

Technology-Based Pancasila Education and Student Motivation and Digital Literacy in Jeneponto Vocational Schools

Sriwahyuni ¹⁾, Hasnawi Haris ²⁾, Bakhtiar ³⁾, Iman Suyitno ⁴⁾, Najamuddin ⁵⁾,
Rohmansyah Sahabuddin ⁶⁾

^{1, 2, 3, 4, 5, 6)} Social Science Study Program, Universitas Negeri Makassar, Indonesia

Corresponding Author: Sriwahyuni, Email: sriwahyuni.s22024@student.unm.ac.id

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Abstract. The urgency of this study arises from the limited empirical evidence on how technology-based Pancasila education can strengthen students' learning motivation and digital literacy in vocational school settings, whereas most technology integration studies have focused on science and vocational subjects. This study aims to analyze the influence of technology-based Pancasila learning on students' learning motivation and digital literacy in state vocational schools in Jeneponto Regency. A quantitative descriptive-correlational design was employed involving 97 students selected through purposive sampling; data were collected using validated questionnaires and analyzed using simple linear regression. The findings indicate that technology-based Pancasila learning has a positive and statistically significant effect on learning motivation ($B = 0.702$; $p < 0.001$), explaining 70.7% of its variance, and on digital literacy ($B = 0.766$; $p < 0.001$), explaining 69.7% of its variance. These results suggest that systematic integration of digital platforms and media in Pancasila instruction is effective in promoting both affective engagement and critical use of digital information among vocational students. The novelty of this research lies in providing contextual empirical evidence that technology-enhanced learning is not only relevant for STEM and vocational content, but also highly effective in the domain of Pancasila education to foster 21st-century competencies. This study contributes theoretically by expanding the discourse on technology-based civic and character education and, practically, by offering pedagogical implications for optimizing technology integration in Pancasila learning in vocational schools.

Keywords: *Technology-Based learning; Pancasila Education; Learning Motivation; Digital Literacy; Vocational Secondary Education*

INTRODUCTION

Digital transformation has reshaped educational ecosystems worldwide, shifting instructional practices from teacher-centred, transmission-oriented models towards interactive, collaborative, and student-centred learning environments that foster twenty-first-century competencies such as critical thinking, creativity, and digital literacy (Delcker & Ifenthaler, 2022; Masduki et al., 2024; Nurdin et al., 2023). The rapid diffusion of digital platforms, learning management systems, and data-driven pedagogies has encouraged schools and universities to reconfigure curricula and leadership practices to respond to the demands of Society 5.0 and the Fourth Industrial Revolution (Boztas et al., 2025; O' Brien, 2025; Umah et al., 2023). Empirical studies show that effective digital learning transformation is closely linked to institutional capacity building, professional development, and organizational learning processes, which in turn influence instructional quality and student outcomes (Farrell et al., 2024; Langseth et al., 2023; Rof et al., 2022). In parallel, educational innovation initiatives emphasise the integration of experiential and entrepreneurial learning models that leverage digital technologies to prepare

learners for complex socio-economic challenges (Rahmi et al., 2025; Rahayu et al., 2025; Ramirez & Inga, 2022).

Concurrently, research on digital learning points to the central role of motivation and engagement in determining the effectiveness of technology-enhanced instruction. AI-supported and digital platforms have been shown to enhance learning performance, motivation, and self-regulation when they are pedagogically aligned and responsive to learner needs (Huang et al., 2025; Pham et al., 2023; Romero Ariza et al., 2025). Various studies highlight that well-designed digital environments—such as blended, flipped, game-based, and simulation-based learning—can strengthen intrinsic motivation, self-efficacy, and meaningful learning, provided that they scaffold autonomy, competence, and relatedness in line with self-determination theory (Chen & Liu, 2025; Chen et al., 2025; Deci & Ryan, 2012; Listiana et al., 2025; Wu et al., 2025). At the same time, digital transformation raises questions regarding equity, digital literacy, and learners' capacity to navigate complex information ecosystems responsibly and critically (Mhlanga & Moloi, 2020; O' Brien, 2025; Qarkaxhija et al., 2021). These developments underscore the strategic importance of examining how technology-based learning models can simultaneously cultivate learning motivation and digital literacy across diverse educational contexts, including civic and character education.

In Indonesia, Pancasila functions as the philosophical foundation of the state and the normative basis for citizenship and character education, requiring schools to internalize its values in both formal and informal learning settings (Andriawan, 2022; Kameo & Prasetyo, 2021; Rosidah, 2020; Winarni, 2020). Pancasila-based education is increasingly recognized as a key vehicle for strengthening democratic awareness, social cohesion, and moral responsibility among the younger generation, especially amid contemporary socio-political and technological challenges (Ardi et al., 2024; Karyono et al., 2023; Muqsith et al., 2022; Trisiana & Supeni, 2021). Several studies demonstrate that Pancasila values can be effectively integrated into school programs and community engagement activities to enhance national identity, social resilience, and civic responsibility (Arifin et al., 2024; Patras et al., 2025; Widjaja et al., 2021; Za et al., 2024). In this context, digital spaces and media are no longer peripheral but have become crucial arenas for the expression and contestation of civic values, making the cultivation of digitally literate and ethically grounded citizens an urgent educational priority (Fenton, 2024; Marwiyah et al., 2025; Yorman & Sadam, 2025a; Zein et al., 2023).

Despite this normative emphasis, there remains a substantial gap between the transformative potential of technology and its concrete implementation in Pancasila education, particularly at the vocational secondary level. Empirical reports indicate that teachers' mastery of

Technological Pedagogical Content Knowledge (TPACK) and their ability to design integrative digital learning scenarios for Pancasila and Citizenship Education (PPKn) are still uneven, especially outside major urban centres (Handayani et al., 2025; Ismail et al., 2023; Nurdin et al., 2023). Studies in Indonesian schools reveal that while the use of information and communication technologies can increase learning efficiency and participation, its sustained impact on motivation and character formation depends on deliberate pedagogical design and value-oriented content (Bau Kati, 2017; Nurhakim & Lestari, 2023; Putriyani et al., 2023; Rusmiati et al., 2021; Salahudin Permadi et al., 2020). Furthermore, recent surveys highlight that students' learning motivation and digital literacy in various regions remain at moderate levels, which can undermine engagement and the internalization of civic and ethical competencies intended by Pancasila education (Bahari et al., 2024; Habibi et al., 2024; M, U., et al., 2025). These challenges are compounded in peripheral and rural districts, where digital infrastructure and support systems for teachers and students are still developing (Dakey & Akakpo, 2025; Ndegong Madung & Mere, 2021; Swaramarinda et al., 2025).

To address these issues, numerous pedagogical approaches have been proposed to increase student engagement and support the internalization of Pancasila values in digital contexts. Research on culturally responsive and gamified Pancasila education demonstrates that digital games, interactive narratives, and locally grounded learning scenarios can enhance students' multicultural competence and civic awareness (Halim, 2024; Patras et al., 2025; Strengthening character education in Indonesia, 2020; Supriyanto & Herlambang, 2025). Studies on mobile learning, webtoon-based comics, and digital media integration in Pancasila and PPKn courses show promising results in terms of empathy, critical thinking, and alignment with the media practices of digital-native students (Casmana et al., 2020; Kurniadi et al., 2025; WIDIATMOKO et al., 2024; Zein et al., 2023). At the vocational level, the use of digital platforms and learning media has been associated with improved motivation and performance in citizenship-related subjects when combined with cooperative and student-centred strategies (Handayani et al., 2025; Mohammadifard, 2023; Nur'aeni & Hasanudin, 2023). In parallel, conceptual work on Pancasila and digital citizenship underscores the need to position Pancasila as an ethical compass for social media and online interaction, thereby framing technology not only as a delivery tool but also as a space for value formation (Nugroho, 2023; Yorman & Sadam, 2025a, 2025b).

Beyond these Pancasila-specific initiatives, broader scholarship on motivation and digital literacy offers more targeted solutions that can inform the design of technology-based civic education. Studies on AI- and ICT-enhanced learning environments indicate that features such as adaptive feedback, multi-modal representations, and structured inquiry can raise learning

motivation, self-efficacy, and higher-order thinking across disciplines (Huang et al., 2025; Huang X. et al., 2025; Listiana et al., 2025; Wu et al., 2025). Parallel research on digital literacy frameworks and interventions has developed validated instruments and curricular models for measuring and strengthening students' capacity to access, evaluate, and create digital information responsibly (Chang & Kuo, 2025; Son & Ha, 2025; Wijayanti et al., 2025; Yuniar et al., 2025). Design-based and scenario-based digital literacy programs have been shown to improve learners' critical and practical competencies through activity-based and self-directed learning (Akkhateerathitiphum & Srikolchan, 2025; Jeffcoat & Tang, 2025; Kittipongpisut et al., 2025; Moundy et al., 2025). Empirical evidence further suggests that digital literacy is positively associated with academic performance, innovation, and resilience in online learning, particularly when supported by conducive digital atmospheres and teacher support (Pan & Zhu, 2025; Salimi et al., 2025; Yuan et al., 2025; Zheng et al., 2025).

Overall, the literature reveals several converging trends. First, technology-enhanced learning can foster motivation and engagement when grounded in robust motivational theories and thoughtful instructional design (Chen & Liu, 2025; Deci & Ryan, 2012; Romero Ariza et al., 2025). Second, digital literacy has emerged as a core competency that mediates students' participation, knowledge sharing, and academic success in digitally mediated environments (Dzidzornu & Xu, 2025; Gökçe & Nacaroglu, 2025; Salimi et al., 2025; Xie & Lu, 2025). Third, Pancasila education is gradually being adapted to digital contexts through gamification, mobile learning, and multimedia resources, yet empirical evaluations of these innovations often focus on specific skills or attitudes rather than integrated learning outcomes (Bahari et al., 2024; Halim, 2024; Patras et al., 2025; WIDIATMOKO et al., 2024). However, most studies either examine motivation or digital literacy in isolation, or they treat Pancasila and citizenship content as ancillary to other subject domains, leaving limited evidence on how technology-based Pancasila learning can simultaneously enhance students' learning motivation and digital literacy in vocational secondary schools, particularly in regions with constrained digital infrastructure such as Jenepono.

This study addresses these gaps by proposing a technology-based Pancasila learning framework that explicitly links digital pedagogical design, learning motivation, and digital literacy within the context of Indonesian vocational education. The proposed framework is theoretically supported by self-determination theory, which posits that autonomy-supportive and competence-enhancing environments foster higher quality motivation (Deci & Ryan, 2012), as well as by contemporary models of digital literacy and digital citizenship that emphasise critical, ethical, and participatory engagement in online spaces (Chang & Kuo, 2025; Marwiyah et al.,

2025; Nugroho, 2023; Yaseen et al., 2025). The novelty of this research lies in its focus on Pancasila as both content and ethical framework within technology-enhanced instruction, and in its simultaneous consideration of motivation and digital literacy as key learning outcomes for vocational students (Bahari & Tabbu, 2025; Swaramarinda et al., 2025; Widjaja et al., 2021; Za et al., 2024). The scope of the study is delimited to state vocational schools (SMK) in Jeneponto Regency, thereby providing contextualised empirical evidence from a district that is often underrepresented in digital education research (Dakey & Akakpo, 2025; M, U., et al., 2025).

Accordingly, the present study aims to empirically analyse the influence of technology-based Pancasila education on students' learning motivation and digital literacy in vocational secondary schools in Jeneponto. By employing a quantitative descriptive–correlational design, the research seeks to test whether the systematic integration of digital media, platforms, and interactive activities into Pancasila instruction is associated with higher levels of motivation and digital literacy among SMK students, thereby responding to national and international calls for evidence-informed digital citizenship and character education (Ho, 2024; O' Brien, 2025; Swaramarinda et al., 2025). Specifically, the study is guided by the following research questions: (1) To what extent does technology-based Pancasila learning influence the learning motivation of vocational students in Jeneponto Regency? and (2) To what extent does technology-based Pancasila learning influence the digital literacy of vocational students in Jeneponto Regency? By answering these questions, the study is expected to contribute to the refinement of Pancasila pedagogy in the digital era and to inform policy and practice in vocational education.

RESEARCH METHODS

Research Design and Approach

This study employed a quantitative descriptive–correlational design to examine the influence of technology-based Pancasila learning on students' learning motivation and digital literacy in vocational schools. A correlational approach was deemed appropriate because it allows the investigation of statistical relationships among variables without manipulating the learning environment, which is consistent with recent digital learning and transformation research in educational settings (Delcker & Ifenthaler, 2022; Graham et al., 2023; Langseth et al., 2023; Nurdin et al., 2023). Quantitative survey designs have been widely used to evaluate the effectiveness of digital and AI-supported learning interventions on motivational and cognitive outcomes, thereby providing a relevant methodological precedent for this study (Aditya & Andrisyah, 2023; Huang et al., 2025; Pham et al., 2023; Romero Ariza et al., 2025). The choice of a non-experimental, cross-sectional design also aligns with prior investigations of digital literacy and learning motivation in large student populations, where standardized instruments and

statistical modelling are used to test hypothesised relationships among variables (Chang & Kuo, 2025; Listiana et al., 2025; Salimi et al., 2025; Yuan et al., 2025).

The adoption of a descriptive–correlational framework was further informed by literature on digital transformation in education, which underscores the need for empirical mapping of how technology integration relates to pedagogical, affective, and competency-based indicators in authentic institutional contexts (Farrell et al., 2024; Masduki et al., 2024; O’ Brien, 2025; Rof et al., 2022). Similar designs have been applied to explore technology-supported motivation and engagement in blended, gamified, and AI-enhanced environments, demonstrating their suitability for capturing complex associations between learning processes and outcomes (Ho, 2024; Lin et al., 2025; Wu et al., 2025; Xie & Lu, 2025). In line with these precedents, the present study used inferential statistics to test the hypothesised effects of technology-based Pancasila learning on learning motivation and digital literacy, while also providing descriptive statistics to characterise the sample and the distribution of key variables.

Research Setting, Population, and Sample

The research was conducted in four state vocational high schools (SMK Negeri) in Jeneponto Regency, South Sulawesi, Indonesia, during August–October 2025. Jeneponto represents a district with developing digital infrastructure, making it a relevant context for studying technology-based learning and digital literacy in non-metropolitan settings (Dakey & Akakpo, 2025; M, U., et al., 2025; Ndegong Madung & Mere, 2021). The population consisted of 2,151 students enrolled in 10 state vocational schools. The minimum sample size was determined using the Slovin formula with a 10% margin of error, yielding at least 95 participants; to enhance statistical power and compensate for potential non-response, data were ultimately collected from 97 students who met the inclusion criteria. The use of such sampling parameters is comparable to other survey-based studies in digital and vocational education contexts (Habibi et al., 2024; Handayani et al., 2025; Swaramarinda et al., 2025; Yuniar et al., 2025).

A purposive sampling technique was applied to ensure that participants had direct experience with technology-based learning in Pancasila education. Inclusion criteria required that students (a) were enrolled in Pancasila education classes during the study period, and (b) had participated in learning activities employing digital platforms or media (e.g., learning management systems, interactive applications, or online assessment tools). Purposive sampling is commonly employed in digital literacy and digital citizenship studies when specific exposure to technology or curricular programs is required (Bahari et al., 2024; Nugroho, 2023; Patras et al., 2025; Zein et al., 2023). Potential selection bias was mitigated by recruiting participants across

different grade levels and study programs within each school and by reporting detailed demographic and contextual characteristics of the sample.

Instruments and Materials

Data were collected using a structured questionnaire with items rated on a five-point Likert scale (1 = strongly disagree to 5 = strongly agree). The instrument consisted of three main scales reflecting the study variables: (1) technology-based Pancasila learning, (2) learning motivation, and (3) digital literacy. The scale on technology-based Pancasila learning was developed by adapting indicators from research on Pancasila and citizenship education that integrates digital media, gamification, and online platforms, focusing on aspects such as digital content delivery, interactivity, technology-based assessment, and collaborative activities (Casma et al., 2020; Halim, 2024; Patras et al., 2025; WIDIATMOKO et al., 2024; Yorman & Sadam, 2025a, 2025b). Additional indicators reflecting the ethical and civic dimension of technology use were derived from studies on Pancasila as a framework for digital citizenship and social media ethics (Bahari et al., 2024; Nugroho, 2023; Yorman & Sadam, 2025a; Zein et al., 2023).

The learning motivation scale was constructed with reference to self-determination theory and contemporary research on motivation in technology-enhanced learning environments. Items were designed to capture intrinsic interest, perceived value, self-efficacy, and persistence, informed by theoretical and empirical work showing that autonomy-supportive and competence-enhancing digital learning contexts can strengthen motivation (Deci & Ryan, 2012; Huang et al., 2025; Listiana et al., 2025; Romero Ariza et al., 2025; Wu et al., 2025). Empirical studies on learning motivation in various disciplinary and digital settings—such as hybrid learning, game-based learning, and AI-supported courses—were used as methodological references for item wording and factor structure (Chen & Liu, 2025; Erden et al., 2025; Kim et al., 2025; Şimşek et al., 2025; Xiong, 2025). This helped ensure that the scale captured both cognitive and affective dimensions of motivation relevant to vocational students.

The digital literacy scale drew upon established frameworks and validated instruments developed to measure students' abilities to access, evaluate, create, and ethically use digital information. Conceptual guidance was taken from studies that operationalized digital literacy through multiple dimensions, including technical skills, information evaluation, communication, safety, and critical engagement (Chang & Kuo, 2025; Son & Ha, 2025; Wijayanti et al., 2025; Yaseen et al., 2025). Additional items reflecting civic and participatory aspects of digital literacy were adapted from research on digital citizenship, media literacy, and online civic engagement (Jeffcoat & Tang, 2025; Marwiyah et al., 2025; Prastyanti et al., 2025; Wui et al., 2025). The inclusion of contextually relevant indicators for Indonesian vocational students was supported by

prior work on digital literacy in local educational settings and the digital economy (Kurniadi et al., 2025; Maulana & Wijaya, 2025; Swaramarinda et al., 2025; Yuniar et al., 2025).

Instrument Development and Validation

Instrument development followed a multi-step procedure. First, an initial pool of items was drafted in Indonesian based on the literature and the operational definitions of each construct. Content validity was assessed through expert review by lecturers and practitioners with expertise in Pancasila education, digital learning, and educational measurement. This procedure is consistent with validation practices adopted in digital literacy and motivation scale development studies, where expert judgement is used to refine item clarity, relevance, and cultural appropriateness (Chang & Kuo, 2025; Son & Ha, 2025; Susiani et al., 2025; Wijayanti et al., 2025). Based on feedback, items were revised to ensure alignment with the study context and to minimise ambiguity.

Second, a pilot test was conducted on a small group of students with similar characteristics to the target sample to examine item functioning and preliminary reliability. Item-total correlations were calculated using Pearson's product-moment correlation, and items with low or non-significant correlations were considered for revision or removal, following practices commonly reported in survey-based educational research (Habibi et al., 2024; Ho, 2024; Nurdin et al., 2023; Salimi et al., 2025). Internal consistency reliability for each scale was evaluated using Cronbach's alpha, with values above 0.70 interpreted as acceptable indicators of internal consistency, in line with thresholds widely adopted in social science measurement studies (Akkhateerathitiphum & Srikolchan, 2025; Jeffcoat & Tang, 2025; Listiana et al., 2025; Yuan et al., 2025).

Third, construct validity was examined in the main study through exploratory analyses of item distributions and intercorrelations. While full factor-analytic procedures were beyond the scope of this article, the pattern of correlations and reliability indices was compared with those reported in prior validation research on digital literacy and motivation instruments to support the interpretability of the scales (Ayalon & Aharony, 2025; Cebollero-Salinas et al., 2025; Dzidzornu & Xu, 2025; Moundy et al., 2025). Collectively, these procedures were designed to enhance the psychometric robustness of the instruments used to measure technology-based Pancasila learning, learning motivation, and digital literacy.

Data Collection Procedures

Data collection was carried out in four stages. The preparation stage included a review of the literature, the development and piloting of the questionnaire, and the completion of

administrative and ethical clearance procedures at the institutional and school levels. The implementation stage involved coordinating with Pancasila teachers and school administrators to schedule classroom visits and online distribution of the survey. The questionnaire was administered using both printed forms and a secure online format (Google Forms) to accommodate variability in school infrastructure and student access, a dual-mode approach commonly reported in contemporary digital education surveys (Ho, 2024; O' Brien, 2025; Pham et al., 2023; Swaramarinda et al., 2025).

The third stage comprised the retrieval and verification of responses, including checking for completeness and consistency of data, and excluding cases with substantial missing information. This step was important to maintain data quality and is in line with procedures used in large-scale studies on digital literacy and online learning (Aljamaan et al., 2025; Liu et al., 2025; Nacaroglu et al., 2025; Yaseen et al., 2025). The final stage involved data coding, entry into SPSS, and preliminary descriptive analysis to profile the sample and to identify any anomalies in the data. Throughout the process, ethical principles were observed, including voluntary participation, informed consent, confidentiality of responses, and protection of students from any form of harm or undue pressure, as recommended in educational research involving minors and digital data (Jeffcoat & Tang, 2025; M, U., et al., 2025; Pan & Zhu, 2025; Qarkaxhija et al., 2021).

Data Analysis Techniques

Data analysis was conducted using SPSS with several sequential procedures. First, descriptive statistics (means, standard deviations, and frequency distributions) were computed for all variables to summarise central tendencies and dispersion. Second, item-level validity was assessed through Pearson product-moment correlations between each item and its respective scale score, and items with correlations below the recommended threshold were scrutinised, following practices in previous digital literacy and motivation studies (Chang & Kuo, 2025; Listiana et al., 2025; Son & Ha, 2025; Wijayanti et al., 2025). Third, internal consistency reliability for each scale was estimated using Cronbach's alpha.

Prior to regression analysis, classical assumption tests were performed, including normality of residuals and homogeneity of variance, to ensure that the data met the assumptions of linear regression models commonly used in educational research (Habibi et al., 2024; Ho, 2024; Nurdin et al., 2023; Salimi et al., 2025). Simple linear regression analyses were then conducted separately to estimate the influence of technology-based Pancasila learning on learning motivation and on digital literacy. For each model, regression coefficients (B), t-statistics, significance values (p), and coefficients of determination (R^2) were computed and interpreted. This analytic strategy

mirrors approaches adopted in previous work examining the predictive contribution of digital learning variables to motivational and literacy-related outcomes (Handayani et al., 2025; Kittipongpisut et al., 2025; Salimi et al., 2025; Swamarinda et al., 2025).

In addition to the primary regression analyses, effect sizes were interpreted to contextualise the magnitude of the relationships observed, drawing on benchmarks used in similar quantitative studies in digital education and Pancasila-related contexts (Bahari et al., 2024; Halim, 2024; Patras et al., 2025; Zein et al., 2023). The decision to employ separate regression models for motivation and digital literacy was guided by both theoretical considerations—treating them as distinct but related outcome constructs—and methodological precedents in the literature (Dzidzornu & Xu, 2025; Nacaroglu et al., 2025; Yuan et al., 2025; Zheng et al., 2025).

Data Quality and Ethical Considerations

Several strategies were implemented to enhance data quality and mitigate potential sources of bias. The use of previously validated constructs and the systematic process of content validation, pilot testing, and reliability analysis were intended to strengthen measurement accuracy, in line with recommendations from recent instrument development studies in digital literacy and motivation research (Akkhateerathitiphum & Srikolchan, 2025; Chang & Kuo, 2025; Jeffcoat & Tang, 2025; Wijayanti et al., 2025). To reduce social desirability bias, students were assured that their responses would be anonymous and would not influence their grades or school status, consistent with ethical protocols in survey research involving adolescents (Casmara et al., 2020; Ho, 2024; M, U., et al., 2025; Qarkaxhija et al., 2021).

Nevertheless, the study recognises inherent limitations associated with purposive sampling, cross-sectional design, and self-report measures. Purposive sampling, while appropriate for ensuring that participants had relevant exposure to technology-based Pancasila learning, may limit the generalisability of findings beyond the participating schools and district (Dakey & Akakpo, 2025; Habibi et al., 2024; Swamarinda et al., 2025; Yuniar et al., 2025). The cross-sectional nature of the data precludes causal inferences, a constraint commonly noted in correlational studies on digital transformation and learning outcomes (Farrell et al., 2024; Masduki et al., 2024; O' Brien, 2025; Rof et al., 2022). Finally, reliance on self-report instruments introduces the possibility of perception bias; however, prior research suggests that carefully designed questionnaires with demonstrated reliability and validity can still yield robust insights into students' motivational and literacy profiles in digital learning contexts (Ayalon & Aharony, 2025; Cebollero-Salinas et al., 2025; Salimi et al., 2025; Yuan et al., 2025).

RESULT

Respondent Characteristics

This study examined the influence of technology-based Pancasila learning on students' learning motivation and digital literacy in four state vocational schools (SMK) in Jeneponto Regency with a sample of 95 students. The instrument comprised 17 items for technology-based Pancasila learning (X), 12 items for learning motivation (Y1), and 16 items for digital literacy (Y2), all measured using a five-point Likert Summated Rating (LSR) scale. The use of multi-item Likert scales is consistent with survey-based research in digital learning, motivation, and literacy that operationalises latent constructs numerically for subsequent inferential analysis (Chang & Kuo, 2025; Delcker & Ifenthaler, 2022; Listiana et al., 2025; Nurdin et al., 2023).

Table 1. Likert Scale Used in the Questionnaire

Response category	Score
Strongly agree	5
Agree	4
Disagree somewhat	3
Disagree	2
Strongly disagree	1

The 95 respondents were distributed across four SMKs that had implemented technology-supported Pancasila learning, as shown in Table 2.

Table 2. Respondents by School

No	School	Frequency	Percentage (%)
1	SMKN 1 Jeneponto	44	45.83
2	SMKN 4 Jeneponto	22	22.92
3	SMKN 8 Jeneponto	21	21.88
4	SMKN 10 Jeneponto	10	10.42
	Total	95	100

This distribution indicates that the sample captures institutional variation in technology integration practices across several SMKs. Multi-site sampling of this kind is in line with recommendations in research on digital transformation and digital literacy, which emphasise contextual diversity in organisational capacity and infrastructure (Farrell et al., 2024; Graham et al., 2023; Langseth et al., 2023; O'Brien, 2025). Gender composition is presented in Table 3.

Table 3. Respondents by Gender

No	Gender	Frequency	Percentage (%)
1	Male	50	52.63
2	Female	45	47.37
	Total	95	100

The relatively balanced gender distribution reflects an equitable participation of male and female students in technology-based learning. This is important because studies on digital learning and literacy have noted that gender may moderate access, confidence, and usage patterns, with potential implications for outcomes (Bipasha et al., 2025; Ma et al., 2025; Sunny & Ramasamy, 2025; Vaszkun & Mihalkov Szakács, 2025).

Instrument Validity

Item validity was assessed using Pearson's product-moment correlation between item scores and total scale scores, with an r -table threshold of 0.197.

Table 4. Item Validity for Technology-Based Pancasila Learning (X)

Item	r-value	r-table	Decision
1	0.561	0.197	Valid
2	0.506	0.197	Valid
3	0.607	0.197	Valid
4	0.646	0.197	Valid
5	0.618	0.197	Valid
6	0.596	0.197	Valid
7	0.527	0.197	Valid
8	0.580	0.197	Valid
9	0.542	0.197	Valid
10	0.540	0.197	Valid
11	0.718	0.197	Valid
12	0.556	0.197	Valid
13	0.593	0.197	Valid
14	0.615	0.197	Valid
15	0.580	0.197	Valid
16	0.539	0.197	Valid
17	0.098	0.197	Not valid

Sixteen of the 17 items showed r -values above 0.197, indicating adequate item-total correlations and justifying their retention. Only one item fell below the threshold and was excluded from further analysis. Similar iterative item screening procedures are reported in studies developing instruments for technology use, digital transformation, and learning environments (Delcker & Ifenthaler, 2022; Masduki et al., 2024; Nurdin et al., 2023; Rof et al., 2022).

Table 5. Item Validity for Learning Motivation (Y1)

Item	r-value	r-table	Decision
1	0.660	0.197	Valid
2	0.506	0.197	Valid
3	0.586	0.197	Valid
4	0.641	0.197	Valid
5	0.702	0.197	Valid

6	0.639	0.197	Valid
7	0.736	0.197	Valid
8	0.699	0.197	Valid
9	0.633	0.197	Valid
10	0.694	0.197	Valid
11	0.629	0.197	Valid
12	0.731	0.197	Valid

All items for learning motivation met the validity criterion, with r-values between 0.506 and 0.736. This indicates that each item contributes significantly to the overall construct, consistent with earlier work on motivation scales in technology-enhanced and hybrid learning settings (Chen & Liu, 2025; Huang et al., 2025; Romero Ariza et al., 2025; Wu et al., 2025).

Table 6. Item Validity for Digital Literacy (Y2)

Item	r-value	r-table	Decision
1	0.575	0.197	Valid
2	0.575	0.197	Valid
3	0.151	0.197	Not valid
4	0.557	0.197	Valid
5	0.650	0.197	Valid
6	0.542	0.197	Valid
7	0.563	0.197	Valid
8	0.432	0.197	Valid
9	0.674	0.197	Valid
10	0.683	0.197	Valid
11	0.536	0.197	Valid
12	0.705	0.197	Valid
13	0.640	0.197	Valid
14	0.570	0.197	Valid
15	0.602	0.197	Valid
16	0.645	0.197	Valid

Fifteen of 16 items for digital literacy were valid, while one item did not reach the correlation threshold. This pattern is typical in validation studies of multi-dimensional digital literacy instruments, where a small number of items are often discarded to improve construct clarity (Ayalon & Aharony, 2025; Chang & Kuo, 2025; Son & Ha, 2025; Wijayanti et al., 2025). Retaining only valid items ensures that the scale reflects critical aspects of technical, informational, and ethical digital practices (Jeffcoat & Tang, 2025; Salimi et al., 2025; Yaseen et al., 2025; Yuniar et al., 2025).

Instrument Reliability

Reliability was assessed using Cronbach's alpha for each construct.

Table 7. Reliability of Technology-Based Pancasila Learning (X)

Statistic	Value
Cronbach's alpha	0.859
Cronbach's alpha (standardised items)	0.874
Number of items	16

Table 8. Reliability of Learning Motivation (Y1)

Statistic	Value
Cronbach's alpha	0.861
Cronbach's alpha (standardised items)	0.881
Number of items	12

Table 9. Reliability of Digital Literacy (Y2)

Statistic	Value
Cronbach's alpha	0.858
Cronbach's alpha (standardised items)	0.874
Number of items	15

All alpha values exceed 0.85, indicating very good internal consistency for the three scales. These coefficients compare favourably with those reported in recent instrument development and survey studies on motivation and digital literacy, where alpha coefficients above 0.80 are generally considered robust (Akkhateerathitiphum & Srikolchan, 2025; Habibi et al., 2024; Listiana et al., 2025; Yuan et al., 2025).

Assumption Testing

Normality of residuals was examined using the Kolmogorov–Smirnov test for both regression models.

Table 10. Normality Test for Residuals (X → Y1)

Statistic	Value
N	95
Mean of residuals	0.0000000
Std. deviation	3.73578091
Test statistic (K–S)	0.080
Asymp. Sig. (2-tailed)	0.132

The significance value of 0.132 (> 0.05) indicates normally distributed residuals for the model predicting learning motivation.

Table 11. Normality Test for Residuals (X → Y2)

Statistic	Value
N	95
Mean of residuals	0.0000000

Std. deviation	4.16984015
Test statistic (K-S)	0.071
Asymp. Sig. (2-tailed)	0.200

Similarly, residuals for the digital literacy model are normally distributed ($p = 0.200 > 0.05$). These results fulfil the normality assumption underlying linear regression models commonly used in educational research (Habibi et al., 2024; Ho, 2024; Nurdin et al., 2023; Salimi et al., 2025).

Homogeneity of variance was assessed using Levene's test.

Table 12. Homogeneity Test ($X \rightarrow Y1$)

Dependent variable	Levene statistic	df1	df2	Sig.
Learning motivation	1.590	21	63	0.081

Table 13. Homogeneity Test ($X \rightarrow Y2$)

Dependent variable	Levene statistic	df1	df2	Sig.
Digital literacy	1.287	21	63	0.219

In both models, significance levels exceed 0.05, indicating homogeneous variances. Fulfilling normality and homogeneity assumptions validates the use of parametric regression analysis and ANOVA in this study (Farrell et al., 2024; Graham et al., 2023; Rof et al., 2022; Swaramarinda et al., 2025).

Effect of Technology-Based Pancasila Learning on Learning Motivation

The first regression model tested the effect of technology-based Pancasila learning (X) on learning motivation ($Y1$).

Table 14. Simple Linear Regression Coefficients ($X \rightarrow Y1$)

Model	Predictor	B	Std. Error	Beta
1	Constant	1.919	2.901	–
	Technology-based Pancasila learning	0.702	0.046	0.841

Table 16. t-Test for Regression Coefficients ($X \rightarrow Y1$)

Predictor	t	Sig.
Constant	0.661	0.510
Technology-based Pancasila learning	15.154	0.000

The unstandardised coefficient $B = 0.702$ and standardised Beta = 0.841 indicate a strong positive association: higher levels of technology-based Pancasila learning are associated with higher learning motivation. The predictor is highly significant ($t = 15.154$; $p < 0.001$), whereas

the constant is not, suggesting that variability in motivation is primarily driven by differences in technology-based learning exposure. This pattern aligns with findings that well-designed digital and gamified learning environments significantly enhance motivation and engagement (Chen & Liu, 2025; Huang et al., 2025; Listiana et al., 2025; Wu et al., 2025).

Table 17. ANOVA for Regression Model ($X \rightarrow Y1$)

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	3238.466	1	3238.466	229.630	0.000
Residual	1339.782	93	14.103	—	—
Total	4578.247	94	—	—	—

Table 18. Model Summary ($X \rightarrow Y1$)

Model	R	R ²	Adjusted R ²	Std. Error of Estimate
1	0.841	0.707	0.704	3.75539

The model is highly significant ($F = 229.630$; $p < 0.001$), with $R^2 = 0.707$ indicating that 70.7% of the variance in learning motivation is explained by technology-based Pancasila learning. This large effect suggests that technology integration in Pancasila classrooms is a major determinant of students' motivational profiles, consistent with evidence that technology-enhanced and student-centred pedagogies can substantially raise motivation in civic and related subjects (Bau Kati, 2017; Handayani et al., 2025; Rusmiati et al., 2021; Salahudin Permadi et al., 2020).

Effect of Technology-Based Pancasila Learning on Digital Literacy

The second regression model examined the effect of technology-based Pancasila learning (X) on digital literacy ($Y2$).

Table 19. Simple Linear Regression Coefficients ($X \rightarrow Y2$)

Model	Predictor	B	Std. Error	Beta
1	Constant	10.074	3.238	—
	Technology-based Pancasila learning	0.766	0.052	0.835

Table 20. t-Test for Regression Coefficients ($X \rightarrow Y2$)

Predictor	t	Sig.
Constant	3.111	0.002
Technology-based Pancasila learning	14.800	0.000

The unstandardised coefficient $B = 0.766$ and $Beta = 0.835$ show a strong positive effect of technology-based Pancasila learning on digital literacy. Both the predictor and constant are significant, indicating that students possess a pre-existing baseline of digital literacy that is substantially enhanced through structured technology integration in Pancasila learning. This is

consistent with research demonstrating that formal educational uses of digital platforms and media improve students' operational, informational, and critical digital skills (Amihardja et al., 2022; Habibi et al., 2024; Kristanto et al., 2025; Maulana & Wijaya, 2025; Merga & Mat Roni, 2025).

Table 19. ANOVA for Regression Model ($X \rightarrow Y2$)

Source	Sum of Squares	df	Mean Square	F	Sig.
Regression	3848.464	1	3848.464	219.029	0.000
Residual	1669.206	93	17.571	—	—
Total	5517.670	94	—	—	—

Table 21. Model Summary ($X \rightarrow Y2$)

Model	R	R ²	Adjusted R ²	Std. Error of Estimate
1	0.835	0.697	0.694	4.19173

The model is highly significant ($F = 219.029$; $p < 0.001$), with $R^2 = 0.697$ indicating that 69.7% of the variance in digital literacy is explained by technology-based Pancasila learning. This strong explanatory power reinforces evidence that structured curricular integration of technology—rather than incidental digital exposure alone—plays a key role in developing students' digital competencies in vocational contexts (Bahari et al., 2024; Habibi et al., 2024; Maulana & Wijaya, 2025; Swaramarinda et al., 2025; Yuniar et al., 2025).

Conceptual Summary of Findings

Synthesising these results, a conceptual map of the findings can be outlined as follows:

1. Technology-based Pancasila learning is positioned as the central predictor variable, conceptualised through indicators of digital content delivery, interactivity, technology-based assessment, and collaborative activities.
2. This construct is linked via strong positive paths to learning motivation ($R^2 = 0.707$) and digital literacy ($R^2 = 0.697$).
3. Both outcome variables are embedded in a broader framework of Pancasila-based digital citizenship, highlighting the dual role of technology as an instructional medium and as an arena for ethical, civic engagement.

This configuration is consistent with, and extends, prior work on technology integration in Pancasila and citizenship education, which has shown that digital media, gamification, and mobile learning can strengthen both value internalisation and digital competencies when pedagogically aligned with Pancasila as an ethical framework (Bahari et al., 2024; Casmana et al., 2020; Halim, 2024; Lazuardy et al., 2025; Nugroho, 2023; Patras et al., 2025; Widiatmoko et al., 2024; Yorman & Sadam, 2025a, 2025b; Zein et al., 2023).

DISCUSSION

The findings of this study empirically demonstrate that technology-based Pancasila learning exerts a strong and significant influence on both students' learning motivation ($B = 0.702$, $\beta = 0.841$, $R^2 = .707$) and digital literacy ($B = 0.766$, $\beta = 0.835$, $R^2 = .697$). These results are congruent with Self-Determination Theory, which posits that fulfilling learners' basic psychological needs for autonomy, competence, and relatedness fosters intrinsic motivation and sustained engagement (Deci & Ryan, 2012). In the present context, interactive digital platforms, multimedia resources, and collaborative online tasks within Pancasila learning provide opportunities for autonomous choice, competence feedback, and social connection, thereby strengthening motivational regulation. This pattern is consistent with a broad body of work showing that digital and AI-supported learning environments, when pedagogically well-designed, enhance motivation, engagement, and self-efficacy in diverse subject areas (Chen & Liu, 2025; Chen et al., 2025; Gu et al., 2025; Hong & Guo, 2025; Huang et al., 2025; Lee, 2025; Lin et al., 2025; Romero Ariza et al., 2025; Şimşek et al., 2025; Wu et al., 2025; Xiong, 2025).

From a theoretical perspective, the strong predictive power of technology-based Pancasila learning also aligns with contemporary conceptions of digital transformation in education, which emphasise that technology should be integrated as a core pedagogical infrastructure rather than an optional add-on (Delcker & Ifenthaler, 2022; Gardner, 2022; Graham et al., 2023; Langseth et al., 2023; Nurdin et al., 2023; O'Brien, 2025). The high R^2 values obtained in this study indicate that a substantial proportion of variance in both motivation and digital literacy is explained by the extent and quality of technology integration in Pancasila lessons, supporting the view that digital transformation at the classroom level materially reshapes learning processes and outcomes (Aditya & Andrisyah, 2023; Bygstad et al., 2022; Farrell et al., 2024; Ho, 2024; Masduki et al., 2024; Mhlanga & Moloi, 2020; Pham et al., 2023; Rof et al., 2022; Umah et al., 2023). In the specific domain of Pancasila and citizenship education, this implies that digital media are not merely vehicles for information delivery, but instruments for cultivating reflective, collaborative, and value-laden learning experiences.

When compared with previous empirical studies, the present findings show a high degree of convergence. Research in Indonesian contexts has consistently reported that the use of digital media, e-learning platforms, and interactive tools can enhance students' motivation, autonomy, and participation in learning (Bahari et al., 2024; Bau Kati, 2017; Handayani et al., 2025; Nur'aeni & Hasanudin, 2023; Nurhakim & Lestari, 2023; Putriyani et al., 2023; Rusmiati et al., 2021; Salahudin Permadi et al., 2020; WIDIATMOKO et al., 2024). Studies specifically linking

Pancasila or civic education with digital innovation, such as mobile learning, gamification, and webtoon-based comics, also show positive effects on engagement, empathy, and the development of Pancasila student profiles (Casma et al., 2020; Halim, 2024; Nugroho, 2023; Patras et al., 2025; Zein et al., 2023). The strong regression coefficients observed in this study for both motivation and digital literacy therefore extend this literature by providing robust quantitative evidence from a vocational school context in a region with relatively constrained digital infrastructure.

At the same time, the significant relationship between technology-based Pancasila learning and digital literacy resonates with international research demonstrating that structured educational uses of digital resources—rather than informal, unsupervised use alone—are crucial for developing higher-order digital competencies (Akkhateerathitiphum & Srikolchan, 2025; Chang & Kuo, 2025; Habibi et al., 2024; Jeffcoat & Tang, 2025; Liu et al., 2025; Nacaroglu et al., 2025; Pan & Zhu, 2025; Salimi et al., 2025; Son & Ha, 2025; Yuniar et al., 2025). Studies across school and university settings have shown that digital literacy is strengthened when learners are systematically engaged in tasks that require critical evaluation of information, collaborative online production, and responsible participation in digital public spheres (Ayalon & Aharony, 2025; Begimbetova et al., 2025; Indriyani et al., 2025; Kittipongpisut et al., 2025; M, U., et al., 2025; Mullen, 2025; Swaramarinda et al., 2025; Wui et al., 2025; Yuan et al., 2025; Zheng et al., 2025). The present results confirm that when Pancasila learning is deliberately designed to leverage digital media, students' digital literacy is substantially improved, even in vocational settings where academic orientation is often more practice-oriented than theoretical.

The study also contributes to scholarship on Pancasila-based character and citizenship education in the digital era. Prior research has underscored that Pancasila remains a central normative framework for character formation, civic responsibility, and social cohesion in Indonesia, including in times of rapid socio-technological change (Ardi et al., 2024; Arifin et al., 2024; Karyono et al., 2023; Strengthening character education in Indonesia, 2020; Widjaja et al., 2021; Yorman & Sadam, 2025a). Empirical studies have further shown that Pancasila values can be actualised through community engagement, local wisdom, and school-based programmes that integrate moral, religious, and civic dimensions (Cahyani et al., 2023; Husni, 2021; Rahawarin, 2021; Trisiana & Supeni, 2021; Za et al., 2024). By demonstrating that technology-based Pancasila learning significantly enhances both motivation and digital literacy, this study shows that Pancasila education can simultaneously serve as a vehicle for character formation and as a strategic domain for strengthening digital citizenship competencies, including ethical

participation, critical media awareness, and responsible social media behaviour (Bahari et al., 2024; Lazuardy et al., 2025; Marwiyah et al., 2025; Yorman & Sadam, 2025b).

On the basis of these convergent findings, this article advances the argument that technology-based Pancasila learning has a dual pedagogical function: first, as a powerful driver of learning motivation through the fulfilment of psychological needs and meaningful engagement; and second, as an effective accelerator of students' digital literacy and digital citizenship. The author's position is that technology should not be treated as an auxiliary tool attached to an otherwise traditional civics curriculum, but as an integral component of a redesigned Pancasila pedagogy that foregrounds interaction, collaboration, and reflective digital practice (Handayani et al., 2025; Maulana & Wijaya, 2025; Putriyani et al., 2023; Tahar et al., 2022). In this sense, technology-based Pancasila learning becomes a platform through which abstract values—such as justice, democracy, and human dignity—are translated into concrete digital activities, discussions, and projects that are relevant to young citizens' everyday experiences in online environments (Casma et al., 2020; Halim, 2024; Nugroho, 2023; Patras et al., 2025; Prastyanti et al., 2025).

However, the study also implicitly highlights structural conditions that may constrain the translation of these benefits into all school contexts. Previous research has found that disparities in infrastructure, teacher digital competence, and institutional support can limit the effectiveness of digital transformation initiatives, particularly in regions with fewer resources (Aditya & Andrisyah, 2023; Delcker & Ifenthaler, 2022; Langseth et al., 2023; Masduki et al., 2024; Mhlana & Moloi, 2020; Nurdin et al., 2023; O'Brien, 2025; Umah et al., 2023). In line with these insights, the present study's strong effect sizes should be interpreted as evidence of what is possible when technology-based Pancasila learning is reasonably supported by infrastructure, teacher readiness, and school leadership, rather than as a guarantee that similar outcomes will automatically occur in settings where these enabling conditions are absent (Awad & Martin-Rojas, 2024; Gardner, 2022; Graham et al., 2023; Rahayu et al., 2025; Starke & Ludviga, 2024).

In response to these challenges, several practical recommendations can be derived from the findings. At the pedagogical level, Pancasila teachers are encouraged to adopt project-based, problem-based, and gamified learning designs that utilise digital platforms to engage students in authentic civic issues, collaborative inquiry, and creative digital production (Casma et al., 2020; Halim, 2024; Patras et al., 2025; WIDIATMOKO et al., 2024; Yorman & Sadam, 2025b). These approaches can sustain motivation while simultaneously requiring students to exercise digital literacy skills such as searching, evaluating, remixing, and ethically sharing information (Chang & Kuo, 2025; Habibi et al., 2024; Kristanto et al., 2025; Salimi et al., 2025; Swaramarinda et al., 2025). At the institutional level, school leaders and policymakers should prioritise continuous

professional development to strengthen teachers' technological and pedagogical competence (Ismail et al., 2023; Lazuardy et al., 2025; Nurdin et al., 2023; O'Brien, 2025; Umah et al., 2023), allocate sustainable budgets for digital infrastructure, and adopt clear policies that support safe, ethical, and inclusive use of digital tools in Pancasila learning (Gardner, 2022; Ho, 2024; Masduki et al., 2024; Mhlanga & Moloi, 2020).

Furthermore, the strong link between technology-based Pancasila learning and digital literacy in this study suggests that Pancasila education can be strategically positioned as a hub for school-wide digital citizenship initiatives. Collaborative programmes involving librarians, ICT teachers, and civic education teachers can, for example, develop integrated modules that combine Pancasila values with explicit instruction in digital information evaluation, online deliberation, and responsible social media engagement (Amihardja et al., 2022; Jeffcoat & Tang, 2025; Merga & Mat Roni, 2025; Mullen, 2025; Wui et al., 2025). Family and community partnerships may also be leveraged to reinforce digital ethics and civic responsibility beyond the classroom, extending the reach of school-based digital literacy efforts (Ardi et al., 2024; Cahyani et al., 2023; Husni, 2021; Strengthening character education in Indonesia, 2020; Widjaja et al., 2021).

Finally, the study opens several avenues for future research. Given its correlational design and regional focus on SMK in Jeneponto, further studies are needed to examine how teacher competence, school culture, and local socio-economic conditions moderate the relationship between technology-based Pancasila learning, motivation, and digital literacy (Aditya & Andrisyah, 2023; Farrell et al., 2024; Langseth et al., 2023; Nurdin et al., 2023; Swaramarinda et al., 2025). Longitudinal and experimental designs could also be employed to explore causal mechanisms and to compare different models of technology integration in Pancasila education, such as AI-supported platforms, augmented reality, or immersive simulations (Gökçe & Nacaroglu, 2025; Haroud & Saqri, 2025; Hong & Kim, 2025; Pham et al., 2023; Şahin Kölemen, 2024). By deepening and expanding this line of inquiry, future research can help ensure that Pancasila education remains both normatively grounded and technologically responsive in the face of ongoing digital transformation.

CONCLUSION

This study examined the influence of technology-based Pancasila learning on students' learning motivation and digital literacy in state vocational schools in Jeneponto Regency. Using a quantitative descriptive–correlational design, the findings showed that technology-based Pancasila learning has a strong and statistically significant effect on both learning motivation ($R^2 = 0.707$) and digital literacy ($R^2 = 0.697$). These results indicate that systematic integration of digital platforms, interactive media, and collaborative online activities within Pancasila

instruction substantially enhances students' psychological engagement and their ability to navigate, evaluate, and utilise digital information.

Theoretically, the study contributes to the growing body of knowledge on digital pedagogy and Pancasila education by demonstrating that Pancasila, as a value foundation, can simultaneously serve as an effective vehicle for strengthening twenty-first-century competencies, particularly digital literacy and digital citizenship, in vocational settings. Practically, the results underscore the need to position technology-based Pancasila learning as a strategic component of school-level digital transformation, supported by teacher capacity-building, adequate infrastructure, and sustained policy commitment. Future research should employ longitudinal or experimental designs, involve wider institutional and regional samples, and investigate moderating factors such as teacher digital competence, school culture, and socio-economic context to deepen understanding of how technology-based Pancasila learning can be optimally implemented and scaled.

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