Digital Culture and Education Review

Vol.1, Issue.1, (2025)

Digital Culture and Education Review

How Technology Reshapes Learning Beyond the Classroom in the Post-Digital Education in China

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Article Information

Article Type: Research Article

Dates:
Received: 06 April 2025
Revised: 30 April 2025
Accepted: 28 May 2025
Available online: 09 June 2025

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ABSTRACT

In the age of post-digital education, technology has been integrated into the learning environment, porting the traditional learning paradigm into a new era. Using the Community of Inquiry (CoI) Framework, the current study examines the impact of prior knowledge, student engagement, and integrating technology on learning beyond the classroom. Using the structural equation modeling approach, data were collected from 211 participants (students and educators) at higher education institutions in China. A path coefficient of 0.341 (t = 12.729, p = 0.000) was strongly positive between Prior Knowledge towards Learning Outcomes beyond the Classroom. By examining the path coefficient of Student Engagement and the Learning outcomes beyond Classroom, 0.240 (t = 8.405, p = 0.000), it is clear that participant engagement does affect learning outcomes in a broader context. Another hypothesis results of the path coefficient (t=11.693; p=0.000) revealed a significant relationship between prior knowledge in learning and Technology Integration in Learning against the Prior Knowledge. Whereas Technology Integration in Learning impact on Student Engagement has the strongest relationship as expressed in the path coefficient of 0.372 (t = 14.423, p = 0.000). This signals the central role of technology in promoting student engagement, a key factor for successful learning settings. The direct effect on Learning Outcomes beyond the Classroom was significant, with a path coefficient of 0.185 (t = 10.700, p = 0.000).The findings are consistent with previous literature and strengthen the case regarding the CoI framework for post-digital educational contexts. However, this study helps expand the CoI framework. It provides practical implications for designing technology-driven, learner-centered educational models and provides theoretical contributions Theoretically, future research directions are to validate the framework with moderating factors such as cultural diversity and technological access. Beyond the classroom, technology's transformative role in the education landscape is a subject.

Keywords: Post-digital education, Technology integration, Prior knowledge, Student engagement, Learning outcomes

1. INTRODUCTION

That digital transformation in education has come to the emergence of the post-digital era, which finds the integration of technology not as a novelty but as an integrated part of pedagogy practices. The "Post-Digital Education" concept embraces the ubiquitous presence of (often seamless) digital technologies that have rewritten the ways teaching and learning occur, in and out of the classroom and in and outside the control of the traditional institutional system (Ball & Savin-Baden, 2022). Unlike traditional digital interventions, post-digital education attaches importance to how human, social, and technological dimensions interact during education. A critical reorientation of technology's role from instrumental adoption to learning that is meaningful and grounded in context is required within this paradigm (Gratani et al., 2023).

Research about digital technology in education has grown extensively. However, scientists still need to determine how these platforms increase learning outside standard classroom settings. Research on technology usage typically examines classrooms and fails to explain the teaching and social presence's combined effect on learning in the digital age (Jandrić et al., 2018). Study researchers have not yet analyzed how social activity and learners' sense of knowledge impact education results beyond classroom settings (Huang et al., 2024). This research examines simultaneous links between technology integration at school and class beyond school with students' engagement in social activities and perception of knowledge to assess learning results.

This shift is central to the Community of Inquiry CoI framework, which offers a theoretical basis for investigating the interplay among cognitive, social, and teaching presences that foster learning of significance (Kerruish, 2024). In this context of post-digital education, the CoI framework provides an important perspective on how technology mediates these presences. Technological tools that extend their learning opportunities provide a medium for amplifying cognitive presence (both knowledge construction and critical thinking) (Shea et al., 2012). Social presence is redefined through virtual spaces and digital platforms for collaboration and community. Finally, teaching presence, that is, instructional design and facilitation, develops as educators utilize technology to aid learning in and out of the classroom (Jandrić et al., 2018).

This study analyzes how four critical constructs of post-digital education, Technological Integration for Learning (TIL),' Perceived Knowledge (PK),' Social Engagement (SE),' and Learning Outcome Beyond the Classroom (LOBC) , interact. Educational Technologies allow us to create interactive and learner-centered environments through Technological Integration for Learning (TIL). PK provides learners with confidence and perceived mastery of content through digital means. Social Engagement (SE) refers to how learners socialize to construct a community in virtual spaces (Mathier, 2022). LOBC accounts for the applicability of learned knowledge and skills in authentic world settings, a criterion of success in post-digital learning and its outcomes (Gratani et al., 2023; Kerruish, 2024).

This research makes essential discoveries to post-digital education research on how students benefit from academic and social technology in outside-of-class activities. The study applies the Community of Inquiry model to analyze learning dynamics when digital technology is a fundamental component of educational platforms today. This analysis shows how technology affects learning environments beyond traditional classrooms by connecting it with human mental activity and teaching approaches while developing social bonds.

However, so much research has been conducted on digital education that huge gaps persist (Huang et al., 2024; X. Wang et al., 2023). First, existing studies rarely focus on the classroom context but not on how technology extends learning beyond the confines of the classroom. Second, there is a gap in research about the interaction between cognitive, social, and teaching presences in the post-digital era regarding how they promote outcomes in learning outside a traditional educational setting (Jandrić et al., 2018). Third, there has not been a complete examination of the mediating and moderating effects of other variables, such as social engagement, on learning outcomes beyond the classroom, for which questions still exist on how digital tools can be used to support meaningful, real-world learning experiences (Rahmatalla et al., 2024).

Thus, this study fills the gaps by using the CoI framework to investigate the effects of technological integration, perceived knowledge, and social engagement on the learning outcomes of post-digital education. The research has used a quantitative approach to test this model with empirical evidence of how these constructs are related and their implications. Specifically, the study poses the following research question:

What role do perceived knowledge, social engagement, and technological integration play in shaping the learning outcomes beyond the classroom in post-digital education?

By doing so in relation to the CoI framework, this research further extends learning opportunities beyond traditional classroom boundaries, as demonstrated in post-digital education. It is not just that post-digital education focuses on learning outcomes beyond the classroom, which also aligns with the requirements of the modern knowledge economy (Robertson*, 2005). However, it also illustrates the potential of post-digital education to transform learners for actual-world challenges. By extending the CoI framework to explore the effect of new technological practices on education in and out of 'traditional' learning spaces (Shea et al., 2012). This study makes a timely and theoretical contribution to the discourse of post-digital education.

The need to examine how educational technology supports learning experiences grew out of the fast technology updates because schools need proper testing now. In present digital age features technology as essential to routine educational operations. Researchers have not fully determined how digital tools enhance learning conditions, especially regarding social interaction and brain growth in online environments (Rahmatalla et al., 2024; Shea et al., 2012). Through the CoI framework, this study tries to connect these gaps by studying how learning success changes outside regular classrooms. Technology use in education strongly enhances learning results by increasing students' feelings about understanding the subject matter and building social connections online. Through technology, students can participate in learning settings where they develop knowledge and analyze content in an active learner-centered way (Han & Geng, 2023). Students learn better in the open environment of virtual spaces because building a community strengthens their educational results beyond regular classroom study. When educational technology features unite, students experience better learning that solves actual life problems according to post-digital education principles (Muis et al., 2015).

Expanding the Community of Inquiry model reveals essential methods for effectively using educational technology to improve learning. This results help explain post-digital learning theories and offer valuable ideas for teachers who want to integrate digital tools into full-fledged modern educational environments.

2. LITERATURE REVIEW

Technology integration is at the forefront of education evolution in boosting learning. The classroom boundaries undergo traditional boundaries and new definitions of learning that go beyond the classroom and enter the actual world. The integration of educational technology makes available to students tools and platforms to think critically, be a team player, and learn for themselves. This syncs with this community of inquiry (CoI) framework (Rahmatalla et al., 2024) that believes the shared presence of teaching, social, and cognitive to complement meaningful learning experiences (Jandrić et al., 2018; Shea et al., 2012).

2.1 Learning with technology integration

Technology has reshaped the way knowledge is delivered and acquired in learning processes. Today, such tools as virtual learning environments, adaptive technologies, and collaboration of digital platforms enable the learner-centered approach by giving the students greater possibility to stretch with the content in dynamic ways (Mathier, 2022). Technology integration can be applied beyond an attempt to assist with content delivery to offer avenues for students to learn and apply their knowledge outside of the classroom. Research into successful technology integration reveals that it increases engagement, strengthens understanding, and, more generally, allows critical thinking to flourish (Kolb et al., 2021).

2.2 Learning outcomes and prior knowledge

It is known that prior knowledge is essential for students' success in grasping new concepts and their subsequent real-life applications. The cognitive presence highlighted in the CoI framework indicates the validation of what is known to deepen learning and critical thinking (Shea et al., 2012). Previous studies have demonstrated that students with potent prior knowledge bring more valuable information to a learning environment and can synthesize and extract new knowledge, leading to more realistic learning outcomes (Arbaugh et al., 2010). Finally, learners also benefit when the technological tools that contextualize and reinforce the prior knowledge provide prior learning (Swan et al., 2009).

2.3 Student engagement, student learning outcomes

Meaningful learning depends on engagement; it drives motivation, collaboration, and sustained interaction with the content. In other words, it emphasizes interpersonal relationships and collaborative learning to create an engaging environment (Arbaugh, 2007). Yidana and Aboagye (2024) demonstrated better learning outcomes with all technology-enabled ways of engagement, like gamified learning, interactive assessments, and collaborative platforms, which make the content more accessible and relatable. High-level engagement encourages students to invest time and effort in their learning. They are more likely to retain and apply knowledge learned outside the classroom (Muis et al., 2015).

2.4 Technology integration and prior knowledge

There has been much documentation regarding how technology can support prior knowledge acquisition. Simulations, videos, and adaptive content are brand-new material as an addition to the existing knowledge framework (Lambert & Fisher, 2013). Technology scaffolds by providing contextual examples in the form of technology and interactive content that bridges gaps in understanding. Additionally, technology supports self-directed learning by allowing students to review, repeat, or revise their learning path based on their prior knowledge level (Clark & Mayer, 2016).

2.5 Technology integration and student engagement

Technology increases cognitive presence and improves social and teaching presences, thus creating more engaging learning experiences. Through the use of discussion forums, social media platforms, and collaborative tools, students can engage with others and instructors, forming a community of practice and a sense of shared purpose (Annand, 2011). Research suggests that the level of engagement increases dramatically with technology integration, creating immersive learning environments in which students are actively involved in discussions, projects, and assessments (Wertz, 2022). Finally, the CoI framework clarifies the need for technology to support continuous engagement and the possibility for technology to enable interaction beyond traditional learning spaces.

2.6 Learning beyond the classroom

To educate is to prepare learners to use what they know in increasingly numerous real-world contexts. The surprises from formal education are applied outside the classroom; hence, there are learning outcomes beyond the classroom (Bentley, 2012). As has been studied, technology integration facilitates experiential learning whereby students apply theoretical concepts to real-world problems through simulations, case studies, group projects, etc. (Shea et al., 2014). Additionally, technology-mediated learning guarantees that the knowledge is retained and applied maturely, masking the gap between formal and real-life challenges.

2.7 Theoretical framework

2.7.1 Learning outcomes beyond the classroom: prior knowledge

Without prior knowledge, it is impossible to learn effectively. In addition, it dramatically impacts learners' ability to synthesize and apply new concepts; those students with strong prior knowledge are more capable of linking new information to their pre-existing knowledge structures (Shea et al., 2010). This relationship allows educators to foster critical thinking and problem-solving skills, leading to meaningful learning outcomes outside the classroom. By tapping into previous knowledge, students are better prepared to interface with new concepts and apply them to real-world applications (Birenbaum & Dochy, 2012).

Hypothesis 1: *Learning Outcomes beyond the Classroom is positively affected by Learning Outcomes and Prior Knowledge.*

2.7.2 Going beyond classroom learning to student engagement and learning outcomes

Successful outcomes for students depend heavily on engagement. Nolan Grant (2019) indicates engaged students are more motivated, persistent, and collaborate effectively with peers, enabling them to effectuate and externalize knowledge. The Community of Inquiry framework emphasizes the importance of social presence, motivating engagement, assisting collaborative learning, and applying learned knowledge in practical settings (Han & Geng, 2023). We can develop environments that deepen students' engagement so that learning outcomes post-school will be better than usual in the traditional classroom (Bentley, 2012).

Hypothesis 2: *Learning Outcomes beyond the Classroom positively relate to Student Engagement.*

2.7.3 Technology and prior knowledge integration

Technology can integrate with education, allowing learners to interact and adapt to acquiring and applying prior knowledge. Virtual labs, multimedia resources, and personalized learning platforms have become educational technologies that help learners effectively bridge the knowledge gap (Robertson*, 2005). Technology allows learners to add valuable information to their knowledge, increasing their readiness for other concepts (Nolan-Grant, 2019).

Hypothesis 3: *Prior Knowledge is affected by the positive Technology Integration in Learning*.

2.7.4 Student engagement and technology

Technology integration has enhanced the interactive and immersive learning experience. Tools such as gamification, honest feedback, and collaborative tools give students a hand in participating in their learning trips (Heilporn & Lakhal, 2020). The presentation of the CoI framework highlights how technology allows for social and teaching presence that sustains motivation and connectivity across the course of learning (Rahmatalla et al., 2024).

Hypothesis 4: *Student Engagement is affected positively by Technology Integration in Learning.*

2.7.5 Teaching with technology and learning outcomes beyond the classrooms

Technology encourages students to use the new knowledge they learned in class for practical, specifically real-world applications (Mathier, 2022). Promoting experiential, critical thinking, and problem-solving in technology-mediated learning environments promotes meaningful learning (Micsky & Foels, 2019). By integrating theories, theories can be bridged to practical applications and equipped to handle future challenges properly.

Hypothesis 5: *Learning Outcomes beyond the Classroom are enhanced by Technology Integration in Learning.*

The proposed research model (Figure 1) incorporates the key constructs, Technology Integration, Prior Knowledge, Student Engagement, and Learning Outcomes beyond the Classroom, and the hypothesized relationships among these variables are shown.

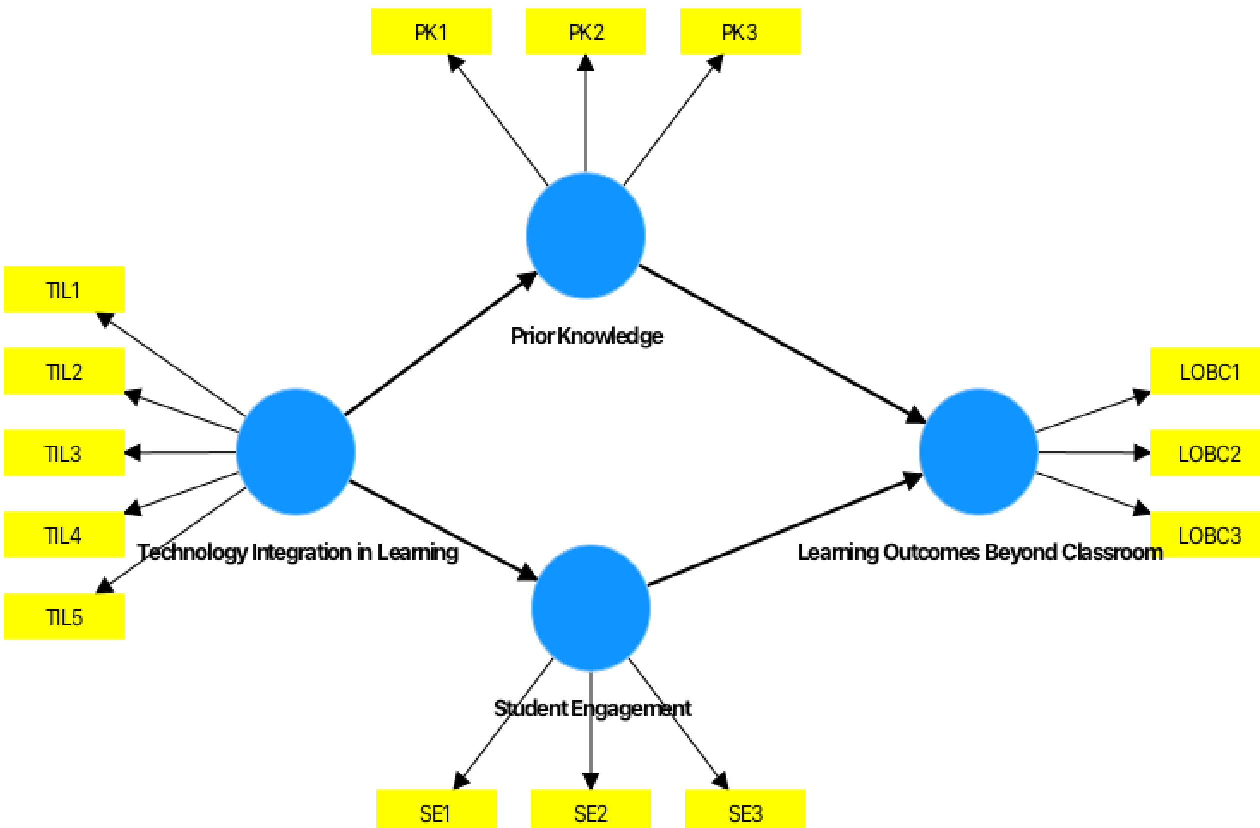

Figure 1: Framework of the study

3. METHODOLOGY

This section describes the research methodology used in this study, including the research design, participants, data collection methods, and analysis techniques. The study employs the Community of Inquiry (CoI) framework to explore the factors of technology integration, prior knowledge, and student engagement and their impact on learning outcomes located beyond the classroom.

3.1 Research design

The research design employed in this study is quantitative, with a structured survey used to solicit data from respondents. The CoI framework is the ground for the research framework, which includes the teaching, social, and cognitive presences. Operationally, however, the constructs of the study Technology Integration in Learning (TIL), Prior Knowledge (PK), Student Engagement (SE), and Learning Outcomes beyond the Classroom (LOBC) were operationalized with the use of validated items from prior literature and then adapted to the educational context.

3.2 Participants

The study sample includes 211 educators, policymakers, and university teachers from China. Convenience sampling was used to select participants, allowing diversity in educational roles. Table 2 presents the sample's demographic characteristics, such as age, gender, education level, and years of experience.

3.3 Ethical considerations

Ethical guidelines were established to ensure anonymity and confidentiality, and participants gave informed consent. The relevant institutional review board approved the ethical approval. This methodology ensures a comprehensive and robust study of how technology is used in learning outside of the classroom.

3.4 Survey instrument

The constructs identified in the conceptual model (Figure 1) were then measured using the survey instrument. Four constructs and 15 items were used across the four constructs. We measured each item with a five-point Likert scale (1 = Strongly Disagree; 5 = Strongly Agree). Adaptation from previous validated scales was ensured about reliability and content validity. Table 1 provides the details of the survey instrument.

Table 1: Survey design

Construct	Items	Source
Technology Integration in Learning (TIL)	TIL1: Technology facilitates the creation of effective learning environments. TIL2: The integration of technology enhances classroom teaching methods. TIL3: Technology encourages students to engage with content outside class. TIL4: Technology bridges gaps between theoretical concepts and practical applications. TIL5: The use of technology enhances collaboration among students.	(Keengwe et al., 2008)
Prior Knowledge (PK)	PK1: Students bring relevant prior knowledge to the learning environment. PK2: Prior knowledge helps students connect new concepts effectively. PK3: Students' foundational knowledge aids their understanding of advanced topics.	(Byrne et al., 2024)
Student Engagement (SE)	SE1: Students actively participate in technology-driven learning activities.	(Wong et al., 2024)

	SE2: Engagement in class is enhanced by the use of digital platforms. SE3: Students are more involved when technology is integrated into lessons.	
Learning Outcomes Beyond the Classroom (LOBC)	LOBC1: Students apply learned concepts to solve real-world problems. LOBC2: Technology facilitates lifelong learning beyond academic settings. LOBC3: Students demonstrate improved critical thinking skills due to technology use.	(Harefa et al., 2023)

3.5 Data collection

The survey was distributed online through an institutional network, and the target population was higher education institutions. Participants were told about the purpose of the study in detail and assured that their confidence would be kept. A total of 211 responses were collected; 196 were valid responses included in the final analysis after data evaluation process.

4. RESULTS AND ANALYSIS

4.1 Demographic profile of study participants

Table 2 reports the demographic characteristics of the sample. Details of gender distribution, age range, educational qualifications, and experience in education are provided in the table.

Table 2: Demographic statistics

Demographic Characteristic	Category	Frequency	Percentage
Gender	Male	115	58.70%
	Female	81	41.30%
Age	20-29 years	38	19.40%
	30-39 years	88	44.90%
	40-49 years	47	24.00%
	50 and above	23	11.70%
Educational Qualification	Bachelor’s Degree	29	14.80%
	Master’s Degree	124	63.30%
	Doctorate	43	21.90%
Experience in Education	1-5 years	58	29.60%
	6-10 years	73	37.20%
	More than 10 years	65	33.20%

4.2 Data analysis

Structural Equation Modeling (SEM) was used to analyze the relationships between the constructs. The reliability and validity of the measurement model were tested, followed by the structural model to test the hypothesized relationships: descriptive statistics computed means, standard deviations, and correlations for all constructs.

4.3 Measurement model

To evaluate the measurement model, the reliability, convergent validity, and discriminant validity of the constructs were tested (Harefa et al., 2023). Therefore, this assessment is very important to evaluate the measurement items and the underlying latent constructs. The measurement model diagram (Figure 2) and the results of these evaluations are presented in Tables 3, 4, and 5.

4.4 Convergent validity and reliability

Cronbach's alpha and composite reliability (CR) values were calculated for each construct to assess reliability. Table 1 shows that all constructs in the constructs have Cronbach's alpha and CR values greater than the threshold of 0.70, indicating strong internal consistency (Hair et al., 2010) (Hamdan et al., 2021). For example, Learning Outcomes beyond Classroom had Cronbach's alpha of 0.929 and CR of 0.955, Prior Knowledge Cronbach's alpha of 0.977 and CR of 0.985. This confirms the reliability of the measurement items.

We tested convergent validity by examining the average variance extracted (AVE) for each of the constructs with values greater than or equal to 0.50 (Afthanorhan et al., 2021). All constructed constructs met this criterion, as shown in Table 3. The AVE for Technology Integration in Learning was 0.927, which shows an adequate explanation of the variance by the items in their respective constructs.

Table 3: Construct reliability and validity

	Cronbach's alpha	Composite reliability (rho_a)	Composite reliability (rho_c)	Average variance extracted (AVE)
Learning Outcomes Beyond Classroom	0.929	0.931	0.955	0.876
Prior Knowledge	0.977	0.978	0.985	0.957
Student Engagement	0.882	0.886	0.927	0.809
Technology Integration in Learning	0.980	0.983	0.984	0.927

4.5 Cross-loadings

Examination of the cross-loadings of the items ensured that each item loaded more strongly on its intended construct than on others. The measurement model's discriminant validity is supported by all items having higher loadings upon their respective construct than on other constructs, as shown in Table 4. TIL3, TIL2, and TIL1 loadings of 0.965, 0.973, and 0.945, respectively, loaded strongly on Technology Integration in Learning with no significant cross-loadings on other constructs.

Table 4: Cross loadings

	Learning Outcomes Beyond Classroom	Prior Knowledge	Student Engagement	Technology Integration in Learning
LOBC1	0.954			
LOBC2	0.913			
LOBC3	0.941			
PK1		0.980		
PK2		0.978		
PK3		0.976		
SE1			0.925	
SE2			0.906	
SE3			0.867	
TIL1				0.965
TIL2				0.973
TIL3				0.945
TIL4				0.966
TIL5				0.964

4.6 Discriminant validity

The Heterotrait-Monotrait Ratio (HTMT) and the Fornell-Larcker criterion were used to assess discriminant validity. All of the HTMT values (reported in Table 5) were below the recommended threshold of 0.90. Therefore, the discriminant validity of the constructs was confirmed (Henseler et al., 2015). The Health Team Method (HTMT) values between Learning Outcomes beyond the Classroom and Prior Knowledge of 0.496 were clearly within acceptable limits.

Table 5: Heterotrait-monotrait ratio (HTMT) - Matrix

	Learning Outcomes Beyond Classroom	Prior Knowledge	Student Engagement	Technology Integration in Learning
Learning Outcomes Beyond Classroom				
Prior Knowledge	0.496			
Student Engagement	0.471	0.591		
Technology Integration in Learning	0.237	0.285	0.398	

The Fornell-Larcker criterion (Table 6) was used to assess discriminant validity. According to this criterion, the correlation between each construct and other constructs should have a value lower than the square root of the AVE for each construct. We tested all constructs against this condition, as depicted in Table 4, and all constructs were satisfied. For instance, the square root of the AVE for Learning Outcomes beyond Classroom (0.936) exceeds the correlations of this variable with Prior Knowledge (0.472) and Student Engagement (0.427).

Table 6: Fornell-Larcker criterion

	Learning Outcomes Beyond Classroom	Prior Knowledge	Student Engagement	Technology Integration in Learning
Learning Outcomes Beyond Classroom	0.936			
Prior Knowledge	0.472	0.978		
Student Engagement	0.427	0.549	0.900	
Technology Integration in Learning	0.226	0.280	0.372	0.963

The measurement model's results indicate the constructs under consideration have adequate reliability and convergent and discriminant validity. Thus, the measurement items capture their constructs in an acceptable manner, enabling testing of the structural model. The next section focuses on the structural model analysis and testing of the hypotheses.

The measurement model is represented graphically in Figure 2, and the restricted maximum likelihood results for reliability, validity, and cross-loading are summarized in Tables 3, 4,5, and 6. These results validate the measurement model and allow it to be used in future structural model earnings.

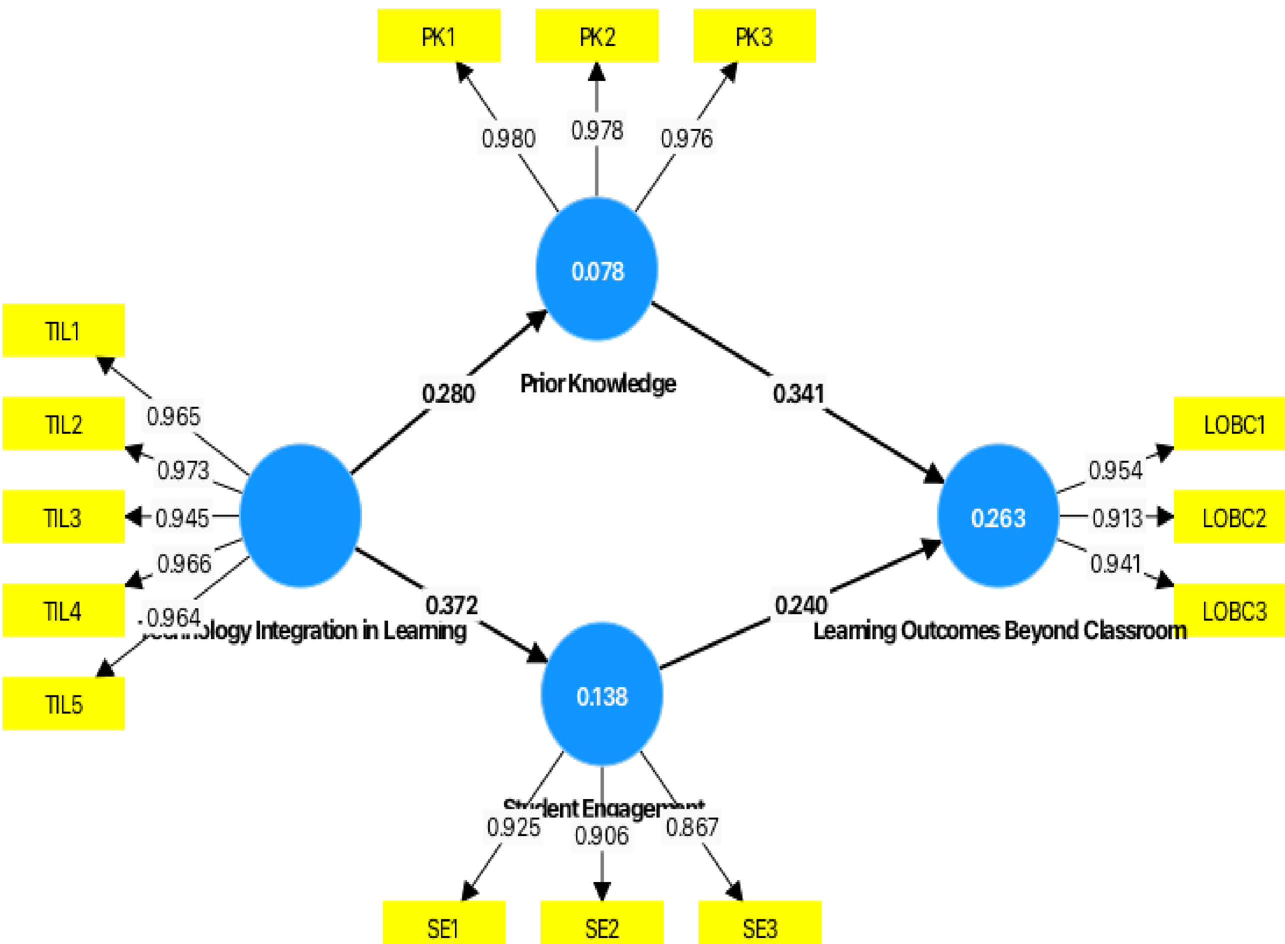

Figure 2: Measurement Model

4.6.1 Structural Model

The model tested the hypothesized relationships and the overall model fit and was conducted via structural analysis. Results, including path coefficients and statistical significance, confirm the proposed model and offer insights into factors that influence learning outcomes in a post-digital educational environment.

4.6.2 Model Fit Evaluation

The structural model is characterized by acceptable fit indices in the model fit. The SRMR values for the saturated and estimated models were 0.030 and 0.128, respectively, with the SRMR for the saturated model far below the 0.08 threshold for a good fit (Marsh et al., 2004). The estimated model also met the recommended benchmark of 0.90 (Bentler, 2007) according to the Normed Fit Index (NFI) of 0.909. The Chi-square value of the estimated model was 3123.511, which is a significant value because there is a large sample size, but other fit measures support that the model appears to be adequate. Table 7 provides a model fit summary of the study below.

Table 7: Fit Summary

	Saturated model	**Estimated model**
SRMR	0.030	0.128
d_ULS	0.092	1.710
d_G	0.247	0.297
Chi-square	2833.554	3123.511
NFI	0.918	0.909

4.7 Hypotheses testing and path coefficients

Relationships among the variables were analyzed by analyzing the path coefficients. The estimates are significant at $p < 0.001$ for all hypothesized relationships. Specifically: H1: A path coefficient of 0.341 ($t = 12.729$, $p = 0.000$) was strongly positive between Prior Knowledge → Learning Outcomes beyond the Classroom. This suggests that reading external knowledge is as important for shaping learning outcomes as what occurs in regular classrooms. H2: By examining the path coefficient of Student Engagement → Learning Outcomes beyond Classroom, 0.240 ($t = 8.405$, $p = 0.000$), it is clear that participant engagement does affect learning outcomes in a broader context. H3: Results of the path coefficient ($t=11.693$; $p=0.000$) revealed a significant relationship between prior knowledge in learning and Technology Integration in Learning → Prior Knowledge and verification were formed because technology integration increased prior knowledge acquisition. H4: Among the models of the mediating relationships, Technology Integration in Learning → Student Engagement has the strongest relationship as expressed in the path coefficient of 0.372 ($t = 14.423$, $p = 0.000$). This signals the central role of technology in promoting student engagement, a key factor for successful learning settings. H5: The direct effect on Learning Outcomes beyond the Classroom was significant, with a path coefficient of 0.185 ($t = 10.700$, $p = 0.000$), suggesting technological integration into learning was associated with learning outcomes beyond the classroom boundaries. Table 8 provides the path coefficient in detail below.

Table 8: Path coefficients

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values
H1:Prior Knowledge -> Learning Outcomes Beyond Classroom	0.341	0.341	0.027	12.729	0.000
H2:Student Engagement -> Learning Outcomes Beyond Classroom	0.240	0.240	0.029	8.405	0.000
H3:Technology Integration in Learning -> Prior Knowledge	0.280	0.280	0.024	11.693	0.000
H4:Technology Integration in Learning -> Student Engagement	0.372	0.372	0.026	14.423	0.000
H5:Technology Integration in Learning -> Learning Outcomes Beyond Classroom	0.185	0.185	0.017	10.700	0.000

4.7.1 Interpretation of results

The findings show that technology integration is a major driver of prior knowledge and student engagement. The resultant impact on learning outcomes of being in or out of the classroom is significant.

Further evidence of the essential role of technology integration in post-digital education is through the direct positive effect of technology integration on learning outcomes. In this structural model, technology is depicted as a transformative force in education, a way to close the gap between teacher-led instruction and broader educational experiences. All relationships in the model are aligned with the theoretical framework and support the proposed hypotheses, which also bring out the interconnections between these constructs in helping nurture learning in an era after the digital. Figure 3 provides the structural model of the study.

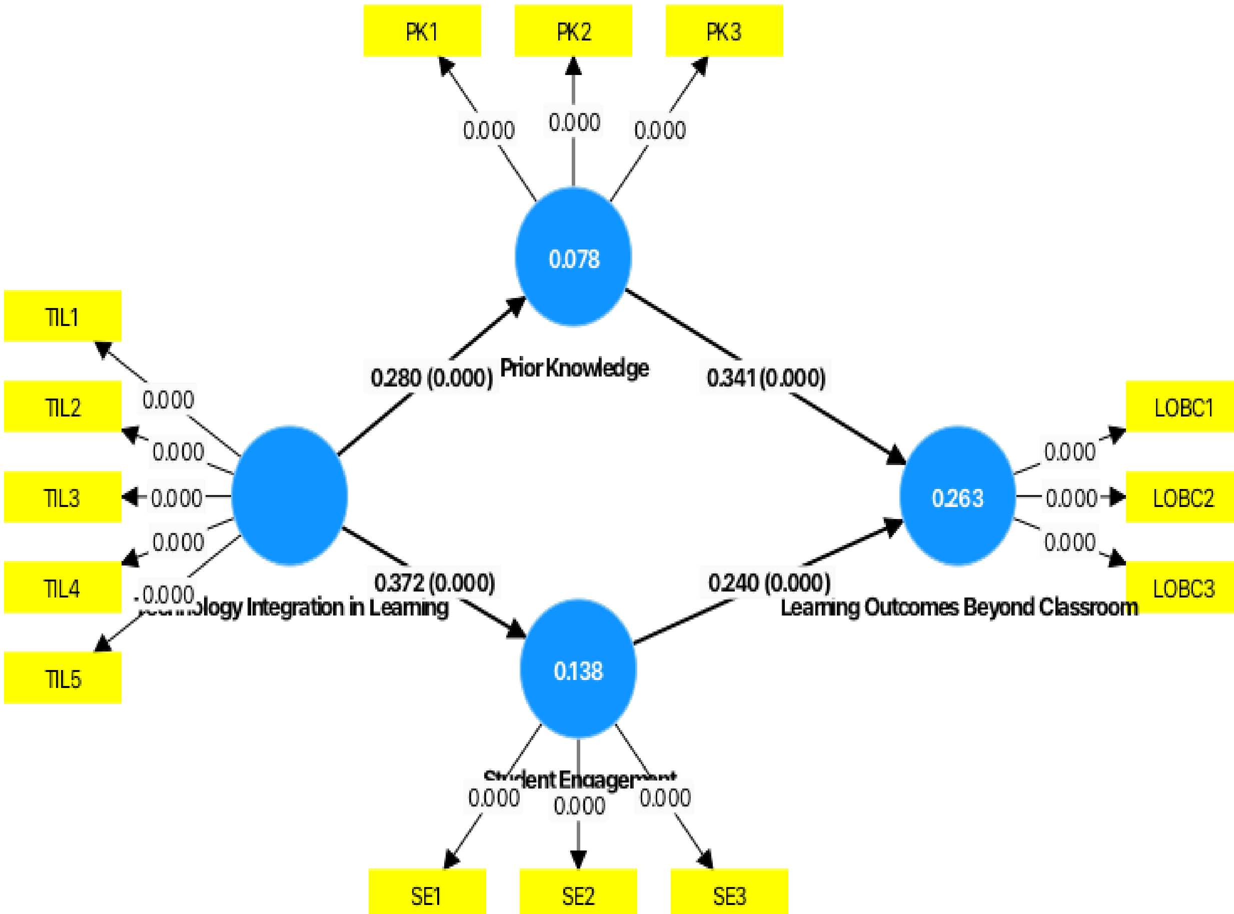

Figure 3: Structural Model

5. DISCUSSION

This study's findings offer important pointers regarding the factors that affect learning outcomes outside of the classroom within a post-digital educational space. H1 differs only slightly from previous studies Kerres and Buchner (2022), emphasizing the fundamental role of prior knowledge in determining learner performance. Building upon suggestions of Riesland (2023), prior knowledge empowers students to contextualize and apply the new information in a broader learning context leading to improved outcomes. As in H2, the impact of Student Engagement on Learning Outcomes beyond the Classroom (H2) also points to the relationship between engagement and deeper learning, as well as higher participation. The work of Bacalja (2024) echoes these results that engagement drives motivation and the ability to learn in non-traditional environments.

The positive relationship between Technology Integration in Learning (H3) and Prior Knowledge (H3) supports previous work C. Wang et al. (2023), which contends that technology is not only about access to many disparate resources but also about developing learning skills of high-value for acquiring prior knowledge. In addition, H4, assessing the consequential role of Technology Integration in Learning on Student Engagement, is consistent with Rincon-Flores et al. (2024), who argue that a technology-empowered environment leads to interactive and collaborative experiences that do engage the students. The second hypothesis concerning the impact of Teaching with Technology Integration on Outcomes Beyond the Classroom (H5) directly verifies the transformative role of technology in education based on Liu et al. (2024) proposed change of the paradigm under the theory of Community of Inquiry in which technology extends the learning beyond the traditional boundaries. These findings support the hypotheses and theoretical framework, with the recurring message that prior knowledge, engagement, and technology integration work jointly to affect broader learning outcomes.

6. CONCLUSION

This study delves into the transformative influence of technology on learning outcomes beyond the conventional classroom, focusing on the post-digital educational landscape in China. Utilizing the Community of Inquiry (CoI) Framework, the research examines the interplay of prior knowledge, student engagement, and technology integration in reshaping how learning occurs in non-traditional settings. The findings highlight that prior knowledge plays a pivotal role in enabling learners to effectively contextualize and apply new information across diverse environments, reinforcing its essential role in educational success. Similarly, student engagement emerges as a key driver, fostering deeper learning and heightened motivation that enhance participation and outcomes in post-digital contexts. Technology integration serves as a catalyst, amplifying these effects by providing access to a wide array of resources and enabling interactive, collaborative experiences that bridge theoretical knowledge with practical, real-world applications.

The study's results validate the applicability of the CoI framework in post-digital education, demonstrating how technology enhances cognitive presence through prior knowledge, social presence through engagement, and learning presence that extends beyond traditional boundaries. By exploring these dynamics, the research provides a comprehensive understanding of how technology redefines learning processes in non-traditional settings. The significant relationships identified among prior knowledge, engagement, and technology integration underscore their collective impact on fostering robust learning outcomes. This work contributes valuable insights into the evolving nature of education, emphasizing the central role of technology in creating dynamic, inclusive learning environments. Ultimately, the study illuminates the profound ways in which post-digital education in China is being reshaped, offering a foundation for understanding the future of learning in a technology-driven era.

6.1 Theoretical implications

This study extends the Community of Inquiry (CoI) Framework by expanding how technology integration can support cognitive presence (preparation), social presence (motivation), and learning presence (over the classroom). These results contribute to the body of empirical research surrounding post-digital education by providing evidence for the CoI framework in varying learning contexts. Additionally, this research sheds light on the mediating functions of prior knowledge and engagement by advancing a more nuanced understanding of how both mediate learning in non-traditional contexts.

6.2 Practical implications

Based on these findings, educators and policymakers could design learning environments that emphasize technology integration to increase engagement and prior knowledge acquisition. Engagement has proven effective in improving learning outcomes. Therefore, institutions should invest in adaptive technologies that facilitate active participation and personalized learning and experiences. Additionally, teaching professional development programs for teachers should emphasize how teaching with technology creates meaningful connections between classroom learning and real-world use.

6.3 Future insights and limitations

However, particular limitations exist with this study. After describing the data collection, the findings are discussed with a sample of higher education students who are not sufficiently generalizable to other educational levels or professional training contexts. This research could be replicated with broader demographic profiles to validate the model across different populations. Second, this study does not examine individual differences in digital competencies and exposure to digital tools in learning environments. However, it examines the integration of technology in learning environments. Future research would study how these factors relate to technology and learning outcomes. Lastly, although the study analyzes direct relationships of variables, it has not been able to analyze potential moderating factors like cultural context or institutional support. Future work could feed these factors together to provide a more robust account of learning outcomes in post-digital education.

Acknowledgements:
We express our sincere gratitude to the faculty and staff of the Institute of Regional and International Studies at **North Minzu University** and the School of Economics and Management at **Yango University** for their invaluable support during the research process. We also extend our thanks to the participants for their cooperation and contributions to the interviews conducted for this study..

Author contributions:
All authors equally contributed to this study. **Wang Meitong** designed the study, conducted data collection, and contributed to drafting the manuscript. **Zhang Qichun** performed data analysis, interpreted the results, and revised the manuscript. **Jianfu Ma** developed the theoretical framework, supervised the research process, and contributed to the final manuscript preparation.

Ethical Statement:
This study was conducted in compliance with ethical guidelines. Informed consent was obtained from all participants prior to their involvement. The research involved human participants through interviews, and ethical approval was granted by the Institutional Review Board of North Minzu University. Participants were fully informed about the study's objectives, their right to withdraw at any time, and the confidentiality of their data, which was used solely for research purposes.

Consent to Participate:
Before conducting this research study, the researcher obtained permission from the host department at North Minzu University. The objectives of the study were clearly explained to the respondents before the interviews. Respondents were assured that their information would be used exclusively for research purposes. They were also informed that they could withdraw from the interview at any stage if they felt uneasy or did not wish to continue.

Competing Interests: The author declares that this work has no competing interests.

Grant/Funding information: The author declared that no grants supported this work.

Data Availability Statement: The associated data is available upon request from the corresponding author.

Declaration Statement of Generative AI: The authors declare that no generative AI was used during the preparation of this study.

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