Parental Digital Literacy and Involvement in Blended Learning: A Mixed-Methods Psychological Analysis

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A r t i c l e I n f o

Article type:
Original Article

How to cite this article:

A B S T R A C T

Objective: This study aimed to examine how parental digital literacy predicts and shapes parental involvement in blended learning environments using an integrated mixed-methods psychological approach.

Methods and Materials: A convergent mixed-methods design was employed with 384 parents completing validated digital literacy and parental involvement scales, while 22 parents participated in in-depth semi-structured interviews. Quantitative data were analyzed using descriptive statistics, Pearson correlations, multiple regression, and PLS-SEM to assess predictive relationships across domains of digital literacy and involvement. Qualitative data were analyzed using reflexive thematic analysis to identify psychological processes underlying digital engagement. Results from both strands were integrated through triangulation to capture convergent and complementary patterns.

Findings: Parents demonstrated moderate digital literacy, with communication and problem-solving competencies showing the strongest associations with involvement. Correlation analyses revealed robust positive relationships between all literacy domains and involvement dimensions ($r = .22$ to $.41$, $p < .01$). Multiple regression showed that information literacy ($\beta = .18$, $p = .003$), communication literacy ($\beta = .21$, $p < .001$), and problem-solving skills ($\beta = .24$, $p < .001$) significantly predicted parental involvement, explaining 43% of its variance. PLS-SEM confirmed strong paths from problem-solving to cognitive–instructional involvement ($\beta = .24$, $p < .001$) and behavioral supervision ($\beta = .21$, $p < .001$), and from communication literacy to school–home communication ($\beta = .27$, $p < .001$). Digital content creation and cybersecurity skills showed weaker, nonsignificant effects. Model fit indices demonstrated strong reliability ($CR = .85–.91$) and convergent validity ($AVE = .57–.67$).

Conclusion: Parental digital literacy substantially influences the quality and depth of parental involvement in blended learning, with problem-solving, information handling, and communication competencies emerging as the most critical predictors. Strengthening parental digital literacy may therefore enhance home–school collaboration, support student engagement, and promote more equitable participation in blended learning ecosystems.

Keywords: Digital literacy; parental involvement; blended learning; mixed-methods; parental mediation; digital parenting

1.   Introduction

The rapid global integration of digital technologies into educational systems has reshaped the nature of learning, teaching, and family engagement in unprecedented ways. Blended learning—an instructional model that combines face-to-face instruction with online, technology-mediated activities—has become a dominant pedagogical paradigm after the disruptions of COVID-19 and the subsequent push toward digital transformation in schools. As digital platforms increasingly structure communication, assessment, and learning pathways, families have assumed new responsibilities in students' learning journeys. Parents, in particular, now serve as co-facilitators of digital learning, acting not merely as observers but as active mediators of technology use, emotional supporters, and co-designers of structured learning routines. This shift has underscored the importance of parental digital literacy as a psychological, social, and pedagogical factor influencing students' learning outcomes. Without the capacity to navigate digital tools confidently and responsibly, parents encounter barriers that can directly impair the quality of support they provide at home, thereby widening gaps in students' academic engagement, emotional well-being, and overall learning achievement (Ciboci & Labaš, 2019).

In recent years, research has documented how parental digital literacy intersects with contemporary parenting practices. Studies have shown that parents' ability to critically interpret, evaluate, and use digital information shapes their mediation of children's technology use and influences children's digital behaviors, safety, and learning outcomes. For example, the psychological and pedagogical importance of building media literacy among parents has been emphasized as a preventive strategy against emerging risks such as digital overuse and digital autism, which are increasingly discussed within developmental psychology and education research (Zhangaliyeva & Zhukenova, 2025). Likewise, cross-national evidence from African contexts demonstrates that parental competencies in social media literacy significantly shape children's tendencies toward problematic media consumption and digital media addiction, highlighting the broader social and behavioral implications of inadequate parental literacy (Okela et al., 2025). These findings collectively point to digital literacy not only as a set of technical skills but also as a socio-cognitive capability deeply rooted in parents' beliefs, practices, and interactions with their children and with digital learning environments.

The expansion of blended learning has further heightened the urgency of examining digital literacy among parents, especially because schools increasingly rely on mobile applications, learning management systems, and digital communication channels to disseminate learning materials, track student progress, and maintain home–school partnerships. Research on early childhood and primary education settings indicates that parents' engagement in digital activities—such as reading digital stories, completing tasks on educational apps, and managing digital content—correlates strongly with the development of children's foundational literacy skills and digital autonomy (Karabanov & Aram, 2024). In language-learning contexts, parental involvement in app-based learning environments helps young learners maintain motivation, supports the reinforcement of linguistic skills, and sustains engagement in learning routines beyond the classroom (Bang & Mackey, 2024). Collectively, these findings situate parental digital literacy as a multidimensional construct involving cognitive, behavioral, emotional, and communicative components that vary widely across cultural and socioeconomic contexts.

International scholarship also highlights significant disparities in how parents interpret and enact digital parenting roles. For instance, studies of digital media parenting reveal that high levels of digital literacy can buffer young children from harmful patterns such as excessive screen dependence and problematic device use (Choi & Choi, 2024). Conversely, insufficient digital literacy can limit parents' ability to monitor content, use filters, or provide guidance, thereby increasing risks associated with unguided digital consumption. In Indonesia, research demonstrates that balanced screen time, access to digital tools, and parental involvement meaningfully shape early childhood digital literacy development, suggesting that digital parenting practices and technological access are intertwined with family functioning and cultural expectations around child-rearing (Asmayawati, 2023). In line with this, studies on parental mediation show that guidance, boundary-setting, and co-use strategies are strongly influenced by parental literacy levels, cultural values, and family communication patterns (Sarini, 2024). These insights reinforce the notion that digital parenting operates at the intersection of psychological, sociocultural, and technological domains.

A growing body of evidence links parental digital literacy to children's educational outcomes, including learning engagement, satisfaction, and academic performance in digital and blended learning environments. During the

pandemic-driven surge in online learning, parents with higher digital literacy were found to support students more effectively by organizing routines, troubleshooting tasks, and encouraging active online engagement. For instance, research among junior high students demonstrates that parental educational expectations and digital involvement significantly moderate the relationship between digital literacy and student engagement, illustrating how family values interface with digital competence to shape learning trajectories (Liu et al., 2023). Similarly, in vocational high school contexts, parental digital literacy combines with parental involvement to influence student achievement, signaling a strong predictive relationship between home-based digital support and academic success (Dianawati et al., 2025). These findings suggest that digital literacy is not only a technical competence but also a determinant of students' cognitive, emotional, and behavioral engagement in blended learning ecosystems.

At the same time, numerous studies call attention to the challenges families face when adapting to blended learning models. Parents report difficulties navigating digital platforms, maintaining routines, managing their children's emotional responses, and coping with the stressors associated with digital homework and communication demands. Evidence from Ontario shows that digital health literacy among parents strongly influences their ability to evaluate digital information and make informed decisions, underscoring the connection between literacy, emotional burdens, and parental confidence (Ashfield et al., 2024). More broadly, research has shown that digital parenting practices and literacy vary according to socioeconomic status, education level, and cultural background, which can create disparities in children's access to high-quality digital learning experiences (Adigwe et al., 2024). In Nigeria, studies have highlighted how demographic variables shape parental literacy and mediation practices, revealing the importance of contextualized approaches to understanding digital parenting across diverse populations (Adigwe, 2021). These findings collectively suggest that parental digital literacy is socially patterned, and that blended learning environments may inadvertently reinforce educational inequities if adequate support structures are not implemented.

A complementary strand of research focuses on the role of educators and educational institutions in facilitating parental engagement. Teachers' strategies for designing interactive learning spaces, modeling digital behaviors, and communicating effectively with families have been shown

to significantly influence the quality of parental involvement. For example, recent work highlights that interactive digital learning environments designed deliberately by teachers can foster meaningful parent participation in language learning and blended instructional contexts (Guo, 2025). The role of schools becomes particularly important in homeschooling contexts, where parents function as primary facilitators of digital learning. Studies indicate that effective communication, transparency, and shared responsibility between parents and adolescents shape the success of technology integration in homeschooling environments, ultimately supporting more cohesive family–school partnerships (Maaghop & Que, 2024). These insights suggest that parental digital involvement emerges from a complex interplay between individual literacy, school support, and interpersonal dynamics, emphasizing the need for systemic approaches to fostering effective family engagement.

Furthermore, research on the psychological and behavioral dimensions of digital involvement reveals that parents often experience stress, role conflict, and uncertainty as they attempt to guide their children through digital learning environments. Studies from Southeast Asia show that parental role, access to technology, and balanced screen management significantly moderate the development of digital literacy among children, illustrating how family environments shape digital learning trajectories (Suryadi, 2025). In the domain of adolescent mental health, research demonstrates that digital parenting practices exert significant influence on stress, well-being, and family functioning, especially among urban families negotiating complex online risks and digital communication overload (Tariq, 2025). These psychological findings underscore the need to consider parental emotional states, cognitive load, and perceptions of competence when evaluating their engagement in blended learning.

Also relevant is evidence that parental digital literacy directly supports early literacy development, not only by facilitating platform navigation but also by modeling digital reading and writing activities in everyday family life. For instance, training parents to use digital storytelling techniques has been shown to improve early childhood literacy outcomes, highlighting the powerful link between parental digital competence and children's foundational learning experiences (Adara, 2020). More broadly, qualitative research reveals that parents' digital media literacy shapes childcare practices and influences how they construct learning spaces within the home, adapting daily

routines around technology in ways that affect both cognitive and emotional development (Robbets, 2023). These insights show that parental digital literacy is not merely reactive but also generative, influencing how parents design interactions, create learning opportunities, and collaborate with educational institutions.

A central challenge that emerges from the existing body of literature is the variability in how different families conceptualize digital literacy and digital involvement. Some studies find that parenting styles and digital literacy levels are tightly correlated, with more authoritative or supportive parenting styles corresponding to higher digital engagement and more effective mediation practices (Kusumalestari et al., 2023). Others highlight the importance of structured parental mediation programs, which can significantly enhance both student and parent digital literacy through guided consultation and information sessions (Muslih, 2022). These findings indicate that interventions aimed at improving parental digital literacy must be sensitive to family dynamics, cultural norms, and socioeconomic realities, rather than relying on one-size-fits-all approaches.

Despite the rapid growth of blended learning research, there remains a critical need for psychological analyses that integrate both quantitative and qualitative perspectives to understand how parents perceive, experience, and enact their digital roles in blended learning contexts. Current evidence tends to examine either behavioral outcomes or technological competencies in isolation; yet, parental involvement is a deeply psychological process encompassing motivation, self-efficacy, emotional regulation, identity formation, and interpersonal communication. Moreover, existing studies rarely explore how digital literacy interacts with these psychological processes to shape parental behaviors. The complexity of blended learning environments—with their constant digital notifications, shifting expectations, and increased cognitive demands—necessitates comprehensive research that captures how parents negotiate these roles, particularly in diverse and technologically uneven communities. A mixed-methods study therefore offers a timely and nuanced lens for understanding the mechanisms that underlie parental digital literacy and its relationship with involvement.

The aim of this study is to investigate how parental digital literacy shapes and predicts parental involvement in blended learning through a mixed-methods psychological approach.

2. Methods and Materials

2.1. Study Design and Participants

The present study employed a convergent mixed-methods design to investigate the relationship between parental digital literacy and their involvement in children's blended learning environments. A mixed-methods framework was selected to allow the integration of quantitative behavioral indicators with qualitative psychological insights, enabling a deep exploration of both the measurable and experiential dimensions of parental engagement. In this design, quantitative and qualitative data were collected simultaneously, analyzed independently, and merged during the interpretation phase to enhance the validity and explanatory power of the results. The quantitative component followed a descriptive-correlational approach aimed at identifying predictive relationships between digital literacy competencies and multiple forms of parental involvement, including instructional support, emotional encouragement, learning supervision, and communication with teachers. The qualitative component adopted a phenomenological orientation to capture parents' subjective experiences, perceived challenges, and psychological processes influencing their engagement with blended learning.

Participants were recruited from five public and private lower-secondary schools that adopted blended learning models during the academic year 2024–2025. A multistage sampling strategy was used. First, schools were selected through purposive sampling based on their technological readiness and long-term implementation of blended learning. Within each school, parents were recruited through stratified random sampling proportional to grade level and socioeconomic status to ensure representativeness across demographic groups. Eligibility criteria included being the primary caregiver responsible for supporting the student's learning at home, engaging in at least one digital learning platform used by the school, and willingness to participate in both quantitative and qualitative components. The final quantitative sample consisted of 384 parents, consistent with power analysis requirements for multiple regression with medium effect sizes and ten predictors. The sample included fathers and mothers aged between 28 and 54 years with diverse educational backgrounds and varying levels of digital experience. For the qualitative strand, 22 parents were selected through maximum variation sampling to capture heterogeneity in digital skills, involvement intensity, and subjective perceptions. Semi-structured interviews

continued until thematic saturation was reached, ensuring that no new conceptual categories emerged. Participation was voluntary, anonymity was guaranteed, and written informed consent was obtained from all respondents. The study received ethical approval from the university's institutional review board.

2.2. Measures

Quantitative data were collected using two standardized instruments adapted for the blended-learning context. Parental digital literacy was measured using the Digital Literacy Competence Scale for Parents (DLCS-P), originally grounded in the European Digital Competence Framework and revised for educational settings. The scale assesses five domains of competence: information and data literacy, communication and collaboration, digital content creation, safety and cybersecurity, and problem-solving in digital environments. Items were rated on a five-point Likert scale ranging from "strongly disagree" to "strongly agree." In the present study, the scale demonstrated excellent internal consistency, with Cronbach's alpha values ranging from .82 to .91 across subscales. Content validity was reviewed by three experts in educational psychology and digital learning, and minor linguistic adjustments were made to improve clarity.

Parental involvement in blended learning was assessed using the Blended Learning Parental Involvement Inventory (BLPII), developed by the research team based on theoretical frameworks of ecological parental engagement and technology-mediated learning support. The instrument covers multiple dimensions, including cognitive–instructional involvement (assisting with digital tasks, monitoring comprehension), emotional–motivational involvement (providing encouragement, reducing anxiety related to digital platforms), behavioral supervision (managing schedules, monitoring platform use), and school–home communication (interaction with teachers through digital systems). The BLPII contains Likert-type items anchored from "never" to "always." Exploratory factor analysis conducted during pilot testing confirmed a four-factor structure explaining 71 percent of the total variance, with alpha coefficients between .79 and .88.

Qualitative data were collected through semi-structured interviews lasting between 45 and 70 minutes each. The interview guide explored parents' narratives regarding digital challenges, psychological barriers, emotional experiences in supporting their children, perceived role changes in blended learning, and expectations of schools. Questions were open-ended to encourage detailed elaboration, while probes were used to explore cognitive and emotional dimensions of digital involvement, such as stress regulation, self-efficacy, digital confidence, and perceived competence in navigating online platforms. Interviews were conducted in a private setting either face-to-face or via encrypted video conferencing, depending on participant preference. All interviews were audio-recorded with permission and transcribed verbatim for analysis. To ensure credibility, transcripts were member-checked by participants, and analytic memos were prepared throughout the data collection process.

2.3. Data Analysis

Quantitative data were analyzed using SPSS (version 28) and SmartPLS (version 4) to allow both traditional inferential statistics and structural modeling. Preliminary analyses included screening for missing data, assessing outliers, and verifying normality assumptions. Missing values were handled through expectation-maximization procedures after confirming randomness. Descriptive statistics were computed to profile levels of digital literacy and parental involvement. Pearson correlation coefficients assessed bivariate associations between variables. Multiple linear regression models were constructed to examine the predictive role of digital literacy domains on each dimension of parental involvement while controlling for demographic variables such as parental age, education, socioeconomic status, and technology access. To provide a more robust understanding of the direct and indirect effects, partial least squares structural equation modeling (PLS-SEM) was conducted. Measurement models were evaluated through indicator reliability, composite reliability, average variance extracted, and discriminant validity using the Fornell–Larcker criterion and heterotrait–monotrait ratio. Structural model evaluation included path coefficients, effect sizes, bootstrapping significance testing with 5,000 resamples, and predictive relevance (Q^2). Model fit was further examined using standardized root mean square residual (SRMR) values.

Qualitative data analysis followed Braun and Clarke's six-phase thematic analysis approach. First, transcribed interviews were read repeatedly to ensure familiarity with the data. Generative coding was conducted line by line to identify meaningful units related to digital literacy experiences, psychological reactions, and involvement

behaviors. Codes were then collated into initial themes representing recurring patterns in parents' perceptions and practices. Themes were reviewed, refined, and organized into higher-order categories that captured structural, emotional, motivational, and cognitive aspects of parental engagement in blended learning. Throughout the analysis, constant comparison across participants was performed to ensure conceptual consistency and depth. Credibility was strengthened through triangulation with quantitative findings, peer debriefing with two experts in digital education, and maintaining an audit trail documenting analytic decisions.

Following independent analysis, quantitative and qualitative results were integrated using a convergence matrix to identify agreements, contradictions, and complementary insights. This merging phase facilitated a richer interpretation of how parental digital skills influence not only observable involvement behaviors but also psychological motivations and barriers underlying those behaviors. Integration enhanced the validity of inferences and supported the development of a multidimensional explanatory framework for parental engagement in blended learning environments.

3. Findings and Results

The qualitative strand yielded a coherent set of themes that illuminate how parents psychologically experience and enact their role in blended learning. Analysis of the 22 interviews revealed that parents' digital literacy is not merely a technical skill set, but deeply intertwined with emotional regulation, perceived self-efficacy, identity as a "good parent," and the quality of collaboration with schools. Four overarching themes emerged: negotiating a new form of homework and learning support, managing digital stress and emotional load, engaging in intergenerational learning and self-efficacy building, and navigating the school–home partnership within digital platforms. These themes provide a rich context for interpreting the quantitative patterns reported below.

Table 1

Themes, subthemes, and representative quotes from parents regarding digital literacy and blended learning (N = 22)

Theme	Subtheme	Description	Representative quote	Number of parents endorsing (n)
Negotiating the "new homework"	Redefined parental role	Parents describe a shift from checking notebooks to monitoring platforms, assignments, and digital notifications, often feeling that they have become "assistant teachers."	"Before blended learning, I just checked if homework was done. Now I have to log in, check assignments, deadlines, messages, and even troubleshoot when the platform freezes. It feels like I am the second teacher at home."	18
	Time and boundary management	Parents struggle to set boundaries around when and how often to engage with digital platforms, leading to a sense that school demands have entered the home continuously.	"There is no end to school now. Messages and tasks pop up all day on my phone. If I don't check constantly, I'm afraid my child will miss something important."	16
	Role conflict with work and caregiving	Parents report tension between digital learning support and other responsibilities, especially for working parents and those caring for multiple children or elders.	"During my online meetings for work, my son asks for help with the platform. I feel torn, like I am failing both as an employee and as a mother."	14
Emotional burden and digital stress	Anxiety and fear of "doing it wrong"	Limited digital skills produce anxiety about mis-clicking, deleting assignments, or missing deadlines, which in turn shapes how confidently parents engage with blended learning.	"Sometimes I am scared to click anything because I think I might delete his homework. I feel more nervous than my child when we open the system."	15
	Guilt and self-blame	Parents with lower digital literacy often internalize difficulties as personal failure, questioning their adequacy as parents in a digital age.	"When I can't help my daughter upload a file, I feel like an illiterate parent. I ask myself, 'What kind of mother can't even handle this simple thing?'"	13
	Emotional contagion to children	Emotional states such as stress, frustration, or anger during digital problem-solving spill over to children, affecting their motivation and attitude toward learning.	"When the internet disconnects, I get so frustrated that I raise my voice. Then my son loses his motivation and says, 'I hate online school.' I know my reaction affects him."	17
Intergenerational learning and self-efficacy	Children as "digital tutors"	Parents frequently rely on their children to demonstrate platform use, reversing traditional knowledge	"My daughter teaches me how to navigate the classroom page. She laughs and says,	19

		hierarchies and creating opportunities for collaborative learning.	'Mom, you're my student now.' It's strange but also nice to learn from her."	
	Gradual skill acquisition and confidence	Repeated exposure to platforms leads to incremental improvement in digital skills and a growing sense of competence, which increases willingness to be involved.	"At first I asked other parents about every small step. Now I can log in, download tasks, and send files myself. I feel more confident and less dependent."	18
	Peer support and informal learning networks	Parent groups on messaging apps function as informal learning communities where parents exchange tips, screenshots, and video tutorials.	"When I get stuck, I send a screenshot in our parents' group. Usually someone explains or sends a short video. Without this group, I would be lost."	16
School–home partnership and platform design	Communication quality with teachers	The tone, frequency, and clarity of teachers' digital communication significantly shape how supported or overwhelmed parents feel.	"Some teachers write clear, kind messages and even send short instructions. Others just upload tasks without explanation. With them, I feel very alone in this."	17
	Usability of platforms and tools	Parents emphasize that intuitive design, clear navigation, and multilingual options reduce cognitive load and lower the barrier to active involvement.	"When the platform is simple and the buttons are clear, I participate more. If I need to click five times just to see one task, I give up more easily."	18
	Perceived fairness and inclusivity	Parents express concern that families with limited devices, unstable internet, or low digital literacy are disadvantaged, raising equity issues in blended learning.	"We only have one smartphone for three children. How can I make sure they all attend? Sometimes I feel the system is designed for families with many devices, not for us."	14

The qualitative findings in Table 1 show that parental digital literacy is embedded in a complex psychosocial ecosystem. Parents' narratives reveal that blended learning has redefined the very notion of homework, transforming it into a continuous, digitally mediated responsibility that extends beyond traditional school hours. This redefinition creates role conflict as parents simultaneously juggle professional obligations and caregiving, often feeling compelled to be permanently available to monitor platforms and support children. Emotional processes are central: limited digital competence generates anxiety, fear of making mistakes, and guilt, which spill over into interactions with children and shape their motivation toward online learning. At the same time, the digital context opens new possibilities for intergenerational learning, with children teaching parents and peer parent networks functioning as informal training spaces that gradually build self-efficacy. Finally, parents link their involvement to the quality of school–home communication and the usability of platforms, emphasizing that supportive teacher messages and user-friendly interfaces lower psychological and cognitive barriers, while poorly designed systems and unequal access exacerbate feelings of exclusion and injustice.

Table 2

Descriptive statistics for parental digital literacy and involvement in blended learning (N = 384)

Variable	Scale range	M	SD
Information and data literacy	1–5	3.62	0.74
Communication and collaboration	1–5	3.88	0.69
Digital content creation	1–5	3.21	0.81
Safety and cybersecurity	1–5	3.47	0.77
Problem-solving in digital environments	1–5	3.55	0.72
Overall digital literacy (composite)	1–5	3.55	0.64
Cognitive–instructional involvement	1–5	3.72	0.68
Emotional–motivational involvement	1–5	3.94	0.66
Behavioral supervision	1–5	3.48	0.71
School–home digital communication	1–5	3.59	0.73
Overall parental involvement (composite)	1–5	3.68	0.60

Descriptive statistics in Table 2 indicate that, on average, parents reported moderate to moderately high levels of digital literacy across domains, with the highest mean level observed for communication and collaboration and the lowest for digital content creation. This pattern suggests that parents feel relatively comfortable using communication tools (e.g., messaging apps, basic platform messaging) but are less confident in more advanced tasks such as creating,

editing, and uploading digital content. The composite digital literacy score was above the midpoint of the scale, reflecting a generally functional level of competence in the sample. In terms of involvement, emotional–motivational involvement showed the highest mean, indicating that parents most frequently provide encouragement and emotional support around blended learning, while behavioral supervision and school–home digital communication were somewhat lower, though still above the midpoint. The overall involvement composite suggests that, despite the challenges described qualitatively, parents are actively engaged in supporting their children's blended learning experiences.

Table 3

Pearson correlations among parental digital literacy and involvement variables (N = 384)

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Information and data literacy	—										
2. Communication and collaboration	.54**	—									
3. Digital content creation	.49**	.57**	—								
4. Safety and cybersecurity	.46**	.51**	.44**	—							
5. Problem-solving in digital environments	.52**	.56**	.48**	.50**	—						
6. Overall digital literacy	.78**	.81**	.76**	.73**	.80**	—					
7. Cognitive–instructional involvement	.29**	.34**	.31**	.24**	.36**	.40**	—				
8. Emotional–motivational involvement	.22**	.28**	.24**	.19**	.27**	.30**	.58**	—			
9. Behavioral supervision	.26**	.32**	.27**	.23**	.30**	.34**	.49**	.45**	—		
10. School–home digital communication	.31**	.38**	.33**	.27**	.35**	.39**	.52**	.47**	.50**	—	
11. Overall parental involvement	.33**	.40**	.35**	.28**	.41**	.45**	.82**	.78**	.76**	.75**	—

**p<0.01

The correlation matrix presented in Table 3 shows robust associations both within and between the domains of parental digital literacy and involvement in blended learning. As expected, the five digital literacy subscales are strongly intercorrelated, supporting the notion that they represent related facets of a broader competence profile. The overall digital literacy composite is very strongly related to each subscale, reflecting its role as a summary indicator. Importantly, all digital literacy domains show significant positive correlations with the four involvement dimensions. The strongest cross-domain relationships emerge between problem-solving in digital environments and cognitive–instructional involvement, and between communication and collaboration literacy and school–home digital communication, suggesting theoretically coherent linkages between specific digital skills and corresponding forms of involvement. The overall digital literacy composite is moderately correlated with the overall parental involvement index, indicating that higher digital competence tends to co-occur with more frequent and multifaceted engagement in children's blended learning. Correlations among involvement dimensions themselves are high, particularly between cognitive–instructional and emotional–motivational involvement, reflecting the tendency for parents who actively help with tasks also to provide emotional support.

Table 4

Multiple regression analysis predicting overall parental involvement from digital literacy domains and control variables (N = 384)

Predictor	B	SE B	β	t	p
Constant	1.12	0.21	—	5.33	< .001
Parent education (years)	0.02	0.01	.09	1.91	.057
Household socioeconomic status	0.04	0.02	.08	1.98	.048
Number of internet-connected devices	0.03	0.01	.11	2.44	.015
Child grade level (7–9)	0.01	0.01	.03	0.82	.413
Information and data literacy	0.09	0.03	.18	3.01	.003
Communication and collaboration	0.11	0.03	.21	3.64	< .001
Digital content creation	0.05	0.03	.09	1.80	.073
Safety and cybersecurity	0.03	0.03	.05	1.25	.212
Problem-solving in digital environments	0.13	0.03	.24	4.26	< .001

Note. Dependent variable: overall parental involvement. Household socioeconomic status was coded on a standardized composite index. R^2 = .43, adjusted R^2 = .41, $F_{(9, 374)}$ = 31.12, p < .001.

The regression results in Table 4 indicate that digital literacy domains make a substantial and statistically significant contribution to explaining variance in overall parental involvement, even after controlling for education, socioeconomic status, number of devices, and child grade level. The model accounts for 43% of the variance in involvement, which is a large effect in psychological and educational research. Among the control variables, household socioeconomic status and the number of internet-connected devices show small but significant positive effects, suggesting that material resources facilitate more consistent involvement. Parent education and child grade level do not emerge as strong predictors once digital literacy

is taken into account. Regarding the focal predictors, information and data literacy, communication and collaboration competence, and problem-solving in digital environments each have significant positive standardized coefficients, with problem-solving showing the largest effect (β = .24), followed by communication and collaboration (β = .21) and information literacy (β = .18). In contrast, digital content creation and safety/cybersecurity do not reach conventional significance levels in this model, implying that, in this sample, basic information handling, communicative skills, and problem-solving are more central to day-to-day involvement in blended learning than more advanced content production or security-related skills.

Table 5

PLS-SEM structural model: Paths from digital literacy domains to dimensions of parental involvement (N = 384)

Predictor → Outcome	β	t (bootstrapped)	p
Information and data literacy → Cognitive–instructional involvement	.19	3.54	< .001
Information and data literacy → Emotional–motivational involvement	.11	2.12	.034
Information and data literacy → Behavioral supervision	.14	2.78	.006
Information and data literacy → School–home digital communication	.12	2.39	.017
Communication and collaboration → Cognitive–instructional involvement	.16	3.02	.003
Communication and collaboration → Emotional–motivational involvement	.18	3.45	< .001
Communication and collaboration → Behavioral supervision	.13	2.59	.010
Communication and collaboration → School–home digital communication	.27	5.11	< .001
Digital content creation → Cognitive–instructional involvement	.08	1.71	.088
Digital content creation → Emotional–motivational involvement	.07	1.48	.140
Digital content creation → Behavioral supervision	.06	1.32	.187
Digital content creation → School–home digital communication	.09	1.87	.062
Safety and cybersecurity → Cognitive–instructional involvement	.05	1.09	.277
Safety and cybersecurity → Emotional–motivational involvement	.04	0.92	.357
Safety and cybersecurity → Behavioral supervision	.09	1.93	.054
Safety and cybersecurity → School–home digital communication	.07	1.51	.131
Problem-solving in digital environments → Cognitive–instructional involvement	.24	4.21	< .001
Problem-solving in digital environments → Emotional–motivational involvement	.16	3.01	.003
Problem-solving in digital environments → Behavioral supervision	.21	3.89	< .001
Problem-solving in digital environments → School–home digital communication	.19	3.56	< .001

Note. All coefficients are standardized. Bootstrapping was conducted with 5,000 resamples. R^2 values for endogenous constructs: cognitive–instructional involvement = .41; emotional–motivational involvement = .37; behavioral supervision = .33; school–home digital communication = .39. SRMR = .061.

The PLS-SEM structural model reported in Table 5 provides a more differentiated picture of how specific digital literacy domains relate to distinct forms of parental involvement. Across outcomes, problem-solving in digital environments consistently shows the strongest and most reliable positive paths, particularly for cognitive–instructional involvement and behavioral supervision. This suggests that parents who feel capable of resolving technical issues and navigating complex digital tasks are more likely to actively help with learning activities and to monitor and structure their child's engagement with blended learning. Communication and collaboration literacy is especially

important for school–home digital communication, with a relatively large path coefficient, underscoring the intuitive link between communication skills and effective use of messaging and platform-based interaction with teachers. Information and data literacy contributes broadly, albeit with modest effect sizes, to all four involvement dimensions, implying that the ability to locate, interpret, and organize information is a general prerequisite for meaningful engagement. In contrast, digital content creation and safety/cybersecurity skills show weaker and often nonsignificant paths, indicating that these more specialized competencies may be less directly implicated in everyday

parental involvement behaviors in the current context. The R² values for the four involvement dimensions indicate that the digital literacy domains together explain between one-third and two-fifths of their variance, and the acceptable SRMR value suggests an overall good fit of the structural model.

Table 6

Measurement model quality indices for digital literacy and parental involvement constructs (N = 384)

Construct	Number of indicators	Standardized loading range	Composite reliability (CR)	Average variance extracted (AVE)
Information and data literacy	5	.71–.84	.89	.62
Communication and collaboration	5	.73–.86	.90	.64
Digital content creation	4	.70–.82	.87	.60
Safety and cybersecurity	4	.68–.81	.85	.57
Problem-solving in digital environments	4	.74–.87	.89	.67
Cognitive–instructional involvement	5	.72–.85	.90	.63
Emotional–motivational involvement	5	.76–.88	.91	.66
Behavioral supervision	4	.69–.83	.88	.61
School–home digital communication	4	.71–.84	.89	.62

The measurement model indices in Table 6 demonstrate that the latent constructs used in the PLS-SEM analyses possess satisfactory psychometric properties. Across all constructs, standardized factor loadings fall within the acceptable to high range, indicating that individual items are strongly associated with their respective latent variables. Composite reliability values exceed the recommended threshold of .70 for every construct, suggesting high internal consistency. Similarly, the AVE values are above .50 for all constructs, which supports convergent validity by indicating that each latent variable explains more than half of the variance in its indicators. Together, these indices confirm that both parental digital literacy domains and involvement dimensions were measured reliably and coherently, reinforcing confidence in the structural relationships reported in the preceding tables and aligning with the qualitative evidence that these constructs capture meaningful psychological and behavioral patterns in parents' engagement with blended learning.

4. Discussion

The purpose of this study was to examine how parental digital literacy influences parental involvement in blended learning environments through a mixed-methods psychological lens. The results revealed consistent and robust relationships between parents' digital competencies and their levels of cognitive–instructional, emotional–motivational, behavioral supervision, and digital communication involvement. Both quantitative and qualitative findings converged to show that digital literacy is not only a technical capability but a psychological, emotional, and social resource that substantially shapes how parents engage with technology-mediated learning. These findings align with a growing body of international research indicating that parental digital literacy is a critical determinant of children's digital learning experiences, academic engagement, and socio-emotional development (Ciboci & Labaš, 2019; Zhangaliyeva & Zhukenova, 2025).

The strong predictive power of information literacy, communication literacy, and problem-solving skills suggests that the more confident parents are in navigating digital platforms, interpreting information, troubleshooting errors, and communicating online, the more effectively they engage in the blended learning process. This trend is supported by research showing that parental digital competencies reduce barriers to involvement, facilitate home–school partnership, and improve student outcomes in technology-rich learning environments (Guo, 2025; Karabanov & Aram, 2024). In the present study, problem-solving skills emerged as the strongest predictor of involvement, underscoring the cognitive load parents experience when dealing with digital tools. This complements findings from studies conducted in China, Southeast Asia, and Europe, where parents who demonstrate higher levels of digital adaptability and problem-solving abilities are better positioned to guide their children through online assignments, manage digital feedback, and sustain learning routines (Choi & Choi, 2024; Liu et al., 2023; Robbets, 2023).

The qualitative findings deepened this understanding by revealing the emotional and psychological burden many parents face when navigating digital learning. Parents

described heightened anxiety, fear of making mistakes, role conflict, and pervasive stress when digital tasks exceeded their perceived competence. These experiences parallel the emotional difficulties reported in digital parenting research, in which parents with lower digital literacy express guilt, self-doubt, and stress when they cannot effectively support their children (Ashfield et al., 2024; Asmayawati, 2023). Such emotional strain may also influence children's attitudes and motivation toward blended learning, reaffirming that parental digital literacy carries socio-emotional consequences beyond task performance.

Notably, the study found that communication and collaboration literacy strongly predicted school–home digital communication. This relationship aligns with global literature indicating that digital communication skills are crucial for effective partnership between parents and teachers in digital settings. Teachers' strategies, such as designing interactive spaces or providing clear digital instructions, significantly influence parental engagement, especially when parents are confident communicators within digital systems (Guo, 2025; Maaghop & Que, 2024). In contrast, when digital communication lacks clarity or accessibility, parents may feel overwhelmed or disengaged, as echoed in both the present study and previous investigations exploring digital mediation in diverse family contexts (Bang & Mackey, 2024; Kusumalestari et al., 2023).

A compelling finding is that digital content creation and cybersecurity literacy were weaker predictors of parental involvement. While these skills are part of the broader digital literacy framework, the results suggest they may be less relevant for daily engagement with blended learning platforms. This resonates with research highlighting that not all domains of digital literacy contribute equally to digital parenting behaviors. For instance, tasks such as editing digital content or implementing cybersecurity protocols may be perceived as technical skills outside the immediate needs of helping children navigate educational apps, communication portals, or homework systems (Adigwe et al., 2024; Windasari & Dheasari, 2024). Moreover, in many households—particularly those in developing contexts— digital literacy priorities center on navigation, communication, and troubleshooting rather than advanced content creation or platform administration (Muslih, 2022; Okela et al., 2025).

The qualitative findings further highlighted the importance of psychological processes, such as self-efficacy, stress regulation, and emotional contagion, in

shaping parental digital engagement. Parents who lacked confidence in using technology expressed fear of "doing something wrong," which diminished their willingness to engage. These emotions mirror findings from studies documenting the psychological barriers that accompany low parental digital literacy, particularly among those with limited access to digital tools or training opportunities (Sarini, 2024; Suryadi, 2025). Furthermore, parents explained that their emotional reactions during digital problem-solving often transferred to their children, influencing learning motivation—an experience consistent with research identifying emotional contagion as a key mediator in digital learning interactions within families (Tariq, 2025).

Another critical insight concerns the social nature of digital literacy. Parents in this study frequently relied on peer support networks—such as WhatsApp groups—to navigate learning platforms or troubleshoot issues. This phenomenon aligns with findings that parental digital literacy is shaped not only by individual skills but by social support, cultural norms, and community resources. For example, studies from Indonesia and Nigeria emphasize the role of informal networks, parental mediation training, and collaborative learning communities in enhancing digital competence among parents (Adara, 2020; Adigwe, 2021; Asmayawati, 2023). Such networks also help reduce psychological strain and build confidence, reinforcing the idea that digital literacy is socially constructed and relational rather than purely individual.

The findings also underscore concerns about digital inequality. Parents with limited device access, unstable internet connectivity, or lower socioeconomic status described increased difficulty participating in blended learning. These disparities reflect global patterns indicating that access is a critical moderator of parental engagement and children's digital literacy development (Dianawati et al., 2025; Suryadi, 2025). In addition, research on early childhood digital literacy shows that balanced screen time and access to appropriate technologies significantly influence children's foundational literacy development, and parental involvement is central to mediating these experiences (Asmayawati, 2023; Karabanov & Aram, 2024). If digital inequities remain unaddressed, blended learning may exacerbate existing educational gaps.

Another important element involves the role of educators and educational institutions in shaping parental digital engagement. Parents in the study consistently expressed that clear instructions, supportive digital communication, and

intuitive platform design reduced the cognitive and emotional load associated with blended learning. These findings echo studies showing that teacher-designed interactive spaces, scaffolding practices, and communication strategies significantly improve parental participation in digital learning environments (Guo, 2025; Maaghop & Que, 2024). Likewise, digital media literacy research highlights that schools must serve as hubs of digital education not only for students but also for families (Ciboci & Labaš, 2019; Windasari & Dheasari, 2024).

The psychological implications of parental digital involvement were especially evident in findings showing emotional spillover into children's experiences. Parents who felt stressed or incompetent often conveyed these emotions unintentionally to their children, sometimes resulting in resistance or negative attitudes toward digital learning. This observation corroborates research showing that family functioning, parental mediation style, and parental stress directly influence children's digital behavior and mental well-being (Sarini, 2024; Tariq, 2025). It also aligns with recent evidence that parents' digital literacy not only affects their practical involvement but also shapes children's self-efficacy, emotional stability, and adaptability within blended or online learning contexts (Bang & Mackey, 2024; Choi & Choi, 2024).

The mixed-methods approach provided insight into how digital literacy enables parents to negotiate their evolving roles in blended learning systems. Findings show that parents perceive themselves as "assistant teachers," responsible for monitoring digital tasks, troubleshooting platform issues, and offering emotional support. This role expansion resonates with studies documenting how blended learning environments shift responsibilities toward households and require new forms of home–school collaboration (Maaghop & Que, 2024; Robbets, 2023). Yet, the emotional and cognitive burdens of this shift suggest the need for institutional structures that better support parents in fulfilling these expectations.

The present study also confirms that digital literacy is a dynamic and developmental construct. Many parents described gradual growth in their digital skills, often facilitated by intergenerational learning in which children acted as "digital tutors." This dynamic aligns with family-centred digital literacy models showing that children often guide parents' learning and that such reciprocal learning enhances family cohesion and digital confidence (Bang & Mackey, 2024; Karabanov & Aram, 2024). These intergenerational interactions highlight the importance of

conceptualizing digital literacy as a mutual learning process rather than a unidirectional skill transfer.

5. Conclusion

Overall, the findings contribute to the growing international literature emphasizing the multidimensional nature of parental digital literacy and its profound influence on blended learning. They affirm that digital literacy encompasses technical, emotional, social, and communicative competencies that jointly shape parental involvement. Moreover, they illustrate the complexity of digital parenting in blended learning systems, where parents navigate competing demands, psychological pressures, and evolving digital landscapes. The study supports calls for integrated frameworks that position parental digital literacy as foundational to equitable, effective, and emotionally supportive blended learning ecosystems.

6. Suggestions and Limitations

This study's findings must be interpreted in light of several limitations. First, although the sample was diverse, it may not capture the full range of socioeconomic and technological realities experienced by families in rural or underserved communities. Second, self-report instruments may introduce response biases, particularly regarding digital literacy, where parents may overestimate their competency. Third, the cross-sectional design limits causal inference despite the use of structural modelling. Fourth, qualitative findings, though rich, relied on voluntary participants who may differ from less engaged or digitally disconnected parents. Finally, the rapidly evolving nature of digital technologies means that parental experiences may shift over time, limiting the long-term generalizability of the findings.

Future research should explore longitudinal trajectories of parental digital literacy to determine how skills develop over time and influence children's academic and socio-emotional outcomes across different developmental stages. Studies should examine community-based interventions or school-led workshops to determine which forms of training most effectively enhance parental engagement. Future work could also investigate the role of fathers compared with mothers, as parental roles may differ significantly across cultures. Additionally, comparative studies across countries or cultural contexts could illuminate how socio-cultural norms shape digital parenting practices. Finally, incorporating experimental designs could help establish

causality between digital literacy enhancement programs and improved parental involvement.

Schools should provide structured digital literacy training for parents, ensuring that instructions for platform navigation and digital assignments are clear, accessible, and culturally appropriate. Teachers should communicate using concise, supportive digital messages and create user-friendly blended environments that reduce parents' cognitive load. Policymakers should ensure equitable access to devices and internet connectivity and design initiatives that reduce digital inequality. Parents may benefit from participating in peer support networks that facilitate collaborative problem-solving and shared learning. Emphasizing emotional support, stress management, and confidence-building strategies can also empower parents to engage more effectively in their children's blended learning experiences.

Authors' Contributions

All authors have contributed significantly to the research process and the development of the manuscript.

Declaration

In order to correct and improve the academic writing of our paper, we have used the language model ChatGPT.

Transparency Statement

Data are available for research purposes upon reasonable request to the corresponding author.

Acknowledgments

We would like to express our gratitude to all individuals helped us to do the project.

Declaration of Interest

The authors report no conflict of interest.

Funding

This research was carried out independently with personal funding and without the financial support of any governmental or private institution or organization.

Ethical Considerations

The study protocol adhered to the principles outlined in the Helsinki Declaration, which provides guidelines for ethical research involving human participants.

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