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Mobile Application Usage and Academic Performance: Examining the Moderating Effect of Learning Strategies

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Abstract:

Purpose: *The aim of this study was to investigate the moderating effect of learning strategies in the relationship between the mobile application usage and student performance.*
Design/Methodology/Approach: *The study utilized primary data, and 317 participants were purposively selected as representative sample from the population of 1,769 students. The data was analysed using Partial Least Square Structural Equation Model (PLS-SEM).*
Findings: *The findings reported that, effective learning strategies moderate the relationship between mobile application usage and student performance in Kwara State University, Malete.*
Practical Implications: *With rapid development in mobile technology in Nigeria, the use of mobile phone has been regarded as one of the effective learning tools among the students of higher learning.*
Originality/Value: *The study suggests that mobile applications should be integrated into students' learning processes using a pedagogical approach, as their user-friendly design can promotes effective utilization by students.*

Keywords: *Student performance, perceived ease of use, perceived usefulness, attitude towards mobile application usage and technology acceptance model.*

JEL Classification: *G12, G40.*

Paper type: *Research article.*

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1. Introduction

With rapid development in mobile technology in Nigeria, lecturers, educators, and counselors now have avenue to innovative learning tools that simplify and enhance their teaching approaches. By utilizing digital platforms, multimedia tools, and educational software, they can engage and interact with students more effectively in an electronic environment. The COVID-19 pandemic underscored the crucial role of technology in facilitating distance and online learning (Karatas and Arpaci, 2018).

Active learning technologies are reshaping students' learning experiences and motivations, highlighting the need not only to raise educational standards but also to transform the ways students learn and reasoning. The quality of education and the availability of resources significantly impact students' motivation (Samala and Amanda, 2023). Students can continue their education remotely using learning management systems, video conferencing tools, and online collaboration platforms, even when they are not present in a physical classroom.

This approach ensures continuous learning opportunities and improves accessibility. Additionally, technology facilitates smooth collaboration among students, educators, and education providers (Bentri, Hidayati, and Kristiawan, 2022). Virtual discussion boards encourage students to work together, exchange ideas, and actively engage in constructing knowledge. Tools such as video conferencing and networking systems enable collaborative tasks regardless of geographical barriers.

Furthermore, e-books, educational websites, and digital libraries provide extensive access to diverse educational materials, replacing traditional textbooks as the sole source of information (Bentri, Hidayati, and Kristiawan, 2022).

Tertiary institutions, tasked with producing highly competent graduates, must prepare students to adapt to the evolving professional landscape by equipping them with reliable skills. Collaboration between institutions and community stakeholders is crucial to updating the course content to align with the needs of the students. This collaborative effort aims to enhance students' learning opportunities, enabling them to become more informed and capable of addressing the challenges they encounter in their daily lives (Ganefri, Hidayat, Yulastri, and Yondri, 2019).

The integration of smartphone technology into modern education has grown significantly, as remote learning has become a practical option supported by advancements in technological devices and applications. These applications offer learners constant access to lessons and educational materials, allowing them to study at their convenience (Hidayati, Eldarni, Solfema, Handrianto, and Sunarti, 2023).

Students' frequent use of smartphones presents an opportunity to design effective smartphone-based learning tools, enabling access to lessons anytime and anywhere (Marty-Dugas and Smilek, 2020).

Perceived ease of use is a determinant of students' adoption and effective use of mobile applications for educational activities. Despite the potential of mobile apps to enhance learning, several challenges related to ease of use can hinder their integration into students' academic routines. Many educational mobile applications suffer from overly complicated interfaces that are not intuitive for students. Poor navigation, excessive features, or unclear instructions can overwhelm users, making it difficult to find and utilize the intended learning resources.

In addition, not all students possess the same level of technical proficiency. For those less familiar with mobile technology, even straightforward applications can seem daunting, leading to frustration and reduced motivation to engage with these tools. Therefore, without clear tutorials or step-by-step guidance, students may struggle to understand how to use the app effectively.

An inadequate onboarding process often leaves users feeling lost and leads to lower engagement (Venkatesh and Bala, 2018). If these challenges can be properly addressed, educational mobile applications can become more user-friendly, encouraging widespread adoption and effective integration into students' learning activities.

Perceived usefulness is another factor influencing the adoption and continued use of mobile learning tools. If students perceive a mobile application as not useful or only marginally beneficial, they are less likely to engage with it consistently, regardless of its features or accessibility. Mobile applications that fail to align with students' academic needs or curriculum requirements are often seen as irrelevant. If the content provided by the app does not match what students are studying or lacks depth and rigor, students may view it as unnecessary or unhelpful.

Therefore, if the students were struggling to see measurable improvements in their learning outcomes from using the mobile application, such as better grades or a deeper understanding of concepts. Without clear evidence of positive results, students may question the value of investing time and effort into this mobile application. Hence, if these barriers can be properly addressed, mobile learning applications can be better positioned to gain acceptance and achieve meaningful integration into students' academic lives.

Furthermore, students' attitudes toward mobile applications act as a psychological gateway to their adoption and effective use of mobile application technology. A positive attitude fosters engagement, motivation, and self-efficacy, leading to enhanced performance, while a negative or indifferent attitude can hinder these outcomes. By addressing this barrier and actively cultivating a positive perception about the mobile application, educators and application developers can ensure these tools effectively support students in achieving their academic goals (Ifenthaler and Schweinbenz, 2013).

Therefore, if these students can be offered tutorials, guides, and support to help them become comfortable with the application, it will address any initial hesitations or frustrations.

Often, learning strategies play a moderating role in determining how effective students use mobile applications for educational purposes. A mismatch between students' strategies and the application's design can hinder its adoption and negatively impact students' performance. Some applications prioritize passive content consumption, such as videos or text-based materials, rather than active learning methods like problem-solving, quizzes, or discussions.

Students relying on passive learning strategies may struggle with critical thinking and knowledge retention, limiting the impact of the app on their performance. By addressing these challenges and aligning application features with diverse learning needs, developers and educators can fully leverage the capabilities of mobile applications to improve student performance (Moya and Camacho, 2024)

The impact of mobile application usage on students' academic performance is complex and largely depends on how they engage with these tools. While mobile apps can offer significant advantages, such as flexibility, access to diverse resources, personalized learning, and increased motivation, they can also present challenges related to over-reliance, distractions, and ineffective usage.

To optimize the impact on academic performance, students need to use mobile applications thoughtfully, balancing them with traditional learning methods and adopting strategies that support long-term academic goals. Developers and educators can play a key role by ensuring that the mobile applications are well-designed, goal-oriented, and aligned with students' learning needs (Liu and Huang, 2020).

Considering all the factors discussed above, it is essential to highlight the significance of providing empirical evidence on how learning strategies moderate the relationship between mobile application usage and students' academic performance.

2. Literature Review and Hypotheses Development

This section presents an overview of the concept, relevant empirical findings, and the theoretical foundations of the study. Perceived ease of use refers to the degree to which individuals believe that using a system or technology will be effortless. In the context of adopting technologies like mobile apps or other digital tools, it reflects how easy or difficult users perceive the technology to be.

When users find a system or application easy to use, they are more likely to adopt and engage with it frequently. Previous studies have explored the link between mobile application usage and performance management.

For instance, Sung, Chunlei, Nicholson, Scapens, and Yang, (2020) conducted a case study to examine the impact of mobile platforms on performance management, highlighting the significance of flexibility and improvisation in enhancing management control systems. However, the limitation of the study is that the study considered both the geographical and demographic aspect which if incorporate together may overstate the level of mobile application usage by students.

Similarly, Gawer and Cusumano, (2014) emphasize the importance of mobile platform leaders focusing on bringing together multiple groups to create mutual value in platform ecosystems (i.e., multi-sided effects). Omar, Munir, Kaizan, Noranee, and Malik, (2019) employed correlation and regression analysis to examine the impact of employee motivation, perceived usefulness, and perceived ease of use on employee performance, revealing a significant positive relationship among these variables.

However, the study was cross-sectional, limiting its ability to assess trends over time. Similarly, Dauda and Akingbade, (2011) argued that integrating technology can enhance productivity and performance by enabling individuals to use organizational resources more efficiently and ethically. Nonetheless, this study shares the same limitation as Omar, Munir, Kaizan, Noranee, and Malik, (2019).

The Technology Acceptance Model (TAM), proposed by Davis (1989), identifies perceived ease of use as critical factor influencing users' intention to adopt technology, alongside perceived usefulness the belief that the technology will improve performance or assist in achieving goals. Based on these theoretical, empirical, and conceptual insights, the first hypothesis is formulated as follows:

***H_{01}**: There is no statistically significant positive relationship between perceived ease of use and students' academic performance.*

Perceived usefulness refers to the extent to which students believe that using a mobile application will enhance their learning performance. Davis (1989) defines it as the degree to which individuals expect that using a particular system will lead to improved outcomes. According to Davis, perceived usefulness reflects a person's confidence that a specific technology will enhance their job performance. Within the Technology Acceptance Model (TAM), perceived usefulness is a key factor influencing an individual's intention to adopt technology (Park, Song, and Lee, 2014).

Previous research has established a link between perceived usefulness and continued usage across various domains, including e-texts (Baker-Eveleth and Stone, 2015), online travel services (Li and Liu, 2014), e-learning (Lin and Wang, 2012), blog-based learning (Tang, Tang, and Chiang, 2014), instant messaging (Wang, Ngai, and Wei, 2011), mobile service providers (Abbas and Hamdy, 2015), and knowledge creation (Choi and Chang, 2009).

However, these studies treated all variables as equally influential, despite potential differences in their individual contributions. Kuznekoff, Munz, and Titsworth (2015) observed that smartphone use during lectures particularly for messaging disrupts both student performance and the note-taking process. Mobile phones can hinder learning in three keyways: through sources (e.g., notifications and texting), targets (e.g., messaging that may not directly affect reading comprehension), and subjects (e.g., information-seeking behavior and individual personality traits).

Davis (1989) also highlights that perceptions of a technology's usefulness and ease of use are often strong predictors of adoption, though their impact can vary depending on the technology and user context. When users perceive a system as easy to use, it generally leads to higher levels of adoption and engagement critical factors for the success of technologies such as mobile applications in educational environments.

Perceived usefulness remains a core component of the Technology Acceptance Model (TAM), which posits that it significantly influences users' intentions to adopt and utilize mobile technology. Drawing on the theoretical, empirical, and conceptual foundations outlined above, the second hypothesis is proposed as follows:

H_{02}: There is no statistically significant positive correlation between perceived usefulness and students' academic performance.

Individual attitude refers to a person's overall evaluation or feeling about something, whether positive, negative, or neutral. It involves beliefs, emotions, and behavioral tendencies toward an object, person, event, or concept. In the context of technological adoption, such as mobile applications or software, an individual's attitude significantly affects their intention to use it and how they engage with it.

Attitudes are learned tendencies to evaluate and assess things in a specific way, encompassing evaluative judgments, emotional reactions, and behavioral tendencies toward various objects, individuals, groups, or concepts (as in the blog Geek Tonight, 2023). Previous research has highlighted a link between students' attitudes toward mobile app usage and their academic performance.

For instance, Canilao, and Gurat (2023) utilized the Mathematics and Technology Attitudes Scale (MTAS) questionnaire to examine the impact of mobile apps on students' behavioral engagement, confidence in technology and mathematics, emotional involvement, and their interaction with math through technology.

Their results showed that most students had a positive attitude toward using mobile apps, with responses ranging from neutral to favorable. While no significant differences were observed in some areas, the experimental group was generally more optimistic than the control group.

However, the study did not establish which group's results were more reliable. In contrast, Marzouki, Idrissi, and Bennani (2017) reported that mobile learning had a negative effect on knowledge acquisition, academic performance, attitudes, and motivation within social constructivist learning environments.

Fabian, Topping, and Barron (2018) reported that students viewed the use of mobile devices in learning as interesting, rewarding, and beneficial. Baya'a, Daher, and Anabousy, (2019) concluded that integrating mobile apps into blended learning increases flexibility and fosters a collaborative learning environment. Alqahtani (2015) found that the inclusion of mobile technologies in education opens up new learning opportunities beyond traditional classroom settings.

Bray and Tangney (2016) discovered that mobile apps enhanced students' affective engagement and attitudes toward technology, but had no significant effect on behavioral engagement, math confidence, or technology confidence. However, these findings contradicted those of Main and O'Rourke (2011) and Riconscente (2013), who observed positive changes in students' attitudes toward mathematics.

Theoretically, Technology Acceptance Model (TAM) suggests that users' attitudes toward technology, whether positive or negative, directly impact their intention to use it. If users perceive a system as meeting their needs and expectations in terms of usefulness and ease of use, they are more likely to form a positive attitude and adopt it. Based on these theoretical, empirical, and conceptual insights, the second hypothesis is proposed as follows:

***H_{03}**: There is no significant positive relationship between attitude toward mobile application usage and student academic performance.*

Learning strategies refer to the methods employed by students to effectively acquire, process, and retain information. Learner performance can be assessed through various methods, including but not limited to course completion, grade point average, and skill development (Picciano, 2002). These strategies are deliberate actions aimed at enhancing learning outcomes and improving student academic performance. They can be classified as cognitive, metacognitive, or behavioral, depending on how they engage students' thought processes and actions.

For instance, Hendra, Zamzami, Anwar, Kurnia, Saputra, Muji, Syukhri, and Ilmiyati, (2024) used PLS-SEM to examine how students majoring in electronics engineering education at higher education institutions benefited from various learning applications and how these influenced their overall academic performance.

Their findings indicated that combining effective learning strategies with a high level of technology acceptance had a positive effect on student performance, though the results were specific to a particular period.

Similarly, Limniou (2021) examined the behavior of 361 undergraduate psychology students at the University of Liverpool who used digital devices during lectures. The study revealed that students who used only one application during lectures achieved better academic performance, as they were less distracted and more focused on processing and retaining information.

However, the study's methodology was subjective, as noted in the earlier work of Dauda and Akingbade (2011). Limniou, Duret, and Hands (2020) applied Social Cognitive Theory (SCT) to examine how student behavior, the learning environment, personal characteristics, and device usage interact in relation to academic performance. Their findings indicated no significant difference in academic performance based on device usage among first-year undergraduate students within the same field of study.

In contrast, Zhang (2015) explored both the direct and indirect relationships between learning variables such as self-efficacy, intrinsic and extrinsic motivation, test anxiety, and self-regulation laptop multitasking, and academic performance. The study found that self-efficacy had a negative effect on multitasking, while self-regulation was inversely related to extrinsic motivation (e.g., enjoyment).

According to the Technology Acceptance Model (TAM), technology adoption is a gradual process wherein users progress through stages of learning, experiencing, and assessing the perceived usefulness and ease of use of a technology before fully embracing it. This underscores the importance of continuous user engagement, feedback, and learning to support the sustained integration and acceptance of mobile applications.

Drawing on these theoretical, empirical, and conceptual perspectives, the second hypothesis is proposed as follows:

H_{04}: Learning strategies do not significantly moderate relationship between mobile application usage and student academic performance.

3. Research Methodology

The study adopted a cross-sectional research design, focusing on a population of 1,769 students from the Department of Accounting, Finance, and Taxation. Purposive sampling was employed to select participants who aligned with the study's objectives, ensuring the collection of accurate and relevant data.

A sample of 317 students enrolled in the learning management system (LMS) at Kwara State University, Malete, was chosen based on Krejcie and Morgan's (1970) sample size determination method. These students had prior experience using Android-based mobile applications to support their learning activities. Data was collected through the LMS, where participants completed a questionnaire on a

designated web-based platform. The initial analysis assessed the validity and reliability of the constructs in the measurement model. Convergent validity was evaluated using item loading and Average Variance Extracted (AVE).

Additionally, composite reliability (CR), Cronbach's alpha, AVE, and discriminant validity were used to examine the interdependence and internal consistency of the constructs. In the second phase, the study analyzed the statistical significance of structural relationships among the constructs. To achieve this, 317 bootstrap samples were generated. Hypotheses were tested using partial least square structural equation modeling (PLS-SEM).

Table 1. *Population and sample size*

S/N	Dept of Accounting and Finance	Population of the Study	Proportion of sample size in relation to sampling frame	Sample Size
1	Accounting	1,306	(1,306×317) ÷ 1,769	234
2	Finance	421	(421×317) ÷ 1,769	75
3	Taxation	42	(42×317) ÷ 1,769	8
	Total	**1,769**		**317**

Source: *Author`s Computations, 2025.*

4. Results and Discussion

4.1 Descriptive Results

Out of 317 respondents profiled in Table 1, 193 were male, making up 61% of the total sample. In contrast, 124 respondents were female, representing 39% of the population. This highlights a greater male participation in the survey, with males forming the majority at 61%.

Regarding age distribution, 64 respondents, or 20% of the total, were aged 15 to 17 years. The 18-to-20 age group included 156 individuals, accounting for 49% of the sample, making it the largest group. Respondents aged 21 to 25 years totaled 81, representing 26% of the sample, while the smallest group, aged 26 to 30 years, consisted of 16 respondents, or 5% of the total. The data suggests the survey predominantly targeted younger participants, with nearly half aged 18-20, indicating this demographic is likely the most engaged in smartphone usage.

In terms of daily smartphone usage, 22 respondents (7%) reported using their devices for 1 to 3 hours. Those using smartphones for 4 to 6 hours per day numbered 69, representing 22% of the sample. The majority, 144 respondents, or 45%, used their smartphones for 7 to 9 hours daily. Additionally, 82 respondents, or 26%, reported usage ranging from 10 to 12 hours each day. The data reveals that a significant proportion (45%) of participants are heavy smartphone users, spending 7-9 hours on their devices daily.

Table 1. *Respondents Profile*

Demographic	Variable	Frequency	Percentage (%)
Gender	Male	193	61
	Female	124	39
	Total	**317**	**100**
Age	15-17	64	20
	18-20	156	49
	21-25	81	26
	26-30	16	5
	Total		**100**
Amount of time spent using a smartphone each day	1-3	22	7
	4-6	69	22
	7-9	144	45
	10-12	82	26
	Total	**317**	**100**

Source: *Author`s Computation, 2024.*

The factor loadings for students' performance (SP) items (SP_1 to SP_4) are remarkably high, ranging from 0.902 to 0.922, indicating strong correlations with the underlying construct. The reliability and validity analysis reveals a Cronbach's Alpha of 0.853, signifying excellent internal consistency as it exceeds the recommended threshold of 0.7. Similarly, a composite reliability (CR) of 0.802 confirms the construct's reliability, while the average variance extracted (AVE) of 0.671 surpasses the minimum threshold of 0.5, demonstrating sufficient convergent validity. The construct also shows discriminant validity, confirming its distinctiveness from others.

For perceived ease of use (PEU), the factor loadings (PEU_1 to PEU_4) are similarly high, ranging between 0.898 and 0.916, reflecting a strong representation of the construct. A Cronbach's Alpha of 0.806 indicates good internal consistency, while the CR value of 0.884 exceeds the recommended standard, confirming strong reliability. The AVE of 0.691 further demonstrates adequate convergent validity, and discriminant validity affirms the construct's uniqueness.

Regarding attitude toward mobile application usage (AMU), the factor loadings for items AMU_1 to AMU_4 are excellent, ranging from 0.901 to 0.932, indicating strong alignment with the construct. Reliability metrics include a Cronbach's Alpha of 0.910, which reflects very high internal consistency, and a CR of 0.919, confirming robust construct reliability. The AVE of 0.874, being exceptionally high, underscores excellent convergent validity. The presence of discriminant validity further validates the construct's distinctiveness.

The factor loadings for learning strategies (LS) items (LS_1 to LS_4) range from 0.804 to 0.920, indicating moderate to strong representation of the construct. Reliability analysis yields a Cronbach's Alpha of 0.813, signifying good reliability, while the

CR value of 0.943 demonstrates high construct reliability. The AVE of 0.767 exceeds the minimum threshold, confirming strong convergent validity. Discriminant validity further ensures the construct is distinguishable from others in the study.

Lastly, the factor loadings for perceived useful (PU) items (PU_1 to PU_4) range between 0.815 and 0.931, with PU2 slightly lower but still within an acceptable range. A Cronbach's Alpha of 0.879 reflects strong internal consistency, and while the CR of 0.781 is slightly lower than other constructs, it remains acceptable. The AVE of 0.743 is well above the required threshold, indicating robust convergent validity. Discriminant validity also confirms the independence of this construct from others.

In conclusion, the analysis confirms that all the constructs used in this study are both reliable and valid. The high factor loadings indicate strong associations between the items and their corresponding constructs. Reliability indicators, such as Cronbach's Alpha and Composite Reliability (CR), demonstrate excellent internal consistency, while the Average Variance Extracted (AVE) confirms that each construct captures an adequate amount of variance from its items. Additionally, discriminant validity supports the distinctiveness of each construct.

Table 2. *Reliability and Validity Statistic*

Constructs	Items	Factor Loadings	Cronbach's Alpha	Composite Reliability	AVE	Discriminant Validity
Students Performance	SP_1	0.913	0.853	0.802	0.671	Yes
	SP_2	0.902				
	SP_3	0.922				
	SP_4	0.921				
Perceived Ease of Use	PEU_1	0.913	0.806	0.884	0.691	Yes
	PEU_2	0.904				
	PEU_3	0.916				
	PEU_4	0.898				
Attitude Towards Usage	ATU_1	0.932	0.910	0.919	0.874	Yes
	ATU_2	0.915				
	ATU_3	0.914				
	ATU_4	0.901				
Learning Strategies	LS_1	0.920	0.813	0.943	0.767	Yes
	LS_2	0.822				
	LS_3	0.810				
	LS_4	0.804				
Perceived Usefulness	PU_1	0.931	0.879	0.781	0.743	Yes
	PU_2	0.822				
	PU_3	0.815				
	PU_4	0.887				

Source: *Author`s Computation, 2024.*

The findings of this study indicate that Hypothesis (H_1), which suggested no significant positive relationship between perceived ease of use and student performance, was contradicted, as the results revealed a statistically significant positive effect ($\beta = 0.342$, $p = 0.042$).

Similarly, Hypothesis (H_2), which posited no significant positive correlation between perceived usefulness and student performance, was also refuted, with the analysis showing a strong positive relationship ($\beta = 0.511$, $p = 0.002$).

In addition, Hypothesis (H_3), proposing no statistically significant positive relationship between attitudes toward mobile application usage and student performance, was not supported with a highly significant result ($\beta = 0.742$, $p = 0.000$).

Hypothesis (H_4) suggested that the findings confirmed the moderating role of learning strategies in the relationship between mobile application usage and student performance, showing a significant positive effect ($\beta = 0.421$, $p = 0.000$).

Table 3. *Direct and Indirect Effect Hypotheses*

Hypotheses	*B*	*T-value*	*P-value*	*Results*
H_1: PEU → SP	0.342	3.789	0.042	Supported
H_2: PU → SP	0.511	4.223	0.002	Supported
H_3: ATU → SP	0.421	4.391	0.000	Supported
H_4: MAU → LS → SP	0.202	2.134	0.031	Supported

Source: Author`s Computation, 2024.

5. Conclusion and Recommendations

The integration of mobile technology into education and pedagogy is becoming a prominent area of research due to its significant impact on learning outcomes. Studies in accounting and finance frequently utilize the Technology Acceptance Model (TAM) as a framework for examining mobile technology usage. This study explores the effect of mobile application usage on students' academic performance, with learning strategies serving as a moderating variable.

The findings demonstrate that perceived ease of use, perceived usefulness, and attitudes toward mobile application usage positively influence the academic performance of students at Kwara State University (KWASU). Moreover, learning strategies were found to significantly and positively moderate the relationship between mobile application usage and academic performance among these students.

To promote mobile application usage in Nigerian tertiary institutions, this study offers several policy implications and recommendations. It contributes to the expanding literature by identifying critical factors that impact students' academic performance in higher education, particularly within undergraduate programs that

incorporate mobile applications. However, the study acknowledges certain limitations and suggests avenues for future research.

Firstly, the sample size is relatively small compared to the overall student population in Nigerian tertiary institutions. Additionally, the data collection was limited to a single university, which may limit the generalizability of the findings beyond this context. Future studies should consider larger and more diverse sample sizes, encompassing a wider range of universities and colleges across various countries, to yield more comprehensive insights.

The study also notes the reliance on self-reported data, which may introduce biases such as recall bias, potentially affecting the accuracy of the responses in reflecting actual educational experiences. While no significant impact of common method bias was observed in this study, it is recommended that future research replicate the analysis using data from multiple sources to enhance robustness.

Lastly, adopting a longitudinal correlation-effect research design in subsequent studies could improve the reliability and validity of findings, particularly concerning the broader implementation of mobile technology strategies in education.

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