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Fostering a Sustainable Future Through Intrinsic Motivation in Pre-University Students in Kuantan, Pahang: A Journey of Inner Drive Towards Environmental Responsibility

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ABSTRACT

This study embarks on an exploration into the vital connection between the inherent drive to learn, known as intrinsic motivation (IM), and the active involvement in Education for Sustainable Development (ESD) among pre-university students nestled in Kuantan, Pahang, Malaysia. Recognizing that a sustainable future hinges on an engaged and motivated citizenry, we delve into how this inner spark of curiosity and enjoyment can ignite a passion for environmental and social responsibility. Through a quantitative lens, surveying 127 students and employing the robust analytical framework of Partial Least Squares Structural Equation Modeling (PLS-SEM), our findings illuminate a statistically significant and positive relationship: when students are driven by an internal desire to learn, their engagement with ESD flourishes ($\beta = 0.487$, $p < 0.001$), exhibiting a noteworthy medium to large effect ($f^2 = 0.311$). This study investigates whether intrinsic motivation is positively related to engagement in Education for Sustainable Development (ESD) among pre-university students in Kuantan, Pahang, guided by the research question, "Is there a significant positive relationship between intrinsic motivation and ESD engagement?" and the hypothesis that intrinsic motivation significantly influences students' participation in ESD. This suggests that nurturing the joy of learning can be a powerful catalyst in fostering a generation deeply invested in sustainable development. Ultimately, this research underscores the crucial role of intrinsic motivation in shaping environmentally conscious future leaders within the Malaysian pre-university educational landscape, offering valuable insights for educators and policymakers alike.

Keywords: *development, education, intrinsic, motivation, sustainable*

INTRODUCTION

The quest for a sustainable future is inextricably linked to the cultivation of an engaged and responsible global citizenry. At the heart of this cultivation lies the powerful force of student motivation, a key determinant of their involvement and success in education (Ryan & Deci, 2000). Among the various forms of motivation, intrinsic motivation (IM) stands out as a particularly potent driver, fuelled by the

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inherent satisfaction and enjoyment derived from the learning process itself (Deci & Ryan, 2000). This inner spark of curiosity and passion has been consistently shown to ignite deeper learning and more positive educational experiences.

In parallel, the global community increasingly recognizes Education for Sustainable Development (ESD) as a cornerstone of preparing individuals to navigate the complex challenges of our time (UNESCO, 2017). ESD transcends traditional education by aiming to equip learners with the knowledge, skills, values, and attitudes necessary to address pressing issues like climate change, social inequality, and economic instability, thereby fostering a commitment to a more sustainable and just world (UNESCO, 2017). By weaving sustainability principles into the fabric of education, ESD seeks to empower individuals to become proactive agents of change.

Malaysia, acknowledging the urgency of sustainable development, has embarked on various national policies and educational initiatives to promote ESD (Ministry of Education Malaysia, 2021). However, the journey of effective implementation is often fraught with challenges (Gough, 2016). While data from Malaysian higher education institutions reveals interesting trends in student enrollment and output as shown in Table 1, while there has been a general increase in student intake and enrollment from 2021 to 2023, there are fluctuations in student output during the same period. Specifically, the number of graduates decreased from 132,238 in 2021 to 110,154 in 2023, despite a relatively high number of enrollments (517,580 in 2021 and 558,692 in 2023).

This fluctuation in output raises concerns about student retention and persistence in higher education, which can be influenced by various factors, including students' motivation and the perceived relevance of their education to sustainable development. These figures often fail to illuminate the underlying motivational currents that shape students' engagement with their education, particularly in the crucial domain of ESD. Understanding these foundational motivational factors at the pre-university level, a pivotal stage for shaping lifelong values and career aspirations, is essential for ensuring the long-term success of ESD initiatives and the development of sustainability-conscious future leaders. This study, therefore, seeks to bridge this gap by specifically investigating the intricate relationship between the inherent joy of learning – intrinsic motivation – and active engagement with ESD among pre-university students in the vibrant educational landscape of Kuantan, Pahang.

Table 1: Number of Students' Intake, Enrolment and Output based on Gender by Status of Private HEIs 2021-2023

Status of Private HEIs	Year	Intake			Enrolment			Output		
		Male	Female	Total	Male	Female	Total	Male	Female	Total
Total	2023	84,420	95,703	180,123	257,467	301,225	558,692	50,229	59,925	110,154
	2022	78,845	93,044	171,889	237,839	275,684	513,523	59,889	71,732	131,621
	2021	76,439	88,321	164,760	241,618	275,962	517,580	60,397	71,841	132,238

Source: Kementerian Pendidikan Tinggi, 2023

LITERATURE REVIEW

Self-Determination Theory (SDT): A Compass for Understanding Motivation

To navigate the complex landscape of human motivation, this study anchors itself in the robust framework of Self-Determination Theory (SDT) (Ryan & Deci, 2000; Bishnoi, 2024; Do & Do, 2025). SDT posits that at the core of human experience lie three fundamental psychological needs: autonomy, the feeling of volition and self-direction; competence, the sense of effectiveness and capability; and relatedness, the feeling of connection and belonging to others (Viveiros et al., 2025; Baierl & Bogner, 2023). SDT suggests that when social contexts nurture the satisfaction of these innate needs, individuals

are more likely to develop autonomous forms of motivation, encompassing both the pure joy of intrinsic motivation and the well-internalized drive of extrinsic motivation (identified and integrated regulation) (Viveiros et al., 2025; Xiong et al., 2024; Do & Do, 2025; Darner, 2012; Bureau et al., 2025). In essence, SDT provides the theoretical lens through which we can understand how the inner and outer worlds interact to shape an individual's drive to learn and engage.

Intrinsic Motivation (IM): The Inner Fire of Learning

Within the tenets of SDT, Intrinsic Motivation (IM) is precisely defined as the act of engaging in an activity not for any external reward or separable consequence, but for the sheer inherent satisfaction, enjoyment, interest, or challenge that the activity itself provides (Ryan & Deci, 2000). It represents a natural human inclination towards exploration, learning, and the mastery of new skills, a drive ignited by internal factors (Bishnoi, 2024). In addition, rapid loss of motivation is often linked to weaker learning behavior (Annuar et. al., 2021). Key characteristics associated with IM include curiosity, passion, persistence in the face of obstacles, a wellspring of creativity, the capacity for high-quality learning, and an overall sense of enhanced psychological well-being (Ryan & Deci, 2000; Bishnoi, 2024; Martens, Gulikers, & Bastiaens, 2004; Li & Wang, 2024). When intrinsically motivated, individuals experience a profound sense of volition, engaging willingly and often finding the activity itself to be its own reward (Zain, Jan, & Ibrahim, 2013; Bishnoi, 2024). In the realm of education, IM is a highly prized commodity, acting as a powerful engine for deeper learning, sustained engagement with complex tasks, the development of robust conceptual understanding, and ultimately, higher levels of academic achievement (Bishnoi, 2024; Martens et al., 2004; Tsai & Chang, 2024). This inner fire of learning is fuelled by the satisfaction of our fundamental psychological needs for autonomy, competence, and relatedness, as illuminated by SDT (Ryan & Deci, 2000; Viveiros et al., 2025).

When applied to Education for Sustainable Development (ESD), fostering IM becomes crucial, as it cultivates learners who are not only knowledgeable about sustainability issues but are also deeply committed to acting upon them. By creating learning environments that support autonomy, encourage mastery, and promote meaningful connections, educators can ignite the intrinsic drive that empowers students to engage proactively with sustainability challenges thereby nurturing a generation of thoughtful, motivated, and responsible global citizens.

Education for Sustainable Development (ESD): Cultivating Stewards of Tomorrow

Education for Sustainable Development (ESD) stands as a transformative educational approach, its core mission to empower learners with the essential knowledge, skills, values, attitudes, and, crucially, the motivation needed to confront the intricate web of interconnected global challenges that threaten our planet and its societies. These challenges include environmental degradation, stark social inequality, and precarious economic instability.

More than just understanding these issues, ESD aims to cultivate active contributors who can shape a more sustainable, just, and resilient future for all (Stössel et al., 2021; Waltner, Rieß, & Mischo, 2019; Goller & Markert, 2024; Schönstein & Budke, 2024; Malandrakis, Papadopoulou, Gavrilakis, & Mogias, 2018; Batsa, Li, & Khajuria, 2025). The very essence of ESD is its multifaceted nature, seamlessly integrating cognitive learning (e.g., understanding complex systems and scientific literacy), socio-emotional learning (e.g., nurturing values like empathy and responsibility and cultivating intrinsic motivation), and behavioral learning (e.g., equipping learners with action competence and promoting collaboration and participation) (Stössel et al., 2021; Goller & Markert, 2024; Schönstein & Budke, 2024; Batsa, Li, & Khajuria, 2025; Bureau et al., 2025). It represents a significant evolution beyond traditional environmental education (EE), explicitly forging links between environmental concerns and their social and economic dimensions and emphasizing transformative learning and the development of critical thinking skills (Goller & Markert, 2024; Acosta-Castellanos & Queiruga-Dios, 2022; Hung & Pan, 2025).

Given the urgency of global sustainability challenges, studying ESD is not just beneficial it is essential. By understanding how ESD equips learners with the knowledge, values, and skills needed for sustainable living, we lay the groundwork for a future where individuals are not only aware of sustainability issues but are also intrinsically motivated and empowered to act upon them.

Intrinsic Motivation and ESD Engagement: A Symbiotic Relationship

Building upon the understanding of IM as a powerful internal driver and ESD as a crucial educational framework, it becomes logical to explore the potential synergy between the two. Existing research across various educational domains consistently demonstrates that students who are intrinsically motivated tend to exhibit higher levels of engagement and achieve more positive learning outcomes (Ryan & Deci, 2000). When applied to the context of ESD, it is plausible that students who possess a genuine interest in learning and find intellectual stimulation in their studies will be more inclined to actively engage with sustainability-related topics and activities. This deeper engagement, fuelled by intrinsic motivation, can lead to a more profound understanding of the complexities of sustainable development and a stronger personal commitment to adopting sustainable behaviors (Lotz-Sisitka et al., 2015).

Exploring this relationship is highly relevant to current educational research, as it provides critical insights into how motivational factors, especially IM can enhance the effectiveness of ESD. Understanding how IM influences student engagement in sustainability education can inform the development of more impactful pedagogical strategies ultimately contributing to the cultivation of empowered, responsible, and sustainability-conscious future citizens.

METHODOLOGY

To systematically investigate the relationship between IM and ESD engagement. This study adopted a quantitative research design to explore the relationship between the independent and dependent variables (Shao et. al., 2022). This approach allowed for the collection of numerical data, enabling statistical analysis to examine the strength and direction of the hypothesized relationship. Specifically, a survey method employing closed-ended questions was utilized to gather data from pre-university students at a single point in time, adhering to a cross-sectional design.

Participants and Sampling Method

The participants in this study comprised 127 pre-university students enrolled in various programs within educational institutions located in Kuantan, Pahang, Malaysia. To gain access to this specific student population, a convenience sampling method was employed. While this method offers practicality in data collection, it is important to acknowledge its potential limitations in terms of generalizability to the entire population of pre-university students.

Data Collection Instrument: Crafting Our Measurement Tool

Data for this study was systematically collected using a carefully designed, three-section questionnaire. The initial section (Section A) aimed to gather essential demographic information from participating students, including age, gender, and the specific type of pre-university program they were enrolled in, providing valuable context for the study sample. Section B focused on assessing students' inherent motivation towards learning related to sustainability. All items in this section were adapted from established scales rooted in Self-Determination Theory (SDT), ensuring a theoretically grounded and contextually relevant measurement of intrinsic motivation. The adaptation was informed by both primary and secondary data, specifically drawing from the current literature by Ryan and Deci (2020, 2023), to reflect contemporary understandings of motivation in educational settings. Students responded using a 5-point Likert scale, ranging from 1 (strongly disagree) to 5 (strongly agree), to indicate their level of internal drive.

The final section (Section C) was specifically developed to gauge students' engagement with Education for Sustainable Development (ESD). This section explored their awareness of sustainability issues, active participation in ESD-related learning experiences, and the perceived importance of ESD in their lives. All items in this section were adapted based on current contexts using both primary and secondary sources, including Tilbury (2021), UNESCO (2017), and UNESCO (2023), to ensure relevance and alignment with contemporary ESD frameworks. Responses in Section C were captured using a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Nominal, ordinal, and interval scales are some of the measurement scale types employed in this study (Mohd Johan et. al., 2020).

Prior to its widespread use, the questionnaire underwent a rigorous pilot-testing phase with a small group of pre-university students which is 25 pre-university students who were not included in the final sample. This crucial step allowed for the identification of any ambiguities or areas for improvement in the clarity and readability of the questions, ensuring the instrument's validity and reliability (Creswell & Creswell, 2017). A pilot test sample was also collected to validate the data's feasibility and validity. (Johan et al., 2022). Based on the valuable feedback received during the pilot testing, minor revisions were implemented to refine the questionnaire for the main data collection phase. In addition, all participants provided informed consent, and data was collected to preserve their anonymity and privacy (Wei et al., 2020).

Data Analysis: Unveiling Relationships

The collected data were analyzed using Partial Least Squares Structural Equation Modelling (PLS-SEM) with SmartPLS version 4, a robust method suitable for analyzing data potentially deviating from normality assumptions. The analysis involved key stages. First, the measurement model was assessed to confirm the reliability and validity of the scales for IM and ESD Engagement. This included evaluating internal consistency (Composite Reliability), convergent validity (Average Variance Extracted - AVE), indicator reliability, and discriminant validity using criteria such as Fornell-Larcker and the Heterotrait-Monotrait Ratio (HTMT), as well as Cross Loading (Hair et al., 2014).

Following this, the structural model was examined to test the hypothesized relationship between IM and ESD Engagement. The focus was on the path coefficient, assessing its significance, magnitude, and direction. Evaluation also encompassed assessing collinearity, the explanatory power of the model (R2) and, the effect sizes (f2) (Ramayah et al., 2016, 2018). Descriptive statistics were computed for IM and ESD Engagement to summarize the data's characteristics, including the mean, standard deviation, skewness, and kurtosis.

Ethical considerations guided the research process. Ethical approval was secured from the relevant institutional review board prior to data collection. Participation in the study was voluntary, with potential respondents fully informed about the study's objectives and the confidentiality of their data. Informed consent was obtained from all participants before they completed the survey.

RESULTS

Assessment of the Measurement Model: Ensuring Reliable Measures

The assessment of the measurement model revealed robust psychometric properties for both the Intrinsic Motivation (IM) and Education for Sustainable Development (ESD) engagement constructs. Refer in Table 2, both constructs demonstrated high levels of internal consistency, with Cronbach's alpha coefficients of 0.894 for IM and 0.858 for ESD, and composite reliability coefficients of 0.904 for IM and 0.86 for ESD, all comfortably exceeding the generally accepted threshold of 0.70 (Ramayah et al., 2018). Convergent validity was also well-supported, as the Average Variance Extracted (AVE) values for both IM (0.54) and ESD (0.503) were above the recommended minimum of 0.50, indicating that the items effectively captured the underlying constructs.

Table 2: Cronbach's alpha, Composite reliability and Average Variance Extracted (AVE)

	Cronbach's alpha	Composite reliability	Average variance extracted (AVE)
ESD	0.858	0.86	0.503
IM	0.894	0.904	0.54

Furthermore, discriminant validity was established through both the Heterotrait-Monotrait (HTMT) ratio, which was 0.533 (below the conservative threshold of 0.85), and the Fornell-Larcker criterion, where the square root of the AVE for each construct (0.735 for IM and 0.709 for ESD) was greater than the correlation between them (r = 0.487). These results, as detailed in Table 3 and Table 4, support the distinctiveness of the two constructs within the model. Finally, the indicator loadings for all items on their respective constructs were found to be statistically significant, with the 95% bias-corrected bootstrap confidence intervals not containing zero, indicating a strong and reliable relationship between each item and the construct it aimed to measure.

Table 3: Heterotrait-monotrait ratio (HTMT)

	Heterotrait-monotrait ratio (HTMT)
IM <-> ESD	0.533

Table 4: Fornell-Larckel criterion

Fornell-Larckel criterion	ESD	IM
ESD	0.709	
IM	0.487	0.735

Assessment of the Structural Model: Unveiling the Relationship

Based on the structural model results presented in Table 5, the path analysis confirms a statistically significant and positive relationship between IM and ESD Engagement, with a path coefficient (β) of 0.487 and a p-value of 0.000, providing strong support for hypothesis, which is IM significantly influences students' participation in ESD. The t-statistic of 5.613 exceeds the critical value, further affirming the robustness of the result.

Additionally, the model explains 23.7% ($R^2 = 0.237$) of the variance in ESD Engagement, with an adjusted R^2 of 0.231, indicating a moderate level of explanatory power. The effect size (f^2) of 0.311 falls within the medium to large range, emphasizing the substantial practical significance of intrinsic motivation in predicting student engagement with Education for Sustainable Development. Furthermore, the VIF value of 1.451 is well below the conservative threshold of 5.0, indicating that no collinearity issues were present in the model, thereby strengthening the validity of the estimated relationship between the constructs.

Table 5: Structural Model

	Original sample (O)	Sample mean (M)	T statistics (|O/STDEV|)	P values	R-square	R-square adjusted	f-square	VIF
IM -> ESD	0.487	0.51	5.613	0	0.237	0.231	0.311	1.451

Descriptive Statistics: Painting a Picture of the Data

The descriptive statistics for both Intrinsic Motivation and ESD engagement provided further insights into the data distribution. The means for both variables were centered around the midpoint of the 5-point Likert scale. Both distributions exhibited a slight negative skew, suggesting a tendency for students to score somewhat higher on these measures. The kurtosis values indicated a platykurtic (flatter) distribution for ESD and a leptokurtic (more peaked) distribution for IM, indicating some deviation from a perfectly normal distribution. However, these deviations were not deemed severe enough to compromise the validity of the PLS-SEM analysis, which is known for its robustness to such violations.

The descriptive statistics for the key variables, IM and ESD engagement, were analyzed based on a sample of 127 respondents. Prior to analysis, both variables were standardized, resulting in a mean of 0 and a standard deviation of 1 for each variable.

From Table 6 shows descriptive statistics for ESD engagement, the median score was 0.113, with observed values ranging from -2.807 to 1.175. The distribution exhibited slight negative skewness (-0.469) and a kurtosis value of -0.833, indicating a distribution somewhat flatter than the normal curve. The Cramér–von Mises test for normality yielded a test statistic of 0.539 and a p-value of 0, suggesting that the distribution of ESD scores significantly deviates from normality.

Similarly, the IM variable showed a median of 0.120 and a wider range of observed values, from -2.921 to 3.175. The skewness was mildly negative at -0.403, while kurtosis was slightly positive at 0.57, suggesting a modestly more peaked distribution compared to normal. The Cramér–von Mises test statistic was 0.452 with a p-value of 0, indicating a statistically significant departure from normality.

Despite these departures from normality, the skewness and kurtosis values suggest only mild asymmetry and peak variations in the distributions. These results justify the use of Partial Least Squares Structural Equation Modeling (PLS-SEM) for subsequent analysis, given its robustness to non-normal data distributions.

Table 6: Descriptive Statistic

	Mean	Median	Observed min	Observed max	Standard deviation	Excess kurtosis	Skewness	Cramér-von Mises test statistic	Cramér-von Mises p value
ESD	0	0.113	-2.807	1.175	1	-0.833	-0.469	0.539	0
IM	0	0.12	-2.921	3.175	1	0.57	-0.403	0.452	0

DISCUSSION

The findings of this study provide compelling empirical evidence for a statistically significant and positive relationship between IM and ESD engagement among pre-university students in Kuantan, Pahang. This central finding strongly supports our initial hypothesis and resonates deeply with the tenets of Self-Determination Theory (SDT) (Ryan & Deci, 2000). SDT posits that when individuals are driven by the inherent enjoyment and satisfaction of an activity, their engagement and learning outcomes are significantly enhanced.

While the relationship between motivation and education has long been known, this study gives important insight into the Malaysian "status quo." Current data shows a worrying trend: while student enrolment in private HEIs increases to 558,692 in 2023, the total graduate output decreases from

132,238 in 2021 to 110,154 in 2023. This gap shows that high enrolment does not guarantee persistence or engagement. By focusing on the pre-university level, an important level for shaping lifelong values, this research identifies IM as the "inner spark" necessary to bridge this gap. In contrast to traditional studies that focus on general academic achievement, this research directly links IM to action competence, ensuring students are not just knowledgeable but are proactively committed to sustainable living.

By focusing on the critical pre university transition phase, this study uniquely demonstrates a developmental window in which students' intrinsic or spiritual motivation, rooted in ethical and cultural beliefs, is most easily formed (Qingyan, 2025), suggesting that embedding the relationship between IM and ESD into institutional culture, such as transforming orientation programmes from administrative briefings into sustainability immersions, can fulfil students' needs for autonomy and relatedness, ignite early passion for environmental responsibility, and enable learners to move beyond passive acceptance towards internalized sustainability commitment necessary for a global knowledge based economy.

Recent evidence shows that the organizational culture (OC) of a university becomes a determining factor in whether students appreciate sustainability values (Leal Filho et al., 2024). Specifically, institutional support systems such as redesigned orientation programs can act as "intrinsic boosters." When orientation shifts from administrative briefings to include practical activities sustainability challenges, it builds a sense of relatedness to the campus community and competence self-confidence belief in one's ability to act, which is the main condition for intrinsic drive (Chiu, 202).

The study's findings contribute to the limited body of research examining motivational factors in ESD within the Malaysian pre-university context. The statistically significant positive relationship between IM and ESD engagement underscores the importance of creating learning environments that nurture students' inherent curiosity and interest in sustainability issues.

Limitations and Contribution

Several limitations should be acknowledged when interpreting the findings of this study. First, the use of convenience sampling restricts the generalizability of the results to the wider population of pre-university students. This sampling approach may not fully capture the diversity of the target population. Second, the study relied on self-report questionnaires, which are susceptible to response biases, including social desirability bias, potentially affecting the accuracy of the data collected. Finally, the cross-sectional research design employed limits the ability to infer causal relationships between intrinsic motivation and engagement with Education for Sustainable Development (ESD).

Despite its limitations, this study offers several significant contributions. Firstly, it provides empirical evidence supporting a positive relationship between IM and engagement in ESD within the context of Malaysian pre-university students. This evidence enriches the understanding of motivational dynamics in sustainability education. Secondly, the study underscores the practical importance of fostering intrinsic motivation as a critical strategy to enhance student engagement in ESD, highlighting a pathway for educators to improve learning outcomes. Finally, the findings yield valuable practical implications for educators and policymakers aiming to strengthen the effectiveness of ESD initiatives at the pre-university level, supporting efforts to nurture sustainability-conscious future leaders.

Recommendations

Based on the findings of this study, several recommendations are proposed to improve the effectiveness of Education for Sustainable Development (ESD) initiatives. Educators should transition to Inquiry-Based Learning (IBL) where students investigate local environmental issues in Kuantan (e.g., waste management or river health). Additionally, connecting ESD content to students' personal interests and future aspirations can enhance their intrinsic motivation and engagement. Recent studies confirm

that IBL significantly enhances students' motivation and problem-solving efficiency by allowing for "self-exploration" and "deep questioning" (Hala & Xhomara, 2022). By addressing local problems, students develop "action competence," realizing that even small individual actions can lead to collective impact (Koçulu, 2025).

Meanwhile, institutional policy such as universities need to build a culture of sustainability by incorporating ESD into orientation weeks and out-of-classroom activities in the form of sustainability immersion, integrating sustainability into management strategies and organizational culture to ensure real commitment (Leal Filho et al., 2024) while using experiential learning activities such as community projects or green challenges to move students from passive learning to active engagement (Alabi, 2024).

Future studies need to use long-term designs to track the sustainability of intrinsic motivation from pre-university to professional careers while investigating how Malaysian cultural values such as community-centered practices of gotong royong, recognized as an internal domain of human existence, can be used increase engagement in education for sustainable development (Azeqa Ma'rof et al., 2024). Additionally, conducting studies with larger and more diverse samples across different educational levels and regions in Malaysia would improve the generalizability of the findings.

CONCLUSION

This study provides valuable insights into the relationship between IM and ESD engagement among pre-university students in Kuantan, Pahang. The findings of the study revealed that both IM and ESD recorded high mean scores, indicating strong positive responses among pre-university students. Items reflecting IM such as perceiving sustainability education as a lifelong learning journey, experiencing joy and fulfilment in sustainability-related activities, and feeling a sense of accomplishment when acquiring sustainable skills demonstrated that students are internally driven to engage in sustainable practices. Similarly, items related to ESD such as the willingness to make lifestyle changes for a more sustainable future, recognizing the importance of sustainability education in addressing future challenges, and acknowledging the impact of sustainability awareness on personal behaviour also scored highly.

These findings suggest a meaningful relationship between IM and students' engagement with sustainability education. When students are intrinsically motivated, they are more likely to internalize sustainable values and actively participate in sustainability-related initiatives. ESD, in turn, reinforces and nurtures this internal motivation by providing relevant knowledge, meaningful experiences, and a sense of purpose, thereby fostering long-term commitment to sustainable living. By creating learning environments that nurture students' inherent interest in sustainability, educators and policymakers can contribute to developing a generation of engaged and motivated individuals committed to creating a more sustainable future.

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AUTHORS' CONTRIBUTION

Tun Norasida contributed to the writing and data analysis of the manuscript. Po, Fatihah, and Aznira assisted in data collection. Mohd Remie supported the final submission and preparation of the manuscript for publication. Tun Norasida took the lead in writing the manuscript. All authors provided critical feedback and helped shape the research, analysis and manuscript.

CONFLICT OF INTEREST DECLARATION

We hereby declare that this manuscript is the original work of the authors and co-authors. It has not been previously published, nor is it under consideration for publication elsewhere, in whole or in part. All authors have made substantial contributions to the research, including the validity and interpretation of the data, and have approved the final version submitted to *Jurnal Intelek*. There are no conflicts of interest to declare.

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