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Digital platforms and collaborative learning in digital and blended higher education: Evidence from a survey study

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Abstract

The intensity of platform use and students' engagement has a tremendous impact on the quality of collaborative learning. This study examines how the use of digital platforms, student engagement, and collaborative learning are related in digital and blended higher education. A sample of 300 students (150 blended and 150 fully online) of three tertiary institutions in Ukraine was involved using a cross-sectional quantitative approach, with data gathered through a structured questionnaire ($\alpha = 0.87$) and analysed using frequencies, means, standard deviations, independent t-tests, and regression. Results showed that students attending blended learning courses demonstrate a much greater general use of digital platforms ($M = 3.9$, $SD = 0.7$) compared to fully online courses ($M = 3.6$, $SD = 0.8$). The correlation between digital platform use and quality of collaborative learning is positive and statistically significant ($r = 0.52$, $p < 0.05$). Although the relationship is partially mediated by student engagement ($B = 0.29$, $p < 0.05$). The collaboration tools ($\beta = 0.25$) are better predictors of collaborative learning outcomes than the LMS use ($\beta = 0.09$). Moreover, there is a significant difference in the collaborative learning between blended and fully online groups ($t(298) = 3.68$, $p < 0.05$), in favour of blended learning. It concludes that the use of digital platforms is a major indicator of collaborative learning, particularly when collaboration-oriented tools are important. The study offers theoretical knowledge and practical advice to institutions of higher learning that aspire to improve collaborative learning in online and blended learning.

Keywords: Blended learning, Collaborative learning, Higher education, Learning management system, Online education, Student engagement.

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Contents

Contribution of this paper to the literature

This study helps in advancing the research in the field of educational technology from an empirical perspective on collaborative learning in higher education settings through an online and blended environment. It also provides a comparison with the usage of collaboration-oriented tools in comparison to general LMS usage, and gives comparative information from Kazakhstan universities.

1. Introduction

The introduction of digital technologies to higher education has changed the nature of pedagogical spaces, with new opportunities and challenges to collaborative learning. Serwornoo, Danso, Azanu, Semarco, and Aidoo (2024) argue that digital applications (learning management systems (LMS), Moodle, and Canvas) and specific collaboration tools (like Google Workspace, Microsoft Teams, and wikis) have become essential elements of infrastructure in tertiary knowledge co-construction, community building, and academic interaction. Such platforms are not only sources of instruction but also affect the organization of social interaction, interaction with peers, and the building of knowledge together with students (Bach & Thiel, 2024; Brugliera, 2024). In educational technology research, collaborative learning focuses on learning as a socially mediated process facilitated by interaction, dialogue, and joint problem-solving.

Digital and blended learning spaces are progressively anticipated to shift not only in the delivery of content to students but also in the creation of activity and participative learning. According to the previous literature, digital platforms with a deliberate design and pedagogical alignment can help to increase student engagement, peer-to-peer interaction, and shared learning outcomes (Ahmed, Andersion, & Martínez, 2024; Oise, Konyeha, Comfort, Konyeha, & Emmanueld, 2025). Nevertheless, the presence of technology does not ensure good cooperation. The intensity of platform use, functional affordances, and the level of engagement of the students have a tremendous impact on the quality of collaborative learning (Bond, Buntins, Bedenlier, Zawacki-Richter, & Kerres, 2020; Kok et al., 2025).

The topicality of studying digital platforms and collaborative learning is increased by the ongoing growth of online and hybrid higher education in the wake of global calamities like the COVID-19 pandemic (Gopinathan, Kaur, Veeraya, & Raman, 2022; Oise et al., 2025). Online and blended delivery models have been institutionalized in universities across the world, and it is crucial to learn how digital platforms can facilitate fundamental pedagogical objectives, such as collaboration and engagement (OECD, 2021). Study in educational technology are putting an increasing focus on student engagement, cognitive, behavioural, and social, as one of the crucial ways in which the use of technology can be translated into learning outcomes (Kahu, 2013; Kok et al., 2025). This shift calls for an administrative structure that aligns educational and scientific skills with digital technology (Bondar, Humeniuk, Batchenko, Horban, & Honchar, 2021). Furthermore, there is a need for a sound pedagogical response to address challenges or severe socio-political crises (peace, war, or public-health crises) that affect traditional educational models.

Although the literature on the effectiveness of digital learning has increased, there is inconclusive empirical evidence that is inconclusive on the extent to which various forms of digital platforms and particular platform functionality affect collaborative learning. Other researchers emphasise that LMS is superior in the arrangement of learning activities and discussion forums (Al-Fraihat, Joy, Masa'deh, & Sinclair, 2020), and some consider that collaboration-oriented tools are more effective in achieving co-construction of knowledge via real-time communication and shared authoring (Cuendet, Bonnard, Do-Lenh, & Dillenbourg, 2013; Oise et al., 2025). Such a discrepancy implies that there should be integrative models to consider the use of platforms as well as the moderating or mediating effect of student engagement.

There are a number of gaps in the available literature that justify the study. To begin with, most of the previous studies concentrate on single platforms or tools separately and not the integrated and comparative impacts of LMS and collaboration tools in real-life higher education settings (Bond et al., 2020). Beyond, although the collaborative learning outcomes are often studied, they do not test engagement as a mediating factor between platform use and quality of collaboration using mediation models or moderation models (Tang & Shen, 2026). Moreover, there is limited comparative evidence of the fully digital and blended learning cohorts that can be planned despite the theoretical statements suggesting that blended settings provide more comprehensive social interaction and collaboration (Shambharkar & Shukla, 2022). Lastly, the empirical consideration of platform functions, including communication, co-authoring, and feedback, and their different predictive capacity of collaborative learning outcomes is underrepresented.

To fill these gaps, this study provides a contribution to educational technology research in the following ways. Based on surveys, it empirically offers evidence on the degree of use, degree of engagement, and quality of perceived collaborative learning among higher education institutions (HEIs). Theoretically, it suggests and evaluates a framework that connects the use of digital platforms with collaborative learning achievements by means of student involvement, thus combining the perspective of technology adoption and the learning process. Analytically, the research is distinctive in drawing distinctions between LMS usage and collaboration-based tools, as it also draws subtle findings on the differences between digital and blended learning cohorts regarding the contextual variations in collaboration outcomes.

The research also contributes to the research on the predictive value of particular platform operations, communication media, co-authoring tools, and feedback processes to forecast the quality of collaborative learning. The results can be used to inform the design of instruction, choice of platforms, and professional development in postsecondary education by determining which functions most intensely relate to positive experiences of collaboration. In policy and practice, the research gives evidence-based recommendations to the HEIs aiming to maximize digital and blended learning environments to facilitate engagement and collaboration.

The main aim of the research is to explore the relationship between the application of digital platforms and collaborative learning and student engagement in digital and blended higher education settings in the West of Ukraine. To achieve this, there are five research questions (RQs), which are:

RQ1: What is the behaviour of students in digital and blended coursework in terms of the intensity of the use of various digital platforms (LMS and collaboration tools)?

RQ2: What is the relationship between the use of platforms and the perceived quality of collaborative learning?

RQ3: What is the level of mediation of student engagement between collaborative learning and platform use?

RQ4: Are there any differences between the outcomes of collaborative activities of blended and digital cohorts?

RQ5: Which features of the platforms (feedback, co-authoring, and communication) most predict collaboration?

In line with these, the following hypotheses are tested in the study.

H_1: The quality of collaborative learning is correlated with increased intensity in the use of digital platforms.

H_2: Collaboration-oriented tools are superior to an LMS as predictors of collaboration outcomes.

H_3: The bit of the relationship between platform use and quality of collaboration is mediated by student engagement (social/cognitive).

H_4: The students in blended learning indicate a greater quality of collaboration in comparison to those in digital learning (adjusting by course/major).

These places the study to add substantial empirical and theoretical knowledge about the use of digital platforms in collaborative learning in the modern context of higher education.

2. Literature Review

2.1. Theoretical Foundations

2.1.1. Social Constructivism and Community of Inquiry (CoI)

Collaborative learning is a social constructivism-based instructional practice, where learners actively construct knowledge through their social interaction and experience (Ramadevi et al., 2023). This theoretical focus is based on the idea that learning is social, and the socio-cultural theory by Vygotsky has brought to the fore the importance of social interaction in cognitive development (Vygotsky, 1978). This is enabled through digital platforms, which provide different tools that support joint activities, discussions, and problem-solving, and provide environments that can support knowledge construction (Ramadevi et al., 2023). As an example, the use of social media in collaborative learning within higher education has been reviewed systematically, and it has shown how it affects the creation of interactive settings (Du & Ibrahim, 2025).

In addition to social constructivism, when it comes to the interpretation of collaborative learning in online and blended classes, there is the Community of Inquiry (CoI) model (Zheng, Ganotice, Lin, & Tipoe, 2023). According to this model, the interaction of three basic presences: cognitive presence (meaningful learning), social presence (affective and interpersonal connection), and teaching presence (design and facilitation of course activities), produces a meaningful learning experience (Jackson & Yang, 2024; Kaczkó & Ostendorf, 2023; Shea et al., 2010). The latest developments in the CoI model include the addition of a learning presence that focuses on the importance of self-regulated learning in these conciliatory settings (Alsayer, Templin, Niileksela, & Frey, 2025; Zheng et al., 2023). This extended framework is one that recognises the constructive influence that learners assume in the management of their learning processes (Na, Jeong, Clarke-Midura, & Shin, 2024). Studies in the CoI paradigm continue to focus on the significance of using it to assess and implement blended learning experiences to improve them (Khodabandelou, Ahmad, & Mohseni, 2023; Li, Sulaiman, & Aziz, 2024). It is with this theoretical foundation that the mediation models of the current research are informed, including the hypothesis that student engagement is a mechanism that connects the use of digital platforms to collaborative learning outcomes. The changes in a specific context of Ukraine have been at a dramatic pace under local and international pressure. Educational research highlights the role of pedagogical changes in the globalization process and the inclusion of emerging technologies, such as AI, in education. This leads to the creation of a flexible digital environment where physical engagement is unavailable.

2.2. Blended Learning and Online Spaces as the Affordance of Collaborative Learning

The modern higher education environment is becoming more and more influenced by the augmentation of blended learning and sophisticated digital platforms that create an ecosystem that redefines collaborative learning. Blended education is a mixture of digital tools, which are offered online, and in-person education. Blended environments can facilitate discussions, peer reviews, and group projects, which facilitate collaborative engagement and make more interactions possible by allowing modal interaction (Baragash & Al-Samarraie, 2018; Bond et al., 2020; Kok et al., 2025; Koné, 2024; Lin & Wang, 2024). Nevertheless, blended learning also presents such issues as greater distraction during the online aspects and possible isolation when the sense of community is not intentionally created (Sareen & Mandal, 2024). The mode of delivery can also affect interactions and cooperative results. Intermodal interaction improves flexibility in interaction between learners with each other and the content and expands the possibilities of collaborative work in the form of discussions, peer review, and group projects (Baragash & Al-Samarraie, 2018; Bond et al., 2020; Kok et al., 2025; Riadi, Fuad, Yulianti, & Firdaus, 2024). However, the studies on the quality of collaborative learning directly compare learning between these modes and do not consider the differences in courses and disciplines. Online education has opened up opportunities to receive higher education, particularly for students who have geographic disadvantages or reside a long distance from educational institutions (Badanbekkyzy, Kalybekova, Sholakhova, Saktaganov, & Akimbayev, 2025). It has demonstrated its effectiveness in various educational disciplines, such as biomedical engineering, where blended learning is effectively applied. It is

effective in different academic fields, for instance, in biomedical engineering education, where blended learning has proven to be very effective. Digital simulations are useful, especially in the medical field, for situations where obtaining and using physical laboratories is difficult or limited. In addition, the quality of e-textbooks is also crucial in enhancing students' digital literacy and fostering positive learning attitudes for secondary school learners (Zasiekina, Vasylieva, Korshunova, Sipii, & Vashulenko, 2025). Thus, there is a gap that is bridged in the current study.

Interaction, exchange of resources, feedback, and creation of knowledge are supported with the help of digital platforms, especially Learning Management Systems (LMS), and collaboration-based tools, including cloud editors, discussion boards, and platforms of interactive communication (Javed et al., 2025; Wu & Xu, 2025; Zhao, 2024). According to systematic reviews, cloud-based tools can be used to communicate better and share knowledge in blended settings, yet it is difficult to associate tools with learning outcomes. Although LMS platforms offer structural assistance and analytics, their existence does not mean meaningful collaboration, and, in fact, they are frequently employed with the purpose of administration over collaboration. Further, instructional design and student factors, including digital literacy, influence LMS engagement, and much of the research focuses on behavioral indicators as opposed to cognitive or emotional engagement. Notably, the evidence on digital collaboration tools, such as shared documents and real-time communication platforms, suggests that these can not only support the shared work but also require everyone to contribute to the work so that the phenomenon of free-riding can be reduced and the co-creation of outcomes can be encouraged (Lin & Wang, 2024; Singh, Sharma, & Paliwal, 2021). Collectively, the literature indicates that although blended learning offers structural possibilities of collaborating, the success or failure of collaborative learning hinges greatly on the deliberate use of interactive online resources.

2.3. Collaborative Learning (Digital and Blended) Outcomes

Behavioural, emotional, and cognitive levels of student engagement have been widely identified as a factor that is essential in predicting effective learning in technology-mediated settings (Bond et al., 2020; Kok et al., 2025). Systematic reviews emphasize that, even though digital technologies allow flexibility of access and engagement, the definition of engagement across technologies has a range of definitions and is sometimes more of a perceptual than a behavioural measure, which restricts our knowledge about how engagement can be transformed into more profound learning outcomes, such as collaboration quality. The research on the use of online team-based learning models has revealed that when collaboration platforms provide students with the ability to interact in real time, the level of academic engagement and interest in learning improves significantly over time, which highlights the significance of long-term and interactive online experiences (Serwornoo et al., 2024).

The studies of collaborative learning in the context of virtual higher education focus on how digital platforms can support the process of joint knowledge building and autonomy (e.g., group ownership of the work) but claim that without specific attention to group design and facilitation, collaboration can be meaningful and superficial (Bach & Thiel, 2024). As digital space expands and evolves, there will be more and more opportunities for intelligent collaboration to work. However, some of the barriers are related to the digital readiness of staff, ethics, and resistance to change (Ibrayeva, Maimakova, Gavrilova, Akerke, & Akimbayev, 2025). This is consistent with the proven social constructivist assumptions: successful cooperation requires a good level of interaction and mutual problem solving, rather than access to tools. Based on the existing evidence, collaboration-oriented tools (e.g., real-time co-authoring, shared workspaces) have a stronger link with deep collaborative outcomes than LMS tools that are mostly oriented to deliver courses (Zamiri & Esmaeili, 2024). This difference underlies assumptions of the variation in platform type effects on collaboration.

2.4. Conclusion and Research Gap

The literature gives a clear understanding of how digital platforms and blended learning contexts could promote collaborative learning with alignment to the pedagogical design and engagement in support of affordances. The CoI framework and social constructivist theory offer a good explanatory mechanism of the mediation pathways between platform use and engagement and collaboration. However, there are several gaps of interest, such as the lack of empirical studies that directly investigate the role of student engagement as the mediator between platform usage and quality of collaborative learning in both digital and blended learning settings. Besides, a lack of comparative studies of digital and blended cohorts with course/major control was also present. Another gap identified was the lack of granular evidence on which particular platform functions (communication, co-authoring, feedback) have the most significant predictive power in the outcomes of collaborative activities. In this way, the proposed study addresses these gaps by synthesizing theoretical and empirical evidence from surveys and offers subtle insights into the interaction of digital platform affordances with engagement to facilitate the results of collaboration in a wide range of higher education modalities.

3. Methodology

3.1. Research Design

This study employed a cross-sectional quantitative survey design to examine relationships between digital platform use, student engagement, and collaborative learning in higher education in Western Ukraine. This design enabled comparisons between students in fully online (courses delivered entirely through digital platforms with no in-person component) and blended learning (courses combining face-to-face instruction with online digital platform activities) formats and supported correlation and predictive analyses among main variables (Creswell & Creswell, 2018).

3.2. Location and Setting

To achieve external validity and to obtain a diversity of experiences among students, data were gathered in three universities in Ukraine. The chosen institutions had courses in Education, Business and Management Sciences, Science and Engineering, and Technology. Some of the representative courses were Educational Technology,

Marketing, Computer Science, and Electrical Engineering. Courses offered in 100% online or blended courses were included in the previous semester to ensure participants had recent experience with digital learning platforms.

3.3. Participants and Sampling

The participants were students of undergraduate courses of Taras Shevchenko National University of Kyiv, Lviv Polytechnic National University, and Vasyl Stefanyk Precarpathian National University. The universities were chosen because of their active application of online and blended learning in various subjects. The students were selected through a stratified sampling technique, with 300 students selected. Stratification was performed by faculty, course type, and delivery mode to provide even representation across faculty, type, and mode of courses. Nearly 100 participants contributed from each university, with almost a 50/50 split between fully online (n = 150) and blended learning students (n = 150). The sampling frame was created based on students' enrolment in online or blended courses from institutional enrollment data. Four hundred and twenty (420) eligible students were invited using institutional mailing lists and course announcements. Data from 332 responses were collected (79.0% response rate). Following data screening, 32 questionnaires were discarded due to incompleteness and/or due to satisfy the inclusion criteria, leaving 300 questionnaires for final data analysis. Participants were eligible if they had taken at least 1 online/blended course in the last semester and had been using a digital learning platform for 4 or more weeks. Students who withdrew early and/or did not complete the questionnaire were excluded.

3.4. Research Instruments

The study data were gathered through a structured questionnaire with five major sections that addressed demographic characteristics, collaborative learning, student engagement, use of digital platforms, and student digital competence (see Appendix I). Demographic variables consisted of gender, age, academic year, faculty, course, and digital experience. The 8 items of the Community of Inquiry (CoI) framework (Kaczkó & Ostendorf, 2023) were adapted to measure collaborative learning. This study used the Online Student Engagement (OSE) scale to measure student engagement, with 8 items adapted to measure behavioral, emotional, cognitive, and social engagement. Some minor wording changes were made to fit the study context for the scales. The digital platform use was measured by a 10-item platform use index, which was developed by the researcher based on how often and how much the respondents used the various functions, communication tools, co-authoring applications, feedback systems, and group management features of the platforms. The ratings for responses were on a 5-point Likert scale from 1 (Never) to 5 (Very often). Digital competence was measured by 10 items based on validated digital literacy assessment tools, which were self-reported. The course format, academic year, and discipline were entered as control variables. The items in the questionnaire were drawn from previously established and tested questionnaires: the Community of Inquiry (CoI) questionnaire (Social Presence subscale and Teaching Presence subscale) and the Online Student Engagement (OSE) Scale. The adaptation process followed three steps: 1. item wording was reviewed and adjusted for relevance to the Ukrainian higher education context; 2. a panel of three subject-matter experts evaluated content validity, confirming that all items aligned with the study objectives and measurable outcomes; and 3. a pilot study with 20 students was conducted to assess clarity and reliability before full administration.

Principal Component Analysis (PCA) was used for the validation of a 36-item scale (See Appendix I). The Kaiser-Meyer-Olkin value was 0.91, and a significant Bartlett's Test of Sphericity, $\chi^2(630) = 4528.47$, $p < .001$, was used to test the sampling adequacy. The four components that have eigenvalues greater than 1 accounted for 63.91% of the total variance and had factor loadings between 0.79 and 0.81. A pilot study (20 students) and expert review were conducted to further validate and test the reliability of the instrument. The scale was validated to be dependable and relevant to the situation, and then a full administration pilot test was conducted on a sample of 20 students. An expert review was done on the content validity aspect to be sure that all items capture the study objectives and measurable outcomes. Also, the consistency of the instrument was estimated using Cronbach's alpha and gave a total score of 0.87 with subscales of collaborative learning ($\alpha = 0.83$), student engagement ($\alpha = 0.89$), digital platform use ($\alpha = 0.91$), and students' digital competence ($\alpha = 0.87$).

3.5. Data Collection Procedure and Preparation

An online questionnaire (Google Forms) was used to gather data for 2 weeks. Respondents were free to refuse to participate and could discontinue at any time without penalty. Robust data screening and preprocessing were performed before data analysis. Mean imputation was used for missing data (where applicable), and pairwise deletion was employed. To detect and filter out incorrect answers, attention-check items were added.

3.6. Data Analysis

SPSS and the PROCESS Macro (Model 4) were used for data analysis. Descriptive statistics included frequencies, means, and standard deviations. The Pearson correlation analysis was used to study the correlations between variables, and the independent-samples t tests were used to compare the outcomes of collaborative learning groups between the fully online group and the blended group based on Cohen's d as an effect size.

Using a hierarchical multiple regression analysis, the predictive effects of the use of digital platforms on collaborative learning were studied while controlling for course format, academic year, discipline, and digital competence. The standardized residual Shapiro–W statistic was not significant ($W = .987$, $p > .05$). Similarly, the Breusch–Pagan test was not significant, $\chi^2(1) = 1.92$, $p > .05$, indicating that both normality and the homoscedasticity regression assumptions were met. The Durbin–Watson (DW) statistic was used with a value of 1.95, indicating no significant autocorrelation issues in the models. Variance Inflation Factor (VIF) was calculated to assess multicollinearity, with a value of 3.2. To understand whether the mediation effect was observed between the use of digital platforms for collaborative learning, the mediation analysis was carried out using PROCESS Macro (Model 4). Indirect effects, standard errors, and 95% bias-corrected confidence intervals were obtained with 5,000 resamples in the bootstrapping procedure.

Table 1. Study Sample Demographic Characteristics (N=300).

Variables	Category	Frequency (n)	Percentage (%)
Gender	Male	138	46.0
	Female	162	54.0
Age Group	17–20 years	72	24.0
	21–25 years	156	52.0
	26–30 years	48	16.0
	Above 30 years	24	8.0
Academic Year	Year 1	78	26.0
	Year 2	84	28.0
	Year 3	90	30.0
	Year 4	48	16.0
Faculty/Discipline	Education	88	29.4
	Business & Management	76	25.3
	Science	64	21.3
	Engineering & Technology	72	24.0
Previous Digital Learning Experience	Yes	254	84.6
	No	46	15.4
Self-Rated Digital Competence	Low	42	14.0
	Moderate	174	58.0
	High	84	28.0

4. Results

Table 1 results indicate that there are more female students (54.0%) than male students (46.0%). Most of the respondents fell within the 21-25 age bracket (52.0%), then the 17-20 age bracket (24.0%), and a few in the 26-30 age bracket (16.0%) and above 30 (8.0%). In addition, there was a distribution of the students at all study levels; the largest percentage (30.0) was used to depict the Year 3 students, then Year 2 (28.0), and Year 1 (26.0). A sample size of 16.0% comprised final-year students. The biggest percentage of respondents was in the Faculty of Education (29.4%), then Business and Management (25.3%), then Engineering and Technology (24.0), and Science (21.3). Moreover, a majority (84.6) of them stated that they were previously exposed to digital learning, and thus, they were already familiar with a digital learning setting before the study. Lastly, the majority of the students rated their competence as moderate (58.0%), 28.0% rated themselves as highly competent, and 14.0% rated themselves as having low digital competence. This indicates that, in general, the sample was digitally literate enough to successfully use the online and blended learning platforms. RQ1. What is the behaviour of students in digital and blended coursework in terms of the intensity of the use of various digital platforms (LMS and collaboration tools).

Table 2. Descriptive Analysis of the Digital Platforms Used.

Platform Function	Mean (M)	SD
LMS Use (Materials, quizzes, assignments)	3.92	0.81
Communication Tools (Teams, Zoom, forums)	3.84	0.88
Co-authoring Tools (Google Docs, M365)	3.45	0.97
Feedback & Peer Review	3.58	0.89
Group Management (channels, breakout rooms)	3.29	1.02
Overall Platform Use Index	3.76	0.74

The results in Table 2 show that of the students who interacted with digital learning resources very actively, with an Overall Platform Use Index of M = 3.76 and SD = 0.74, meaning that they use the platform regularly in all the activities. LMS use (M = 3.92, SD = 0.81) had the highest mean score since it is a key instructional center. There was also a vast use of communication tools (M = 3.84, SD = 0.88), which were used actively. On the contrary, collaboration-based tools were moderately used; feedback and peer review (M = 3.58, SD = 0.89) and co-authoring tools (M = 3.45, SD = 0.97) were less engaged, and group management (M = 3.29, SD = 1.02) features were less used, which indicated less intensive collaboration activities. Moreover, the degree of digital tool use across course formats is illustrated in Figure 1.

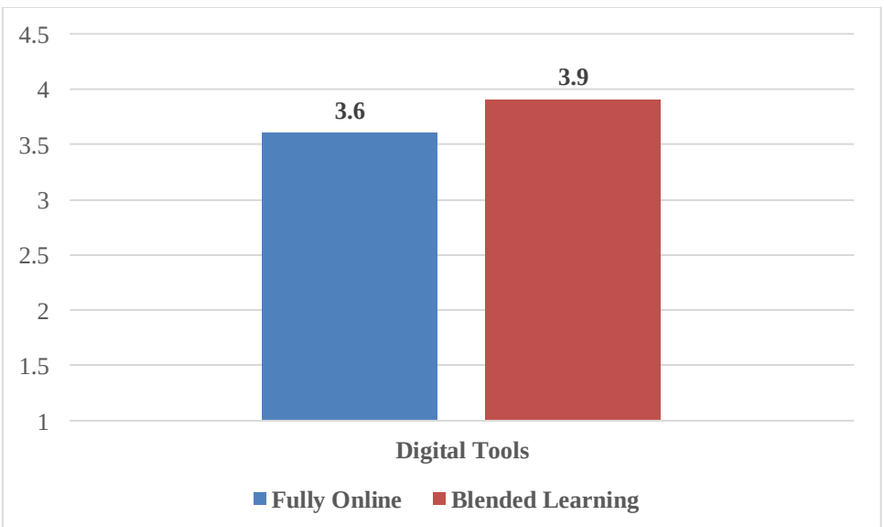

Figure 1. Intensity of Digital Tool Use by Course Format.

Figure 1 illustrates the intensity of digital tool use across course formats. Students in blended learning courses reported higher overall platform use (M = 3.9, SD = 0.7) compared to those in fully online courses (M = 3.6, SD = 0.8). This suggests that students in blended settings felt that digital tools could better assist them in communication, interaction, and collaborative learning activities than did students in fully online settings.

RQ2: What is the relationship between the use of digital platforms and the perceived quality of collaborative learning?

Table 3. Pearson Correlation Analysis of the relationship between the use of digital platforms and perceived quality of collaborative learning.

Correlations			
		Digital Platforms	**Collaborative Outcome**
Digital Platforms	Pearson Correlation	1	0.52
	Sig. (2-tailed)		$p < 0.001$
Collaborative Outcome	Pearson Correlation	0.52	1
	Sig. (2-tailed)	$p < 0.001$	
	N	300	300

The finding in Table 3 shows that there is a moderate positive and significant relationship between the overall intensity of digital platform use and perceived quality of collaborative learning ($r = 0.52$, $p < 0.05$). This result confirms H1 posed by the study, which suggests that the more students work with digital means, the more they are likely to indicate higher rates of collaborative learning. Thus, the hypothesis is accepted.

RQ3: Is platform use mediated by student engagement in the use of collaboration and platform use?

Table 4 presents the results of the mediation analysis (PROCESS Model 4) examining the indirect effect of student engagement on the relationship between platform use and collaborative learning.

Table 4. Mediation Analysis Between Platform Use, Collaborative Learning, and Student Engagement (PROCESS Model 4).

Path	**B**	**SE**	**β**	**t**	**p**	**95% CI**	**Interpretation**
Total Effect (c): Platform Use → Collaborative Learning	0.47	0.05	0.52	9.40	0.00	0.37- 0.57	Significant positive total effect
Direct Effect (c'): Platform Use → Collaborative Learning (controlling Engagement)	0.29	0.05	0.32	5.80	0.00	0.19-0.39	The effect is direct and significant.
Indirect Effect (a x b): Platform Use → Engagement →Collaborative Learning (Bootstrapped CI)	0.18	0.04	—	—	—	0.11- 0.26	The effect is partial when mediated.
Model Summary	R^2	Adjusted R^2	F	df	p		
	0.48	0.46	68.95	297	0.00		

The mediation analysis (PROCESS Model 4) shows that the total effect of using platforms on collaborative learning is significant and positive (B = 0.47, SE = 0.05, $p < 0.05$, 95% CI = 0.37-0.57). The direct influence of platform use is also significant when student engagement is included in the model (B = 0.29, SE = 0.05, $\beta = 0.32$, $p < 0.05$, 95% CI = 0.19-0.39), indicating that platform use has an independent impact on collaborative learning outcomes. Mediation is also observed through the presence of the indirect effect through student engagement (B = 0.18, SE = 0.04, 95% CI = 0.11-0.26). The indirect effect (0.18) constitutes 38% of the overall effect, indicating that student engagement accounts for a significant percentage of the relationship between platform use and collaborative learning. The results indicate that though the mediation is partial, it explains part of the effect, indicating that student engagement performs a partial but statistically significant mediating role.

RQ4: Are there any differences between the outcomes of collaborative activities of blended and digital cohorts?

Table 5. Independent t-test results between outcomes of collaborative activities of blended and digital cohorts.

Course Format	**N**	**Mean**	**SD**	**t**	**df**	**p-value**	**Cohen's d**
Fully Online	150	3.58	0.76	3.68	298	0.001	0.43
Blended Learning	150	3.89	0.69				

Table 5 results show that there is a statistically significant difference in the outcomes of collaborative learning between the two cohorts, $t(298) = 3.68$, $p < 0.05$. Blended learning course students (M = 3.89, SD = 0.69) reported much more positive perceived results of collaborative learning than their fully online course colleagues (M = 3.58, SD = 0.76), with a moderate effect size (0.43).

To examine whether students in blended learning indicate a greater quality of collaboration in comparison to those in digital learning, controlling for course, a hierarchical multiple regression analysis was conducted. Table 6 presents the results of the hierarchical multiple regression analysis examining the predictive effects of course format on collaborative learning quality, controlling for faculty/discipline.

Table 6. Hierarchical Multiple Regression Analysis Predicting Collaborative Learning Quality.

Predictor	**B**	**SE**	**β**	**t**	**p**
Model 1: Only Controls					
(Constant)	3.41	0.09	—	37.89	0.000
Business & Management	0.08	0.09	0.06	0.89	0.374
Science	-0.11	0.10	-0.08	-1.12	0.264
Engineering & Technology	-0.05	0.09	-0.04	-0.63	0.529
Education (Reference)	—	—	—	—	—
R^2	0.06				

Predictor	B	SE	β	t	p
Adjusted R^2	0.05				
F (3, 296)	6.12				0.000
Model 2: Controls + Course Format					
(Constant)	3.28	0.10	—	32.80	0.001
Business & Management	0.06	0.09	0.05	0.71	0.478
Science	-0.09	0.10	-0.07	-0.93	0.353
Engineering & Technology	-0.04	0.09	-0.03	-0.58	0.562
Course Format (Blended/ Online)	0.27	0.07	0.24	3.86	0.000
R^2	0.11				
Adjusted R^2	0.10				
ΔR^2	0.05				
ΔF (1, 295)	14.89				
F (4, 295)	7.21				

In Model 1, the faculty has been keyed in as the sole predictor of collaborative learning with Education as the reference category. The general model was significant ($F(3, 296) = 6.12$, $p < 0.05$), but did not have much explanatory power ($R^2 = 0.06$; Adjusted $R^2 = 0.05$). None of the single types of faculties, Business and Management, Science, and Engineering and Technology, made any significant difference with the reference group. This means that, in spite of the fact that the combination of the variables of discipline was statistically significant, there was no significant difference between the faculties as predictors of the collaborative learning outcomes.

Model 2 included course format (blended or fully online) in the regression model. The model was still important, $F(4, 295) = 7.21$, $p < 0.05$, and the explained variance rose to 11% ($R^2 = 0.11$; Adjusted $R^2 = 0.10$). This added course format to the model substantially increased the variance, with an additional 5% of variance explained ($\Delta R^2 = 0.05$; $\Delta F(1, 295) = 14.89$, $p < 0.05$), which was significant. Course format had been identified as a strong predictor ($B = 0.27$, $\beta = 0.24$, $p < 0.05$), which means that students enrolled in blended classes had much higher scores on collaborative learning than their colleagues taking fully online courses, even after adjusting for the faculty. These results support H4; hence, the hypothesis is accepted.

RQ5: What are the most collaborative features of the platform: feedback, co-authoring, and communication?

Table 7 presents the results of the hierarchical multiple regression analysis examining the predictive effects of digital platform features on collaborative learning outcomes.

Table 7. Regression Results Collaboration outcome Prediction by Digital platforms.

Predictor	B	SE	β	t	p
Model 1: Only Controls					
(Constant)	3.55	0.12	—	27.92	0.000
Course Format (Blended/Online)	0.17	0.06	0.14	2.83	0.005
Academic Year	0.03	0.03	0.04	1.10	0.272
Faculty	0.02	0.03	0.03	0.65	0.517
Digital Competence	0.11	0.04	0.11	2.75	0.006
Model 2: Controls + Digital Platform					
(Constant)	1.94	0.22	—	8.82	0.000
Course Format (Blended/Online)	0.12	0.05	0.10	2.32	0.021
Academic Year	0.02	0.03	0.03	0.89	0.374
Faculty	0.01	0.02	0.02	0.54	0.591
Digital Competence	0.07	0.03	0.08	2.01	0.045
LMS Use	0.08	0.04	0.09	2.10	0.036
Communication Tools	0.23	0.05	0.25	4.60	0.000
Co-authoring Tools	0.25	0.05	0.24	4.80	0.000
Feedback & Peer Review	0.19	0.05	0.21	3.95	0.000
Group Management Tools	0.12	0.05	0.11	2.50	0.013
Model	R^2	Adjusted R^2	ΔR^2	F	p
1	0.18	0.16	0	16.17	0.000
2	0.52	0.50	0.34	34.87	0.000

The collaboration outcomes in Model 1 were attributed to a combination of course format, academic year, faculty, and digital competence ($R^2 = 0.18$, $p < 0.05$). The significant predictors were course format ($\beta = 0.14$, $p < 0.05$) and digital competence ($\beta = 0.11$, $p = 0.006$), and the rest were not significant predictors. The added features of a digital platform in Model 2 made a substantial change in the model, where the explained variance rose to 52% ($R^2 = 0.52$, $p < 0.05$). The strongest predictors were communication tools ($\beta = 0.25$, $p < 0.05$) and co-authoring tools ($\beta = 0.24$, $p < 0.05$), and the third predictor is feedback tools ($\beta = 0.21$, $p < 0.05$). The contributions made by LMS use and group management tools were also small but significant. These results suggest that platform features have a significant contribution to the collaboration results outside the demographic variables.

5. Discussion

The study explores the relationship between the application of digital platforms and collaborative learning and student engagement in digital and blended higher education settings. Generally, the evidence is very empirical in favour of the argument that significant interaction with digital learning platforms, especially with the collaboration-based tools, increases the perceived quality of collaborative learning among students.

The results show that the active interaction of students with digital learning materials is the most common because LMS usage reported the maximum mean value, which proves its core in terms of becoming the institutional focus of delivering instruction. There was also a prevalence of communication tools, and thus, interaction is one of

the central digital learning activities. Features of collaboration, which included co-authoring tools, feedback and peer review, and group management, were not, however, intensively used. This trend fits the results of previous studies suggesting that LMS systems are commonly used not to facilitate close interaction but to distribute the content (Alzahrani, Meccawy, Samra, & El-Sabagh, 2025; Lin & Wang, 2024). It is also indicative of the issues that have been expressed in the literature that students can find communication tools easier to utilize than structured co-construction tools that demand greater cognitive and social investment (Lin & Wang, 2024). The findings suggest that students in blended learning environments had a more positive perception of the digital tools than did students in all-online learning environments. Blended learning offers a more conducive environment for collaborative learning by integrating face-to-face communication and co-authoring with digital communication. The findings align with the conclusions of previous studies, which have shown that blended learning environments have a greater ability to improve the interactions, engagement, and collaborative participation among students than fully online environments (Lin & Wang, 2024).

The results also indicate the presence of a moderate positive correlation, indicating that increased use of digital platforms is correlated with greater perceived collaborative learning. This is in line with social constructivist theory (Vygotsky, 1978) that points to the fact that knowledge is co-constructed in a social interaction. The results also persist with the Community of Inquiry (CoI) model (Nizzolino & Canals, 2024), according to which significant learning is the result of the convergence of social, cognitive, and instructional presence in digital contexts.

The mediation analysis also showed that platform use and collaborative learning are related through student engagement, where engagement partly mediates. Although the indirect effect through engagement was significant, the use of the platform had a direct effect on collaborative learning. This implies that digital tools are better at improving collaboration, partially because they arouse behavioral and cognitive activities. These findings are in line with the engagement theory (Oskarita & Arasy, 2024) that argues that technology enhances learning when it leads to teamwork and enthusiasm.

Additionally, the results have shown that interactive collaboration-related characteristics were better predictors of collaborative learning in comparison to the general use of LMS. Specifically, communication tools and co-authoring tools have become the most powerful predictors, and then feedback and peer review tools. By comparison, the use of LMS showed a lesser but significant impact. The findings are consistent with the existing literature, indicating that the tools that enable the creation of shared knowledge, including collaborative documents and interactive discussion rooms, promote more profound interaction and group problem resolution (Lin & Wang, 2024). The results also align with constructivist and collaborative learning theory that underlines active knowledge co-creation instead of passive access to the content (Dahl & Mørch, 2025; Petko, Vdovichen, Vdovichena, Koroliuk, & Losheniuk, 2026). The relatively small impact of the LMS application implies that access to the course materials is not always guaranteed to have positive effects on the collaborative results. Instead, the presence of structured interactivity features that allow communication, co-authoring, and feedback seems to have a more prominent role in the realization of meaningful collaborative learning experiences.

Blended learning course students indicated their platform usage is significantly higher, and their collaborative learning performance is stronger relative to fully online courses. Controlling for faculty still indicated a significant effect size, which was moderate in nature. These results are consistent with the previous meta-analyses stating that blended learning tends to provide better results than fully online courses because of the combination of face-to-face learning with online support (Oise et al., 2025). The blended environment could maximize the social presence and trust that are vital in collaboration (Kyfyak, Kyfyak, & Koroliuk, 2023; Mushtaq & Iqbal, 2024). This data indicates that online platforms are best supported with face-to-face interaction in a structured form. Despite the overall faculty model being statistically significant, the individual faculties were not significantly different from the reference group. It means that the course design and the use of digital tools have a stronger impact on collaborative learning outcomes than the disciplinary affiliation. This result confirms the thesis statement that effective pedagogical frameworks have the ability to cross-disciplinary boundaries to encourage cooperative learning.

These results have several implications for HEIs. First, the focus on using LMS underlines its support role, yet the research indicates that the use of an LMS is not enough to develop effective collaborative learning. The strategic investments and encouragement of the use of specialized collaboration tools, especially co-authoring, communication, and feedback/peer review capabilities, should be encouraged by HEIs, as they have a greater predictive ability for collaborative learning outcomes. Moreover, the high-quality collaborative learning results related to blended settings speak in favor of the fact that HEIs must consider using and improving the blended learning frameworks, taking advantage of the synergies of the face-to-face and online communication. Instructors must be trained on those pedagogical strategies enabling the effective integration of those collaboration-oriented tools, rather than passively delivering the content, but actively facilitating the discourse and co-creation of knowledge, which is facilitated by teaching presence subscales within the CoI framework (Serwornoo et al., 2024).

The results of this paper are highly reminiscent of the Community of Inquiry (CoI) model, especially when it comes to the interaction between social and teaching presence as a means of developing a collaborative learning experience (Jackson & Yang, 2024). The fact that student engagement mediates the relationship between platform use and collaborative learning to a certain degree also supports the significance of social presence, the capacity of parties to portray themselves as genuine individuals, and to have open communication with them in the context of deeper student learning (Serwornoo et al., 2024; Shpykuliak et al., 2024). The increased predictive value of collaboration-based tools (e.g., co-authoring) compared to the overall LMS functionality underpins the notion that particular instructional design and facilitation (teaching presence) must be the key to capitalizing on digital affordances to achieve cognitive presence in terms of meaningful discourse and reflective learning (Ayodele & Zaine, 2024). The improved collaborative learning in blended environments also contributes to the flexibility of the CoI, thus proving the fact that the properly designed combination of modalities can maximize the advancement of these presences.

Though this research offers useful information, it is limited in a number of aspects. To begin with, its use of self-report measures as the source of platform use, student engagement, and collaborative learning exposes it to possible biases, including social desirability bias and recall errors that might not necessarily mirror actual behaviors and perceptions. Second, a cross-sectional design reflects the relationships at one moment, which does not allow for

establishing a causal connection or seeing the dynamics in collaborative learning and using platforms (Kichuk, Biliuk, Kapinus, Fedenko, & Livak, 2024; Zhanarstanova, Alimzhanov, Dossymkhan, & Kaldybekova, 2024). This implies that, as much as we are in a position to identify associations, we are not in a position to determine how these behaviors develop and the effects of these behaviors over the long term. Third, the research was done in one country, which restricts the ability to generalize the results to another cultural or educational setting. The educational systems, technological systems, and cultural practices can affect the interaction of the students with the digital platform and their participation in cooperative learning. Lastly, the study did not disaggregate the Community of Inquiry (CoI) framework into three major measures (social, teaching, and cognitive). The particular interaction between these theoretical pillars has not been researched by using collaborative learning as a single measure. Although such a high-level method gives a clear picture of platform efficacy, it might fail to detect more specifics in the way teaching presence affects the mediation process of student engagement.

6. Conclusion

Overall, the research indicates that the utilization of digital platforms is a key predictor of collaborative learning so far (in case collaboration-focused tools are prioritized). This relationship is mediated in part by student engagement, and blended learning forms seem particularly useful. The results emphasize that technology is not a sufficient factor to ensure the quality of collaboration; instead, the design should be purposeful and organized, and the interactive tools should be taken in the form of a plan. The insights offer theoretical illumination and a practical guideline to institutions of higher learning aiming to enhance collaborative learning in digital and blended learning. It would be advisable to include objective data (i.e., log files generated in LMS) in future research to counteract self-reported measures and give more precise indicators of what actually happens with the usage of a specific platform. Longitudinal designs are required to test the cause-and-effect relationships and how the use of the platform, engagement, and collaborative learning evolve with time. Multi-institutional or cross-national studies would be better for generalizability and would allow for defining contextual variations. Case studies or interviews might provide more insight into the experiences of collaboration among the students. Furthermore, the importance of instructional interventions and contextual variables, e.g., discipline, class size, assessment procedures, and digital equity, that determine the efficiency of collaboration-based digital tools should be investigated in the future. Validated CoI measurement scales should also be used in future research to investigate the interactive and differentiated effects of the cognitive, social, and teaching presence.

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Appendix I.

Study Questionnaire

Section A: Demographic Characteristics

Instruction: Please tick (√) the response as it applies to you

1. Gender: Female ( ) Male ( ) Prefer not to say ( )
2. Age: Below 18 ( ) 18–21 years ( ) 22–25 years ( ) 26–30 years ( ) Above 30 ( )
3. Academic Year: ----------
4. Faculty: ----------
5. Course of Study: ----------
6. Digital Experience: Below 1 year ( ) 1-2 years ( ) 3-4 years ( ) 5 years and above ( )
7. Have you previously completed a fully online course? Yes ( ) No ( )

Note: Scale: 1 (Never) – 5 (Very often) for Sections B – E

Instruction: Please state the frequency at which you agree with the following statements.

Section B: Collaborative Learning

S/N	Item
1	I am confident and comfortable having academic dialogue with peers online.
2	My colleagues are proactive in sharing ideas and different points of view when doing collaborative work.
3	I experience a sense of belonging and inclusion in the online collaborative activities.
4	Online discussions help a great deal in my capacity to arrive at a common ground with my classmates.
5	The educator gives explicit instructions and group work performance standards.
6	The teacher engages in online discussions as a facilitator and moderator of online conversations to make them productive.
7	The instructor offers systematic direction that facilitates group learning.
8	The positive feedback provided by the instructor directly improves our teamwork performance.

Section C: Student Engagement

S/N	Item
1	I engage in online discussions regularly.
2	I work hard on doing digital learning assignments.
3	I am intrigued by the information presented by the digitized media.
4	I remain alert in digital learning classes.
5	I work with classmates in order to comprehend course materials.
6	I use critical thinking when undertaking online assignments.
7	I communicate with instructors in cases where I am in need of clarification.
8	My digital learning activities are emotionally related to me.

Section D: Digital Platform Use

S/N	Item
1	Learning Materials Learning Management System (LMS)
2	Handing in assignments online.
3	Doing quizzes or exams via the internet.
4	Zoom meetings
5	Applying chat or discussion forums in academic communication.
6	Google Docs or Microsoft 365.
7	Online feedback.
8	Breakout rooms, channels, and group management functionality
9	Using online communication with instructors.
10	Learning through the medium of multimedia (videos, recorded lectures).

Section E: Digital Competence

S/N	Item
1	I have mastered the use of online search to find academic information.
2	I am able to assess the reliability of online sources.
3	I am able to produce academic materials (documents, presentations) online.
4	I can troubleshoot simple technical issues on my own.
5	I can handle computer documents and systematize web-based materials.
6	I am aware of the safety and confidentiality of data on the Internet.
7	I can apply collaborative online tools.
8	I am not an indicator that I am difficult to adjust to new digital learning technologies.
9	I am also able to communicate in a professional way using digital platforms.
10	I can combine various online technologies to accomplish academic tasks.

Factor Component Analysis of the Scale

Component	Initial Eigenvalue (Total)	Initial % of Variance	Initial Cumulative %	Extraction Total	Extraction % of Variance	Extraction Cumulative %
1	10.284	28.567	28.567	10.284	28.567	28.567
2	6.142	17.061	45.628	6.142	17.061	45.628
3	4.218	11.716	57.344	4.218	11.716	57.344
4	2.364	6.567	63.911	2.364	6.567	63.911
5	0.948	2.633	66.544			
6	0.884	2.455	68.999			
7	0.812	2.256	71.255			
8	0.764	2.122	73.377			
9	0.711	1.975	75.352			
10	0.689	1.914	77.266			
11	0.652	1.811	79.077			
12	0.621	1.725	80.802			
13	0.598	1.661	82.463			
14	0.566	1.572	84.035			
15	0.541	1.503	85.538			
16	0.522	1.450	86.988			
17	0.501	1.392	88.380			
18	0.478	1.328	89.708			
19	0.452	1.256	90.964			

Component	Initial Eigenvalue (Total)	Initial % of Variance	Initial Cumulative %	Extraction Total	Extraction % of Variance	Extraction Cumulative %
20	0.431	1.197	92.161			
21	0.409	1.136	93.297			
22	0.387	1.075	94.372			
23	0.366	1.017	95.389			
24	0.348	0.967	96.356			
25	0.327	0.908	97.264			
26	0.304	0.844	98.108			
27	0.286	0.794	98.902			
28	0.264	0.733	99.635			
29	0.213	0.592	100.000			
30	0.000	0.000	100.000			
31	0.000	0.000	100.000			
32	0.000	0.000	100.000			
33	0.000	0.000	100.000			
34	0.000	0.000	100.000			
35	0.000	0.000	100.000			
36	0.000	0.000	100.000			

Factor Loading of the Scale

Item	Factor 1	Factor 2	Factor 3	Factor 4
Collaborative learning item 1	0.78	0.21	0.10	0.08
Collaborative learning item 2	0.74	0.18	0.12	0.06
Student engagement item 1	0.19	0.81	0.11	0.05
The digital platform uses item 1	0.14	0.10	0.84	0.09
Digital competence item 1	0.08	0.12	0.16	0.79

Note: Factor Loadings ≥ 0.40 are retained.