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Project-Based Learning Model in Productive Digital Literacy Training

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Abstract

Background - The low level of productive digital literacy skills among equality education learners in Community Learning Centers (CLC) has become a major challenge to community empowerment in the digital era. Digital literacy training in CLC is still conventional, lecture-centered, and lacks contextual relevance.
Research Urgency - Non-formal education institutions need innovative and participatory learning models to strengthen digital competence and creativity among learners. However, existing digital literacy programs remain limited to basic operational skills and have not yet developed productive digital capabilities.
Research Objectives - This study aims to develop a productive digital literacy training model based on Project-Based Learning (PjBL) that is innovative, participatory, and contextually appropriate for equality education learners in CLC.
Research Method - The research used a modified Borg and Gall Research and Development (R&D) model, consisting of nine stages: preliminary study, planning, initial product development, expert validation, limited trial, first product revision, large-scale trial, second product revision, and dissemination. The research subjects were equality education learners from three CLC in West Bandung Regency.
Research Findings - The findings show that learners' productive digital literacy skills were initially low, particularly in content evaluation, knowledge construction, and digital content creation. The developed PjBL model was validated as highly feasible (average score of 82.7%). Model implementation demonstrated good adherence to the PjBL syntax (85.2%) and positive responses from both learners and tutors (85.3%). The large-scale trial showed a 25.4% improvement in digital literacy, with N-Gain values categorized as moderate to high..
Research Conclusion - The PjBL-based training model effectively enhances the productive digital literacy skills of CLC learners, promoting active learning and digital creativity in non-formal education settings..
Research Novelty/Contribution - This study contributes theoretically by integrating the PjBL framework into digital literacy training within non-formal education, and practically by offering an applicable model for CLC institutions, policymakers, and community educators to improve digital empowerment programs.

Keywords: productive digital literacy; project-based learning; community learning center; non-formal education; empowerment society.

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INTRODUCTION

The rapid advancement of digital technologies in the era of Industry 4.0 and Society 5.0 has significantly transformed how individuals learn, communicate, and participate in society. Digitalization not only demands technical skills but also the ability to use technology creatively, critically, and responsibly (Vuorikari et al., 2022). In this context, digital literacy is no longer limited to accessing and consuming information; it encompasses productive competencies that enable individuals to create, collaborate, and innovate using digital tools (Ilomäki et al., 2016). Productive digital literacy represents a higher level of digital competence that empowers citizens to become producers rather than mere consumers of digital content (Aviram & Eshet-Alkalai, 2020; Pangrazio, 2019). Recent studies further emphasize the role of project-based learning as a means to develop citizens' digital creativity and self-efficacy (Dana, 2025; Nguyen, 2020). According to (Alvarez & Reigeluth, 2020), learner-centered approaches in digital literacy education promote autonomy and reflective learning, which are crucial in community education contexts. Digital transformation in community learning settings also requires adaptive strategies that integrate technology and collaboration (Armawi et al., 2021; Ulaini & Fitrisia, 2025). These developments indicate that project-based learning offers an effective pathway for cultivating productive digital literacy among adult (Detlor et al., 2022).

In Indonesia, internet penetration has reached more than 78% of the population (APJII, 2023), indicating strong access to digital resources. However, several studies show that internet usage among learners is still dominated by entertainment and social networking rather than productive or educational purposes (Tinmaz et al., 2022). This pattern reflects a persistent gap between access and meaningful use of technology (Isrok'atun et al., 2022). The challenge becomes even more critical in non-formal education settings, especially Community Learning Centers (CLC), where equality education learners often have limited exposure to structured digital literacy training (Ambarini et al., 2025; Reddy et al., 2023). Existing programs tend to focus on basic operational skills and lack contextual, project-oriented approaches that could transform digital learning into community empowerment tools (Hair et al., 2019; Sahjat et al., 2025).

According to Saripah & Shantini (2016) , non-formal education programs, particularly in Community Learning Centers (CLC) , face significant barriers to integrating digital literacy into their curricula, often due to limited resources and lack of training for instructors. She emphasizes the need for more comprehensive and context-specific educational strategies to enhance digital competencies among marginalized learners. To bridge this gap, learning models that foster active participation and contextual engagement are needed. One promising approach is Project-Based Learning (PjBL), which encourages learners to design, execute, and present projects that address real-life issues (Hmelo-Silver, 2017; Kokotsaki et al., 2016; Roberts et al., 2017). PjBL emphasizes learner autonomy, collaboration, and creativity, aligning well with the goals of productive digital literacy (Lee et al., 2023; Sahjat et al., 2025). Previous research in formal education has shown that PjBL effectively enhances problem-solving, critical thinking, and digital competence (Saputro & Pritasari, 2025; Yunita et al., 2025). However, its application in non-formal education contexts, particularly in Community Learning Centers (CLC), remains underexplored (Hilmi et al., 2021; Tinmaz et al., 2022). This gap highlights the need to adapt and test the PjBL model to suit the learning characteristics and local contexts of Community Learning Centers (CLC) participants.

Based on this background, the present study aims to develop and validate a Project-Based Learning model for productive digital literacy training in Community Learning Centers (CLC) in West Bandung Regency. The model is expected to provide an innovative, participatory, and effective approach for enhancing the productive digital literacy skills of equality education learners. The study contributes both theoretically by extending the use of PjBL to non-formal digital literacy contexts and practically by offering a model that Community Learning Centers (CLC) institutions can implement to strengthen community empowerment through digital skills.

The DigComp framework serves as a foundation for understanding digital competence dimensions among citizens (Carretero et al., 2020). Earlier models, such as DigComp 2.1, have outlined the importance of

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lifelong learning and adaptability in digital environments Vuorikari et al., (2022) and European Commission. Joint Research Centre. Institute for Prospective Technological Studies (2012) emphasizes that digital competence must be contextualized within practical and social frameworks, focusing not only on access but also on empowerment and creativity. (Tondeur et al., 2021) further argue that integrating digital competence frameworks into both teacher and learner education enhances sustainable digital skills development. In the context of community-based education, empowering adult learners through digital projects can increase participation, collaboration, and self-confidence (Van Der Stap et al., 2024).

This study contributes theoretically, methodologically, and practically to digital literacy and non-formal education research. Theoretically, it extends Project-Based Learning (PjBL) into the domain of productive digital literacy for adult learners in Community Learning Centers (CLC), an underexplored context in existing studies. Methodologically, the study validates a PjBL-based model aligned with the DigComp framework and adapted to the learning characteristics and socio-cultural context of non-formal education. Practically, the model offers an applicable guideline for CLC institutions to shift digital literacy programs from basic technical skills toward productive, creative, and participatory digital practices that support learner empowerment and community development.

METHODS

This study employed a Research and Development (R&D) approach to design, validate, and implement a Project-Based Learning (PjBL) model aimed at enhancing productive digital literacy in Community Learning Centers (CLC). The research utilized a modified Borg and Gall model (Gall et al., 2007), adapted specifically to the context of non-formal education and the unique characteristics of community learners. The model development process followed nine stages: (1) preliminary study, (2) planning, (3) initial product development, (4) expert validation, (5) limited trial, (6) first product revision, (7) large-scale trial, (8) second product revision, and (9) dissemination. This systematic procedure ensured that the developed model was both theoretically grounded and empirically validated (Sugiyono, 2019; Tuckman, 2012).

According to Gall et al. (2007) and Tuckman (2012), the iterative nature of the R&D process ensures the continuous refinement of educational models based on empirical feedback and expert validation. Moreover, the application of the PjBL model in non-formal settings has been shown to improve learners' engagement and critical thinking (Bell, 2010; Hmelo-Silver, 2017).

Research design

The modified Borg and Gall design was selected because it combines theoretical analysis with field validation, allowing for iterative development and refinement of the learning model (Pratama et al., 2024; Sugiyono, 2019). This design emphasizes the practical applicability of educational innovations and is suitable for non-formal education settings where contextual relevance is essential. The final output of this study was a validated and effective PjBL model aimed at enhancing learners' productive digital literacy competencies.

The research was conducted in three Community Learning Centers (CLC) located in West Bandung Regency, involed CLC Bina Terampil Mandiri (Cisarua), CLC Cahaya Kahuripan Bangsa (Lembang), and CLC Daarul Fiqri. These institutions were chosen based on their active involvement in equality education programs and digital literacy training. Participants included 40 equality education learners (aged 15–25 years) enrolled in Package C programs. The selection considered learners' familiarity with digital tools and their need for productive digital literacy enhancement.

The research procedure followed nine stages of the modified Borg and Gall model, such as: 1) Preliminary Study: Needs assessment, literature review, and field observation to identify gaps in current digital literacy practices. 2) Planning: Formulation of learning objectives, model components, and design of research instruments. 3) Initial Product Development: Creation of the first prototype of the PjBL-based training module, tutor guidebook, and learning materials. 4) Expert Validation: Evaluation by three educational experts and two

Community Learning Centers (CLC) practitioners on content validity, practicality, and relevance. 5) Limited Trial: Pilot testing with 10 learners to identify implementation challenges. 6) First Product Revision: Refinement of model components based on validation and pilot feedback. 7) Large-Scale Trial: Implementation in three Community Learning Centers (CLC) with 30 learners to test consistency and effectiveness. 8) Second Product Revision: Adjustment of the model for broader applicability. And Dissemination: Presentation and documentation of the final model for wider use among Community Learning Centers (CLC) and education stakeholders. This structured procedure ensured the credibility, practicality, and sustainability of the developed model (Ambarini et al., 2025).

Data were collected using multiple methods to ensure triangulation (Miles et al., 2018), covering 1) Interviews: Conducted with tutors, learners, and Community Learning Centers (CLC) managers to identify digital literacy challenges and needs. 2) Observation: Used to assess learner engagement and implementation of the PjBL syntax during training. 3) Questionnaires: Administered to measure learners' and tutors' responses to the developed model. 4) Tests: Pre-test and post-test to measure improvement in productive digital literacy skills, and 5) Expert Validation Sheets: Used to determine model validity in terms of content, media, and evaluation. The instruments included Interview guidelines for exploring needs and experiences, Observation sheets for monitoring PjBL implementation, Digital literacy tests covering five dimensions (searching, navigation, evaluation, knowledge construction, and content creation) (Vuorikari et al., 2022), Validation forms for expert review, and Participant response questionnaires using a 4-point Likert scale.

Data analysis involved both qualitative and quantitative methods. Which conducted Qualitative data from interviews and observations were analyzed through reduction, display, and conclusion drawing (Miles et al., 2018), also Quantitative data (validation scores, test results, and questionnaire responses) were analyzed using percentage averages and N-Gain to determine improvement levels (Shieh, 2020). To ensure validity and reliability, triangulation was applied through multiple data sources (learners, tutors, CLC managers) and methods (observation, interviews, and tests). Expert judgment was also employed to confirm the alignment of instruments and model design with theoretical and practical standards (Pratama et al., 2024; Sugiyono, 2019)

RESULTS AND DISCUSSION

This section presents and discusses the findings of the study based on a systematic analysis of learners' needs, model development, implementation, and effectiveness in improving productive digital literacy in Community Learning Centers (CLC). The discussion integrates empirical data from observations, interviews, validation results, and learning outcome measurements with relevant theoretical and empirical studies on digital literacy and project-based learning. By combining descriptive and inferential analysis, this section aims to explain not only *what* was found, but also *why* the findings occurred and *how* they contribute to the broader discourse on digital literacy development in non-formal education contexts.

Needs Analysis

Initial findings show that the level of productive digital literacy among Community Learning Centers (CLC/ Pusat Kegiatan Belajar Masyarakat) learners is still low in almost all indicators measured. Although most learners have access to devices and internet connections, the use of these digital devices is more directed towards entertainment and social media interaction than for learning or producing educational content. This pattern is in line with the 2023 APJII report, which reveals that more than 70% of internet users in Indonesia use the internet primarily for entertainment (APJII, 2023). Similar results were also found in studies by Tinmaz et al. (2022) and Isrok'atun et al. (2022), which showed that the level of digital engagement among community learners tends to be consumptive for example, watching videos, playing games, or following social media trends and has not yet developed into productive skills such as learning content creation, digital-based problem solving, or online collaboration.

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In-depth interviews with tutors and Community Learning centers administrators revealed that this low level of productive digital literacy is inseparable from the lack of structured training programs that specifically integrate digital literacy with community-based projects. Learning activities that have taken place so far are generally still classical in nature and limited to the delivery of basic material, so they do not provide enough space for learners to experiment, collaborate, and use technology creatively. A less participatory learning approach and minimal collaborative activities are also factors that hinder the development of more meaningful digital competencies.

The results of this study confirm previous findings that emphasize the importance of implementing project-based learning models oriented towards solving real problems in the context of community education (Reddy et al., 2023; Ambarini et al., 2025). Such learning models are believed to encourage learners to use technology more productively, increase their sensitivity to community needs, and strengthen their ability to utilize various digital applications for activities relevant to their daily lives. Thus, improving productive digital literacy in Community Learning Centers (CLC) requires not only the provision of access to technology, but also systematic, contextual, and empowering learning designs (Maspupah et al., 2025).

Characteristics of the Developed Model

The productive digital literacy model based on Project-Based Learning (PjBL) is designed as a pedagogical approach that aims to shift the role of learners from mere recipients of information to active and creative producers of digital content. This model is structured through six systematic stages, namely: (1) problem orientation, (2) project planning, (3) project implementation, (4) monitoring and mentoring, (5) evaluation and reflection, and (6) product presentation. Each stage is designed in line with the principles of constructivist learning theory, which emphasizes the importance of independent learning, collaboration, and learner engagement in real contexts (Kolb, 2015; Vygotskij & Cole, 1981; Elyana et al., 2025). Thus, learners are not only guided to understand the concept of digital literacy theoretically, but also to relate it to the needs, challenges, and potential of the social environment in which they live.

The implementation of this model encourages learners to work in small groups to produce useful digital products, such as thematic blogs, educational videos, and digital posters based on social campaigns. These collaborative activities not only train technical skills, but also develop critical thinking, time management, and communication skills among group members. During the monitoring and mentoring stage, tutors act as facilitators who provide guidance, feedback, and technical support as needed by the group. Meanwhile, the evaluation and reflection stage provides space for learners to assess their work processes and results, while identifying areas for improvement.

Expert validation results show that this model has a very high level of feasibility with an average score of 82.7% and is in the “very good” category. The aspect that received the highest score was content relevance, which confirms that the model components are in line with the demands of productive digital literacy and the characteristics of project-based learning. However, experts provided input to strengthen the completeness of the evaluation instrument so that the product assessment and learning process would be more comprehensive. This finding is in line with the validation results of various previous PjBL model developments, which also highlighted the need for improvements in the evaluation aspect (Kokotsaki et al., 2016; Pratama et al., 2024). Thus, the developed model is not only feasible for use but also has a strong theoretical and empirical basis for application in enhancing productive digital literacy in non-formal education settings. The detailed results of expert validation are presented in Table 1.

Table 1. Expert Validation Results of PjBL Model

Aspect	Validator 1	Validator 2	Mean (%)	Category
Content relevance	84.0	83.0	83.5	Very Good
Evaluation component	81.0	82.0	81.5	Very Good

Aspect	Validator 1	Validator 2	Mean (%)	Category
Practicality and usability	82.5	84.0	83.3	Very Good
Language clarity	82.0	83.0	82.5	Very Good
Layout and readability	82.0	82.0	82.0	Very Good
Average			82.7	Highly Feasible

Implementation of the Model

The developed model was implemented in three Community Learning Centers (CLCs), involving a total of 30 learners as participants. The implementation of the model followed all six stages of PjBL as designed, and the observation results showed that each stage could be applied effectively in the field. Overall, the model's implementation level scored an average of 85.2% and was categorized as "good," indicating that the model's structure can be operationalized in the context of non-formal education with a high level of consistency. In the problem orientation and project planning stages, the learners showed increasing ability to identify issues relevant to their environment and to design work plans that could be realized through the use of digital media.

During the project implementation phase, learners were seen actively searching for information online, processing digital sources, and utilizing various devices and applications to compile content. Collaborative activities that took place through digital platforms such as group discussions, document sharing, and task coordination, reflected their increased ability to work synergistically. This shows that the model is able to encourage learners to move from a pattern of information consumption to a more meaningful practice of digital content production. Tutors in this process play the role of facilitators, rather than dominant instructors. They provide assistance as needed, give feedback, facilitate technical problem solving, and strengthen the digital creativity of the learners (Wahyudin et al., 2019). Details of tutor and learner evaluations are presented in Table 2.

Table 2. Implementation Evaluation by Tutors and Learners

Indicator	Mean Score (%)	Category
Implementation of PjBL syntax	85.2	Good
Learner participation and engagement	84.7	Good
Tutor facilitation and guidance	85.5	Good
Collaborative project outcomes	85.8	Good
Average	85.3	Good

The results are in line with findings by Hmelo-Silver (2017) and Lee et al. (2023), which demonstrate that project-based learning improves critical thinking, communication, and digital content creation. Similarly, Tinmaz et al. (2022) found that PjBL implementation in Community Learning Centers increases learner motivation and engagement. These consistent results confirm that contextual, project-oriented learning is effective even in non-formal education environments (Ilyas, et al., 2025).

The evaluation and reflection stage conducted at the end of the cycle showed that learners had a good level of participation in assessing the products they produced and the learning process they underwent. They were able to identify the strengths and weaknesses of their work and suggest improvement strategies for future activities. In general, the results of the implementation evaluation confirm that the model is not only applicable, but also successful in creating a more active, collaborative, and productive learning experience for Community Learning Centers learners. Thus, this model has strong potential to be further developed as a strategy for improving productive digital literacy in community education.

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Effectiveness of the Model

The effectiveness of the learning model developed in this study was evaluated through a series of pre-test and post-test assessments focused on students' productive digital literacy skills. The measurement results showed an average increase of 25.4%, indicating that the learning intervention had a significant impact on improving students' ability to produce digital content critically and creatively. This improvement was also reflected in the N-Gain scores, which were in the moderate to high category, reinforcing the finding that the learning model had stable effectiveness across the various ability indicators measured. In particular, the aspect of digital content creation showed the most prominent increase, namely 30.6%. This finding is important considering that the ability to produce digital content is at the core of productive digital literacy, as emphasized by Vuorikari et al. (2022) and Pangrazio, (2019), who view this competency as an indicator of the transformation from mere consumers of information to active creators in the digital ecosystem.

In addition, a 26.3% increase in knowledge construction indicates that students are not only skilled in operating digital devices, but also capable of constructing new knowledge through collaborative and reflective processes. This shows that the learning model is able to facilitate a deeper integration of conceptual understanding with digital practices. On the other hand, the content evaluation aspect increased by 24.8%, showing that students' ability to assess the quality, relevance, and credibility of digital information has also developed significantly. This ability is essential because productive digital literacy requires not only the ability to create but also the ability to critique information circulating in an increasingly complex digital space.

Overall, the findings of this study show that the implemented learning model has succeeded in encouraging students to move from a passive position as information users to an active role as digital content producers. This transformation confirms the success of the model in fostering comprehensive productive digital literacy skills that are relevant to the demands of the current digital era and in line with the contemporary digital literacy theoretical framework that emphasizes the importance of empowering users to create value through digital technology. Details of pre-test and post-test improvements are shown in Table 3.

Table 3. Improvement of Productive Digital Literacy (N-Gain Test)

Digital Literacy Aspect	Pre-test Mean	Post-test Mean	N-Gain	Category
Content evaluation	61.4	76.2	0.41	Moderate
Knowledge construction	59.8	75.5	0.43	Moderate
Digital content creation	58.5	76.3	0.45	Moderate–High
Average	59.9	76.0	0.43	Moderate–High

The significant improvement also supports the idea that project-based activities enhance intrinsic motivation and collaborative learning (Saputro & Pritasari, 2025; Yunita et al., 2025). Learners reported that the training helped them gain practical digital skills applicable to real-life contexts, including content marketing and community campaigns. Tutors similarly observed improved learner independence and creativity, aligning with prior research that emphasized PjBL's effectiveness in building 21st-century competencies (Bell, 2010; Sahjat et al., 2025)

The research findings strengthen the argument that integrating PjBL with digital literacy training provides a dual benefit: enhancing learners' technical proficiency while fostering creativity and collaboration. These findings resonate with constructivist theory (Dewey, 1938; Vygotsky, 1978) which suggests that learning is most effective when learners actively construct knowledge through meaningful experiences. Earlier research by Sudiapermana et al., (2025) in Community Learning Centers (CLC) settings found a significant positive relationship between digital literacy and digital awareness among adult learners. Compared with previous studies, this research extends the application of PjBL to non-formal education contexts, proving its effectiveness in empowering community learners through productive digital practices. Similar research in

formal schools by (Thomas, 2000) and (Hmelo-Silver, 2017) showed comparable gains in creativity and collaboration, confirming that the PjBL framework is universally adaptable across educational settings. The contextual nature of the model ensures sustainability and relevance, as it allows Community Learning Centers (CLC) to integrate real community problems into digital project themes an approach supported by Reddy et al., (2023) and Pratama et al., (2024).

The integration of project-based learning (PjBL) with digital literacy training in this study shows that the two not only run parallel but also reinforce each other. PjBL encourages learners to actively engage in designing, executing, and reflecting on projects that are relevant to their daily lives, while digital literacy provides a set of technical and critical skills needed to execute these projects productively. These findings are in line with the constructivist perspective, which emphasizes that knowledge is actively constructed through meaningful and contextual learning experiences, rather than simply transferred unidirectionally from the tutor to the learners (Firdaus & Ansori, 2019). Research by Arafah et al. (2023) shows that the application of constructivist principles in learning contributes to higher cognitive and affective engagement, as learners are involved in the process of constructing meaning through challenging collaborative activities. The findings of a meta-analysis by Wigati et al. (2023) also confirm that digital literacy has a significant influence on improving the quality of learning, with an effect size in the high category, so that the integration of digital literacy into learning design can no longer be seen as a complement, but as the core of 21st-century learning strategies.

Compared to previous studies in the context of formal education, the results of this study expand the empirical evidence that PjBL is effective in developing creative, collaborative, and digital literacy skills at various levels and settings of education. Safitri & Alatas (2025) show that the application of digital literacy-oriented PjBL in descriptive text learning in junior high schools can increase student engagement in accessing, analyzing, and producing digital content creatively and contextually. Similarly, a study by Oktaviana and Oriyani (2025) found that PjBL effectively improves the digital literacy and creativity skills of elementary school students, especially through collaborative projects that require problem solving and technology-based idea exploration. At the madrasah ibtidaiyah level, Faridah et al. (2022) proved that PjBL has a significant effect on numeracy and digital literacy skills, confirming that this model is capable of integrating cognitive, technical, and social aspects into a single, comprehensive learning experience.

These results are reinforced by the findings of Meriatami et al. (2025), which emphasize that the integration of PjBL with digital literacy reinforcement contributes to the character building of students, particularly in terms of responsibility, discipline, and the ability to work together when students have to complete digital projects in groups. Recent experimental research on deep learning-based PjBL in the context of science also shows a significant improvement in students' scientific and critical thinking skills, indicating that PjBL is relevant to various higher-order competency domains that are highly needed in the digital era (Firdaus & Robandi, 2021).

The main contribution of this study lies in expanding the application of PjBL to the realm of non-formal education, particularly Community Learning Centers (CLC), which has been relatively untouched by studies based on innovative learning models. In Community Learning Centers (CLC), learners are generally adults or teenagers who have life experiences, practical needs, and time constraints that differ from those of formal school students. The results of research by Dana, (2025) show that the development of digital literacy competencies of learners in CLC through structured training can improve their skills in using ICT productively, including participation in digital spaces and the use of the internet for job opportunities. Research by Akbar & Wijaya (2024) on rural communities also found that although the digital infrastructure gap remains an obstacle, people in rural areas demonstrate relatively good digital ethics and culture, while technical skills still need to be strengthened through contextual educational interventions.

In this context, the digital literacy-based PjBL developed in this study provides a framework that enables CLC learners to produce digital works that are relevant to the needs of the community, such as promotional content for micro businesses, digital financial literacy campaigns, or documentation of local

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potential, so that digital literacy does not stop at the level of device use, but rather transforms into productive practices that have an impact on socio-economic empowerment (Mulyono, 2018). This is in line with the digital literacy research map in Indonesia, which shows a shift in focus from mere access to technology to strengthening the critical, ethical, and transformative dimensions of its use in the context of education and community. Institutionally, the digital literacy-based PjBL model developed in this study is also in line with the National Digital Literacy Movement (GNLD) policy launched by the Ministry of Communication and Information Technology. A study by Banyu Hikmah et al. (2024) shows that GNLD contributes significantly to increasing public awareness and digital literacy skills, especially in urban areas, despite still facing challenges in the form of unequal access to technology and low digital literacy in some vulnerable groups.

By utilizing PjBL, Community Learning Centers (CLC) can implement the four pillars of GNLD digital literacy (digital skills, digital culture, digital ethics, and digital security) into project themes that are directly taken from real issues in society, so that national programs do not just stop at campaigns, but have an impact in changing practices at the grassroots level (Ambarini et al., 2025);. For example, projects that produce content on hoaxes and personal data security not only train technical skills in using applications, but also foster critical awareness of the risks of disinformation and the importance of privacy protection, in line with the latest research findings on the relationship between digital literacy, information resilience, and vulnerability to misinformation in Indonesia (Mulyono & Ansori, 2020). Thus, the model produced by this research serves as a bridge between GNLD macro policies and micro implementation in Community Learning Centers (CLC), making non-formal education a strategic partner of the state in the inclusive digital transformation agenda (Ardiwinata & Mulyono, 2018).

Overall, the results of the study confirm that the PjBL-based productive digital literacy model is effective in improving the digital competence of learners, while facilitating active, collaborative, and reflective learning. The integration of community-oriented digital projects with systematic digital literacy assistance makes the learning process relevant, challenging, and meaningful for adult learners (Mulyono et al., 2024). This is consistent with the findings of a national meta-analysis which shows that digital literacy has a significant impact on the quality of learning processes and outcomes at various levels of education, both formal and non-formal (Andika Pratama et al., 2023). At the same time, international studies on digital literacy in Indonesia show that strengthening digital competencies needs to be accompanied by efforts to reduce access gaps, develop inclusive policies, and design educational interventions that are sensitive to the local socio-cultural context (Sari et al., 2024; Saepudin & Mulyono, 2019).

The implementation of this model in Community Learning Centers (CLC) shows that non-formal education is not merely a “complement” to the formal system, but can be a strategic space to accelerate the equitable distribution of digital literacy (Mulyono, 2012) , expand community participation in the digital ecosystem (Mulyono & Ansori, 2020) and encourage community empowerment through productive and sustainable digital practices (Hadiyanti et al., 2024). Overall, these findings reinforce the strategic role of Project-Based Learning in positioning Community Learning Centers as inclusive and transformative spaces for productive digital literacy development. By integrating contextual digital projects with learner-centered facilitation, the model contributes to sustainable community empowerment and supports more equitable participation in digital society.

CONCLUSION

This study developed and validated a Project-Based Learning (PjBL) model for productive digital literacy training in Community Learning Centers (CLC) in West Bandung Regency. The results confirmed that the model is theoretically sound, practically feasible, and empirically effective in improving learners’ productive digital literacy skills. The PjBL model’s structured syntax comprising problem orientation, project planning, implementation, monitoring, evaluation, and presentation proved effective in fostering learners’ ability to create digital content, collaborate, and apply technology for meaningful purposes. Learners

demonstrated significant improvement in all dimensions of digital literacy, particularly digital content creation, knowledge construction, and content evaluation. The study contributes theoretically by extending the application of PjBL to non-formal education and emphasizing the productive dimension of digital literacy, while practically, it provides CLC institutions with an applicable model to enhance community empowerment through digital skills. Therefore, integrating project-based learning into non-formal digital literacy programs is a strategic and sustainable approach to strengthening community readiness in the digital era.

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