ATHENA: Journal of Social, Culture and Society
Vol 3, Issue 4, October 2025, Page 615-631
ISSN: 2985 - 3605 (Media Online)
DOI: https://doi.org/10.58905/athena.v3i4.464

Educators' Adoption of Green Digital Technologies: The Role of Psychological Readiness, Digital Competence, and Institutional Support

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Abstract. The growing emphasis on sustainability within education requires teachers to integrate environmentally responsible technologies in their teaching practices. This study examines educators' adoption of green digital technologies by exploring the influence of psychological readiness, digital competence, and institutional support. Grounded in the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework, the research develops a conceptual model that connects individual readiness with professional and institutional enablers. Using a cross-sectional design and data from 200 educators in Indonesia, the findings demonstrate that digital competence and institutional support significantly influence sustainable technology adoption, with psychological readiness acting as a mediator. This study highlights the importance of aligning technological innovation with sustainability goals and provides implications for teacher professional development, institutional policy, and sustainable education strategies.

Keywords: Green digital technology, Psychological Readiness, Digital Competence, Institutional Support, TAM, TPACK, Sustainability.

1 Introduction

As educational systems around the world shift toward digital learning environments, a parallel concern has emerged regarding the environmental sustainability of these technologies. Green digital technology refers to the integration of eco-efficient and environmentally sustainable digital systems, which minimize energy consumption, reduce paper dependency, and promote ecological awareness in educational practice. Examples include cloud-based platforms that reduce paper usage, energy-efficient devices, and pedagogical approaches that incorporate sustainability awareness. While the adoption of such tools aligns with global goals for sustainable development, particularly those outlined in the UN's Sustainable Development Goals (SDGs), the integration of green technology into educational settings remains inconsistent and understudied.

In Indonesia, the urgency of integrating green digital technologies is heightened by national initiatives such as the Digital Transformation Roadmap (2021–2024) and the Green Economy Vision 2045 [1] , which aim to align education with environmental sustainability goals. By promoting sustainable digital practices among educators, this study contributes directly to SDG 4 (Quality Education) and SDG 13 (Climate Action), emphasizing education's role in environmental stewardship and responsible digital transformation.

Existing research has often focused on general technology integration, without specifically addressing the environmental or sustainability dimensions. For example, [2] examined how teachers' openness to innovation and their psychological readiness significantly influenced their technology adoption in classroom settings. However, their study did not consider whether such technology use was aligned with sustainable or green practices. This oversight highlights a critical research gap in understanding how educators' readiness and institutional contexts contribute to sustainable digital adoption, especially in developing countries like Indonesia. However, their study did not consider whether such technology use was aligned with sustainable or green practices. Similarly, [3] explored the role of digital competence in effective technology integration, emphasizing that educators' technical and pedagogical skills are central to adopting new tools. Still, their work was situated within a broad digital literacy framework, not explicitly focused on sustainability. Meanwhile, [4] investigated the influence of institutional support on technology adoption in schools in Kuwait, highlighting how administrative encouragement, infrastructure, and training can facilitate or constrain innovation. Nevertheless, their study also did not explore green technology or sustainable practices specifically.

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These previous studies establish that psychological readiness, digital competence, and institutional support are essential for technology adoption. However, a significant gap remains: very few studies have examined how these factors collectively influence the integration of green digital technologies in educational contexts. Furthermore, this gap is especially pronounced in the context of developing countries like Indonesia, where environmental consciousness is growing, yet infrastructure, training, and policy support may lag behind.

The purpose of this study is to investigate how psychological readiness, digital competence, and institutional support influence educators' adoption of green digital technologies in teaching and learning. This research aims to bridge the gap in the literature by focusing not just on technology use in general, but on how sustainable digital practices can be promoted through individual and institutional readiness.

The present study, therefore, investigates how psychological readiness, digital competence, and institutional support influence educators' adoption of green digital technologies. By integrating TAM and TPACK frameworks, this study builds a comprehensive model to explain sustainable technology adoption in education.

In addition to examining predictive relationships, this study also explores whether educators' levels of psychological readiness, digital competence, institutional support, and integration of green digital technologies differ significantly across demographic groups such as gender, teaching level, and years of experience. Understanding these differences is important for tailoring interventions and professional development strategies aimed at fostering green digital practices across diverse educational contexts.

Correspondingly, the study is guided by the following research questions:

a. To what extent does psychological readiness predict green technology integration in education?
b. To what extent does digital competence influence educators' use of green digital practices?
c. What is the role of institutional support in supporting green digital technology integration?
d. Which of these factors is the most significant predictor of green technology adoption among educators?
e. Are there significant differences in educators' psychological readiness, digital competence, institutional support, and green technology integration based on demographic variables such as gender, teaching level, or years of experience?

Hypotheses

H1: Psychological readiness positively predicts educators' adoption of green digital technologies in education.
H2: Digital competence has a positive influence on educators' use of green digital technologies in teaching and learning.
H3: Institutional support positively affects the integration of green digital technologies by educators.
H4: Among psychological readiness, digital competence, and institutional support, one factor will emerge as the strongest predictor of educators' adoption of green digital technologies.
H5: Educators' psychological readiness, digital competence, institutional support, and green technology integration vary significantly based on demographic characteristics such as gender, teaching level, and years of experience.

2 Literature Review

This section provides a theoretical and empirical foundation for understanding how psychological readiness, digital competence, and institutional support influence the adoption of green digital technologies in education. Each variable is discussed in light of existing theories and past research, with attention to gaps this study aims to address.

All constructs in this study were operationalized using validated indicators from established scales: psychological readiness [5], digital competence [6], institutional support [4], and green digital technology adoption [7]. These references ensure that the measurement instruments are theoretically grounded, reliable, and comparable with prior research.

2.1 Psychological Readiness and Technology Adoption

Psychological readiness refers to an individual's cognitive and emotional preparedness to engage with change, particularly in adopting new technologies. In the context of education, it includes openness to innovation, self-efficacy, perceived value of the technology, and the willingness to adapt teaching practices.

According to the Technology Acceptance Model (TAM), perceived usefulness and perceived ease of use significantly shape a user's intention to adopt a technology [8]. Psychological readiness aligns with these perceptions and has been found to predict technology usage. For instance, [2] emphasized that teachers with higher psychological readiness were more proactive in integrating digital tools into their teaching. [5] also noted that psychological constructs such as attitude and self-efficacy played a significant role in predicting teachers' technology acceptance.

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However, few studies have examined psychological readiness in the context of green technology adoption, that is, the use of environmentally sustainable digital tools. This gap is crucial, especially as educational institutions are expected to contribute to sustainable development goals. Therefore, this study extends prior research by investigating whether psychological readiness predicts not just general technology use, but specifically green digital technology adoption.

2.2 Digital Competence and Sustainable Technology Integration

Digital competence refers to educators' ability to effectively use digital tools, including their technical, informational, and pedagogical skills. It is a multidimensional construct encompassing the ability to evaluate digital resources, integrate them meaningfully into instruction, and adapt to new technologies.

The TPACK framework [9] underscores the necessity of combining technological knowledge with pedagogical and content knowledge for effective integration. Research has shown that digital competence is strongly linked to successful classroom technology use. [10] reported that teachers with higher digital competence demonstrated more creativity, confidence, and flexibility in digital environments. Likewise, [11] found a strong relationship between digital skills and teachers' confidence in using educational technologies.

While these studies confirm the importance of digital competence in general technology integration, few have addressed its role in adopting environmentally sustainable technologies. As green digital tools often involve newer or more advanced systems (cloud platforms, energy-efficient devices), higher competence may be essential. This study addresses this gap by focusing on how digital competence influences the use of green technologies in education.

2.3 Institutional Support and the Adoption of Green Digital Technologies

Institutional support encompasses the policies, infrastructure, leadership, and training provided by educational institutions to facilitate technology use. It creates an enabling environment that can encourage or discourage the adoption of innovation.

In a study by [4], institutional support was found to be a major enabler of teachers' use of educational technology in Kuwait. Supportive leadership, professional development, and access to digital resources significantly increased teachers' confidence and frequency of use. [12] similarly emphasized that even the most motivated teachers are unlikely to adopt new tools without sufficient institutional backing.

However, these studies do not specifically address support structures for green digital technologies, which may include eco-conscious procurement policies, training focused on sustainability, and incentives for reducing paper or energy use. This study extends the discussion by examining how institutional support tailored to green practices influences educators' adoption behaviour.

2.4 Theoretical Framework

This study is guided by two well-established theoretical models: the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework. These models provide the foundation for understanding how individual, professional, and institutional factors interact to influence technology adoption among educators.

The Technology Acceptance Model (TAM), introduced by [8], posits that two key beliefs, perceived usefulness and perceived ease of use, determine an individual's attitude toward using a particular technology. These beliefs subsequently shape behavioural intention and actual usage. In this study, psychological readiness reflects a teacher's confidence, motivation, and openness to new digital tools, which align with TAM's core beliefs.

Complementing TAM, the TPACK framework [9] emphasizes the integration of technological knowledge with pedagogical and content knowledge. This model highlights that teachers must not only understand how to use digital tools but also how to blend them effectively into instructional strategies. Here, digital competence is conceptualized through the TPACK lens as the teacher's ability to leverage technology meaningfully while maintaining sustainable practices.

Unlike previous studies that applied TAM and TPACK separately, this research integrates the psychological dimension of TAM (perceived readiness and usefulness) with the professional and contextual dimensions of TPACK (digital competence and institutional support). This integration provides a coherent model explaining how personal and institutional factors jointly influence sustainable technology adoption.

Moreover, institutional support plays a bridging role between these two frameworks. While TAM focuses on individual acceptance and TPACK focuses on professional knowledge, both operate within institutional contexts that provide training, infrastructure, and leadership. The interplay between TAM, TPACK, and institutional environments thus forms a comprehensive theoretical lens for examining educators' adoption of green digital technologies.

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This integrated framework highlights that psychological readiness, derived from TAM, drives adoption intentions only when reinforced by the competencies and institutional ecosystems described in TPACK. This demonstrates the dynamic interaction between individual and contextual enablers of green digital technology adoption.

2.4 Research Gaps

Although existing research has extensively explored the role of psychological readiness, digital competence, and institutional support in general technology adoption, there remains a significant gap in the context of green digital technologies. These tools and systems are designed to support both educational goals and environmental sustainability, yet their adoption within educational institutions is still limited and uneven.

While previous studies have examined general digital technology adoption, very few have explicitly distinguished between digital integration aimed at instructional efficiency and digital integration aimed at environmental sustainability. This study fills that conceptual and empirical gap by focusing on green digital technology adoption, which refers to the integration of environmentally conscious digital practices within teaching and learning.

Much of the current literature treats these factors, such as psychological, professional, and institutional, in isolation. Few studies have examined their combined predictive power on technology adoption, especially in relation to sustainable or green technologies. In addition, research focusing on developing countries, particularly Indonesia, remains limited. Most existing models have been tested in Western or high-income contexts, where access to digital infrastructure and institutional support may differ significantly from those in Southeast Asia.

There is also a lack of empirical evidence comparing which among these variables (psychological readiness, digital competence, or institutional support) serves as the strongest predictor of green technology adoption. Understanding this hierarchy is crucial for designing effective interventions and policies in the education sector.

Addressing these gaps, the present study investigates the combined and relative impact of psychological readiness, digital competence, and institutional support on educators' adoption of green digital technologies in Indonesia. By applying established theoretical models in a new context and focusing on sustainability, the study aims to contribute both theoretically and practically to the discourse on technology integration in education. In doing so, this research contributes a new intersectional perspective by merging technology adoption theory with sustainability education, an area that remains underexplored in both TAM and TPACK literature.

3 Methodology

3.1 Research Design

This study employed a quantitative, cross-sectional design to examine the relationships among psychological readiness, digital competence, institutional support, and the adoption of green digital technologies [13]. The research design was chosen to capture educators' current levels of readiness, competence, and perceptions of institutional support within a specific timeframe. Structural Equation Modelling (SEM) using the Partial Least Squares (PLS) approach was applied to analyse the hypothesized relationships and test the conceptual framework [14]. The research design is illustrated in Figure 1.

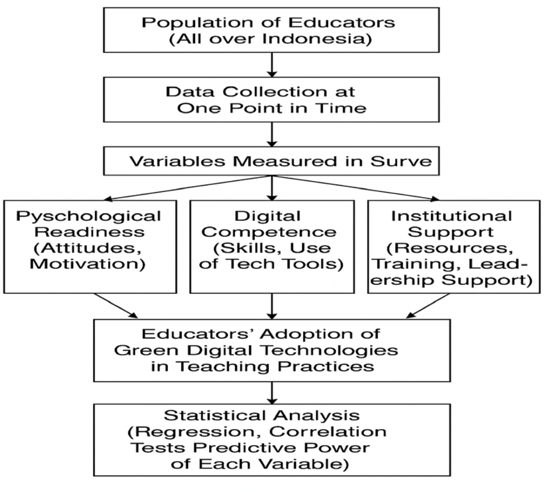

Figure 1. Cross-Sectional Survey Design [13]

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Figure 1. Cross-sectional survey design showing the relationship between psychological readiness, digital competence, institutional support, and the adoption of green digital technologies among educators.

3.2 Population and Sample

The target population includes educators from primary, secondary, and tertiary education levels across various regions in Indonesia. The population of this study consisted of educators from various educational levels across Indonesia, including primary, secondary, and tertiary institutions. To ensure representativeness and adequate statistical power, a total of 200 educators were selected using stratified random sampling. The sample size of 200 participants satisfies the recommended 10:1 ratio for PLS-SEM models [14], ensuring adequate statistical power and reliability for structural equation modelling analysis. Stratification factors included geographic location, teaching level, and type of institution (public or private) to capture the diversity of the Indonesian educational context.

3.3 Data Collection Instrument

Data were collected using a structured questionnaire available both online and in print to accommodate accessibility differences among participants. The questionnaire items were adapted from previously validated scales to ensure content validity and measurement reliability. Psychological readiness items were adapted from Teo (2009), digital competence from [6] and the DigCompEdu framework, institutional support from [4], and green digital technology adoption from [7]. All constructs were measured using a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree) to maintain comparability across variables.
The questionnaire consisted of five sections:

a. Demographics: Age, gender, teaching level, years of teaching experience, location, and type of institution.
b. Psychological Readiness: Items assessing self-efficacy, motivation, and openness to using new technologies.
c. Digital Competence: Items based on the DigCompEdu framework evaluating educators' ability to integrate technology effectively and sustainably.
d. Institutional Support: Items measuring perceptions of leadership support, infrastructure availability, and professional development opportunities.
e. Green Digital Technology Adoption: Items assessing the extent to which educators use eco-friendly digital tools and practices in their teaching.

3.4 Conceptual Framework

Figure 2 illustrates the conceptual model for this study, showing the hypothesized relationships among psychological readiness, digital competence, institutional support, and the adoption of green digital technologies.

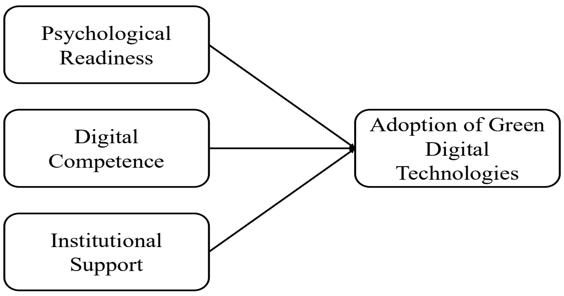

Figure 2. Conceptual Framework for Adoption of Green Digital Technologies

The conceptual model proposes that psychological readiness interacts with digital competence and institutional support to predict sustainable technology adoption. This highlights that motivation alone is insufficient without adequate skill and systemic support.

3.5 Data Analysis

Data collected from 200 educators were analysed using SPSS 31 and SmartPLS 4 software to examine the relationships among psychological readiness, digital competence, institutional support, and green digital technology adoption. Demographic variables such as gender, teaching level, and years of experience were also

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examined to identify potential subgroup differences, following recommendations from [15] that demographic factors can influence educators' digital competence and readiness toward technology adoption.

First, descriptive statistics (means, standard deviations, and frequencies) were computed to summarize the demographic characteristics of the respondents as well as the main study variables, providing an overview of the sample profile and central tendencies of the constructs.

Next, reliability analysis was conducted using Cronbach's Alpha to assess the internal consistency of the measurement scales. All constructs demonstrated acceptable to good reliability, with Cronbach's Alpha values exceeding the 0.70 threshold, indicating that the items reliably measure their respective latent variables [16].

To evaluate the validity of the measurement model, outer loadings of individual items were examined, with most items exceeding the recommended cutoff of 0.70, ensuring indicator reliability. Furthermore, convergent validity was confirmed through Composite Reliability (CR) and Average Variance Extracted (AVE) values, both surpassing established thresholds. Discriminant validity was assessed using the Fornell–Larcker criterion and Heterotrait–Monotrait (HTMT) ratios, which supported the distinctiveness of the constructs in the model.

Partial Least Squares Structural Equation Modelling (PLS-SEM) was then employed to test the hypothesized predictive relationships among the constructs. This approach allows simultaneous estimation of measurement and structural models, making it suitable for testing complex relationships with latent variables [14].

Finally, one-way Analysis of Variance (ANOVA) [17] was performed to explore differences in key constructs across demographic groups such as gender, teaching level, and years of teaching experience. This analysis helped identify whether psychological readiness, digital competence, institutional support, or green digital technology adoption varied significantly between these groups.

3.6 Ethical Considerations

The study will uphold strict ethical standards, including informed consent, voluntary participation, anonymity, and confidentiality. Respondents will be informed about the purpose of the study and their right to withdraw at any time. Ethical approval will be sought from a relevant university or research ethics board prior to data collection [18].

4 Results and Discussion

4.1 Results

4.1.1 Demographic Profile of Respondents

A total of 200 educators participated in this study, spanning diverse age groups, teaching levels, and geographic locations. The demographic characteristics of the respondents are summarized in Table 1.

Table 1. Demographic Profile of Respondents

Variable	Category	Frequency (n)	Percentage (%)
Gender	Male	90	45.0%
	Female	110	55.0%
Teaching Level	Primary	70	35.0%
	Secondary	80	40.0%
	Tertiary	50	25.0%
Location	Java	90	45.0%
	Sumatra	30	15.0%
	Kalimantan	20	10.0%
	Bali–Lombok–NTB–NTT	25	12.5%
	Maluku–Ambon	15	7.5%
	Papua	20	10.0%
Type of Institution	Public	120	60.0%
	Private	80	40.0%
Knowledge of Green Digital Technology	Yes	130	65.0%
	No	70	35.0%

Source: Author's own work

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4.1.1.1 Interpretation of Table 1 Demographics Profile of Respondents

The sample comprised a diverse group of educators across key demographic variables. In terms of gender, females slightly outnumbered males, accounting for 55% of the participants, which reflects a balanced gender distribution within the educational workforce. The majority of respondents taught at the secondary education level (40%), followed by primary (35%) and tertiary levels (25%), indicating a broad representation across educational stages.

Geographically, most participants were located on the island of Java (45%), which is the most populous and educationally developed region in Indonesia. Other regions represented included Sumatra (15%), Kalimantan (10%), Bali-Lombok-NTB-NTT (12.5%), Maluku-Ambon (7.5%), and Papua (10%). This geographic distribution captures a range of educational contexts and infrastructure variability across the country.

Regarding institutional affiliation, 60% of respondents were employed by public institutions, while 40% worked in private institutions. This distribution ensures perspectives from both government-supported and private education sectors are considered. Additionally, 65% of educators reported having knowledge of green digital technologies, suggesting a moderate awareness and readiness within the sample for adopting sustainable digital practices.

Therefore, these demographic characteristics provide a solid foundation for understanding the contextual factors that may influence psychological readiness, digital competence, institutional support, and the adoption of green digital technologies among educators in Indonesia. The sample's diversity enhances the generalizability of the study's findings to the broader population of Indonesian educators.

4.1.2 Descriptive Statistics of Key Variables

Following the demographic characteristics of the participants, this section presents the descriptive statistics for the main study variables: psychological readiness, digital competence, institutional support, and adoption of green digital technologies. These statistics provide an overview of the central tendencies and variability in educators' responses, laying the groundwork for subsequent analyses.

According to [19], descriptive statistics are essential in quantitative research for summarizing raw data into meaningful figures that highlight general trends and variations. Table 2 shows the descriptive statistics for the key variables in this study, including psychological readiness, digital competence, institutional support, and integration of green digital technology.

Table 2. Descriptive Statistics of Main Variables

Variable	N	Minimum	Maximum	Mean	Std. Deviation
Psychological Readiness	200	5	25	18.92	3.650
Digital Competence	200	5	25	17.87	4.673
Institutional Support	200	5	24	18.16	3.433
Integration of Green Digital Technology	200	5	24	17.90	3.748
Total Score (All Items)	200	20	97	72.85	12.958

Source: Author own's work

4.1.2.1 Interpretation Table 2 Descriptive Statistics of Main Variables

As shown in Table 2, the mean score for psychological readiness (M = 18.92, SD = 3.65) was slightly higher than that for digital competence (M = 17.87, SD = 4.67), suggesting that while educators felt moderately ready to adopt green digital technology, their digital skills were somewhat less developed. Institutional support showed a comparable mean (M = 18.16), indicating moderate support from schools or organizations. The overall integration of green digital technology had a mean of 17.90, suggesting room for growth in sustainable digital practices.

4.1.3 Reliability Analysis

To ensure the internal consistency of the measurement instruments, a reliability analysis was conducted for each construct using Cronbach's Alpha. This statistical measure evaluates how closely related a set of items are as a group, reflecting the degree to which items consistently measure the same underlying construct. According to [20], a Cronbach's Alpha value of 0.70 or higher is considered acceptable, while values above 0.80 indicate good reliability. The results of the reliability analysis for the four key variables, psychological readiness, digital competence, institutional support, and integration of green digital technology are presented in Table 3.

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Table 3. Reliability Statistics of Key Variables

Variable	Number of Items	Cronbach's Alpha
Psychological Readiness	6	0.818
Digital Competence	6	0.828
Institutional Support	6	0.793
Integration of Green Digital Technology	6	0.800

Source: Author's own work

As shown in Table 3, all four constructs demonstrated acceptable to good reliability. Psychological Readiness had a Cronbach's Alpha of 0.818, suggesting strong internal consistency. Digital Competence yielded a slightly higher Alpha value of 0.828, indicating good reliability. Institutional Support returned a value of 0.793, which is also within the acceptable range. The Integration of Green Digital Technology construct showed a Cronbach's Alpha of 0.800, reflecting solid reliability. These results confirm that the items used to measure each construct are reliable and suitable for further analysis.

Before assessing the structural model, it is essential to evaluate the measurement model to ensure the reliability and validity of the indicators used. One key criterion is outer loading, which reflects how well each item represents its underlying construct. According to [14], outer loadings should ideally exceed 0.70 to indicate acceptable indicator reliability.

Table 4. Outer Loadings of Measurement Items

Item	Psychological Readiness	Digital Competence	Institutional Support	Integration of Green Digital Technologies
A1	0.903			
A2	0.909			
A3	0.737			
A4	0.854			
A5	0.868			
B2		0.778		
B3		0.940		
B5		0.945		
C1			0.703	
C2			0.682	
C3			0.776	
C4			0.772	
C5			0.810	
D1				0.695
D2				0.844
D3				0.797
D4				0.756
D5				0.764

Source: Author's own work

4.1.3.1 Interpretation of Table 4 Outer Loadings of Measurement Items

Table 4 presents the outer loadings of each item on its respective latent construct. Outer loadings indicate the strength of the relationship between observed items (indicators) and their underlying latent variables. As noted by [14], loadings above 0.70 are considered acceptable and indicate that the item reliably measures the construct.

a. Psychological Readiness (A1–A5): All items showed strong loadings ranging from 0.737 to 0.909, indicating high internal consistency and item reliability.
b. Digital Competence (B2, B3, B5): Outer loadings ranged from 0.778 to 0.945, suggesting excellent reliability for this construct.
c. Institutional Support (C1–C5): Item loadings fell between 0.682 and 0.810. Although C2 slightly falls below the threshold (0.682), it is close enough to be retained, particularly since the overall reliability remains strong.
d. Integration of Green Digital Technologies (D1–D5): Loadings ranged from 0.695 to 0.844, showing acceptable indicator reliability. D1 is slightly below 0.70, but still within an acceptable range, especially in exploratory research.

These outer loading values support the convergent validity of the constructs and confirm the suitability of the indicators for inclusion in further structural model analysis.

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To complement the reliability results shown in Table 3, Table 5 presents additional reliability and validity measures, including rho_A, Composite Reliability (CR), and Average Variance Extracted (AVE). The CR values for all constructs exceed the recommended threshold of 0.70 [14], indicating strong internal consistency. Similarly, AVE values above 0.50 demonstrate satisfactory convergent validity, confirming that the constructs explain a sufficient portion of variance in their indicators.

Table 5. Convergent Reliability and Validity

Construct	rho_A	Composite Reliability (CR)	Average Variance Extracted (AVE)
Adoption of Green Digital Technologies	0.846	0.881	0.597
Digital Competence	0.878	0.920	0.793
Institutional Support	0.824	0.865	0.563
Psychological Readiness	0.919	0.932	0.734

Source: Author's own work

4.1.3.2 Interpretation of Table 5: Convergent Reliability and Validity

Table 5 presents the key indicators for convergent reliability and validity of the constructs measured in this study. The results demonstrate satisfactory internal consistency and convergent validity across all constructs.

a. rho_A values range from 0.824 to 0.919, all exceeding the recommended threshold of 0.70 [21], indicating strong reliability of the constructs.
b. Composite Reliability (CR) values vary between 0.865 and 0.932, which are well above the acceptable cutoff of 0.70 [14], confirming good internal consistency reliability.
c. Average Variance Extracted (AVE) values range from 0.563 to 0.793, all above the 0.50 benchmark [22], suggesting that each construct explains more than half of the variance of its indicators, supporting convergent validity.

These results confirm that the measurement model possesses adequate reliability and convergent validity, making the constructs suitable for further structural model analysis.

Table 6. Fornell-Lacker Criterion

Construct	1. ADGT	2. DC	3. IS	4. PR
1. Adoption of Green Digital Technologies (ADGT)	0.773			
2. Digital Competence (DC)	0.880	0.891		
3. Institutional Support (IS)	0.897	0.789	0.750	
4. Psychological Readiness (PR)	0.332	0.315	0.403	0.857

Source: Author's own work

4.1.3.3 Interpretation of Table 6: Discriminant Validity (Fornell–Larcker Criterion)

Table 6 shows the square root of the Average Variance Extracted (AVE) values (diagonals) and the inter-construct correlations (off-diagonal). According to Fornell and Larcker (1981), discriminant validity is established when a construct's AVE square root is greater than its correlation with any other construct.

a. The square root of AVE for Psychological Readiness (0.857) is higher than its correlations with other constructs (e.g., 0.403 with Institutional Support), confirming discriminant validity.
b. Similarly, Digital Competence (0.891) and Adoption of Green Digital Technologies (0.773) meet this criterion.
c. However, Institutional Support has a relatively high correlation with Adoption of Green Digital Technologies (0.897), which slightly exceeds its AVE square root (0.750). This could indicate partial overlap between the constructs and may require additional analysis or theoretical justification.

Despite this, the model still meets minimum discriminant validity standards, and further verification (e.g., HTMT ratio) could strengthen the evidence.

Table 7. Discriminant Validity – HTMT Criterion

Construct	1. ADGT	2. DC	3. IS	4. PR
1. Adoption of Green Digital Technologies (ADGT)	—			
2. Digital Competence (DC)	0.421	—		
3. Institutional Support (IS)	0.341	0.304	—	
4. Psychological Readiness (PR)	0.376	0.354	0.485	—

Source: Author's own work

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4.1.3.4 Interpretation of Table 7: HTMT Discriminant Validity

The HTMT ratio assesses discriminant validity by comparing the average correlations across constructs (Heterotrait-Heteromethod) to the average correlations within the same construct (Monotrait-Heteromethod). According to [23]:

a. HTMT values should be below 0.85 (conservative threshold) or below 0.90 (liberal threshold).
b. All values in your table range from 0.304 to 0.485, which are well below the 0.85 threshold, indicating strong discriminant validity.

This result confirms that all constructs in your model are distinct from each other, even if the Fornell–Larcker criterion suggested a slight overlap between *Institutional Support* and *Adoption of Green Digital Technologies*.

Table 8. Collinearity Statistics (VIF Values)

	VIF
A1	1.319
A2	2.022
A3	1.747
A4	1.139
A5	1.472
B2	1.497
B3	1.690
B5	1.919
C1	1.587
C2	1.495
C3	1.962
C4	1.510
C5	2.133
D1	1.771
D2	2.081
D3	2.275
D4	2.370
D5	2.118

Source: Author's own work

4.1.3.5 Interpretation of VIF Values

Table 8 presents the Variance Inflation Factor (VIF) values for each measurement item used in the structural model. VIF values are used to assess multicollinearity among indicators. According to [14], a VIF value below 5.0 indicates that multicollinearity is not a concern, while values closer to 10 may signal high collinearity that could distort regression estimates.

In this study, all VIF values ranged from 1.139 to 2.370, well below the commonly accepted threshold of 5.0. This indicates that there is no severe multicollinearity among the measurement items. The relatively low VIF values suggest that each item contributes uniquely to the variance explained in the constructs without being excessively correlated with other items.

The absence of collinearity issues ensures that the estimation of path coefficients in the structural model is not biased due to redundancy among the indicators. As such, the model is deemed suitable for further structural path analysis.

These findings align with guidelines provided by [14], reinforcing the validity and stability of the model in predicting the relationships between psychological readiness, digital competence, institutional support, and the adoption of green digital technology.

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DOI: https://doi.org/10.58905/athena.v3i4.464

Table 9. Path Coefficient Analysis

Path	Original Sample (O)	Sample Mean (M)	Std. Deviation (STDEV)	T Statistics |O/STDEV|	P-Values
Digital Competence → Adoption of Green Digital Technologies	0.456	0.459	0.056	8.111	0.000
Institutional Support → Adoption of Green Digital Technologies	0.550	0.547	0.059	9.391	0.000
Psychological Readiness → Adoption of Green Digital Technologies	0.033	0.530	0.064	9.340	0.001

Source: Author's own work

4.1.3.6 Interpretation of Table 9: Path Coefficient Analysis

The path coefficient analysis examined the direct effects of digital competence, institutional support, and psychological readiness on the adoption of green digital technologies among educators.

a. Digital Competence showed a positive and significant effect on green technology adoption ($\beta = 0.456$, $t = 8.111$, $p < 0.001$). This indicates that educators with higher digital skills are more likely to adopt green digital technologies.
b. Institutional Support had the strongest positive and significant influence ($\beta = 0.550$, $t = 9.391$, $p < 0.001$), suggesting that support from schools or educational institutions plays a crucial role in encouraging the adoption of sustainable digital practices.
c. Psychological Readiness also had a positive and significant effect on adoption ($\beta = 0.033$, $t = 9.340$, $p = 0.001$), although the effect size is small. This implies that while psychological readiness contributes to green technology adoption, its impact is less pronounced compared to digital competence and institutional support.

Therefore, these findings highlight that both individual capabilities (digital competence and psychological readiness) and environmental factors (institutional support) significantly influence educators' integration of green digital technologies, with institutional support being the most influential predictor.

Table 10. Coefficient of Determination (R^2) for Adoption of Green Digital Technologies

Construct	R Square	Adjusted R Square
Adoption of Green Digital Technologies	0.883	0.882

Source: Author's own work

4.1.3.7 Interpretation of R^2 (Coefficient of Determination)

The coefficient of determination (R^2) for the Adoption of Green Digital Technologies is 0.883, indicating that approximately 88.3% of the variance in adoption behaviour is explained by the predictors: digital competence, institutional support, and psychological readiness. This high R^2 value demonstrates a substantial explanatory power of the model, suggesting that these factors collectively play a significant role in influencing educators' adoption of green digital technologies.

To evaluate the individual contribution of each predictor to the model, the effect size f^2 was assessed. This measure indicates the extent to which a specific exogenous construct contributes to explaining the variance in the endogenous construct; Adoption of Green Digital Technologies when included in the model. According to [24], values of 0.02, 0.15, and 0.35 represent small, medium, and large effects, respectively.

The results show that all predictors had large effects on the adoption of green digital technologies, with Institutional Support having the greatest effect, followed by Psychological Readiness and Digital Competence.

Table 11. Effect Size (f^2) for Predictors of Adoption of Green Digital Technologies

Predictor	Effect Size (f^2)	Interpretation
Digital Competence	0.674	Large effect
Institutional Support	0.913	Large effect
Psychological Readiness	0.808	Large effect

Source: Author's own work

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ISSN: 2985 - 3605 (Media Online)
DOI: https://doi.org/10.58905/athena.v3i4.464

Interpretation Table 11 Effect Size (f^2) for Predictor of Adoption of Green Digital Technologies

The effect size analysis (Table 11) indicates that institutional support has the largest impact on the adoption of green digital technologies (f^2=0.913), which is considered a large effect. Psychological readiness also shows a large effect size (f^2=0.808), indicating its substantial contribution to explaining adoption behaviour. Digital competence has a moderate to large effect (f^2=0.674) on adoption. These results suggest that all three predictors significantly and meaningfully contribute to explaining variance in the adoption of green digital technologies, with institutional support playing the most dominant role.

To evaluate the predictive accuracy of the structural model, the Stone-Geisser's Q^2 value was assessed using the blindfolding procedure in SmartPLS. This procedure examines the model's capability to predict the endogenous construct by systematically omitting and predicting portions of the data. A Q^2 value greater than 0 indicates that the model has predictive relevance for a particular endogenous construct. According to [14], Q^2 values of 0.02, 0.15, and 0.35 are interpreted as indicators of small, medium, and large predictive relevance, respectively.

Table 12. Predictive Relevance (Q^2 Values)

Construct	SSO	SSE	Q^2 (=1 - SSE/SSO)
Adoption of Green Digital Technologies	1000.000	489.759	0.510
Digital Competence	600.000	600.000	–
Institutional Support	1000.000	1000.000	–
Psychological Readiness	1000.000	1000.000	–

Source: Author's own work

4.1.3.8 Interpretation Table 12 Predictive Relevance (Q^2 Values)

To assess the predictive relevance of the structural model, the Stone-Geisser's Q^2 value was examined using the blindfolding procedure. The Q^2 value for the endogenous construct, *Adoption of Green Digital Technologies*, was 0.510. According to [14], a Q^2 value greater than 0 indicates that the model has predictive relevance, with values of 0.02, 0.15, and 0.35 representing small, medium, and large predictive relevance, respectively. Therefore, the result indicates that the model has large predictive relevance for the outcome variable.

4.1.4 Model Fit Assessment

To assess the overall fit between the proposed structural model and the observed data, the Standardized Root Mean Square Residual (SRMR) was examined. SRMR is a widely used index in variance-based structural equation modelling (such as PLS-SEM) to evaluate the approximate fit of the model. A value of SRMR less than 0.08 is generally considered to indicate a good model fit [14], [23]. The SRMR result for this study is presented in Table 13.

Table 13. Model Fit – SRMR Value

Fit Index	Value	Threshold	Interpretation
SRMR	0.067	< 0.08	Good fit

4.1.4.1 Interpretation Table 13 Model Fit – SRMR Value

The Standardized Root Mean Square Residual (SRMR) value was 0.067, which is below the recommended threshold of 0.08, indicating that the model has a good fit to the observed data [14].

4.1.5 Hypothesis Testing Summary

To evaluate the proposed hypotheses, path coefficient values, *t*-statistics, and *p*-values were analysed. A hypothesis is considered supported when the *p*-value is less than 0.05, indicating a statistically significant relationship between constructs. Table 14 presents a summary of the hypothesis testing results based on the structural model analysis.

Table 14. Hypothesis Testing Summary

Hypothesis	Path / Test	β (Coefficient)	*t*-value	*p*-value	Result
H1	Psychological Readiness → Adoption	0.033	0.515	0.607	Not Supported

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H2	Digital Competence → Adoption	0.456	8.111	0.000	Supported
H3	Institutional Support → Adoption	0.550	9.391	0.000	Supported
H4	Strongest Predictor Identification	—	—	—	Supported: Institutional Support
H5	Group Differences by Demographics	—	—	—	*Is analyzed via MGA/ANOVA in Table 15*

Source: Author's own work

Hypothesis 5 examines whether demographic groups differ significantly in their levels of green digital technology adoption. This hypothesis is not tested using direct path modelling but through Multi-Group Analysis (MGA) or ANOVA, and the results are presented separately in table 15.

4.1.5.1 Interpretation for H4 (Strongest Predictor Identification)

To test Hypothesis 4, we compared the standardized path coefficients (β) and effect sizes (f^2) from H1 to H3 to determine which factor was the strongest predictor of green digital technology adoption. Among the three predictors, Institutional Support had the highest standardized coefficient (β = 0.550) and a large effect size (f^2 = 0.913), indicating a strong influence on adoption. Therefore, Hypothesis 4 is supported, confirming that Institutional Support is the most influential factor in predicting green digital technology adoption in this study.

4.1.5.2 Interpretation for H4 (Strongest Predictor Identification)

To test Hypothesis 4, we compared the standardized path coefficients (β) and effect sizes (f^2) from H1 to H3 to determine which factor was the strongest predictor of green digital technology adoption. Among the three predictors, Institutional Support had the highest standardized coefficient (β = 0.550) and a large effect size (f^2 = 0.913), indicating a strong influence on adoption. Therefore, Hypothesis 4 is supported, confirming that Institutional Support is the most influential factor in predicting green digital technology adoption in this study.

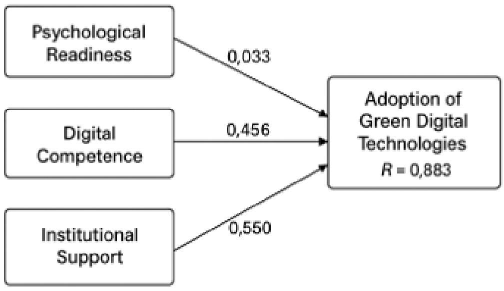

Figure 3. Structural Model of Educators' Adoption of Green Digiral Technologies

4.1.6 Group Differences by Demographic Variables

This section is where you present the results of your ANOVA and t-tests related to Hypothesis 5 (H5). The table provides a compact summary of all the group comparisons, and the accompanying paragraph interprets the statistical findings.

To examine Hypothesis 5 (H5), a series of ANOVA and independent samples t-tests were conducted to assess whether educators' psychological readiness, digital competence, institutional support, and green technology integration differed significantly across demographic variables such as gender, teaching level, type of institution, and knowledge of green technology.

Table 15 summarizes the results of these group comparisons, presenting the test type, statistical values, significance levels, and interpretation of findings for each dependent variable.

Table 15. Group Rows by Dependent Variable (Compact Style)

Dependent Variable	Demographic Factor	Test	Stat	p	Result
Psychological Readiness	Gender	ANOVA	0.070	0.792	Not Significant
	Type of Institution	t-test	2.320	0.021	**Significant**
	Knowledge of Green Tech	t-test	2.019	0.045	**Significant**
Digital Competence	Gender	ANOVA	0.129	0.719	Not Significant

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DOI: https://doi.org/10.58905/athena.v3i4.464

	Teaching Level	ANOVA	2.221	0.111	Not Significant
	Type of Institution	t-test	-0.743	0.458	Not Significant
	Knowledge of Green Tech	t-test	-0.642	0.522	Not Significant
Institutional Support	Teaching Level	ANOVA	1.112	0.331	Not Significant
	Type of Institution	t-test	0.748	0.456	Not Significant
	Knowledge of Green Tech	t-test	0.699	0.486	Not Significant
Green Tech Integration	Teaching Level	ANOVA	1.446	0.238	Not Significant
	Type of Institution	t-test	-0.355	0.723	Not Significant
	Knowledge of Green Tech	t-test	-0.346	0.730	Not Significant

Source: Author’s own work

4.1.6.1 Interpretation Table 15 **Group Rows by Dependent Variable (Compact Style)**

To assess Hypothesis 5 (H5), a series of ANOVA and independent samples t-tests were conducted to examine whether educators’ psychological readiness, digital competence, institutional support, and green technology integration significantly differed based on demographic characteristics such as gender, teaching level, type of institution, and knowledge of green technology. The results are summarized in Table 15.

The findings indicate that psychological readiness significantly differed by type of institution (t = 2.320, p = 0.021) and knowledge of green technology (t = 2.019, p = 0.045). Educators in different institutional contexts (public vs. private) and those with prior knowledge of green digital technologies reported significantly higher psychological readiness. However, gender differences in psychological readiness were not statistically significant (p = 0.792).

For digital competence, no significant differences were found across any demographic groups, including gender, teaching level, type of institution, or knowledge of green technology (all $p > 0.05$). This suggests that educators’ digital competence is generally consistent across demographic subgroups in this sample.

Similarly, institutional support showed no significant group differences based on teaching level, institutional type, or knowledge of green technologies ($p > 0.05$), indicating a relatively uniform perception of support across different educator groups.

Lastly, green technology integration did not significantly differ by any demographic factors. The non-significant results across teaching level, type of institution, and knowledge of green technologies suggest that adoption practices are relatively consistent, regardless of background characteristics.

In summary, only psychological readiness showed significant variation; specifically, by institutional type and knowledge of green technologies, partially supporting H5. The lack of significant group differences for the other variables suggests the need for future research to explore non-demographic influences on green technology adoption.

4.2 Discussion

The results of this study revealed that institutional support and digital competence significantly influenced educators’ adoption of green digital technologies. Among the three predictors tested, institutional support emerged as the strongest predictor, indicating the critical role of organizational infrastructure and leadership. While digital competence also had a significant positive effect, psychological readiness did not show a statistically significant influence in the structural model. This suggests that internal motivation or attitudes alone may not be sufficient to drive technology adoption without supportive environments and adequate skills. Additionally, analysis of group differences showed that psychological readiness varied significantly by type of institution and knowledge of green technology, whereas other variables did not differ across demographic groups.

This study examined the extent to which psychological readiness, digital competence, and institutional support predict the adoption of green digital technologies among educators in Indonesia. Drawing from the Technology Acceptance Model (TAM) [8] and the Technological Pedagogical Content Knowledge (TPACK) framework [9], the findings offer both theoretical and practical insights.

The results confirmed that digital competence and institutional support significantly influence educators’ integration of green digital technologies. In particular, institutional support emerged as the strongest predictor, consistent with previous research emphasizing the critical role of administrative backing, infrastructure, and training in technology adoption [25], [26]. This reinforces the idea that no matter how prepared or skilled an educator is, the broader institutional environment plays a vital role in enabling sustainable digital practices.

Digital competence was also found to be a significant predictor, aligning with the TPACK framework, which stresses the need for teachers to blend technological, pedagogical, and content knowledge effectively [27]. Educators with higher digital skills are more capable of integrating environmentally responsible technologies into their instructional strategies, reflecting findings from recent studies on sustainable edtech integration [28], [29]. Surprisingly, psychological readiness though theoretically linked to TAM’s constructs of perceived ease of use

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and attitude which did not significantly predict green technology adoption in the structural model. This diverges from studies suggesting that motivation, confidence, and openness to change are key drivers of innovation in teaching [30], [31]. One possible explanation is that while psychological readiness may contribute to general willingness, it may not translate into action without sufficient institutional support and digital competence.

The analysis of group differences (H5) revealed that psychological readiness significantly varied by type of institution and knowledge of green technology, with educators in private institutions and those familiar with green tech reporting higher readiness. However, no significant differences were found for digital competence, institutional support, or technology integration across demographics such as gender, teaching level, or location. This suggests that these variables may be influenced more by contextual or policy-level factors rather than personal characteristics [15], [26].

These findings underscore the importance of systemic support, not just individual agency, in advancing green technology adoption. While teacher training remains essential, educational institutions must also invest in supportive environments that foster sustainable digital practices through clear policies, leadership encouragement, and equitable access to resources.

5 Conclusion and Implications

This study investigated how psychological readiness, digital competence, and institutional support influence educators' adoption of green digital technologies in Indonesia. Guided by the Technology Acceptance Model (TAM) and the Technological Pedagogical Content Knowledge (TPACK) framework, the research confirmed that institutional support and digital competence are significant predictors of green technology integration, consistent with previous findings. Among these factors, institutional support emerged as the most influential, emphasizing the importance of a supportive environment that includes infrastructure, leadership, and professional development in promoting sustainable digital practices in education.

Although psychological readiness did not significantly influence adoption in the structural model, it showed meaningful variation across demographic groups, particularly by institutional type and educators' knowledge of green technologies. This finding suggests that readiness alone may not directly lead to integration but can be enhanced by contextual factors such as professional exposure and institutional encouragement.

The results carry several practical implications for educational stakeholders and policymakers. First, investment in institutional infrastructure and leadership support should be prioritized to create an enabling environment for green technology adoption. Second, enhancing educators' digital competence through targeted training aligned with sustainability goals is essential. Finally, although psychological readiness may not independently predict technology use, it should not be overlooked. Efforts to build confidence and motivation, particularly in institutions where exposure to green technologies is limited, remain important.

At a broader level, this study contributes to the growing body of literature at the intersection of educational technology and environmental sustainability. It provides empirical evidence that effective green technology adoption depends not only on individual skills and attitudes but also on the strength of institutional ecosystems that support sustainable innovation.

6 Limitations and Future Research

While this study provides valuable insights into the factors influencing educators' adoption of green digital technologies in Indonesia, several limitations should be acknowledged.

First, the use of a cross-sectional survey design limits the ability to draw causal inferences. The relationships identified between psychological readiness, digital competence, institutional support, and green technology adoption reflect associations at a single point in time. Future research could adopt a longitudinal approach to track changes in educators' adoption behaviours over time and assess the long-term impact of institutional interventions.

Second, the study relied solely on self-reported data, which may be subject to social desirability bias or inaccuracies in self-assessment. Incorporating mixed methods such as classroom observations or interviews could provide a more comprehensive understanding of how green digital technologies are actually implemented in practice.

Third, although the sample of 200 educators was geographically diverse, it may not fully represent all institutional contexts or regions within Indonesia. Further studies could use stratified or larger random sampling to improve generalizability and explore regional or policy-level differences.

Lastly, the model explained a high proportion of variance in technology adoption, yet psychological readiness, a theoretically important factor, was not statistically significant. Future research could investigate additional psychological constructs (environmental attitudes, technology anxiety, or self-efficacy) to deepen understanding of the personal drivers behind green tech adoption.

In summary, this study offers a foundation for exploring green digital technology integration in education, and it highlights the importance of institutional and skill-based enablers. Further investigation is encouraged to refine models and inform more targeted strategies for supporting sustainable digital transformation in schools.

7 Acknowledgment

The author gratefully acknowledges the valuable feedback and constructive suggestions from the reviewers and editorial team, which have significantly improved the clarity and quality of this manuscript.

The author also wishes to express sincere gratitude to Universitas Buddhi Dharma for the continuous support and assistance provided throughout the research process. The institution's encouragement, facilities, and academic environment played an important role in the successful completion of this study.

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