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From Educational Technology to Academic Engagement: A Mixed-Methods Study of Perceived English Language Learning Outcomes in Southern Punjab, Pakistan

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ABSTRACT

The role of educational technology in campus learning has become more and more pervasive in university learning, but educational value is also not only access to digital tools, but also the perception, use and interaction of students with them. Data from Pakistan is still relatively scarce, especially for English-language learning in public universities in towns and cities other than the metropolitan centres. This study aimed to explore the relationship between selected variables of students' attitudes towards educational technology, students' technology engagement, prior experience with technology, educational technology for learning, academic engagement and perceived educational technology for English language learning in four public universities of Southern Punjab, Pakistan, using a sequential mixed-methods approach. The quantitative phase involved 400 students from each of the universities, of whom 100 students per university were selected for the study purpose, while the other students were balanced by the number of males and females in each institutional level. The questionnaire consisted of 38 items that assessed six factors: attitudes (ATT), technology practices (PRA), technology experience (EXP), educational technology for learning (ETL), student academic engagement (SAE), and perceived English-language learning outcomes (LO). The final analysis avoided making strong latent discriminant-validity claims as the original latent specification had considerable overlap in the constructs. Multiple regression with standardized scores and non-parametric bootstrapping of indirect paths were used. All four technology-related domains were significantly and positively correlated with academic engagement, and accounted for 85.2% of the variance in engagement: ATT (beta = .304), ETL (beta = .168), EXP (beta = .233), and PRA (beta = .302). Perceived learning outcomes were strongly correlated with academic engagement (beta = .813; R2 = .661) accounting for 66.1% of the variance of perceived learning outcomes. The qualitative phase was conducted through 24 semi-structured interviews with the English language teachers, which were conducted with half of them at every university, making it a gender-balanced sample. Five convergent themes emerged in the thematic analysis: positive but conditional attitudes toward technology; greater participation and motivation; support for reading and writing; expanded listening and speaking opportunities; and the role of infrastructure, digital literacy, and teacher guidance. Based on the integrated findings, the use of educational technology is most beneficial when it is pedagogically purposeful, accessible and supported by students' active involvement. The study presents evidence on the context of Southern Punjab and highlights the issues of the cross-sectional nature of self-report data, which should not be interpreted as causal.

Introduction

Digital technologies have transformed the way university students find information, communicate with their teachers and fellow students, do their assignments, get feedback, and practice academic skills. In higher education, learning management systems, collaborative writing spaces, mobile apps, multimedia capabilities, artificial-intelligence-powered applications and online communication platforms are increasingly enhancing classroom learning. However, research on educational digitalization reveals that digital technology is not enough for meaningful learning. The success of outcomes relies on the interaction of technology, pedagogy, institutional capacity, teacher and student, more so than on the availability of devices or platforms (Timotheou et al., 2023; Luo et al., 2024).

The fact that this distinction is particularly relevant to English-language learning is significant. Language development needs to be repeated, produced, interacted, fed back, and has to be practiced outside of the short time available in formal classes. These opportunities may be extended in digital environments by providing authentic texts, videos, audio resources, on-line dictionaries and writing resources, pronunciation aids, and interactive exercises, as well as remote communication. Previous studies in mobile-assisted language learning have highlighted the benefits of mobile technologies for collaboration, independent learning, and speaking/listening opportunities (Kukulska-Hulme & Shield, 2008), and various reviews/meta-analyses have reported positive learning effects, though with considerable variations in study design and outcome measures (Burston, 2015, Sung et al., 2015). Empirical studies have shown that technology-enhanced learning environments are associated with listening development (Kostikova et al., 2021), speaking practice and confidence (Tauchid et al., 2024; Lee, 2023), and positive acceptance of digital platforms for English learning (Abdul Aziz et al., 2022; Al Arif et al., 2024). Recent evidence also suggests that there is a behavioural link between digital technology and English performance – where digital technology is used in ways that support learning engagement, students report, or demonstrate, better learning outcomes (Shao et al., 2025).

A central issue is therefore the learner's orientation toward technology. The Technology Acceptance Model proposes that perceptions of usefulness and ease of use shape acceptance and subsequent technology use (Davis, 1989), while the Unified Theory of Acceptance and Use of Technology extends this account to performance expectations, effort expectations, social influence, and facilitating conditions (Venkatesh et al., 2003). In educational settings, these models imply that students are more likely to incorporate technology into learning when they believe that it is useful, manageable, relevant, and supported. In higher-education language learning, acceptance research similarly shows that perceived usefulness, ease, and facilitating conditions shape willingness to use mobile and e-learning systems (Hoi, 2020). In EFL higher education, Al Arif et al. (2024) found that acceptance and readiness were embedded in a wider network of perceived usefulness, ease of use, enjoyment, motivation, self-efficacy, attitude, and actual e-learning use. Likewise, Mohammad-Salehi and Kazemian (2024) showed that attitudes toward digital game-based learning were meaningfully related to EFL learners' motivation and technology adoption.

Attitude, however, is not equivalent to learning. A student may express enthusiasm for digital tools yet use them mainly for entertainment, passive browsing, or task completion without

sustained cognitive effort. Conversely, learners with modest enthusiasm may benefit when technology is integrated into structured, purposeful activities. Student engagement therefore provides an important explanatory bridge. Engagement is commonly understood as multidimensional participation involving behavioural involvement, emotional investment, cognitive effort, and persistence (Fredricks et al., 2004). When digital technology supports active practice, collaboration, feedback, and self-directed learning, it can create conditions for engagement; when it is unreliable, poorly designed, or disconnected from learning goals, the same technology may produce frustration or superficial participation.

The Pakistani higher-education context makes these relationships particularly important. Access to information and communication technologies has expanded, but availability and effective use remain uneven across institutions and student groups. Research with university students in Pakistan has documented the importance of ICT while also pointing to variation in access, competence, and patterns of use (Mumtaz et al., 2023). Public universities in Southern Punjab operate in a context where urban-rural differences, connectivity, institutional resources, device access, and digital literacy may shape how students experience technology-enhanced learning. These contextual conditions mean that evidence from highly resourced systems cannot simply be assumed to transfer without qualification.

The present study addresses three linked gaps. First, much educational-technology research focuses on adoption, intention to use, or general academic learning rather than the relationship between technology-related attitudes and specific English-language learning experiences. Second, studies often treat technology use as a single exposure variable even though students' attitudes, practices, prior experiences, and perceptions of technology for learning may make distinct contributions to engagement. Third, quantitative associations alone do not explain why technology supports or constrains English learning in a particular institutional setting. A mixed-methods design can connect statistical patterns with the experiences of educators who observe students' participation, language practice, and technology-related difficulties.

Accordingly, this study investigated undergraduate students from four public universities in Southern Punjab: Khwaja Fareed University of Engineering and Information Technology, Rahim Yar Khan; The Islamia University of Bahawalpur; Bahauddin Zakariya University, Multan; and Ghazi University, Dera Ghazi Khan. The study asked whether students' attitudes toward educational technology, technology practices, technology experience, and perceptions of educational technology for learning were associated with academic engagement and whether engagement, in turn, was associated with perceived English-language learning outcomes. A qualitative phase involving English-language teachers was used to explain and contextualise the quantitative patterns.

The study makes three contributions. Empirically, it provides balanced multi-institutional evidence from an under-researched region of Pakistan. Analytically, it avoids overstating a problematic latent-variable measurement model by using transparent scale composites and sensitivity analyses where construct overlap is high. Methodologically, it integrates student survey evidence with teacher perspectives to distinguish the availability of technology from its pedagogically meaningful use. The resulting account treats technology not as an automatic cause of language improvement but as a learning resource whose educational value is realised through attitudes, practice, engagement, and institutional conditions.

Theoretical Background and Hypotheses

Technology acceptance and students' attitudes

The Technology Acceptance Model remains one of the most influential explanations of why people accept and use information systems. Davis (1989) proposed that perceived usefulness and perceived ease of use are central determinants of acceptance. Although developed outside language education, the logic transfers readily to learning contexts: students who believe that a digital tool helps them complete academic tasks, communicate, practise language, or receive feedback are more likely to value and use it. UTAUT broadened this perspective by incorporating performance expectancy, effort expectancy, social influence, and facilitating conditions (Venkatesh et al., 2003), thereby highlighting that behaviour is influenced both by individual perceptions and by the surrounding environment.

For English-language learners, positive attitudes may be particularly consequential because much effective digital practice is voluntary and repeated. Students can decide whether to read online English materials, use digital writing tools, practise vocabulary, listen to English-language media, or participate in online discussions beyond formal class requirements. Positive perceptions can lower avoidance and increase willingness to experiment with resources. Evidence from EFL settings supports this general pattern. Al Arif et al. (2024) reported that e-learning acceptance and readiness among university EFL students reflected a complex combination of technology-related beliefs and motivational factors. Mohammad-Salehi and Kazemian (2024) similarly found that technology acceptance and attitudes were related to motivation in digital game-based English learning.

Attitude in the present study is therefore conceptualised as a favourable or unfavourable evaluative orientation toward the use of educational technology for learning. It is expected to matter most not as an endpoint but as an antecedent of engagement. Students who perceive technology positively should be more willing to participate in technology-supported tasks, persist with digital activities, communicate through online environments, and use resources independently. Hence:

H1. Students' attitudes toward educational technology are positively associated with student academic engagement.

Educational technology practices and academic engagement

Attitudes refer to learners' thoughts and feelings about technology, practices refer to what learners actually do with technology in educational settings. This is important because positive thoughts don't always lead to positive actions. Learning tasks and tools are aligned to use effectively in education. Systematic reviews of technology integration emphasise that outcomes are stronger when digital resources are embedded in coherent pedagogical processes rather than added as isolated or occasional features (Timotheou et al., 2023; Luo et al., 2024). Similarly, learning management systems are most educationally useful when institutional policies and teaching practices support purposeful use rather than treating the platform as a repository only (Turnbull et al., 2022).

In English learning, productive practices can include online reading, drafting and revising text, collaborative writing, vocabulary practice, multimedia listening, pronunciation rehearsal, digital discussion, and feedback-seeking. Such practices increase the time students spend actively working with English and can shift technology from passive consumption to active learning. Remote speaking tasks, for example, can provide additional opportunities for practice and confidence-building (Tauchid et al., 2024), while e-portfolios can support speaking practice, self-evaluation, and learner-centred reflection (Lee, 2023). These activity patterns should be directly related to behavioural and cognitive engagement.

H2. Students' educational technology practices are positively associated with student academic engagement.

Technology experience and academic engagement

Prior experience can shape both confidence and efficiency in digital learning. Students who have used online platforms, digital writing tools, multimedia resources, or collaborative applications are less likely to spend their limited cognitive resources navigating unfamiliar interfaces. Experience may therefore reduce friction and allow learners to focus on the academic task itself. In technology-acceptance research, facilitating conditions and self-efficacy frequently operate alongside perceived usefulness and ease of use, suggesting that readiness is partly a function of prior experience and confidence (Venkatesh et al., 2003; Al Arif et al., 2024).

Experience can also enrich students' repertoire. A learner who is familiar with a number of tools can choose a tool that best meets a specific language objective: an online dictionary to clarify words, a collaborative writing application, a video application to listen to words, or an application for recording sounds to practice speaking. This flexibility is essential as language learning is multi-dimensional. Although typically technology will not impact reading, writing, listening, and speaking in the same ways, there is a broader range of experiences that may increase the likelihood that students will find a productive tool-task fit.

H3. Students' experience with educational technology is positively associated with student academic engagement.

Educational technology for learning and academic engagement

This module concentrates on the application of educational technology in the learning and engagement process.

Students' educational value attributed to technology in terms of concepts is conceptually related to, but not same as, general attitude. Technology might be enjoyable for students, but they may not believe it has a purpose in their serious academic studies. The educational technology for learning (ETL) domain shows the degree to which one thinks technology can facilitate learning activities and academic objectives. That separation is based on the principle of TAM, which states that the extent to which technology is adopted into an individual's behaviour is predicated on the user's perception of the performance gain (Davis, 1989).

Perceived learning value is especially powerful in the field of language education. Students may have access to many online tools, but those tools that offer the real content, feedback, flexibility in practice, communication or any specific skill are more likely to engage students. YouTube has

been shown to have a language learning value and user-friendliness for language learning (Abdul Aziz et al., 2022) and has been accepted by the students for learning English. Repeatedly listening to a text and pacing it at one's own speed, are features that cannot be achieved in a single-classroom session, but which can be achieved in technology-supported listening environments (Kostikova et al., 2021).

H4. Perceived educational technology for learning is positively associated with student academic engagement.

Academic engagement and English-language learning outcomes

The learner will demonstrate academic engagement and outcomes in the English-language learning domain.

Engagement is the behaviour by which learning opportunities are translated into a sustained learning activity. Fredricks et al. (2004) define engagement as a combination of three aspects: behaviour, emotion, and cognition. In the field of language learning, these are particularly significant as they are elements that are necessary for learning a language, the necessary repetitions are needed, but not exposure alone. Students should read, write, listen, speak, check for mistakes, ask for feedback and work through the difficult bits.

There are potential opportunities for such engagement in the use of digital tools, but not necessarily gains in learning unless students avail themselves of these opportunities. Recent evidence from EFL settings provides direct support for this mechanism. Shao et al. (2025) found that learning engagement played an important role in the relationship between digital technology use and English academic performance. Their findings reinforce the idea that digital technology should be understood as part of a broader learning process in which students' active involvement matters.

In the current study, learning outcomes are measured as students' perceived English-language learning outcomes rather than independent proficiency-test scores. The outcome construct therefore represents perceived improvement or effectiveness across language-learning domains rather than objective causal gains. Within this scope, students who are more academically engaged are expected to report stronger outcomes.

H5. Student academic engagement is positively associated with perceived English-language learning outcomes.

Indirect pathways through engagement

The proposed model also permits an exploratory assessment of indirect pathways from the four technology-related domains to perceived learning outcomes through engagement. In a cross-sectional study, such paths cannot establish temporal or causal mediation. Nevertheless, bootstrapped indirect associations can indicate whether the data are consistent with an engagement-based mechanism. Hayes (2022) emphasises that indirect effects should be interpreted in relation to research design and should not be treated as proof of causal mediation when temporal ordering has not been established. Accordingly, the indirect analysis in this study is explicitly exploratory and complements, rather than replaces, the direct association tests.

Method

Research Design

This study employed an explanatory sequential mixed-methods design in which quantitative and qualitative evidence was integrated to develop a more comprehensive understanding of the relationship between educational technology and English-language learning in higher education. The quantitative strand examined the associations among students' attitudes toward educational technology, educational technology practices, prior technology experience, perceived educational value of technology for learning, academic engagement, and perceived English-language learning outcomes. The qualitative strand subsequently drew on the perspectives of English-language teachers to explain and contextualise the quantitative patterns, particularly the ways in which technology supported or constrained students' engagement and English-language learning.

The two strands were mainly combined at the interpretation stage. The quantitative results were compared to the qualitative themes to see the areas of convergence, explanation and qualification. Hence, the qualitative results were not only treated as a confirmation of the quantitative results, but were also used to shed light on the pedagogical and institutional conditions that gave rise to the quantitative relationships observed.

Research Setting and Participants

The study population included 400 undergraduate students from four public universities in Southern Punjab of Pakistan namely Khwaja Fareed University of Engineering and Information Technology (KFUEIT) Rahim Yar Khan, The Islamia University of Bahawalpur (IUB), Bahauddin Zakariya University (BZU), Multan, and Ghazi University Dera Ghazi Khan.

A stratified sampling scheme was employed, and the main stratification variables were the university and gender. Equal numbers of 100 students were selected from each university. 50 boys and 50 girls were included in each stratum of each institution. Based on this, the quantitative sample for the study was 200 male and 200 female undergraduate students, making up 400 respondents in total, which was evenly distributed according to institutional and gender variables.

The study did not only focus on students with majoring in English but also involved undergraduate students of other academic programmes. This more expansive sampling method allowed for the study to explore students' technology-based experiences of English-language learning in a range of disciplinary contexts in public higher education.

The qualitative phase consisted of 24 English language teachers from the same four universities. The teachers included were those who had direct experience of English-language teaching and students' technology-supported learning, using a balanced purposive sampling strategy. Three male and three female teachers were included from each University. All four institutional settings and both genders were thus represented in the resulting sample of qualitative data.

The teachers were added to address their professional experience, which allow them to give supplementary evidence on students' perspectives on educational technology, student use of the technology in the context of English-language learning, perceived changes in language learning

practices, or institutional/infrastructural conditions that would affect the ability to integrate technology effectively.

Quantitative Instrument and Measurement

The quantitative data was obtained by means of a structured questionnaire comprising 38 measurement items structured in six domains as follows:

- Students' attitudes toward educational technology (ATT; 8 items)
- Educational technology practices (PRA; 6 items)
- Experience with educational technology (EXP; 5 items)
- Educational technology for learning (ETL; 4 items)
- Student academic engagement (SAE; 11 items)
- Perceived English-language learning outcomes (LO; 4 items)

Responses were captured on a five scale likert-type scale with a higher score indicating greater agreement with the construct. As is common practice, the scores for each domain were computed by taking the mean of the domain item responses, while preserving the original response scale.

Since the dependent construct was not measured by an independently administered standardised English-language proficiency test, it is described in this study as perceived English-language learning outcomes. The study, therefore, explores learners' perceptions of their English language learning experience and does not attempt to draw conclusions about actual gains in English.

Data Screening and Preparation

The data was checked for completeness, acceptable response range, and unusual responses before going through statistical analysis. No missing observations were found for the 38 main measurement items.

When checking the range, 38 responses to ATT2 were recorded as 6 instead of a five-category response scale. These values were outside the acceptable range of responses and were adjusted to the highest acceptable category (5) for the main analysis. This correction did not affect the main conclusions of the study, as a sensitivity analysis was also performed with the same values.

Additionally, there were several response profiles that were shared across the 38 measurement items. However these observations were not deleted automatically because of the fact that identical profiles may occur among the legal respondents. Rather, the primary analysis included all 400 respondents, and each unique response profile was randomly sampled to run a further sensitivity analysis. The major associations were not caused by repeated response patterns alone, as there was no substantive change in the principal coefficients.

The decisions to clean the data were thus made in advance for a variety of measurement constraints or sensitivity assessment, not based on whether the individual cases increased or decreased the statistical significance.

Quantitative Data Analysis

Quantitative analysis proceeded in several stages.

First, descriptive statistics were calculated to summarise the distributions of the six composite measures. Internal consistency was examined using Cronbach's alpha, with reliability coefficients interpreted in relation to the number of items and breadth of each composite measure.

Second, Pearson product-moment correlations were calculated to examine bivariate associations among ATT, PRA, EXP, ETL, SAE, and LO.

Preliminary measurement diagnostics indicated substantial empirical overlap among several of the proposed constructs. In particular, convergent and discriminant validity indices obtained under a latent-variable specification did not provide sufficient evidence to justify treating all six domains as clearly differentiated latent constructs. The main inferential analysis therefore used observed composite scores, providing a more transparent and conservative representation of the data.

Third, standardized multiple regression analysis was conducted with SAE as the dependent variable and ATT, PRA, EXP, and ETL entered simultaneously as predictors. This model estimated the unique association of each technology-related domain with academic engagement while controlling for the shared variance among the predictors. Model explanatory power was evaluated using R^2 and adjusted R^2, while variance inflation factors were examined to assess multicollinearity. Effect sizes were evaluated using f^2.

Fourth, standardized regression analysis examined the relationship between SAE and perceived English-language learning outcomes.

All inferential tests were two-tailed with a significance criterion of $\mathbf{p < .05}$. Effect estimates, confidence intervals, and explanatory statistics were considered alongside statistical significance.

Qualitative Data Collection

The qualitative phase consisted of 24 semi-structured interviews with English-language teachers, with six participants representing each participating university and equal representation of male and female teachers.

The semi-structured interview protocol focused on four main areas:

1. Teachers' perceptions of students' attitudes toward educational technology;
2. Students' participation and engagement in technology-supported English-language learning;
3. Perceived contributions of digital technologies to reading, writing, listening, speaking, vocabulary, and related language-learning activities; and
4. Institutional, infrastructural, pedagogical, and digital-literacy factors that facilitated or constrained effective technology use.

The semi-structured format allowed the researcher to address comparable topics across participants while permitting teachers to elaborate on experiences specific to their institutional contexts.

Qualitative Data Analysis

The qualitative data were analysed using thematic analysis informed by Braun and Clarke's six-phase approach. Analysis involved repeated familiarisation with the interview material, initial coding of meaningful segments, development of candidate themes, review of themes against the underlying data, refinement and definition of themes, and production of the final interpretive account.

Coding remained attentive to the explanatory purpose of the qualitative strand. Particular attention was given to evidence that could clarify how students' technology-related attitudes and practices were translated into engagement and why apparently positive attitudes did not always result in equally effective technology-supported learning.

Five overarching themes were developed:

1. Positive but conditional attitudes toward educational technology;
2. Technology-supported participation and academic engagement;
3. Technology-supported reading and writing;
4. Technology-supported listening and speaking; and
5. Institutional support, digital literacy, connectivity, and teacher guidance.

Representative quotations were selected to illustrate each theme while avoiding the disclosure of participant identities. Teacher quotations were treated as teachers' perceptions and observations of students, not as direct evidence of students' internal experiences.

Where interview material was translated into English, the manuscript should state the actual translation procedure used and should ensure that reported quotations preserve the substantive meaning of participants' original responses.

Integration of Quantitative and Qualitative Findings

Integration was undertaken after the quantitative and qualitative analyses had been completed. The statistical relationships were compared with the themes developed from the teacher interviews to determine how the qualitative evidence explained, elaborated, or qualified the quantitative findings.

For example, the positive statistical associations of attitudes and educational technology practices with academic engagement were interpreted alongside teacher accounts of greater participation in interactive digital assignments, quizzes, collaborative activities, and technology-supported language practice. Similarly, the strong association between academic engagement and perceived English-language learning outcomes was considered together with teachers' accounts of increased opportunities for reading, writing revision, listening exposure, speaking practice, and immediate feedback.

Qualitative evidence concerning inadequate connectivity, limited digital facilities, uneven digital literacy, and teacher guidance also qualified the quantitative findings by demonstrating that favourable student orientations toward technology could not, by themselves, guarantee effective technology-supported learning.

This integration allowed the study to transcend parallel reporting of quantitative and qualitative findings and provide a contextualised interpretation of how the educational technology, student engagement, and perceived English-language learning outcomes were inter-related in the public-university setting of Southern Punjab.

Ethical Considerations

This study was performed following accepted principles of research with human subjects. Student survey and teacher interviews were all voluntary. The purpose of the study, the process participants would go through as a part of the study, the academic purposes of the data, and the freedom to opt out or withdraw from the study without penalty was explained to the participants.

Consent was given prior to data collection. Participants were given assurances of confidentiality, and that their responses would not be used to identify them personally in publications or research reports. Data from students and teachers were analysed and reported in an aggregate or anonymised manner. All teacher quotations were anonymised and information about individual participants omitted from the published results.

Research data were stored in a safe way and accessed only for research purposes. The manuscript did not contain any personal identifying information and participation was not associated with students' academic evaluation or teachers' professional evaluation.

Quantitative Results

Sample structure

The study design resulted in an exactly balanced sample for institutions and gender. A total of 100 students responded for each university, 50 male and 50 female. In the entire sample, 200 subjects were male and 200 female. It was also found from the raw survey that majority of the respondents resided in urban areas with 319 (79.8%) while 81 (20.3%) reported that they lived in rural areas. Causal predictors of these contextual characteristics were not included in the primary model.

Table 1: Quantitative sample by university and gender

University	Male	Female	Total
Khwaja Fareed University of Engineering and Information Technology, Rahim Yar Khan	50	50	100
The Islamia University of Bahawalpur	50	50	100
Bahauddin Zakariya University, Multan	50	50	100
Ghazi University, Dera Ghazi Khan	50	50	100
Total	200	200	400

Descriptive statistics and internal consistency

Means for all six of the construct scores were high on the 5-point response metric, ranging from 4.394 to 4.422. This suggests a high positive approachability within attitudes, technology use, engagement, and outcomes. These high means are consistent with the negative skew in the raw data, and indicate some ceiling effects. The small standard deviation values also suggest that a large number of respondents fell near the middle of the scale options indicating "agree" and "strongly agree".

The internal consistency of the instruments shows that SAE (alpha = .846) and ATT (alpha = .835) have the highest internal consistency. The reliability of EXP was moderate (alpha = .680). PRA (alpha = .625), ETL (alpha = .600), and LO (alpha = .599) were modest. These values support the message of not over-stating latent construct validity. The short scales are thus seen as composite measures of related aspects of the educational-technology experience rather than as being distinct and well-separated latent traits.

Table 2: Descriptive statistics and internal consistency

Construct	Items	Mean	SD	Cronbach's alpha
Attitudes toward educational technology (ATT)	8	4.409	0.450	.835
Educational technology practices (PRA)	6	4.412	0.366	.625
Technology experience (EXP)	5	4.394	0.420	.680
Educational technology for learning (ETL)	4	4.412	0.441	.600
Student academic engagement (SAE)	11	4.410	0.420	.846
Perceived English-language learning outcomes (LO)	4	4.422	0.447	.599

Correlations

All constructs were significantly and positively correlated with each other ($p < .001$). ATT was strongly correlated with SAE ($r = .872$) and LO ($r = .796$). PRA correlated strongly with SAE ($r = .842$) and LO ($r = .784$). EXP was also strongly associated with SAE ($r = .854$) and LO ($r = .810$), while ETL correlated with SAE at $r = .793$ and LO at $r = .744$. The best bivariate relationship in the model was ATT and SAE. The correlation of SAE with LO was .813.

These large correlations suggest the substantive premise that positive technology-related orientations go hand in hand with engagement and perceived learning outcomes. At the same time, they also show why claims about sharply distinct latent constructs would be inappropriate. The analysis therefore focuses on unique regression contributions and integrated interpretation rather than claiming strong discriminant separation.

Table 3: Pearson correlations among construct scores

Construct	1	2	3	4	5	6
1. ATT	1.000					
2. PRA	.782	1.000				
3. EXP	.840	.796	1.000			
4. ETL	.803	.688	.741	1.000		
5. SAE	.872	.842	.854	.793	1.000	
6. LO	.796	.784	.810	.744	.813	1.000

Note. N = 400; all off-diagonal correlations p < .001.

Predictors of student academic engagement

A standardized multiple regression examined whether ATT, ETL, EXP, and PRA simultaneously predicted SAE. The overall model was very strong, R-squared = .852, adjusted R-squared = .851. Thus, the four technology-related composites jointly accounted for approximately 85.2% of the variance in academic engagement in this sample.

All four predictors made statistically significant unique contributions. ATT was positively associated with engagement (beta = .304, SE = .043, t = 7.14, p < .001), supporting H1. PRA had a similarly strong coefficient (beta = .302, SE = .034, t = 8.83, p < .001), supporting H2. EXP was also positively associated with engagement (beta = .233, SE = .040, t = 5.89, p < .001), supporting H3. ETL made the smallest but still significant contribution (beta = .168, SE = .033, t = 5.05, p < .001), supporting H4.

The f-squared effect sizes were .129 for ATT, .197 for PRA, .088 for EXP, and .064 for ETL. These estimates suggest that practices and attitudes made the largest unique contributions to engagement after the overlap among predictors was considered, whereas educational-technology-for-learning and experience made smaller but meaningful contributions.

Table 4. Standardized regression predicting student academic engagement

Predictor	beta	SE	t	p	95% CI	f-squared	Decision
ATT	.304	.043	7.14	<.001	[.220, .388]	.129	H1 supported
ETL	.168	.033	5.05	<.001	[.103, .233]	.064	H4 supported
EXP	.233	.040	5.89	<.001	[.155, .311]	.088	H3 supported
PRA	.302	.034	8.83	<.001	[.235, .369]	.197	H2 supported

Model: R-squared = .852; adjusted R-squared = .851; N = 400.

Academic engagement and perceived learning outcomes

SAE was strongly and positively associated with perceived English-language learning outcomes, beta = .813, SE = .029, t = 27.87, p < .001. The model explained 66.1% of the variance in LO (R-squared = .661; adjusted R-squared = .660), supporting H5. The magnitude of this association is consistent with the view that active participation, persistence, practice, and involvement are central to how students experience language-learning benefits from technology.

The coefficient should not be interpreted as evidence that engagement caused a .813-standard-deviation change in objectively measured English proficiency. Both variables were measured at

the same time through self-report, and LO represents perceived learning outcomes. The result is therefore best understood as a strong association within the reported learning experience.

Exploratory indirect paths

In the constrained engagement-path model, bootstrap analyses indicated positive indirect associations between each technology-related domain and LO through SAE. The standardized indirect estimate was .247 for ATT (95% bootstrap CI [.036, .401]), .137 for ETL (95% CI [.028, .253]), .190 for EXP (95% CI [.087, .317]), and .246 for PRA (95% CI [.127, .386]). The corresponding unstandardized indirect estimates were .246, .139, .202, and .300, respectively.

These intervals did not include zero, showing that the data are statistically consistent with an indirect engagement pathway. Nevertheless, supplementary models that added all direct technology-to-outcome paths produced substantial collinearity and attenuated the unique SAE coefficient. For this reason, the evidence is not described as proof of causal mediation. Instead, it is interpreted as convergent evidence that engagement is one plausible process connecting technology-related orientations with perceived outcomes.

Qualitative Findings

The teacher interviews provided a complementary account of how the statistical relationships appeared in English-language teaching. Five themes were identified. Together they show that teachers generally viewed students as receptive to educational technology, but they repeatedly qualified this positivity: technology was most useful when it was easy to access, connected to practical language tasks, supported by teachers, and accompanied by reliable institutional infrastructure.

Theme 1: Positive attitudes were widespread but conditional

Teachers generally described students as interested in technology because digital activities were familiar, flexible, and often more engaging than conventional tasks. One teacher observed, "Students are interested in using technology because most of the activities are digital and engaging" (T1). Another commented that students valued flexibility because "they can learn English in their own time" (T6). The quantitative mean for ATT is consistent with the observations and is closely related to academic engagement.

Teachers, however, were not seen as consistently enthusiastic about the students. T7 observed that "most students are positive" and some still favoured the traditional teaching. Enthusiasm was also associated with relevance in the eyes of the teachers. In T8, it is explained that, when technology is connected to learning activities of English, students are more motivated. This is a worthwhile qualification! Positive attitudes seemed to be most pronounced when the students had a clear relationship between the technology and a meaningful learning task, in line with the usefulness logic of technology-acceptance theory.

Theme 2: Technology increased participation when activities were interactive

The second theme was about engagement itself. Teachers regularly connected the use of technology to increase participation, especially when students had to do something rather than watch something. The students "are more comfortable with technology, and are more engaged in

English activities," T4 reported. T5 pointed to interactive exercises and quizzes in the online classroom, saying that these "make students participate in class. T9 also found that students who had positive attitudes towards technology showed greater interest in completing digital assignments.

These accounts are helpful in explaining the quantitative results of both ATT and PRA making meaningful unique contributions to SAE. Qualitative data indicate that attitude and practice go hand in hand with each other, a positive attitude can enhance a willingness to participate, and interactive tasks can allow the willingness to take tangible form. Technology seems to be most effective when pedagogy is beyond the content delivery and calls for participation, response, collaboration, or production.

Theme 3: Reading and writing benefited from access, revision, and feedback

Digital environments were found to be especially helpful for reading and writing, both in terms of providing access to material and reducing the feedback time, described by teachers. T2 pointed out that students have the opportunity to use “a great selection of English reading material” via the internet. T9 correlated the use of online English materials with vocabulary and reading comprehension. The following comments highlight another affordance of digital learning: no longer are students limited to one textbook or what is covered in class.

Writing was discussed in terms of revision and error awareness. T5 reported that digital writing tools enabled students to detect grammar and vocabulary mistakes, and T10 reported that digital immediate feedback is beneficial for writing. This is in line with other research that indicates technology can help facilitate multiple writing processes but that it should be used in tandem with teacher judgment, not in place of it. The theme also accounts for the findings in the present study that positively correlated with more educational-technology practice: students' engagement and learning outcomes; the drafting, checking, editing, and resubmission of writing tasks encourage repeated practice of writing.

Theme 4: Multimedia and low-risk practice supported listening and speaking

Listening and speaking were also identified as strengths by teachers. T3 noted that students could watch videos, find on-line resources with native and competent speakers of English. T8 stressed the exposure to foreign accents and dialects of the spoken English language. These enrich the learners' listening input by providing more and different types of sound, and also enable repeat listening, the ability to pause and replay, as described in technology-assisted listening literature (Kostikova et al., 2021), and the pedagogical benefits thereof.

Confidence was correlated with speaking, as was practice. In speaking applications, T7 said he can use them again and again without being embarrassed, and T10 said that using the digital platforms boosted his confidence in conversations. It is a low risk function for rehearsal which is particularly important for learners who are hesitant to speak in front of others. Thus, the interview evidence corroborates studies where speaking tasks were conducted remotely with the support of speaking digital portfolios, as well as self-evaluation and confidence (Tauchid et al., 2024; Lee, 2023).

Theme 5: Infrastructure, digital literacy, and teacher guidance determined whether positive attitudes became learning

The best theme was that of context. If connectivity, facilities, digital skills or guidance was weak, teachers repeatedly stated that the students' willingness was not enough. T5 reported that students were able to access technology but were limited by their internet connection at times. T6 believed that universities should offer enough digital facilities and training for teachers and students. T9 also shared the view that support in the institutions was key since the technology could not be effective without proper infrastructure.

Another common theme was teacher guidance. T8 maintained that it was time to teach students how to use technology "to learn, not to just play. This separation reflects an underlying finding of the entire mixed-methods analysis. Access to technology opens opportunities, but the value of the opportunity will be determined by how it is structured and used in education. Digital literacy is a prerequisite for using digital infrastructure, and pedagogical approaches promote technology as tools for language learning not just for distraction. The theme is aligned with studies that reveal a need for organisational, technology, pedagogical, and human factors to work in tandem for digital transformation (Timotheou et al., 2023; Luo et al., 2024), and with the findings from the study in Pakistan that reveal ICT use is not uniform and depends on the students' condition of access and use (Mumtaz et al., 2023).

Mixed-Methods Integration and Discussion

From positive attitudes to active engagement

There is a clear connection between qualitative and quantitative strands, particularly on the link between attitudes and practices and engagement. After accounting for the shared variance across all four technology domains, quantitatively, ATT and PRA were the two most powerful unique predictors of SAE. On a qualitative level, teachers described the same connection, in terms of behaviour: students who had a positive attitude towards technology were more inclined to engage in language-based tasks using digital resources, such as assignments, quizzes, online activities and practical language activities.

This result substantiates a straightforward interpretation relating technology acceptance to this finding. To explain why learners might accept a system, but that's not the end of the education process. The question in the present study that has educational value is what do you do in the aftermath of acceptance? The data indicates that attitudes have a significant impact as they are connected to involvement and practice. The finding is consistent with Al Arif et al. (2024) who revealed the factors of e-learning acceptance that were embedded in the students' EFL university learners, which were usefulness, ease of use, motivation, self-efficacy, and actual use. Furthermore, it is in line with the digital game-based learning research that has shown a close relationship between attitude and motivation (Mohammad-Salehi & Kazemian, 2024).

The qualitative results supplement an important condition: technology was more engaging when it was used in activities that were practical and interactive. Students' engagement with devices was neither just reported as being enjoyed by teachers; it was described in terms of engagement with quizzes, digital assignments, online practice, hands on writing feedback, and exposure to the language and its related media. This helps illustrate the pedagogical nature of digital

transformation, beyond the technical. Systematic review also shows that technology's impact is affected by the instructional design, implementation processes and the interplay of human and institutional factors (Timotheou et al., 2023; Luo et al., 2024).

Experience and perceived learning value as enabling conditions

EXP and ETL also made significant unique contributions to engagement, although their coefficients were smaller than those of ATT and PRA. This pattern is theoretically plausible. Students with prior technology experience are likely to encounter fewer operational barriers, while students who perceive technology as useful for learning have a clearer reason to invest effort. Yet once actual practices and general attitudes are considered simultaneously, some of the variance associated with experience and perceived learning value is shared.

The high correlations among the technology domains are therefore substantively meaningful as well as statistically important. Students do not experience attitude, practice, experience, and learning value in isolation. Familiarity can make technology easier to use; usefulness can improve attitudes; positive attitudes can encourage practice; and practice can generate further experience. This reciprocal relationship may account for the difficulty with the original latent measurement model to distinguish the constructs. In the present analysis, the overlap is not simply considered as a statistical accident but as a confirmation that the orientation towards educational technology is a coherent set of beliefs and behaviours in this population.

Meanwhile, there must be carefulness with strong overlap. Note that a high R-square for engagement does not necessarily mean that the model has accounted for almost all the causes of engagement. The associations may have been inflated due to the possibility of common method variance or shared response style because all predictors and engagement were measured at the same time from the same respondents. The sensitivity analyses demonstrate that the coefficients are not only a reflection of exact duplicate response patterns, but that this more general measurement concern cannot be ruled out.

Engagement and perceived English-language outcomes

The relationship that was strongest in the downstream direction was between SAE and LO. Students who endorsed higher engagement levels also endorsed higher levels of students' English-language learning outcomes. Teacher accounts provided a variety of mechanisms that could lead to that kind of association. Access to reading material was enhanced, repeated listening was made possible, a vocabulary/gap analysis was made available, writing was made easier by providing instant feedback, and pronunciation and speaking opportunities were made more comfortable due to technology. In both, students' benefit was a function of increased language-related activity.

This interpretation is in line with what Shao et al. (2025) discovered: learning engagement was an important mechanism between the use of Digital Technology and the academic performance in English for an EFL sample. The present study is different in two aspects. First of all, English-language learning is not measured in terms of test scores obtained by the student alone. Secondly, the sample is from public universities of Southern Punjab where infrastructure and connectivity features are clear contextual constraints. The studies do not lend themselves to

direct comparison because of these differences, but they do agree on the role of engagement in the Technology-Learning relationship.

The mechanisms found in the interviews are supported by skill specific evidence from previous research. There are various means for using digital technology to offer controlled and repeatable listening input (Kostikova et al., 2021); there are ways to use remote speaking tasks to provide experiences that contribute to confidence and proficiency development (Tauchid et al., 2024); and there are ways to use e-portfolios to foster speaking practice and reflection (Lee, 2023). Students' acceptance of video platforms in learning English further illustrates students' preference for flexibility in accessing authentic and diverse language input (Abdul Aziz et al., 2022). These affordances are not considered individual interventions, but rather are combined here in one institutional setting, given a new form in the present qualitative findings. The present qualitative results combine these affordances rather than treating each tool and skill as individual interventions.

Why infrastructure and guidance matter

The qualitative strand keeps from an overly psychological interpretation of the quantitative model. Using only attitudes and engagement, analysis could suggest that success or failure of educational technology is the sole responsibility of the student. Instead, teachers spoke of a learning ecology that frames what students can do, where connectivity, institutional resources, training, and guidance play a role. The internet can be a barrier to participation, the facilities can be substandard and make it hard to participate equally, lack of digital literacy can make people feel less confident, and poor pedagogical guidance can create barriers that lead to distraction during learning experiences.

This is consistent with the ecological description of technology integration. In the context of the organization and the place where the technology is implemented, Zhao and Frank (2003) suggested that technology use in education organizations should be considered. Other more recent syntheses also point to a set of interrelated factors as conditions for the realization of digital transformation: infrastructure, institutional processes, teacher capacity, pedagogy, and learner factors (Timotheou et al., 2023; Luo et al., 2024). This is significant in Pakistan, where institutions and students' access to resources may differ significantly (Mumtaz et al., 2023).

The take-away message is that universities must not make the mistake of thinking digital provision is digital learning. This would require an LMS account, Computer Laboratory or Internet connection but not enough. It is important that students have easy access to it, clear learning goals, suitable tools, digital-literacy support, and teachers who are able to develop tasks that demand meaningful use to language. The teacher feedback regarding technology being used for "learning rather than entertainment" succinctly highlights this difference.

Interpreting the exploratory indirect paths

The bootstrap results were consistent with positive indirect paths from ATT, PRA, EXP, and ETL to LO through SAE in the constrained model. These findings support engagement as a plausible explanatory process, but they should not be reported as definitive causal mediation. Hayes (2022) distinguishes statistical indirect effects from the stronger causal claims that require

appropriate temporal ordering and design. Here, predictor, mediator, and outcome variables were measured cross-sectionally, and the outcome was self-reported.

The appropriate interpretation is therefore modest: students who reported more positive and productive relationships with educational technology also tended to report higher engagement, and those who reported higher engagement tended to report stronger learning outcomes. The teacher interviews provide a plausible process account involving greater practice, participation, feedback, and exposure. Longitudinal or experimental studies are needed to establish whether changes in technology use produce later changes in engagement and proficiency.

Theoretical and Practical Implications

Theoretically, the study supports a shift from technology acceptance as an endpoint to technology-supported engagement as the educationally relevant process. TAM and UTAUT remain useful for understanding why students adopt or value technology, but English-language learning requires sustained activity. The present findings suggest a layered interpretation: attitudes, experience, perceived learning value, and practices form an interconnected technology orientation; this orientation is strongly associated with engagement; and engagement is strongly associated with perceived language-learning outcomes. The data also caution against forcing these closely related domains into an overly differentiated latent model when empirical discriminant validity is weak.

The results suggest that a blend of pedagogy and infrastructure investment is suitable for universities. Basic requirements include reliable internet, effective digital platforms, access to devices and language-learning resources, and technical support. But, as is evident from the teacher interviews, training is also crucial. English-language teachers need to be able to create tasks that will involve students in learning the language through interactive activities, to be able to use digital feedback, to support online cooperation and to link tools to specific language skills through professional development. Institutional technology policies should thus focus on learning design, rather than just procurement.

The best practical advice for teachers is to refine the use of technology to facilitate active language use. Digital activities should involve students in a critical reading experience, writing and editing, listening, speaking and recording, collaboration, feedback, and reflection. Engaging tools are likely to be those that students can see are relevant to their academic or communicative objectives. Blended may be particularly well suited as the survey results revealed high acceptance of digital modes, and teacher interviews also indicated that some students still prefer traditional modes.

Digital literacy should be defined as a pedagogic competency and not just a technical one for students. Effective learners should identify credible resources, use writing and language tools for critical analysis, ensure academic honesty, control distractions, and analyze automated feedback but not take it at face value. The skills are more important in Higher Education as AI supported tools are introduced into the classroom (Kasneci et al., 2023).

Limitations and Future Research

There are some restrictions to be taken into account when interpreting the results. The first thing was that the quantitative design was of a cross sectional type. It is not possible to determine the direction of the association and conclusions should not be drawn as causal effects. Students already engaged may develop more positive attitudes towards technology and positive attitudes may encourage engagement.

Second, the dependent variable was perceived English-language learning outcomes not actual assessments of English-language proficiency. Future research should include a survey instrument along with course grades, a standardised language assessment, a rubric language assessment for writing, or a language assessment based on speaking and listening performance. This would differentiate between what benefits might be perceived and what might be proven.

Thirdly, there were significant ceiling effects and high inter-correlations in the data. Modest Cronbach alpha values were also found in some of the scales, and the original latent PLS measurement model was not found to be valid enough regarding convergent and discriminant validity. The present composite-score strategy is more transparent and future research should improve the instrument, do cognitive pre-testing, test item wording, test structure of the measure, and test the instrument with an independent sample.

Fourth, the raw data showed inconsistencies in labels for institutions, 38 ATT2 entries out of range, and repeated exact response profiles. Path estimates for the primary paths were relatively stable across range correction and duplicate-profile sensitivity analyses and improvements in data-management were recommended for future fieldwork. Survey forms on a computer should impose acceptable bounds on responses, use consistent institutional codes, provide length of response measures, and have predetermined checks for careless answering.

The fifth strand was qualitative, which was for teacher perspectives. It is very difficult for teachers to represent students' internal experiences in the classroom and in participation. The mixed-methods research should also include student interviews or focus groups, and the full qualitative audit trail, including the duration of interviews and the methods of transcribing, coding, and making reflexive notes, should also be documented.

Lastly, the deliberate balancing of samples among four public universities of Southern Punjab was done. This design helps in strengthening within study representation rather than the sample is not statistically representative of all Higher Education in Pakistan. Replication is required in other Provinces, private Universities, disciplines and postgraduate programmes. Longitudinal designs might be used to investigate the influence of technology orientation on later engagement, and experimental or quasi-experimental designs might be useful to test particular technology-supported language-learning interventions.

Conclusion

The present study used a mixed method approach to assess the role of educational technology and use of English-language learning in four public universities of Southern Punjab. The quantitative results confirmed the positive relationship between students' attitudes toward learning and academic engagement, as well as the positive relationship between prior experience

and academic engagement, educational technology practices and academic engagement, and perceived value of learning and academic engagement. Attitudes and practices made the greatest unique contributions and engagement was strongly related to perceptions of English language learning outcomes. The results of exploratory bootstraps were congruent with engagement as an indirect pathway, but do not justify making causal mediation inferences due to the cross-sectional study design.

The qualitative evidence provides an understanding of why these associations are plausible. Technology was described by teachers as flexible, participation, access to English materials, writing feedback, low risk speaking, and exposure to spoken English. However, they also stressed that positive attitudes need to be supported. Technology can be a problematic means to meaningful learning due to poor connectivity, limited facilities, lack of digital literacy and lack of teacher guidance.

It is not a conclusion that technology necessarily enhances English. Educational technology is useful when students feel it is relevant, when they apply it in a purposeful way, and when they are active participants in the language-learning process in an institutional setting that provides support. In the context of universities in Southern Punjab and similar environments, the policy challenge is shifting from technology as a service to conditions in which technology helps to sustain participation, practice, feedback and equity.

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