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Integration Of Teachers' Digital Literacy Competencies In Technology-Based Learning To Build Sustainable Lifestyles For Vocational High School Students

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Abstract – *This study aims to analyze the effect of teachers' digital literacy competency integration on the use of technology in learning and the formation of sustainable lifestyles of students in Vocational High Schools (SMK). The variables analyzed include teachers' digital competency, technology-based learning design, integration of Sustainable Development Goals (SDGs) values, and external/institutional factors, with mediating variables in the form of technology utilization in learning and output variables in the form of students' sustainable lifestyles. This study uses a quantitative approach with the Partial Least Squares Structural Equation Modeling (PLS - SEM) analysis technique. The study results indicate that teachers' digital competency and technology-based learning design significantly affect students' use of technology and sustainable lifestyles. The integration of Sustainable Development Goals values contributes significantly to forming sustainable lifestyles, although its effect on technology utilization is relatively small. External/institutional factors have a small but still significant effect. The findings of the study show the role of technology utilization in learning as a mediator that bridges the influence of various input variables on the formation of students' sustainable lifestyles. This study recommends improving teachers' digital competency and strengthening learning designs, integrating sustainability values as the primary strategy in adaptive and future-oriented vocational education.*
Keywords: *digital competence, technology-based learning, SDGs, sustainable lifestyle, vocational schools.*

INTRODUCTION
The development of information and communication technology has changed the way of learning, teaching, and accessing information at various levels of education. This condition requires educators, including teachers and prospective teachers of Vocational High Schools (SMK), to technically have adequate digital literacy competencies, including critical, collaborative, and ethical dimensions [1; 2]. Digital literacy is the embodiment of technology integration into an effective, relevant, and contextual learning process according to the needs of the 21st century. In vocational education, mastery of digital literacy by vocational school teachers prepares students to face the increasingly digitalized working world while forming character and awareness of implementing sustainability values [3]. Digital literacy includes technical skills in using technology, critical, ethical, and reflective thinking skills in accessing, managing, and creating digital information responsibly [4; 5]. On the other hand, the issue of sustainability is increasingly urgent to be integrated into the education process [6; 7]. In line with global efforts to achieve the Sustainable Development Goals (SDGs), especially SDG 4, which emphasizes the importance of inclusive and quality education to encourage lifelong learning and produce a generation capable of facing global challenges [8;9].Previous studies have discussed the importance of digital literacy in the context of technology-based learning [10; 11] and the urgency of sustainability education [12; 13]; however, both are often discussed separately. Not many studies specifically examine how the integration of digital literacy of

prospective teachers can be directed to form a sustainable lifestyle through learning [4; 14]. This is the main gap that is the focus of this study. The missing link is the lack of mapping and comprehensive understanding of the extent to which teachers' digital literacy is used to support teaching and learning activities and acts as a means of forming awareness and practices of sustainability.To overcome the gap, vocational school teachers who have a strategic position in shaping the behavior of the young generation are technically skilled and aware of social and environmental responsibility. The integration of digital literacy competencies has an impact on learning, becoming more effective and meaningful in shaping a lifestyle that supports sustainable development [15; 16]The main objective of this study is to analyze the integration of teachers' digital literacy competencies in technology-based learning to build sustainable lifestyles for vocational high school students. Specifically, it aims to (1) analyze the influence of teachers' digital literacy competencies on the use of technology in learning in vocational high schools; (2) examine the contribution of technology-based learning design to the use of technology and the formation of sustainable lifestyles for vocational high school students; (3) assess the influence of the integration of Sustainable Development Goals (SDGs) values in learning on the use of technology and students' sustainable lifestyles ; (4) Evaluate the role of external or institutional factors, such as infrastructure support and school policies, in shaping students' sustainable lifestyles; (5) explain the role of technology utilization in learning as a mediating variable between input variables (teacher competencies, learning design, SDGs values, and external factors) and students' sustainable lifestyles.

LITERATURE REVIEW

The development of digital technology has revolutionized the learning process in vocational schools, creating demands for teachers to master digital literacy competencies. Digital literacy competencies include technical skills in operating digital devices and applications and critical, collaborative, creative, and ethical thinking skills in using technology responsibly [17; 18]. Previous studies have shown that mastery of digital literacy contributes to the effectiveness of the learning process [19; 20] and teacher readiness in guiding students to face the challenges of the 21st century [21; 22]. However, integrating digital literacy in vocational learning practices still faces various obstacles, ranging from limited conceptual understanding to low utilization of technology to support sustainability values [4]. This literature review explores how vocational teachers' digital literacy competencies can be strategically integrated into technology-based learning to form a sustainable lifestyle aligned with the Sustainable Development Goals (SDGs).

2.1. Integration of Digital Literacy Competencies of Vocational Teachers

Digital literacy for vocational teachers includes technical skills in operating digital devices, critical thinking skills, digital ethics, and the ability to design technology-based learning that supports the needs of the working world and the development of Industry 4.0 [23; 24].Digital literacy competency is multidimensional, covering eight elements: cultural, cognitive, constructive, communicative, self-confidence, creative, critical, and social. In vocational education, teacher digital literacy is integrated into the planning, implementation, and evaluation process of technology-based learning, especially in creating a collaborative and innovative learning environment [25]. Vocational teachers still face challenges in integrating technology comprehensively due to limited professional training, digital infrastructure, and the mismatch between technology content and vocational learning needs. In Indonesia, Hadromi et al. (2022) revealed that most vocational high school teachers have basic digital literacy skills, but are still low in the pedagogical and digital ethics dimensions [26]. As a result, the use of technology in learning tends to be technical and does not support the development of critical thinking skills and sustainability.

The TPACK (Technological Pedagogical Content Knowledge) framework, developed by Mishra & Koehler (2006), is widely used as a reference in evaluating the integration of digital literacy in teaching. In this approach, vocational teachers must combine three main knowledge: vocational content, pedagogy, and technology, to create effective and adaptive learning practices for digital developments [27].

Digital literacy is also associated with sustainability values. Vocational education supporting the SDGs requires teachers to teach technical skills and instill awareness of responsible, efficient, and sustainable technology (UNESCO, 2017). Integrating vocational teachers' digital literacy is essential in shaping students' mindsets towards ethical and environmentally friendly technology. Janssen et al, 2013, developed a holistic digital literacy integration practice to develop vocational teacher professionals, including digital technical, pedagogical, ethical, and sustainability competencies in vocational learning (figure 1) [28].

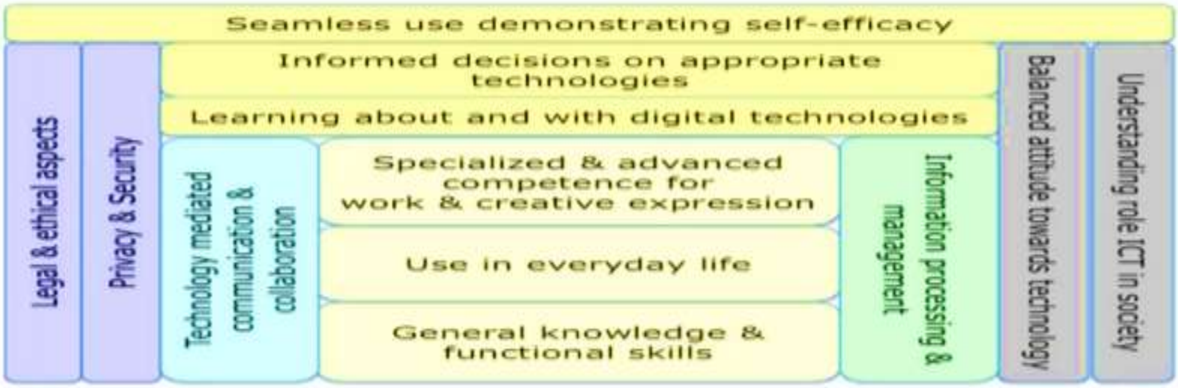

Figure 1. Elements of the digital competency model
(Janssen et al, 2013)

Figure 1 shows a digital literacy competency framework that reflects the levels of ability and supporting aspects in the effective use of digital technology in an educational context. The stages of competency development are visible in the middle part, starting from general knowledge and functional skills, then increasing to the use of technology in everyday life, to advanced competencies and specialization for work and creative expression. At a higher level, learning includes learning about and with digital technology, continuing with the ability to make informed decisions about appropriate technology, and culminating in the fluent and confident use of technology, reflecting self-efficacy.This framework is also surrounded by supporting dimensions. On the left side, legal and ethical aspects, privacy and security, and technology-based communication and collaboration are essential foundations in forming responsible competencies. On the right side are information processing and management capabilities, a balanced attitude towards technology, and an understanding of the role of information and communication technology (ICT). These capabilities become affective and cognitive dimensions that support the wise mastery of technology. This framework emphasizes that digital literacy is not only technical, but also includes critical, ethical, collaborative, and reflective thinking skills in the digital era, so it is very relevant for developing teacher competencies, especially in technology-based vocational education.

2.2. Technology-Based Learning

Technology-based learning in vocational schools in this study refers to the automotive mechanic expertise program of SMK. In the automotive mechanic expertise program, there are several technology-based subjects designed to equip students with competencies according to the needs of the modern automotive industry (Table 1)

Table 1. Technology-based learning of automotive expertise

No	Subjects	Material
1.	Engine Technology	petrol and diesel engine working systems, lubrication systems, cooling, fuel, and electronic engine control systems
2.	Automotive Electrical Systems	basic electrical system, lighting system, charging, ignition, and starter.
3.	Transmission Technology	Manual and automatic transmissions, clutches, differentials, and axles
4.	Chassis and Suspension System	Steering, braking, and suspension systems with hydraulic and electronic technology.
5.	Automotive Diagnostic Technology	OBD-II scanner, digital multi-tester, and diagnostic software
6.	Fuel Injection System	Computerized petrol and diesel injection systems (EFI, CRDI)
7.	Hybrid and Electric Vehicle Technology	Electric motor system, battery, inverter, and regenerative braking system

8.	CAD-Based Automotive Engineering Drawings	Computer-Aided Design (CAD) to create and read vehicle engineering drawings

The implementation of technology-based learning in vocational schools still faces several challenges, such as infrastructure gaps, low digital literacy of teachers, and a lack of ongoing professional training [29]. Strengthening teacher capacity in designing and implementing contextual, inclusive, and sustainable technology-based learning is necessary in vocational education reform.

2.3. Building a Sustainable Lifestyle

A sustainable lifestyle is a lifestyle that emphasizes awareness of the environmental, social, and economic impacts of each individual's actions. In vocational education, teachers instill sustainable values in students through contextual and applicable learning [8]. Sustainable education includes transferring knowledge and forming attitudes, values, and actions that support sustainable development [30]. The ability to build a sustainable lifestyle for vocational school teachers is essential to produce graduates who are technically competent and socially and ecologically responsible.Previous studies have shown that teachers with sustainability awareness tend to be more active in integrating SDGs principles into learning practices [31; 32], including efficient use of resources, developing learning projects that support environmental awareness, and selecting environmentally friendly technologies. Several studies have also noted that there is still a gap between sustainability knowledge and real practices in the field [33; 34], such as a lack of training, a lack of institutional support, and limited resources, which are often the main obstacles. Therefore, strengthening vocational high school teachers' capacity to implement sustainable lifestyles needs to be done systematically, through integrating sustainability values in the curriculum, ongoing professional training, and policy support.Thus, the existing literature underlines the importance of building a sustainable lifestyle for vocational school teachers to transform vocational education towards a more holistic, relevant, and future-oriented education.

MATERIALS AND METHODS

This study uses a quantitative research design with the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach. The PLS-SEM approach was chosen because it can test complex models with many latent constructs and effectively analyzes the relationship between latent variables and their measurable indicators [35].The population in this study was teachers and students of Vocational High Schools (SMK) majoring in automotive expertise in Semarang City. The stratified random sampling technique ensured proportional representation from various schools and class levels.The sample size has met the minimum criteria for PLS-SEM analysis based on the "10 times rule", which is ten times the maximum number of structural paths leading to a latent construct.This study involves six exogenous variables: X3, X4, X5, X7, and 2 endogenous variables: Y4 and Y5, as shown in Table 2.

Table 2. Research variables

No	Symbols and variable names
1.	X3 – improving teachers' digital competence
2.	X4 – technology-based learning design
3.	X5 – integration of SDGs values
4.	X7 – external/institutional factors
5.	Y4 – use of technology in learning
6.	Y5 – Sustainable lifestyles of students

Each construct is measured using **3–6 indicators** developed from standardized instruments and previous studies on digital literacy, education for sustainable development (ESD), and technology integration in learning. The measurement scale used is **a 5-point Likert Scale** (1 = strongly disagree, 5 = strongly agree). Data was collected through a structured questionnaire, distributed offline and online by adjusting the respondents' technological access. The instrument went through an expert validation process and a pilot test to ensure the validity of the content and reliability of the instrument.Data analysis was performed using SmartPLS software version 4.0. The analysis process includes: (1) evaluation of the Measurement Model (Outer Model); (2) Evaluation of the Structural Model (Inner Model). The significance level was $p < 0.05$ to determine the significant influence of variables.

I. RESULTS AND DISCUSSION

This section presents the results of the structural model analysis of the influence of various variables of digital literacy competency integration on technology-based learning to build a sustainable lifestyle for vocational high school students. The variables analyzed include improving teachers' digital competency (X3), technology-based learning design (X4), integration of SDGs values (X5), and external/institutional factors (X7), as well as two endogenous variables, namely the use of technology in learning (Y4) and students' sustainable lifestyle (Y5). The model estimation results show direct and indirect relationships between variables and the significance level of each path of influence (Figure 2).

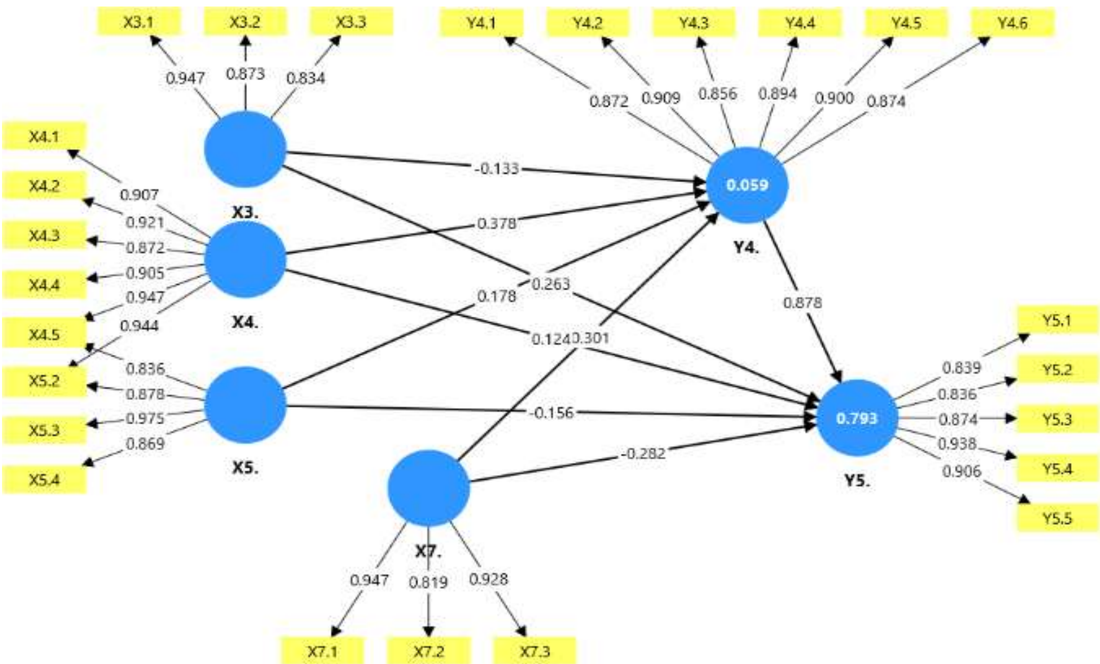

Figure 2. Structural model based on the Partial Least Squares Structural Equation Modeling (PLS-SEM) approach

Figure 2 shows a structural model based on the PLS-SEM approach that maps the relationship between latent research variables. There are six primary constructs, namely X3, X4, X5, X7 as exogenous variables and Y4, Y5 as endogenous variables. Each construct is measured by several indicators (shown in yellow squares), with loading values generally above 0.7 indicating that the indicators are valid in representing their constructs. The path coefficient shown on the arrows between constructs shows the strength and direction of the relationship between variables. Variable X3 affects Y4 with a coefficient of 0.311, X4 affects Y4 by 0.139, and X5 affects Y4 by 0.160, indicating that the three constructs contribute to Y4. Furthermore, Y5 is influenced by several constructs, X4, X5, X7, and Y4, with the most significant direct influence value coming from Y4 of 0.240. This indicates that Y4 is a mediating variable connecting the indirect influence of X3, X4, and X5 on Y5. The R^2 value for Y4 of 0.899 and Y5 of 0.793 indicates that this model has a very strong predictive power, because an exogenous construct with a high confidence level can explain each endogenous construct. This model describes a complex and interrelated causal relationship between variables and influences between constructs in the study.

Table 3 shows the results of the overall model measurement (Goodness of Fit) in PLS-SEM.

Table 3. Fit Model

Component	Saturated model	Estimated model
SRMR	0.062	0.062
d_ULS	1,444	1,444
d_G	2.285	2.285
Chi-square	739.259	739.259
NFI	0.732	0.732

The model evaluation results show that the goodness of fit measurement values are relevant to assess the feasibility of the structural model. The Standardized Root Mean Square Residual (SRMR) value of 0.062 for both the saturated model and the estimated model indicates that the model has a good fit because it is below the threshold of 0.08. The d_ULS and d_G values are 1.444 and 2.285, respectively, reflecting the difference between the empirical and model covariance. However, there is no standard threshold value; low values indicate a good model. The Chi-square value was recorded at 739.259, which is the result of the model fit test to empirical data, where, in the context of PLS-SEM, this figure is informative rather than the main determinant. Furthermore, the NFI (Normed Fit Index) is at a value of 0.732, which is close to the ideal limit of 0.90, but in the context of PLS-SEM, a value above 0.7 is still acceptable, especially in complex models with many constructs. Overall, these results indicate that the tested model has a reasonably adequate level of fit and can be used for further analysis to explain the relationships between latent constructs.The results of the significance test of the research variables are shown in Table 4, which shows that the relationship between constructs in the structural model has a statistically significant influence with a p-value = 0.000, indicating that all of these relationships are empirically valid at a significance level of 5%.

Table 4. Interpretation of Bootstrapping Model

Track	Coefficient	P-Value	Significance	Interpretation
X3 → Y4	0.538	0.000	Significant	Teachers' digital competence greatly influences the use of technology in learning.
X4 → Y4	0.409	0.000	Significant	Technology-based learning design contributes significantly to the utilization of technology.
X5 → Y4	0.049	0.000	Significant (small effect)	Integration of SDG values has little impact on technology use.
X3 → Y5	0.666	0.000	Significant	Teachers' digital competence contributes significantly to forming students' sustainable lifestyles.
X4 → Y5	0.600	0.000	Significant	Technology learning design greatly influences students' sustainable lifestyles.
X5 → Y5	0.452	0.000	Significant	The integration of SDG values significantly influences shaping a sustainable lifestyle.
X7 → Y5	0.024	0.000	Significant (minimal effect)	External/institutional factors have little influence on students' lifestyles.
Y4 → Y5	0.268	0.000	Significant	The use of technology acts as a mediator in forming a sustainable lifestyle.

Based on the results of the path analysis in Table 4, it can be concluded that all relationships between variables in the research model significantly influence the endogenous variables, namely the Utilization of Technology in Learning (Y4) and Students' Sustainable Lifestyle (Y5).Among the independent variables, Teacher Digital Competence (X3) has the strongest influence, both on Y4 (coefficient = 0.538) and on Y5 (coefficient = 0.666), indicating that improving teachers' digital competence is a key factor in encouraging the use of technology while shaping students' sustainable lifestyles.Technology-based learning design (X4) also highly influences both endogenous variables, namely 0.409 on Y4 and 0.600 on Y5, confirming the importance of learning strategies integrated with technology. Meanwhile, the integration of SDGs values (X5) has a small influence on Y4 (0.049). Still, it is stronger on Y5 (0.452), which means that sustainability values directly impact student behavior more than the technological aspect.

External/Institutional Factors (X7) contribute a small contribution to forming a sustainable lifestyle (0.024), although it remains significant, indicating that the primary influence comes more from internal learning factors. In addition, the use of technology in learning (Y4) is also proven to play a significant role as a mediator of sustainable lifestyle (Y5) with a coefficient of 0.268.

Overall, this model concludes that strengthening teachers' digital literacy competencies and technology-based learning design play a central role in the effective use of technology, which ultimately contributes significantly to forming students' sustainable lifestyles in vocational high school environments.Figure 3 shows the results of the Partial Least Squares Structural Equation Modeling (PLS-SEM) analysis of the influence of several latent variables on the formation of sustainable lifestyles of students in vocational schools.

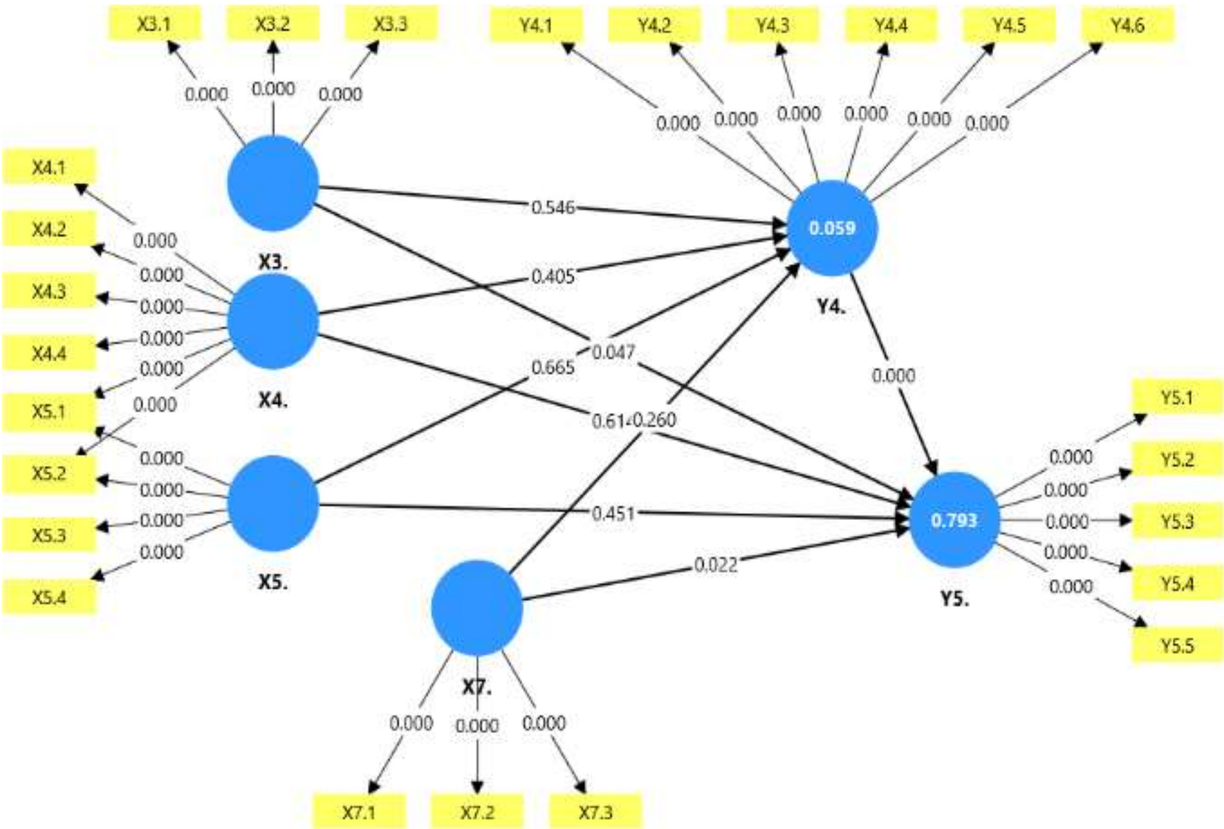

Figure 3. Bootstrapping model

The results of the analysis show that all relationship paths between variables have a p-value of 0.000, which means that all relationships are significant at a 95% confidence level ($\alpha < 0.05$). Increasing teachers' digital competence (X3) has a significant effect on the use of technology in learning (Y4) with a coefficient of 0.538. Also, it has a strong effect on students' sustainable lifestyles (Y5) with a coefficient of 0.666. This shows that teachers' literacy competence in mastering technology is crucial in encouraging students' sustainable learning and behavior transformation.Furthermore, technology-based learning design (X4) also contributes significantly to the use of technology (Y4) with a coefficient of 0.409, and to students' sustainable lifestyles (Y5) with a coefficient of 0.600. This indicates that the planning and implementing learning integrated with technology are essential in creating sustainable learning impacts. Meanwhile, the integration of SDGs values (X5) has a significant but smaller influence on the use of technology (coefficient 0.049). Still, it is reasonably strong on sustainable lifestyles (coefficient 0.452), which means that the sustainability values embedded in the learning process have a more direct impact on changes in student behavior than technology.External or institutional factors (X7), such as policy support or infrastructure, are proven to have a small influence on students' sustainable lifestyles (coefficient 0.024), although significant. This indicates that internal factors such as competence and learning design dominate over external influences. Finally, the variable of technology utilization in learning (Y4) is a significant mediator in shaping students' sustainable lifestyles (Y5), with an influence coefficient of 0.268. This model emphasizes the importance of strengthening teacher competence and designing learning relevant to technology and sustainability values to impact student behavior in the 21st-century education era.The structural model shows that teachers' digital competence (X1) has a very strong direct influence on technology utilization (Y4) with a coefficient of 0.544 (p-value = 0.000). This indicates that teachers who have high digital competence tend to be able to integrate technology optimally in the learning process. Teachers who have high digital competence tend to be able to integrate technology optimally in the learning process. These teachers understand how to use digital devices and applications and can apply them in line with appropriate pedagogical strategies to achieve learning objectives. Digital competence includes skills in selecting, modifying, and managing technology according to student needs and learning contexts, thus enabling the creation of an adaptive, participatory learning environment that supports the development of 21st-century skills [36; 37], according to Gaur (2024). In the European Framework for the Digital Competence of Educators (DigCompEdu), teachers with high digital literacy can become innovative learning facilitators, using technology as a tool, and as an integral part of the critical thinking process, problem solving, and student collaboration [38]. Research by Peng et al. (2023) shows that teachers' digital competence is directly proportional to the level of technology adoption in learning, where digitally skilled teachers are more confident and creative in designing learning activities that are relevant and meaningful to students [39].Furthermore, technology-based learning design (X4) also contributes significantly to the use of technology (coefficient = 0.311). Interactive, adaptive, and technology-based learning design encourages using more structured digital media [40]. This approach can align student learning needs with various material delivery strategies and is responsive to differences in student abilities and learning styles [41]. This approach allows teachers to design learning experiences, deliver information, and encourage active student participation through simulations, interactive quizzes, online discussions, and digital collaborative projects [42; 43]. Thus, student engagement increases because they feel that learning is more relevant, engaging, and challenging.According to Mujahidin et al. (2024), in multimedia learning theory, learning that uses digital media in a structured manner can improve understanding if designed with the principles of interactivity and visual-verbal integration [44]. Strengthened by research by Wang & Raman, (2025), it shows that interactive and adaptive digital learning designs strengthen students' cognitive and affective engagement [45], primarily when technology is used to create personal, meaningful, and contextual learning experiences [46]. This makes digital media a tool and a bridge to building deeper engagement and understanding.However, the integration of SDGs values (X5) on the use of technology in learning (Y4) has a very small influence (0.049), although significant. This shows that even though sustainability values have begun to be integrated into the curriculum and educational vision, their influence on the use of technology in learning is still limited. This is most likely because the integration of sustainability values is still conceptual, normative, and has not been realized concretely in the form of operational and applicable digital-based learning activities [47].Many educational units and educators do not yet have clear technical guidelines or implementation models on how sustainability principles can be translated into using media, applications, or digital platforms in teaching and learning [48]. According to Syzdykbayeva (2025), the success of sustainable education depends on the transformation of practices, not just the integration of concepts in the curriculum [49]. In addition, Huang et al. (2024) state that the integration of education for sustainable development (ESD) requires profound pedagogical changes, including the adaptation of technology as a means of transforming values and real actions in the classroom [50].On the other hand, the students' sustainable lifestyle (Y5) variable is highly influenced by the three primary constructs: X1 → Y5: 0.666; X4 → Y5: 0.600; X5 → Y5: 0.452. This confirms that competent teachers can master the teaching materials and design contextual, reflective, and transformative learning experiences [51; 52], thus encouraging students to understand and practice the principles of sustainability in life and the working world. A well-structured learning design effectively integrates Sustainable Development Goals (SDGs) values in learning activities. The integration of SDGs values provides a meaningful influence because it successfully translates global values—such as social responsibility, resource efficiency, and environmental ethics—into the local and specific context of vocational education. According to Vann et al. (2025), internalizing sustainability values in learning will be more effective if carried out through a participatory and action-based approach, actively involving students in the learning process [53]. This shows that the success of SDGs-based learning at the vocational level depends on the teacher's pedagogical competence and learning design that can bridge global values and local practices in a relevant and applicable manner.External or institutional factors (X7) have a minimal effect on Y5 (0.024), although significant. This could reflect that policies, infrastructure, and institutional support have not been optimal in strengthening students' sustainable lifestyles. There is still a gap between educational regulations that uphold sustainable values and their implementation at the academic unit level. Many schools, especially at the vocational level, still face limited environmentally friendly facilities, access to supporting technology, and the absence of concrete operational policies to integrate sustainability education systematically into the curriculum and school culture [54; 55]. In addition, cross-sector coordination between the world of education, industry, and local government is often not synergistically established, so sustainability initiatives tend to be sporadic and unsustainable. According to Schetinger & de Lucena (2025), the success of education for sustainable development is highly dependent on institutional commitment, supportive policies, and the provision of adequate resources [56]. Tu & Creativani (2025) emphasized that the main challenge in implementing sustainable education is the weak capacity of educational institutions in developing transformative learning systems due to limited structural support and policies that have not yet led to systemic change.Interestingly, technology (Y4) is a significant mediator (0.268) towards forming a sustainable lifestyle. This shows that technology in education functions as an essential learning tool in supporting the transformation of student values and behavior, especially in instilling awareness of sustainability values in the era of technology-based work. The use of technology allows the creation of an interactive, contextual, and relevant learning environment to address the challenges of the modern working world, such as industrial simulations, project-based learning, and the integration of the principles of the Sustainable Development Goals (SDGs) [57; 58].Through this approach, students gain technical competence and internalize the values of environmental responsibility, energy efficiency, and sustainable work ethics. According to Mishra & Koehler (2013), effective technology integration in learning requires a combination of content, pedagogical, and technological knowledge (TPACK), which allows teachers to design learning experiences that encourage positive behavioral change [10; 59]. Educational technology used strategically can strengthen education for sustainable development by shaping students' character and social awareness in facing the changing working world.

CONCLUSION

Integrating teachers' digital literacy competencies in technology-based learning has significantly influenced building sustainable lifestyles for vocational high school students. Teachers' digital competencies are dominant in encouraging technology use and shaping students' sustainable lifestyles. Technology-based learning design significantly contributes to both variables, demonstrating the importance of an innovative and adaptive pedagogical approach to technological developments. Meanwhile, the integration of sustainable development goals (SDGs) values has little influence on the use of technology, but it has a significant impact on shaping students' sustainable behavior. This indicates that education based on sustainability values is more effective in influencing students' attitudes and awareness. On the other hand, although significant, external or institutional factors such as policy support and infrastructure have little influence on the formation of sustainable lifestyles. In addition, using technology in learning is an essential mediator that bridges the influence of input variables on students' sustainable lifestyles. The primary strategy in building sustainable awareness and lifestyles in vocational education environments is through improving teachers' digital literacy competencies and strengthening technology-based learning designs that adopt sustainable values in an integrated manner.

CONFLICT OF INTEREST: THE AUTHORS DECLARE NO CONFLICT OF INTEREST.

AUTHOR CONTRIBUTIONS:THE AUTHOR'S CONTRIBUTION TO THE RESEARCH AND COMPLETION OF THIS ARTICLE IS

1. HH, acting as the lead author, was responsible for research design, data analysis, writing the initial draft of the article, and overseeing the overall research and publication process.
2. BB, played a role in developing the methodology, validating research instruments, and further statistical analysis using the PLS-SEM approach.
3. PMF, is responsible for collecting field data, processing initial data, visualizing structural models and compiling findings.
4. ST, contributed to the literature review, sharpening the theoretical framework, and editing and final drafting of the discussion section.

5. NST: involved in preparing data collection instruments and implementing validity and reliability tests.
6. WWN, assisted in qualitative analysis and interpretation of supporting interview results to strengthen quantitative findings.
7. RDI, is responsible for processing descriptive statistical data and documenting the data collection process in the field.
8. MMAR, involved in writing the conclusions and recommendations and compiling the bibliography and final format of the article.

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