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The Effect of A Practical Life-Based Digital Literacy Approach on Students' Digital Competence and Workload Efficiency

Uswatun Hasanah[1], Arpinda Syifa'a Awalin[1]

[1] Universitas Islam Negeri Sayyid Ali Rahmatullah Tulungagung, Indonesia

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ABSTRACT

This study examines the effect of a Practical Life-Based Digital Literacy (PLDL) approach on university students' digital competence and workload efficiency within Islamic higher education. Guided by experiential learning theory and the DigComp 2.1 framework, the research investigates how practical life–oriented digital literacy activities contribute to students' technological proficiency and task management. Data were obtained from 172 teacher education students who completed validated self-assessment instruments measuring digital competence and workload efficiency. ANOVA and MANOVA results indicate that the PLDL approach has a significant effect on digital competence ($F = 12.636$, $p < 0.001$) and workload efficiency ($F = 7.000$, $p < 0.001$), with the multivariate test (Wilks' $\Lambda = 0.220$, $p < 0.001$) explaining 71.2% and 57.8% of variance in the respective outcomes. Students engaged in PLDL activities demonstrated stronger skills in digital information management, collaboration, and ethical and reflective technology use. These findings highlight PLDL as an effective experiential model for enhancing competence and efficiency, offering strategic insights for the digital transformation of Islamic higher education.

Corresponding Author:
Uswatun Hasanah
Universitas Islam Negeri Sayyid Ali Rahmatullah Tulungagung, Indonesia; uswatun_hasanah@uinsatu.ac.id

1. INTRODUCTION

In higher education, digital competence has become a crucial component of students' academic readiness and professional development (Basilotta-Gómez-Pablos et al., 2022). Universities are not only required to provide technological access but also to cultivate students' abilities to use digital tools critically, efficiently, and ethically (Zhao et al., 2021). However, despite the increasingly widespread integration of digital platforms, studies show that students' digital engagement often remains superficial and task-oriented, rather than developing into higher-order digital problem-solving or reflective digital citizenship (Castaño Muñoz et al., 2023; Inamorato dos Santos et al., 2023). This condition widens the gap between access and competence, particularly in teacher education, where students are expected to serve as models of digital literacy for their future pupils (Bergdahl et al., 2020). This issue has become increasingly urgent as preservice teachers are expected not only to use digital

technologies effectively but also to prepare future generations for digitally mediated learning environments.

On the other hand, the digitalization of academic activities has created challenges related to workload management (Ibrahim et al., 2025). Students have become increasingly vulnerable to digital overload due to multitasking, fragmented attention, and difficulties in time management within online and hybrid learning environments (Carruana Martín et al., 2023; Ochs et al., 2024). From a self-regulated learning perspective, excessive digital demands consume students' cognitive resources, making it more difficult to prioritize tasks, maintain attention, and complete academic activities efficiently. This situation contributes to the emergence of digital fatigue, where the intensity of technology use ultimately diminishes productivity and well-being. Therefore, workload efficiency, defined as the ability to manage digital tasks effectively, has become an essential issue in the context of digital learning (May & Elder, 2018).

In response to these two challenges, strengthening digital competence and workload efficiency requires pedagogical designs that connect digital learning with real-life experiences. The ability to search, evaluate, and utilize digital information constitutes the core of digital literacy, which determines the quality of students' interactions with technology (Ng, 2012). To enhance relevance, digital literacy must be integrated with practical life experiences that emphasize authentic activities, hands-on engagement, and autonomy. In this context, students are trained to design learning plans, manage academic communication, and solve classroom-related problems through digital platforms as part of authentic academic tasks (Oktarina et al., 2025). This approach fosters learning by doing (Alqadri et al., 2025) and bridges theoretical knowledge with digital practice. However, existing digital literacy approaches predominantly emphasize technical skills rather than authentic academic practices, highlighting the need for a contextual pedagogical approach such as Practical Life-Based Digital Literacy (PLDL), which integrates direct experience, personal relevance, and real-world application (Oktarina et al., 2025; Setuju et al., 2024).

The PLDL model aligns with the DigComp 2.1 framework (Inamorato dos Santos et al., 2023; Mieg et al., 2024; Vuorikari et al., 2022), which conceptualizes digital competence as a multifaceted construct encompassing information literacy, communication and collaboration, content creation, safety, and problem-solving. Within this framework, competence refers not only to the ability to operate technology but also to understanding the reasons for and contexts of its appropriate and efficient use (Rioseco-Pais et al., 2024). However, in this study, PLDL is conceptualized as a pedagogical approach rather than a competence construct. While digital competence refers to students' abilities in using technology effectively and responsibly, PLDL refers to the contextual learning process through which students engage in authentic digital academic practices. Thus, DigComp 2.1 serves as the framework for measuring competence outcomes, whereas PLDL functions as the experiential instructional approach that supports the development of such competence. At the same time, the model addresses the challenge of workload efficiency by promoting digital habits that streamline task management and reduce excessive cognitive effort (Wang et al., 2021). Through structured yet autonomous activities, students learn to balance technological proficiency with cognitive regulation (Cabero-Almenar et al., 2023).

A growing body of research underscores the importance of context-oriented digital literacy. For example, Falloon, (2020) found that hands-on practice enhances autonomy and learning reflection, while Liao et al., (2022) showed that experiential digital learning strengthens students' competence and confidence. However, previous studies have primarily examined digital competence or digital literacy as separate constructs. Evidence regarding whether Practical Life-Based Digital Literacy simultaneously contributes to digital competence and workload efficiency remains limited, particularly in teacher education within developing-country contexts (González-Prida et al., 2024; Zakir et al., 2025), especially in developing countries where technology adoption often outpaces pedagogical adaptation (Scheel et al., 2022).

In Indonesia, particularly within Islamic higher education institutions, the rapid post-pandemic digitalization has not been fully matched by students' ability to manage workload, as reflected in delayed submissions, repeated work, and low levels of critical engagement (Alam Putra et al., 2022; Saleh et al., 2023). The PLDL model, which has been implemented in several teacher education programs, offers an opportunity to examine how real-life-based digital experiences enhance students' competence and efficiency (Kayen & Agustia, 2025; Riswanto et al., 2025), especially when studied in natural settings that reflect authentic variations in learning practices (Susanto et al., 2025). Therefore, this study investigates the relationship between Practical Life-Based Digital Literacy, digital competence, and workload efficiency among preservice teachers in Indonesian Islamic higher education. The findings are expected to enrich the application of the DigComp framework in authentic learning contexts while providing practical implications for designing more contextual digital learning environments in teacher education.

2. METHODS

a. Research Design

This study employed an ex post facto quantitative design to examine the relationship between the Practical Life-Based Digital Literacy (PLDL) approach, students' digital competence, and workload efficiency. The design was selected because PLDL had already been implemented as part of academic learning activities. Therefore, the independent variable was not experimentally manipulated but was observed through naturally occurring variations in students' learning experiences. In this study, PLDL was treated as a pedagogical practice embedded within authentic academic activities rather than as an experimental intervention. The observed PLDL activities included developing lesson plans, managing academic communication through digital platforms, and utilizing digital tools for academic task management.

b. Research Setting and Participants

The study was conducted at two Islamic higher education institutions that implement the PLDL approach in their teacher education programs, namely UIN Sayyid Ali Rahmatullah Tulungagung and UIN Syekh Wasil Kediri. These institutions provide comparable learning environments that emphasize contextualized digital learning through authentic academic tasks, including developing digital teaching materials, engaging in online collaboration, and producing educational content, making them appropriate settings for examining the relationship between PLDL, digital competence, and workload efficiency. A total of 172 students from the Faculty of Education and Teacher Training voluntarily participated in the study. The sample was selected purposively based on the criteria that participants had completed at least one semester of PLDL-based coursework and had experience in practical life based digital literacy activities.

c. Research Variables

The study included one independent variable and two dependent variables, operationalized as follows:

Table 1. Research Variables

Variable	Instrument/Indicators
Practical Life-Based Digital Literacy (PLDL)	Questionnaire items were adapted from DigComp 2.1 and contextualized into practical life activities across four domains: (1) Information and Data Literacy, such as searching, organizing, and evaluating materials; (2) Communication and Collaboration through effective use of digital platforms; (3) Digital Safety, including privacy and ethical awareness; and (4) Digital Problem-Solving, reflected in students' ability to independently resolve technological challenges
Digital Competence	Self-assessment items adapted from DigComp 2.1 emphasize practical application across four areas: (1) Technical and Creative Skills for digital tool

	use and content creation; (2) Cognitive and Critical Skills for evaluating information and applying concepts; (3) Ethical and Collaborative Skills for safe, responsible, and cooperative digital engagement; and (4) Reflective and Adaptive Skills for confidence, adaptability, and ongoing improvement in digital contexts.
Workload Efficiency	Indicators adapted from NASA-TLX and self-regulated learning constructs focus on: (1) Task Management Efficiency, including speed, balance, and time optimization; (2) Cognitive Load Reduction, reflected in lighter perceived workload and reduced mental effort; and (3) Flexibility and Adaptability, capturing students' ability to adjust and manage academic demands through digital tasks

According to Table 1, the independent variable was Practical Life-Based Digital Literacy (PLDL), defined as students' engagement in contextual, experiential, and reflective digital learning activities integrated with practical life elements. The two dependent variables were digital competence, referring to students' ability to access, evaluate, create, and communicate digital information effectively, and workload efficiency, defined as students' perceived ability to manage digital academic tasks, time, and cognitive effort more effectively after experiencing PLDL-based learning. Although both PLDL and Digital Competence were developed with reference to the DigComp 2.1 framework, the two constructs differ conceptually and operationally. PLDL was conceptualized as a pedagogical and contextual learning approach reflecting students' engagement in authentic digital academic practices, whereas Digital Competence referred to students' individual capabilities in using digital technology effectively, critically, and responsibly.

d. Instruments and Data Collection

Data were collected through a structured questionnaire administered via Google Forms, encompassing three primary scales: PLDL, Digital Competence, and Workload Efficiency. The instrument development was theory-driven, with item construction based on the conceptual dimensions of DigComp 2.1 (Carretero & Urban, 2017) for PLDL and Digital Competence, and NASA-TLX (Hart & Staveland, 1988) for Workload Efficiency, thereby ensuring alignment between the measurement items and their underlying constructs. The instruments were validated through expert judgment by three specialists and subsequently piloted with 30 students to assess statistical validity and reliability.

Pearson's test at $\alpha = 0.05$ indicated that all items were valid (r-calculated > 0.4227), accompanied by high reliability across the three scales (α = 0.845; 0.847; 0.844), consistent with strong internal consistency standards (Van Tam et al., 2023). Normality testing using the One-Sample Kolmogorov–Smirnov procedure yielded Exact Sig. values of 0.286 and 0.383 (> 0.05), demonstrating that the residuals were normally distributed; this finding was further supported by residual means approaching zero and standard deviations ranging from 2.96 to 2.97. Therefore, the instrument is empirically validated, reliable, and meets the required statistical assumptions, rendering it appropriate for use in the main data collection (Hair et al., 2019).

e. Data Analysis Procedures

Data analysis was conducted in sequential stages using SPSS 24. The first stage involved descriptive statistics to obtain the mean, standard deviation, and frequency distribution. Students' digital literacy levels were classified into five categories (very low, low, moderate, high, and very high) using the ideal score range method adapted from psychometric score categorization procedures. Since the instrument consisted of 13 items measured on a five-point Likert scale, the possible total scores ranged from 13 to 65. The interval width for each category was calculated by dividing the theoretical score range by the number of categories: (65 − 13) / 5 = 10.4. This procedure produced statistically and

theoretically grounded score intervals for interpreting students' digital literacy levels. Based on this calculation, the score classifications were determined as follows: 13.0–23.4 = Very Low, 23.5–33.8 = Low, 33.9–44.2 = Moderate, 44.3–54.6 = High, and 54.7–65.0 = Very High.

The second stage examined prerequisite assumptions prior to inferential testing, including the Shapiro–Wilk normality test (all variables met the criteria, $p > 0.05$), multicollinearity using Pearson correlations (all values < 0.80), and variance homogeneity using Levene's Test. Levene's results indicated non-homogeneous variances for digital competence ($p = 0.017$) and workload efficiency ($p = 0.000$), leading to the use of the Games–Howell post hoc test, which is appropriate when variances are unequal (Field, 2022).

The final stage employed MANOVA to assess the simultaneous effect of PLDL on digital competence and workload efficiency, interpreted using Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root at a 5% significance level ($p < 0.05$). This was followed by univariate ANOVA and effect size calculations (η^2) using thresholds of 0.01, 0.06, and 0.14 to categorize small, medium, and large effects (Cohen, 2021). This multivariate approach provides a comprehensive understanding of how practical life–based digital literacy experiences within the PLDL model enhance students' competence and their ability to manage academic workload more efficiently.

3. FINDINGS AND DISCUSSION

3. 1. Descriptive Analysis of Students' Digital Literacy Competence

The assessment of students' digital literacy competence was developed based on five core domains adapted from the European DigComp 2.1 Framework: (1) information and data literacy (3 items), (2) communication and collaboration (3 items), (3) digital content creation (3 items), (4) safety and digital security (2 items), and (5) problem-solving in digital environments (2 items). All items were measured using a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree), resulting in a possible total score range of 13 to 65.

Descriptive analysis was conducted to understand the distribution of students' responses regarding their experience with *Practical Life-Based Digital Literacy (PLDL)*, their *digital competence*, and *workload efficiency*.

Table 2. Descriptive Statistics of Each Variable

Variable	N	Mean	SD	Score Interval	Category
PLDL Experience	172	51.42	6.08	44.3–54.6	High
Digital Competence	172	49.63	6.22	44.3–54.6	High
Workload Efficiency	172	48.21	6.37	44.3–54.6	High

As shown in Table 2, the average score for PLDL experience (M = 51.42) and digital competence (M = 49.63) fell within the "high" category, indicating that students perceived practical, real-life-based digital activities as significantly integrated into their learning. Meanwhile, workload efficiency (M = 48.21) was in the high range, suggesting that students experienced improved task management through digital tools.

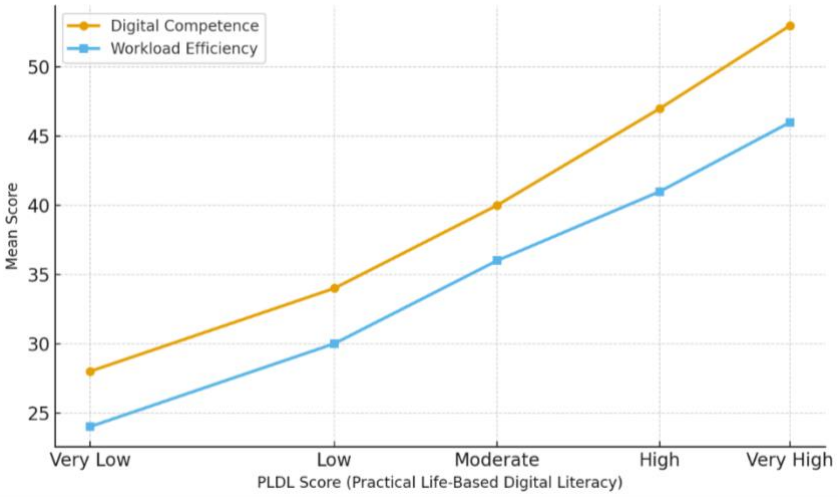

Fig. 1. Trends in Digital Competence and Workload Efficiency across PLDL Levels

Figure 1 demonstrates an increasing trend in digital competence and workload efficiency as PLDL levels rise. Students with higher PLDL scores tended to possess better digital competence and more effective abilities in managing academic workload, indicating a positive relationship among the variables. The relatively parallel line patterns reflect a proportional and consistent relationship, while minor fluctuations represent natural individual variation. These findings suggest that PLDL functions not merely as a digital literacy activity, but as a contextual pedagogical approach that integrates authentic academic routines, reflective digital engagement, and practical task management within learning experiences. These findings confirm that PLDL plays a role in bridging digital competence and workload efficiency through authentic learning experiences, in line with the studies of Riina Vuorikari et al., (2022) and Zhao et al., (2021), which emphasize the importance of task-based digital environments in promoting meaningful technology use. This result is further supported by Inamorato dos Santos et al., (2023), who found that real-life digital practices contribute to improved self-regulation and students' time management. Therefore, these descriptive findings provide preliminary evidence of the pedagogical potential of PLDL in fostering sustainable and skills-oriented digital engagement in higher education.

3. 2. Effect of Practical Life-Based Digital Literacy on Students' Digital Competence and Workload Efficiency

This visual pattern is statistically supported by the results of the Analysis of Variance (ANOVA), as presented in Table 3.

Table 3. ANOVA Results: Effect of PLDL on Digital Competence

Source	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3209.543	28	114.627	12.636	.000
Within Groups	1297.224	143	9.071		
Total	4506.767	171			

The analysis yielded an F-value of 12.636 with a significance level of $p < 0.001$, indicating that the variations in digital competence among student groups are significantly associated with their level of PLDL engagement. The relatively high Between-Groups Sum of Squares (3209.543) compared to the Within-Groups variance (1297.224) reinforces the interpretation that the observed differences are not random but systematically related to the implementation of PLDL. These results affirm that PLDL effectively bridges the gap between digital literacy theory and applied practice, leading to measurable improvements in student performance. Because digital competence and workload efficiency are

conceptually related dependent variables, MANOVA was subsequently conducted to examine their simultaneous relationship with PLDL.

The consistency between the graphical trends and statistical results in this study confirms that higher engagement in PLDL is associated with significant improvements in digital competence and academic efficiency, as also reported by (Kayen & Agustia, 2025) in teacher education contexts. Pedagogically, PLDL emerges as a transformative model that cultivates both technical skills and adaptive learning habits, preparing prospective teachers to become critical, reflective, and ethical technology users in digital education ecosystems, in line with the experiential learning framework (Kolb, 1984)and constructivist approaches in higher education. These results are in line with May & Elder, (2018) who highlight the role of reflective digital literacy in academic workload management.

3. 3. Simultaneous Effect of PLDL on Digital Competence and Workload Efficiency (MANOVA Results)

A Multivariate Analysis of Variance (MANOVA**)** was conducted to determine whether PLDL simultaneously influenced both dependent variables: digital competence and workload efficiency. The summary results are displayed in Table 4.

Table 4. MANOVA Multivariate Tests

Effect	Test	Value	F	Hypothesis df	Error df	Sig.
Intercept	Pillai's Trace	.988	5834.302	2	142	.000
	Wilks' Lambda	.012	5834.302	2	142	.000
X1 (PLDL)	Pillai's Trace	.933	4.469	56	286	.000
	Wilks' Lambda	.220	5.737	56	284	.000
	Hotelling's Trace	2.845	7.163	56	282	.000
	Roy's Largest Root	2.574	13.145	28	143	.000

Table 4 shows that all multivariate criteria, Pillai's Trace, Wilks' Lambda, Hotelling's Trace, and Roy's Largest Root, yield $p < 0.001$, confirming the simultaneous effect of PLDL on digital competence and workload efficiency. The model explains 71.2% of the variance in digital competence and 57.8% of the variance in workload efficiency, consistent with the ANOVA and MANOVA results as well as prior findings (Hasanah et al., 2024; Spante et al., 2018). The graph presented in Figure 3 displays parallel positive trends, supporting (Kolb, 1984) experiential learning theory. The stronger response in digital competence indicates that PLDL activities, such as project documentation, online collaboration, and ethical reflection, are closely associated with skill development while also improving workload efficiency. Furthermore, the significant PLDL, workload efficiency relationship reinforces literature linking digital literacy with self-regulation and time management (Ibrahim et al., 2024; Scheel et al., 2022; Yuan et al., 2024; Zakir et al., 2025).

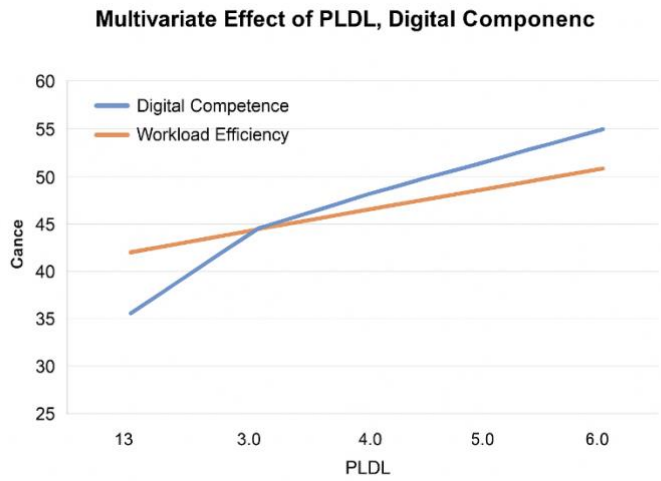

Fig. 3. Multivariate Effect of Practical Life-Based Digital Literacy (PLDL) on Digital Competence and Workload Efficiency

The line graph (Fig. 3) illustrates a consistent positive relationship between Practical Life-Based Digital Literacy (PLDL), digital competence, and workload efficiency, with both variables increasing alongside higher PLDL levels, and with greater sensitivity observed for digital competence. This visual pattern aligns with the MANOVA results ($p < .001$), which confirm a significant multivariate effect and show that PLDL explains 71.2% of the variance in digital competence and 57.8% of the variance in workload efficiency, indicating strong predictive power for both skill development and task efficiency.

These findings underscore that contextual and experience-based digital literacy effectively enhances students' competence and productivity, while pedagogically positioning PLDL as an integrative instructional framework that develops both instrumental and transformative competencies. These include technical proficiency, information management, digital content production, ethical awareness, critical reflection, and creative problem-solving (Ferrari et al., 2013; Hasanah et al., 2022), thereby preparing future teachers to model responsible and innovative digital practices.

These findings suggest that digital literacy initiatives in teacher education should move beyond technological access and procedural tool use toward more reflective, contextual, and workload-oriented digital learning practices. Such outcomes align with the objectives of Indonesia's National Digital Literacy Movement (KOMINFO, 2021) and resonate with global initiatives emphasizing sustainable and human-centered digital education (Inamorato dos Santos et al., 2023; Mieg et al., 2024; Rioseco-Pais et al., 2024; UNESCO, 2022).

The implications for curriculum design are substantial. Digital literacy training in teacher education should emphasize authentic, contextual, and experience-oriented digital learning practices grounded in real academic problem-solving situations. As demonstrated by Dewanti, (2025), contextual and integrative learning environments effectively foster students' critical engagement, reflective practice, and self-directed learning. These pedagogical mechanisms align with the principles of PLDL, which integrates digital competence with authentic academic practices to support lifelong learning readiness and adaptive digital engagement in 21st-century education.

4. CONCLUSION

This study confirms that the Practical Life-Based Digital Literacy (PLDL) framework significantly enhances students' digital competence and workload efficiency. Consistent engagement with PLDL leads to more robust digital skills and improved task management, with statistical analyses indicating that PLDL accounts for 71.2% of the variance in digital competence and 57.8% in workload efficiency. These effects are strengthened by experiential components such as collaboration, ethical technology

use, and reflective practice. Accordingly, the study recommends embedding PLDL-based experiential tasks into coursework, strengthening mentoring for ethical and responsible digital practices, and developing project-based assessments aligned with authentic professional demands. Future research should explore the long-term influence of PLDL on teaching readiness and technology integration in classroom settings.

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