

Table 3. Descriptive Statistics of Key Variables

	Indicator	Mean (M)	Std. Deviation (SD)	Interpretation
Positive Education (PERMA)	Positive Emotion	3.89	0.99	Moderate–High
	Engagement	4.02	0.78	High
	Relationships	4.21	0.78	High
	Meaning	4.28	0.78	High
	Accomplishment	3.95	0.96	Moderate–High
Psychological Well-Being (PWB)	Self-Acceptance	4.23	0.75	High
	Positive Relations	4.21	0.74	High
	Autonomy	4.05	0.79	Moderate–High
	Environmental Mastery	3.98	0.81	Moderate–High
	Purpose in Life	4.30	0.76	High
	Personal Growth	4.18	0.77	High
Academic Achievement	Learning Commitment	4.38	0.74	High
	Academic Responsibility	4.21	0.74	High
	Readiness for Academic Challenges	4.21	0.74	High
	Achievement Motivation	4.53	0.74	Very High

Within the PERMA dimensions, Meaning ($M = 4.28$, $SD = 0.78$) and Relationships ($M = 4.21$, $SD = 0.78$) obtained the highest mean values. In the Psychological Well-Being construct, Purpose in Life ($M = 4.30$, $SD = 0.76$) showed the strongest central tendency. For Academic Achievement, Achievement Motivation recorded the highest mean score ($M = 4.53$, $SD = 0.74$). All constructs demonstrated acceptable internal consistency, with Cronbach's α values ranging from 0.80 to 0.89.

3.1.2 Correlation Analysis

A Pearson correlation analysis was conducted to examine the relationships among the main study variables. The results indicated that all variables were positively and significantly correlated, suggesting a consistent directional relationship across the model. These correlations ranged from moderate to strong, providing preliminary support for the hypothesized paths. Detailed coefficients and significance levels for these associations are presented in Table 4.

Table 4. Qualitative Findings by Theme

Variable	1	2	3
1. Positive Education (PERMA)	—		
2. Psychological Well-Being	.52**	—	
3. Academic Achievement	.48**	.55**	—

3.1.3 Mediation Analysis

The mediation analysis was performed using the SPSS PROCESS macro with a bootstrapping procedure based on 5,000 resamples and a 95% confidence interval. Detailed results for the direct effects are presented in Table 5 to illustrate the primary relationships between variables. Furthermore, the significance of the indirect effects, which indicate the presence of a mediating relationship, is documented in Table 6.

Table 5. Direct Effects

Path	β	SE	t	p	95% CI
PERMA → PWB	0.45	0.05	9.12	< .001	[0.35, 0.55]
PWB → Achievement	0.38	0.06	6.84	< .001	[0.27, 0.49]
PERMA → Achievement	0.21	0.07	3.00	.003	[0.07, 0.35]

Table 6. Direct Effects (Bootstrapping)

Indirect Path	Effect	Boot SE	95% CI
PERMA → PWB → Achievement	0.17	0.04	[0.10, 0.26]

The bootstrapped confidence interval did not include zero, indicating a statistically significant indirect effect and providing empirical evidence for the mediation hypothesis. This result suggests that the influence of the independent variable on academic outcomes is partially transmitted through the mediating factor. Furthermore, the overall model explained 41% of the variance in Academic Achievement ($R^2=.41$), which represents a substantial proportion of the total variation. This level of predictive power indicates that the combined effect of Positive Education and Psychological Well-Being serves as a meaningful predictor of student success within this Gen Z sample.

3.1.4 Data-Informed Analytical Findings Using Machine Learning

To complement the regression analysis, predictive modeling was conducted using Orange software, which allowed for a robust comparison of algorithmic performance as seen in table 7. The dataset was partitioned into an 80% training set and a 20% testing set to ensure that the model could be validated on unseen data. Default parameters were applied to establish a baseline performance level, providing a transparent benchmark for the models' inherent predictive capabilities. This approach was chosen to minimize the risk of overfitting, particularly given the specific characteristics of the Gen Z student sample.

Table 7. Machine Learning Model Performance

Model	R^2	RMSE	MAE	MSE
Random Forest	0.62	0.41	0.33	0.17
XGBoost	0.66	0.38	0.29	0.14

Table 8. Feature Importance

Rank	Predictor Variable	Relative Importance
1	Purpose in Life (PWB)	0.21
2	Engagement (PERMA)	0.18
3	Meaning (PERMA)	0.16
4	Environmental Mastery (PWB)	0.14
5	Achievement Motivation	0.12
6	Positive Emotion (PERMA)	0.10
7	Relationships (PERMA)	0.09

Feature importance values in Table 8 below represent the relative contribution of each predictor variable to the model's prediction of Academic Achievement. Purpose in Life demonstrated the highest relative importance (0.21), followed by Engagement (0.18) and Meaning (0.16). Predictors associated with psychological regulation and meaningful academic involvement showed comparatively higher contribution scores, while relational and emotional dimensions contributed at slightly lower but still

substantive levels. The distribution of importance values indicates that multiple dimensions jointly contribute to prediction performance rather than a single dominant predictor.

3.1.5 Qualitative Results

Semi-structured interviews were conducted with 30 students selected to represent variation in academic performance and psychological well-being levels. Thematic analysis identified five recurring themes, summarized in Table 9. Participants consistently described experiences corresponding to the quantitative dimensions identified in the survey data.

Table 9. Summary of Qualitative Themes

Theme	Description	Related Construct
Positive Learning Emotions	Feelings of appreciation and psychological safety	PERMA – Positive Emotion
Meaningful Learning Experiences	Learning connected to values and future goals	PERMA – Meaning; PWB – Purpose in Life
Supportive Academic Relationships	Positive lecturer and peer interactions	PERMA – Relationships; PWB – Positive Relations
Psychological Self-Regulation	Time management and emotional control	PWB – Environmental Mastery, Autonomy
Well-Being–Achievement Link	Perceived connection between mental well-being and academic performance	PWB → Academic Achievement

3.1.6 Integrated Results (Meta-Inference)

Integration of quantitative and qualitative strands indicates convergence across analytical approaches. Quantitative findings demonstrated significant direct and indirect effects among Positive Education, Psychological Well-Being, and Academic Achievement. Qualitative themes reflected similar patterns at the experiential level. Across analyses, Positive Education was associated with higher Psychological Well-Being, which in turn was linked to Academic Achievement. Predictive modeling further supported the contribution of both constructs in explaining variance in academic outcomes.

3.2 Discussion

This study examined how Positive Education and Psychological Well-Being are associated with Academic Achievement among Generation Z students in Muhammadiyah and ‘Aisyiyah higher education institutions in Riau Province. By integrating quantitative findings, qualitative insights, and data-informed analytical modeling, the study provides a multidimensional interpretation of academic achievement that extends beyond conventional performance-based explanations. The discussion interprets the findings in relation to established theoretical frameworks, prior empirical research, and the contextual characteristics of higher education environments.

3.2.1 Positive Education as a Foundational Educational Context

The findings indicate that Positive Education is positively associated with students’ psychological well-being and academic engagement. Students who reported higher exposure to positive educational practices—particularly those related to meaningful learning experiences and supportive relationships—also tended to report stronger psychological well-being.

The pattern is consistent with the theoretical foundations of the PERMA framework, which conceptualizes well-being as emerging from five key dimensions: positive emotion, engagement, relationships, meaning, and accomplishment. Within this framework, educational environments that cultivate these dimensions are expected to promote not only students’ emotional well-being but also their motivation and persistence in learning activities. The relatively high mean scores observed in the dimensions of Meaning and Relationships suggest that students perceive their learning experiences as personally relevant and socially supportive.

The qualitative findings provide further explanation for this pattern. Students frequently described learning environments characterized by appreciation, constructive feedback, and collaborative interactions with lecturers and peers. Such experiences appear to foster a sense of belonging and relevance within the learning process, which can strengthen students' willingness to engage with academic tasks.

These findings are consistent with previous empirical research suggesting that positive educational environments can enhance students' engagement, motivation, and academic persistence. When learning activities are perceived as meaningful and socially supported, students are more likely to invest sustained effort in their academic work. However, given the cross-sectional design of the study, these results should be interpreted as associational rather than causal relationships between Positive Education and student outcomes.

3.2.2 Psychological Well-Being as a Central Mechanism

A key finding of this study is the identification of Psychological Well-Being as a mediating mechanism linking Positive Education and Academic Achievement. The mediation analysis indicates that Positive Education is associated with Academic Achievement primarily through its relationship with students' psychological well-being. This finding aligns with Ryff's Psychological Well-Being theory, which conceptualizes well-being as a multidimensional construct encompassing autonomy, personal growth, purpose in life, environmental mastery, self-acceptance, and positive relationships. These psychological capacities are essential for effective functioning in demanding environments such as higher education.

The results show that dimensions related to purpose in life and environmental mastery were among the most influential predictors of academic achievement in the data-informed analytical models. Students who demonstrated a stronger sense of purpose and greater ability to manage academic demands were more likely to report higher levels of academic motivation and readiness to face academic challenges. Qualitative narratives provide additional insight into how these mechanisms operate. Students with stronger psychological well-being described greater ability to regulate emotions, manage academic pressure, and maintain focus on learning goals. These capacities appear to support consistent engagement with academic tasks, particularly during periods of increased academic workload.

These findings extend prior research suggesting that psychological well-being functions as an important internal resource for students. Rather than being merely an outcome of academic success, well-being appears to facilitate students' ability to translate positive learning environments into sustained academic engagement. In this sense, psychological well-being can be understood as a psychological bridge between educational context and academic functioning.

3.2.3 Academic Achievement Beyond Performance Metrics

Another important insight from this study is that Academic Achievement among Generation Z students appears to be supported by a combination of motivational, behavioral, and psychological factors. The descriptive results show high levels of achievement motivation, learning commitment, and readiness to face academic challenges. These findings suggest that academic success should not be interpreted solely through traditional performance indicators such as grades or examination outcomes. Instead, academic achievement appears closely connected to students' psychological resources and their perceptions of the learning environment.

This interpretation is consistent with contemporary educational perspectives that emphasize the importance of student engagement and psychological functioning in academic success. When students possess strong internal resources such as purpose, self-acceptance, and resilience. They may be better equipped to cope with academic demands and sustain effort in challenging learning contexts.

For Generation Z students, this relationship may be particularly relevant. This generation is often characterized by high levels of digital engagement and rapid access to information, but also by increased exposure to academic pressure and psychological stressors. In such contexts, psychological

well-being may play a critical role in enabling students to maintain focus, motivation, and persistence in their academic pursuits.

3.2.4 Contextual Implications in Muhammadiyah and 'Aisyiyah Higher Education

The findings should also be interpreted within the institutional and cultural context in which the study was conducted. Muhammadiyah and 'Aisyiyah higher education institutions emphasize values such as community engagement, moral development, and holistic education. These institutional characteristics may contribute to learning environments that emphasize supportive relationships, meaningful learning, and social responsibility. Such contexts may reinforce the principles of Positive Education by integrating academic instruction with broader developmental goals. The strong emphasis on meaningful learning and positive relationships observed in the findings may therefore reflect both educational practices and broader institutional values within these institutions.

Understanding these contextual dynamics is important because educational environments are not culturally neutral. The ways in which students interpret and experience learning environments may vary across institutional and cultural contexts. Consequently, the relationships identified in this study should be interpreted as contextually situated rather than universally generalizable.

3.2.5 Theoretical Contribution

This study contributes to the literature on student development and educational psychology in several ways. First, it provides empirical evidence supporting the theoretical integration of Positive Education and Psychological Well-Being within a single explanatory model of academic achievement. While previous studies have examined these constructs separately, the present research demonstrates how they interact within a holistic framework. Second, the study clarifies the mediating role of psychological well-being, highlighting its function as a mechanism through which positive educational practices are associated with academic outcomes. This finding reinforces the conceptual argument that well-being should be understood not only as an outcome of education but also as a process that enables effective learning. Finally, by focusing on Generation Z students, the study contributes to a growing body of research examining how psychological and educational factors interact in contemporary higher education contexts.

3.2.6 Methodological Contribution

In addition to its theoretical implications, this study also contributes methodologically by integrating mixed-methods analysis with data-informed analytical modeling. The combination of quantitative statistical analysis, qualitative thematic interpretation, and machine learning-based prediction offers a more comprehensive understanding of the relationships among Positive Education, Psychological Well-Being, and Academic Achievement. Rather than relying solely on traditional statistical models, the inclusion of data-informed analytical approaches allows the study to explore complex patterns in the data and identify influential predictors of academic achievement. This approach demonstrates how educational research can benefit from combining theory-driven analysis with emerging analytical techniques. By integrating multiple analytical perspectives, the study provides richer insights into how educational environments and psychological resources interact to shape students' academic experiences.

4. CONCLUSION

This study demonstrates that Positive Education and Psychological Well-Being are significantly associated with Academic Achievement among Generation Z students in Muhammadiyah and 'Aisyiyah higher education institutions in Riau Province. The findings indicate that Positive Education is positively related to Psychological Well-Being, while Psychological Well-Being is positively associated with Academic Achievement and partially mediates the relationship between Positive Education and academic outcomes. The integration of quantitative, qualitative, and machine learning analyses further highlights that psychological resources, particularly purpose in life, engagement, and

meaning, are among the most influential factors associated with academic success. These findings support the view that academic achievement should be understood not only as an educational outcome but also as a function of students' psychological well-being and learning experiences. Nevertheless, several limitations should be acknowledged. The cross-sectional design limits causal inference, the use of self-reported measures may introduce response bias, and the focus on Muhammadiyah and 'Aisyiyah higher education institutions in Riau Province may restrict the generalizability of the findings to other educational and cultural contexts. Future research is therefore recommended to employ longitudinal or experimental designs to examine causal relationships more rigorously, incorporate objective academic performance indicators, explore additional psychological and contextual variables, and validate the proposed model across diverse higher education settings. Furthermore, more advanced educational data analytics and machine learning approaches may be utilized to deepen understanding of the complex factors influencing student well-being and academic achievement.

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