PEDAGOGIK JURNAL PENDIDIKAN
P-ISSN : 2528-5793
E-ISSN : 2354-7960

MEASURING INTERPERSONAL AND INTRAPERSONAL INTELLIGENCE: THE MEDIATING ROLE OF NATURALIST INTELLIGENCE IN PREDICTING EXISTENTIAL INTELLIGENCE

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Received: March 2026	**Accepted:** August 2026	**Published:** August 2026
DOI: https://doi.org/10.33650.pjp.v13i2.15180		

Abstract : *Higher education institutions need to understand students more holistically, as student success is determined not only by cognitive abilities but also by interpersonal and intrapersonal skills, as well as existential intelligence. This study aims to examine the structural relationships among interpersonal and intrapersonal intelligence in predicting existential intelligence, with naturalist intelligence as a mediating variable. This study employs a quantitative approach using Partial Least Squares Structural Equation Modeling (PLS-SEM). The research results indicate that the measurement model meets the requirements for validity and reliability. Structural model analysis reveals that interpersonal, intrapersonal, and naturalist intelligences each significantly influence existential and naturalist intelligences. According to mediation analysis, naturalist intelligence significantly mediates the relationship between existential and interpersonal intelligence. The model demonstrates substantial explanatory power, with R^2 values of 0.806 for existential intelligence and 0.697 for naturalist intelligence. These findings emphasise the need of integrating different intelligences into a structural measurement framework and the mediating function of naturalist intelligence in existential intelligence prediction.*

Keywords : *Interpersonal Intelligence; Intrapersonal Intelligence; Naturalist Intelligence.*

Abstrak : *Perguruan tinggi perlu memahami mahasiswa secara lebih holistik karena keberhasilan mahasiswa tidak hanya ditentukan oleh kemampuan kognitif, akan tetapi juga ditentukan oleh kemampuan interpersonal, intrapersonal dan existential intelligence. Penelitian ini bertujuan untuk mengkaji hubungan struktural antara kecerdasan interpersonal dan intrapersonal dalam memprediksi kecerdasan eksistensial, dengan kecerdasan naturalis sebagai variabel mediasi. Penelitian ini menggunakan pendekatan kuantitatif dengan Partial Least Squares Structural Equation Modeling (PLS-SEM). Hasil studi menunjukkan bahwa model pengukuran memenuhi persyaratan validitas dan reliabilitas. Kecerdasan interpersonal dan intrapersonal dan kecerdasan naturalis masing-masing berpengaruh secara signifikan terhadap kecerdasan eksistensial dan naturalis, menurut analisis model struktural. Menurut analisis mediasi, kecerdasan naturalis secara signifikan memediasi hubungan antara kecerdasan eksistensial dan interpersonal. Model ini menunjukkan daya penjelas yang substansial, dengan nilai R^2 sebesar 0,806 untuk kecerdasan eksistensial dan 0,697 untuk kecerdasan naturalis. Temuan ini menekankan pentingnya mengintegrasikan berbagai jenis kecerdasan ke dalam kerangka pengukuran struktural serta peran mediasi kecerdasan naturalis dalam prediksi kecerdasan eksistensial.*

Kata Kunci : *Interpersonal Intelligence; Intrapersonal Intelligence; Naturalist Intelligence.*

INTRODUCTION

The increasing complexity of educational demands in higher education requires a comprehensive understanding of students' cognitive and non-cognitive capacities. Recent studies emphasize that learning outcomes are not solely determined by cognitive abilities but are also influenced by social, emotional, and reflective dimensions of learners (Privado et al., 2024; Zickafoose & Wingenbach, 2023). Within this context, the framework of multiple intelligences remains relevant as it provides a multidimensional perspective for understanding individual differences in learning processes.

This need is also reflected in empirical evidence showing that students' social and emotional competencies are associated with important educational and well-being outcomes. The OECD's recent evidence indicates that social and emotional skills are related to academic success, psychological well-being, life satisfaction, and students' preparedness for future education and careers (OECD, 2024). These findings reinforce the need for educational approaches that assess and develop students beyond conventional cognitive achievement, particularly by considering competencies related to social interaction, self-awareness, and broader meaning-making.

Interpersonal and intrapersonal intelligence have gained increasing attention in recent educational research due to their roles in shaping students' social interaction and self-regulation abilities. Interpersonal intelligence enables students to collaborate and communicate effectively, while intrapersonal intelligence supports self-awareness and reflective thinking. Recent findings indicate that these intelligences significantly contribute to learning engagement, motivation, and academic development in higher education (Astiti et al., 2024; Huda et al., 2022; Yaumi et al., 2018). However, existing studies tend to examine these constructs separately or focus on their direct influence, without exploring how they interact within a structural framework.

Although interpersonal and intrapersonal intelligence have been widely recognized as essential components of students' socio-emotional development, the mechanisms through which they may jointly contribute to higher-order cognitive and reflective development remain insufficiently explained. Existing literature has focused mainly on their direct influence on academic achievement, learning engagement, or emotional regulation, while limited attention has been devoted to identifying intermediary processes that may connect social and self-related capacities with broader forms of meaning-making. Consequently, further investigation is needed to determine whether other dimensions of intelligence can explain how interpersonal and intrapersonal capacities translate into higher-order reflective and existential development.

In addition, existential intelligence has emerged as an important dimension in educational discourse, particularly in developing students' ability to reflect on meaning, purpose, and values in life. This dimension is increasingly relevant in contemporary education, which emphasizes holistic student development beyond academic achievement. Despite its importance, empirical studies examining the predictors of existential intelligence remain limited, especially those employing advanced statistical modeling approaches. This limitation is particularly important because existential intelligence concerns meaning, purpose, and values, which may emerge from the interaction between individuals' internal reflection, social experiences, and their interpretation of the broader environment.

Another dimension that has received relatively less attention is naturalist intelligence, which relates to individuals' sensitivity to the environment and their ability to recognize patterns in nature. Recent studies suggest that contextual and environmental factors play a significant role in shaping learning behavior and student competencies (Sudaryono et al., 2024). This indicates the potential role of naturalist intelligence as an intermediary construct in understanding the relationships among other dimensions of intelligence. However, its mediating role has not been widely investigated in previous empirical studies. Empirical evidence also supports the relevance of naturalistic intelligence to environmental awareness among university students. For example, previous research among graduate students at Universitas Indonesia reported a strong and significant relationship between naturalistic intelligence and environmental awareness, while a recent intervention study among college students found that an educational program based on naturalistic intelligence improved cognitive, affective, and active dimensions of environmental awareness (Adeoye et al., 2025; Ningrum et al., 2018).

More importantly, the potential mediating function of naturalist intelligence has rarely been investigated despite theoretical arguments suggesting that engagement with and awareness of the natural environment may support broader reflective and meaning-making processes. Recent empirical evidence among college students provides further support for this connection: nature connectedness has been found to be associated with meaning in life and to operate within a broader psychological mechanism involving resilience and mental health (Ma et al., 2025; Murniarti et al., 2026). From the perspective of Gardner's Multiple Intelligences Theory, naturalist intelligence may therefore provide a meaningful bridge between students' interpersonal and intrapersonal capacities and their interpretation of broader life contexts. Interpersonal intelligence enables individuals to engage with others and exchange perspectives, while intrapersonal intelligence supports self-awareness and reflection; naturalist intelligence may extend these processes toward awareness of relationships between the self, other people, and the natural environment.

Such contextual awareness can provide experiences through which students interpret values, purpose, interconnectedness, and meaning, thereby offering a plausible theoretical mechanism linking interpersonal and intrapersonal intelligence to existential intelligence. However, empirical evidence directly testing naturalist intelligence as a mediator in this relationship remains scarce, particularly within higher education contexts using structural equation modeling approaches.

Furthermore, the importance of integrated and multidimensional approaches in improving educational quality, particularly through innovative learning strategies, competency-based education, and the development of students' holistic abilities (Hidayah et al., 2024; Husna et al., 2023; Putri & Abdullah, 2024). These findings reinforce the need for research that examines the interrelationships among multiple dimensions of intelligence within a comprehensive analytical framework. Taken together, these findings support the need to move beyond isolated assessments of individual competencies toward integrated models capable of examining how different forms of intelligence interact in educational settings

Unlike previous studies that primarily investigated direct relationships among multiple intelligence dimensions, this study introduces naturalist intelligence as a mediating construct linking interpersonal and intrapersonal intelligence to existential intelligence. This mediation perspective offers a more comprehensive explanation of how multiple intelligences operate collectively rather than independently. Accordingly, the present study extends the existing body of knowledge by integrating these four intelligence dimensions into a single structural model tested using Partial Least Squares Structural Equation Modeling (PLS-SEM). The novelty of this approach lies not merely in combining four intelligence dimensions, but in testing a theoretically motivated indirect pathway in which naturalist intelligence is positioned as a mediator between interpersonal and intrapersonal intelligence and existential intelligence.

Despite these developments, three gaps remain. First, existing studies have largely examined interpersonal, intrapersonal, naturalist, and existential intelligence as separate constructs or through direct relationships, leaving their simultaneous structural relationships insufficiently tested. Second, although naturalist intelligence has been associated with environmental awareness and nature-related meaning-making, its specific role as a mediator linking interpersonal and intrapersonal intelligence to existential intelligence has not been adequately established empirically. Third, limited research has applied a measurement-based structural approach to test these relationships simultaneously in higher education contexts. Addressing these gaps is important for

determining whether the proposed relationships represent direct associations alone or involve an underlying mediating mechanism.

Therefore, this study aims to measure the structural relationships among interpersonal and intrapersonal intelligence in predicting existential intelligence, with naturalist intelligence as a mediating variable. By employing Partial Least Squares Structural Equation Modeling (PLS-SEM), this study seeks to provide a robust measurement-based analysis of multiple intelligences (Jr. et al., 2017; Sudaryono et al., 2024). Unlike previous studies that primarily examined the direct relationships among individual intelligence dimensions, this study integrates interpersonal, intrapersonal, naturalist, and existential intelligence into a single structural model to examine both direct and indirect effects. Accordingly, the proposed model extends the application of Multiple Intelligences Theory by empirically investigating the mediating role of naturalist intelligence within the context of higher education. The findings are expected to contribute to the advancement of educational measurement, enrich the empirical literature on multiple intelligences, and support the development of holistic learning strategies that foster students' social, personal, environmental, and existential competencies in higher education.

METHOD

This study employed a quantitative research design to measure the structural relationships among multiple intelligences using Partial Least Squares Structural Equation Modeling (PLS-SEM). This approach was selected due to its ability to simultaneously evaluate the measurement model and the structural model, enabling a comprehensive assessment of construct validity, reliability, and the relationships among latent variables (Hair et al., 2022; Sarstedt et al., 2022). The use of PLS-SEM is widely recommended in educational research for analyzing complex models involving mediation and multiple constructs. In the present study, PLS-SEM was selected because the proposed model contains four latent constructs measured by multiple indicators and examines both direct and indirect relationships through a mediating construct. The analysis is therefore oriented toward estimating the predictive relationships among the constructs and assessing the contribution of the proposed mediation mechanism. This characteristic is consistent with the use of PLS-SEM for models involving multiple constructs and relatively complex structural relationships.

In addition, PLS-SEM was considered appropriate because the proposed research model involves multiple latent constructs with both direct and indirect relationships. The method is particularly suitable for predictive research and theory development, especially when examining mediation effects among psychological constructs measured through

multiple indicators. Furthermore, PLS-SEM allows the simultaneous assessment of measurement quality and structural relationships, making it appropriate for examining the proposed complex relationships among multiple intelligence constructs.

The population of this study consisted of all first-semester university students. The sample size was determined using the Slovin formula, which is expressed as follows:

$$n = \frac{N}{1 + N(e)^2}$$

n = minimum sample size
N = total population size
e = margin of error (tolerable error)

Figure 1: Slovin's Formula for Determining Minimum Sample Size

Based on this calculation, a total of 205 students were selected as respondents. The resulting sample size also satisfied the minimum recommendations for Partial Least Squares Structural Equation Modeling (PLS-SEM), which generally requires an adequate number of observations to estimate complex structural relationships involving multiple latent constructs and mediation effects. In addition to the Slovin-based calculation, the adequacy of the sample was considered in relation to the complexity of the proposed PLS-SEM model, including the number of latent constructs, indicators, and structural paths. The final sample of 205 respondents was therefore used for the estimation of the measurement and structural models. Therefore, the sample size was considered sufficient to ensure reliable parameter estimation and hypothesis testing within the proposed research model. The sampling technique applied in this study was simple random sampling, in which each member of the population had an equal probability of being selected (Etikan, 2017; Taherdoost, 2018). Data collection was conducted using an online structured questionnaire distributed through Google Forms. The questionnaire was administered to eligible first-semester undergraduate students, and the collected responses were compiled for subsequent analysis using SmartPLS 4.0. To minimize sampling bias, all students in the target population had an equal opportunity to participate in the study. The random selection procedure was intended to reduce selection bias and improve the representativeness of the sample within the investigated educational context.

Data were collected using a structured questionnaire designed to measure four latent constructs: interpersonal intelligence, intrapersonal intelligence, naturalist intelligence, and existential intelligence. Each construct was operationalized through multiple reflective indicators measured using a five-point Likert scale. Respondents evaluated each statement using a five-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

The questionnaire consisted of 38 reflective indicators, comprising 10 indicators for interpersonal intelligence, 10 indicators for intrapersonal intelligence, 9 indicators for naturalist intelligence, and 9 indicators for existential intelligence. The instrument was developed based on the theoretical framework of multiple intelligences and adapted to the context of higher education (Armstrong Thomas, 2017; Gardner, 2008). The indicators were further refined based on previous educational measurement studies to ensure their content relevance and applicability within the higher education context. The indicators represented the conceptual characteristics of each construct, including social interaction and communication for interpersonal intelligence, self-awareness and self-reflection for intrapersonal intelligence, sensitivity and awareness toward the natural environment for naturalist intelligence, and reflection on meaning, purpose, values, and existence for existential intelligence.

The data analysis was conducted using SmartPLS 4.0. The analysis procedure consisted of two main stages, namely the evaluation of the measurement model (outer model) and the structural model (inner model). Prior to hypothesis testing, the measurement model was evaluated to ensure that all latent constructs satisfied the recommended criteria for validity and reliability. Only after the measurement model demonstrated acceptable psychometric properties was the structural model assessed to evaluate the proposed hypotheses and mediation effects. The measurement model was assessed by examining convergent validity, discriminant validity, and reliability. Convergent validity was evaluated based on outer loadings and Average Variance Extracted (AVE), with threshold values of 0.70 and 0.50, respectively. Discriminant validity was considered in the evaluation of the measurement model to ensure that the four latent constructs were empirically distinguishable from one another (Zhang et al., 2026). Reliability was evaluated using Cronbach's alpha, with a minimum acceptable value of 0.70.

Furthermore, the structural model was evaluated by examining path coefficients, coefficient of determination (R^2). Hypothesis testing was conducted using the bootstrapping technique to determine the significance of both direct and indirect effects, with a significance level of 0.05 (Anggoro et al., 2024; Odell et al., 2021). The mediating role of naturalist intelligence was analyzed through indirect effect testing to identify its contribution in explaining the relationships between interpersonal and intrapersonal intelligence and existential intelligence. The mediation analysis examined the indirect effects of interpersonal intelligence on existential intelligence through naturalist intelligence and the indirect effects of intrapersonal intelligence on existential intelligence through naturalist intelligence (Hair et al., 2017). The mediation effect was interpreted by considering the significance of the indirect effect together with the corresponding direct effect. When both

the direct and indirect effects were statistically significant, the mediation was interpreted as partial mediation.

The overall analytical procedure followed the recommended guidelines for PLS-SEM, beginning with the evaluation of the outer model, followed by the assessment of the inner model, and finally the examination of mediation effects through bootstrapping. This sequential procedure ensured that the structural relationships were interpreted only after the measurement quality of the latent constructs had been adequately established.

RESULT AND DISCUSSION

1. Results

The analysis was conducted using Partial Least Squares Structural Equation Modeling (PLS-SEM), which includes the evaluation of the measurement model and the structural model.

a) Measurement Model Evaluation

The results indicate that the measurement model generally meets the recommended criteria for indicator reliability, convergent validity, and internal consistency. Most indicators demonstrated outer loadings above 0.70, while one indicator (I9) showed a marginal loading of 0.699. The outer loading values ranged from 0.771 to 0.875 for interpersonal intelligence, 0.703 to 0.829 for intrapersonal intelligence, 0.744 to 0.839 for naturalist intelligence, and 0.699 to 0.844 for existential intelligence. Despite the marginal loading of I9, the construct-level results remained satisfactory, as reflected by Average Variance Extracted (AVE) values exceeding 0.50 across all constructs.

Reliability analysis further confirms that all constructs are internally consistent, with Cronbach's alpha values above 0.70. As presented in **Table 1**, the AVE values and Cronbach's alpha coefficients indicate that the constructs of interpersonal intelligence, intrapersonal intelligence, naturalist intelligence, and existential intelligence demonstrate satisfactory convergent validity and internal consistency reliability.

Table 1: Convergent Validity and Internal Consistency of the Measurement Model

Construct	AVE	Cronbach's Alpha
Existential Intelligence	0.636	0.928
Interpersonal Intelligence	0.704	0.953
Intrapersonal Intelligence	0.593	0.923
Naturalist Intelligence	0.649	0.932

The results presented in Table 1 demonstrate that all latent constructs achieved satisfactory levels of convergent validity and internal consistency reliability. Specifically, all Average Variance Extracted (AVE) values exceeded the recommended threshold of 0.50, ranging from 0.593 for intrapersonal intelligence to 0.704 for interpersonal intelligence. Likewise, Cronbach's Alpha ranged from 0.923 to 0.953, indicating high internal consistency among the measurement items. These findings support the adequacy of the measurement model for subsequent structural model evaluation.

b) Structural Model Evaluation

The structural model was evaluated by examining path coefficients, coefficient of determination (R^2), and hypothesis testing results. The structural relationships among variables are illustrated in Figure 1**.**

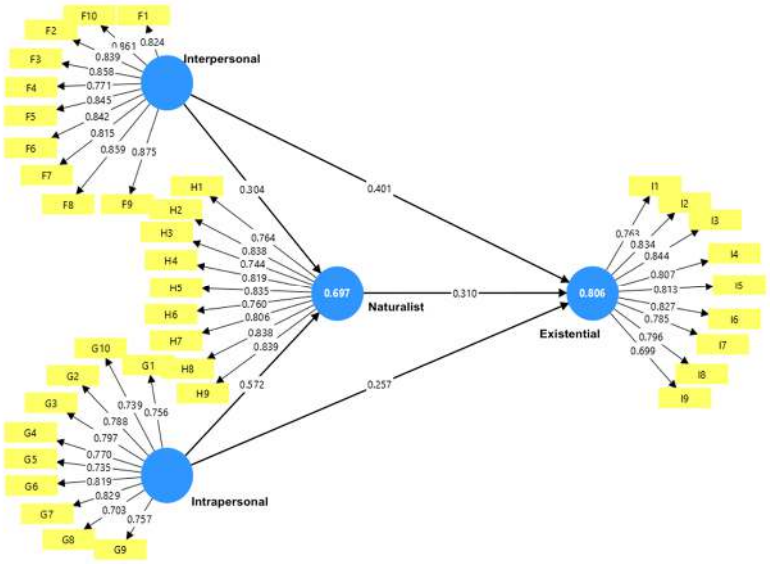


Figure 1: Structural Model

The results show that interpersonal intelligence has a significant effect on existential intelligence (β = 0.401, p < 0.05) and on naturalist intelligence (β = 0.304, p < 0.05). Similarly, intrapersonal intelligence significantly influences existential intelligence (β = 0.257, p < 0.05) and naturalist intelligence (β = 0.572, p < 0.05). Furthermore, naturalist intelligence has a significant effect on existential intelligence (β = 0.310, p < 0.05). Among the direct relationships, the strongest path coefficient was observed between intrapersonal intelligence and naturalist intelligence (β = 0.572), followed by interpersonal intelligence and existential intelligence (β = 0.401). The

remaining relationships also demonstrated positive associations, indicating that each proposed predictor contributes positively to the corresponding endogenous construct.

The indirect pathways are further examined in the mediation analysis. These findings indicate that both interpersonal and intrapersonal intelligence contribute not only directly to students' existential intelligence but also indirectly through the enhancement of naturalist intelligence. The significant relationships observed across all proposed paths provide empirical support for the conceptual framework developed in this study and demonstrate that multiple dimensions of intelligence operate in an interconnected rather than isolated manner.

The coefficient of determination (R^2), as presented in Table 2 indicates substantial explanatory power of the proposed structural model The coefficient of determination further indicates that the proposed structural model possesses substantial explanatory power. The R^2 value for existential intelligence is 0.806, while the R^2 value for naturalist intelligence is 0.697.

Table 2: **Structural Model Results (Path Coefficients, p-values, and R^2)**

Path Relationship	β	t-value	p-value	Result
Interpersonal → Existential	0.401	6.064	0.000	Supported
Interpersonal → Naturalist	0.304	3.688	0.000	Supported
Intrapersonal → Existential	0.257	3.940	0.000	Supported
Intrapersonal → Naturalist	0.572	7.358	0.000	Supported
Naturalist → Existential	0.310	4.817	0.000	Supported
Interpersonal → Naturalist → Existential (Indirect)	0.094	2.886	0.004	Supported
Intrapersonal → Naturalist → Existential (Indirect)	0.177	4.157	0.000	Supported

The coefficient of determination further indicates that the proposed structural model possesses substantial explanatory power. The R^2 value of 0.806 suggests that interpersonal intelligence, intrapersonal intelligence, and naturalist intelligence collectively explain 80.6% of the variance in existential intelligence. Meanwhile, the R^2 value of 0.697 indicates that interpersonal and intrapersonal intelligence explain 69.7% of the variance in naturalist intelligence. These findings indicate that the proposed model accounts for a substantial proportion of the variance in both endogenous constructs and provides empirical support for the proposed structural relationships.

c) Mediation analysis

Mediation analysis reveals that naturalist intelligence plays a significant mediating role in the proposed structural model. As presented in Table 2, naturalist intelligence significantly mediates the relationship between interpersonal intelligence

and existential intelligence ($\beta = 0.094$, $p < 0.05$), as well as the relationship between intrapersonal intelligence and existential intelligence ($\beta = 0.177$, $p < 0.05$). These significant indirect effects provide empirical support for the mediating mechanism proposed in this study.

Since both the direct effects (interpersonal → existential and intrapersonal → existential) and the indirect effects through naturalist intelligence remain statistically significant, the mediation can be interpreted as partial mediation. This indicates that interpersonal and intrapersonal intelligence influence existential intelligence both directly and indirectly through the enhancement of students' environmental awareness and sensitivity represented by naturalist intelligence.

These findings confirm that naturalist intelligence functions as an important intermediary construct within the proposed structural model. The results further suggest that students' awareness of and interaction with the natural environment complement the influence of social and personal intelligence in fostering existential intelligence, thereby strengthening the explanatory capability of the proposed model.

2. Discussion

The findings of this study demonstrate that interpersonal and intrapersonal intelligence significantly influence existential intelligence, both directly and indirectly through naturalist intelligence These results highlight the importance of integrating multiple dimensions of intelligence to better understand students' holistic development in higher education contexts. The findings reinforce the multidimensional perspective of Multiple Intelligences Theory, which proposes that different forms of intelligence interact dynamically rather than functioning as isolated abilities. Consequently, students' holistic development should be understood through the integration of social, personal, environmental, and existential dimensions rather than through cognitive performance alone. The empirical relationships identified in the present model further extend this perspective by demonstrating that the four intelligence dimensions can be examined simultaneously within a single structural framework.

The significant effect of interpersonal intelligence on existential intelligence indicates that social interaction and the ability to understand others contribute to the development of deeper meaning-making and reflective thinking (Liu et al., 2023; Mundiri et al., 2025; Park et al., 2025). The significant effect of interpersonal intelligence on existential intelligence indicates that social interaction and the ability to understand others contribute to the development of deeper meaning-making and reflective thinking (Accurso et al., 2023; Chamdani et al., 2022; Lin et al., 2025). This finding is consistent

with previous studies emphasizing the role of interpersonal competencies in students' learning engagement, motivation, and academic development. From a theoretical perspective, interpersonal intelligence facilitates meaningful communication, empathy, and collaborative problem-solving, all of which encourage students to exchange perspectives and construct deeper interpretations of life experiences. Such interactions create opportunities for reflective dialogue that may strengthen existential understanding.

Similarly, intrapersonal intelligence shows a strong influence on existential intelligence ($\beta = 0.257$), suggesting that self-awareness and self-reflection are essential components in developing individuals' understanding of purpose and values. This supports the view that internal cognitive processes are fundamental in fostering higher-order thinking and personal meaning construction. This finding is also consistent with the proposition that self-awareness enables individuals to critically evaluate their beliefs, goals, and personal experiences, thereby supporting the development of existential intelligence. Students who possess stronger intrapersonal intelligence are more likely to engage in reflective thinking, which contributes to their capacity to understand purpose, identity, and meaning in life.

Furthermore, the significant role of naturalist intelligence as a mediator provides important insight into the indirect mechanisms underlying these relationships. The results indicate that sensitivity to the environment and contextual awareness enhance the way interpersonal and intrapersonal intelligence contribute to existential intelligence (Syafii et al, 2025; Wahyuni et al, 2026). This suggests that learning experiences that connect individuals with their environment may strengthen reflective and existential capacities. The mediating role of naturalist intelligence suggests that environmental awareness serves as a bridge connecting students' social competencies and self-awareness with their capacity for existential reflection. Learning environments that promote interaction with nature, sustainability, or real-world contexts may therefore strengthen students' ability to integrate interpersonal experiences and personal reflection into broader existential perspectives. More importantly, the significant indirect effects of interpersonal intelligence ($\beta = 0.094$) and intrapersonal intelligence ($\beta = 0.177$) indicate that the contribution of naturalist intelligence is not merely conceptual but empirically observable within the proposed structural model

The substantial coefficient of determination for existential intelligence ($R^2 = 0.806$) indicates that interpersonal intelligence, intrapersonal intelligence, and naturalist intelligence collectively explain 80.6% of its variance. In addition, the R^2 value of 0.697 indicates that interpersonal and intrapersonal intelligence explain 69.7% of the variance

in naturalist intelligence. These findings suggest that the proposed model captures a substantial proportion of the variation in the endogenous constructs. Compared with previous studies that primarily focused on direct relationships among intelligence dimensions, the present study extends the literature by incorporating mediation analysis to reveal more complex interactions among multiple intelligences. In particular, the findings demonstrate that naturalist intelligence provides an additional explanatory pathway through which interpersonal and intrapersonal intelligence are associated with existential intelligence.

Overall, this study contributes to educational research by providing empirical evidence that multiple intelligences operate in an interconnected manner rather than independently. These findings suggest that higher education institutions should design learning environments that simultaneously cultivate interpersonal interaction, self-reflection, and environmental awareness. Such integrated learning experiences may contribute not only to academic achievement but also to students' holistic personal development and their capacity to construct meaning from learning experiences. Therefore, the proposed structural model offers practical guidance for educators seeking to develop holistic learning strategies that foster students' cognitive, social, environmental, and existential competencies.

CONCLUSION

This study concludes that interpersonal and intrapersonal intelligence significantly contribute to the development of existential intelligence, both directly and indirectly through naturalist intelligence. The findings confirm that naturalist intelligence plays a significant mediating role in strengthening the influence of social and self-related intelligences on existential understanding. These findings support the view that multiple dimensions of intelligence function as interconnected constructs rather than independent abilities, reinforcing the multidimensional perspective proposed by Multiple Intelligences Theory.

The structural model demonstrates substantial explanatory power, with an R^2 value of 0.806 for existential intelligence and 0.697 for naturalist intelligence, indicating that the integration of multiple intelligences provides a comprehensive framework for understanding students' holistic development. These results highlight that existential intelligence is not formed in isolation but is shaped by the interaction of interpersonal, intrapersonal, and environmental awareness. By incorporating naturalist intelligence as a mediating construct, this study extends previous empirical research that predominantly focused on direct relationships among intelligence dimensions, thereby providing a more

comprehensive explanation of students' holistic development.

This study contributes to educational measurement by providing empirical evidence of the structural relationships among multiple intelligences using a robust analytical approach. The findings further demonstrate that naturalist intelligence functions not only as an independent intelligence dimension but also as an intermediary mechanism connecting interpersonal and intrapersonal intelligence with existential intelligence. Practically, the findings suggest the importance of designing learning strategies that integrate social interaction, self-reflection, and environmental awareness to foster students' deeper understanding of meaning and purpose. Accordingly, educators are encouraged to implement learning activities that balance collaborative interaction, reflective practice, and environmental engagement to support students' cognitive, personal, and existential growth.

This study was limited to first-semester university students within a specific higher education context, which may limit the generalizability of the findings. Therefore, future research is recommended to validate the proposed structural model across different educational levels, institutional settings, and cultural contexts. In addition, future studies may incorporate additional psychological, social, or contextual variables to further improve the explanatory capability of the proposed model and examine whether the mediating role of naturalist intelligence remains consistent across different student populations.

ACKNOWLEDGMENT

The authors would like to express their sincere gratitude to all students who participated in this study for their valuable time and responses. Appreciation is also extended to colleagues and reviewers who provided constructive feedback and support throughout the research process. Their contributions have been essential in improving the quality of this manuscript.

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