US JOURNAL OF NEW INSIGHTS IN TECH & EDUCATION

Vol. 1, No. 2 · Article ID: USJNITE-2103 · Journal Homepage: www.edtechinsights.org

Adoption and Effective Use of Mobile Learning Technologies in Higher Education

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Received 3 July 2021; Revised 12 September 2021; Accepted 20 October 2021; Published: 25 November 2021

KEYWORDS

Mobile Learning
Higher Education
Self-Efficacy
Technology Adamption
Learning Outcomes
Student Engagement
Digital Learning

Abstract

Mobile learning has moved from an experimental supplement to an increasingly important component of higher education, yet access to a mobile device does not guarantee meaningful educational use. This integrative literature review synthesizes 27 open-access or freely accessible studies published before 2020 to examine how students and educators adopt mobile learning technologies and under what conditions those technologies are used effectively. The review focuses on technology acceptance, perceived usefulness and ease of use, social influence, facilitating conditions, teacher readiness, usability, pedagogical alignment, engagement, communication, collaboration, flexibility, learning outcomes, and equity. Evidence from TAM-, UTAUT-, TPB-, and uses-and-gratifications-informed studies indicates that perceived usefulness, ease of use, attitudes, social influence, and facilitating conditions repeatedly shape intention and adoption, but the strength of individual predictors varies by context. Qualitative and review studies further show that effective use depends on instructional alignment, meaningful interaction, teacher orchestration, learner self-regulation, technical reliability, institutional support, and equitable access. Mobile applications can support communication, resource access, collaboration, feedback, and continuity of study, and selected studies report positive learning or achievement effects. However, distraction, infrastructure limitations, privacy concerns, digital-literacy gaps, cost, and uneven institutional readiness can constrain sustained use. The review proposes an integrated adoption-to-effective-use framework that distinguishes access, acceptance, adoption, pedagogical integration, and learning outcomes. The central conclusion is conditional: mobile learning is most educationally consequential when mobile affordances are embedded in coherent teaching practices and supported by institutional and equity-aware conditions.

1. Introduction

Mobile learning (m-learning) has become one of the most accessible forms of educational technology in higher education because smartphones and tablets are increasingly embedded in students' daily communication, information access, and study routines. Before 2020, the literature had already moved beyond the question of whether mobile devices could be used for learning and toward more specific questions of acceptance, adoption, pedagogical integration, sustainability, and educational effectiveness. The distinction is important because device ownership or application availability is not equivalent to purposeful academic use. A student can use a smartphone extensively while making little use of it for deep learning, and an institution can deploy a mobile platform without changing the tasks, assessment, feedback, or interaction patterns that shape learning.

Pre-2020 adoption research identifies technology acceptance as an important entry point. Studies using the Technology Acceptance Model (TAM), Unified Theory of Acceptance and Use of Technology (UTAUT), Theory of Planned Behavior (TPB), and uses-and-gratifications perspectives repeatedly examine perceived usefulness, ease of use, attitude, social influence, perceived behavioral control, facilitating conditions, and user gratification. Aburub and Alnawas (2019), for example, integrated TAM and uses-and-gratifications variables in a large Jordanian student sample, while

Almaiah et al. (2019) applied UTAUT to mobile learning acceptance in higher education. Raza et al. (2018) combined TPB and TAM to examine m-learning adoption in Pakistan. These studies show that adoption is multi-dimensional and context-sensitive rather than a simple response to device availability.

The literature also demonstrates that adoption is only the first transition. Studies of actual use and pedagogical integration describe mobile learning as a means for communication, management of learning materials, collaboration, feedback, flexible access, and practice. Khan et al. (2019), using students from four Bangladeshi universities, identified communication, management of learning materials, effective learning, collaborative learning, and idea development as distinct conceptions of mobile learning. Eppard et al. (2019) found that UAE higher-education users valued ubiquitous learning but also reported obstacles to integration. The critical review by Pedro et al. (2018) similarly argues that mobile integration depends on classroom orchestration, attention, and the teacher's ability to coordinate mobile resources with learning goals.

Effectiveness therefore requires a broader model. In addition to adoption predictors, the evidence emphasizes teacher readiness, usability, technical infrastructure, institutional policy, affordability, digital literacy, and equity. Kaliisa and Picard (2019) argue that African higher education requires mobile-learning-specific policy to move from scattered experimentation to inclusive implementation. Sarrab et al. (2018) propose educational requirements that combine instructional design with mobile-app quality. Alrasheedi et al. (2015), in a systematic review of 30 studies across 17 countries, identified 13 critical success factors for effective m-learning implementation. These contributions make it possible to examine mobile learning not as a single technology but as an educational system with interacting individual, pedagogical, technological, and institutional layers.

Against this background, this paper examines how mobile learning technologies are adopted and effectively used in higher education using a pre-2020 evidence base. The review focuses on the pathway from access and acceptance to sustained use, pedagogical integration, and learning outcomes. It also identifies barriers that can widen inequalities or reduce the effectiveness of otherwise promising mobile-learning interventions.

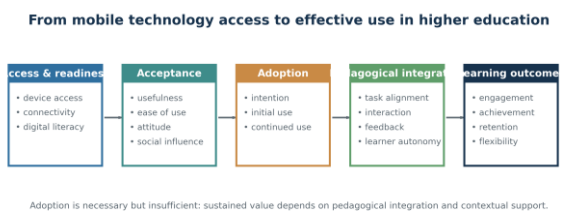

Figure 1. Adoption-to-effective-use pathway for mobile learning in higher education.

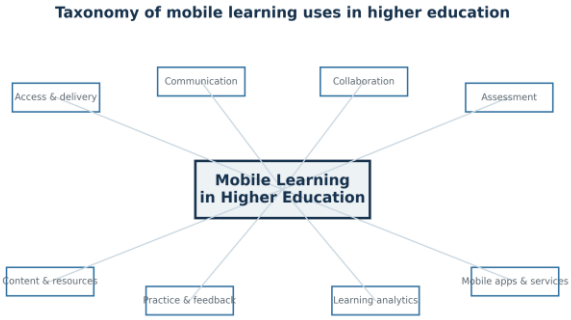

Figure 2. Taxonomy of mobile learning uses in higher education.

2. Problem Statement

The central problem is a persistent gap between having access to mobile technologies, accepting them as useful learning tools, adopting them in practice, and using them in ways that produce meaningful educational outcomes. Higher-education students often own smartphones, yet the educational value of mobile use depends on whether devices are connected to purposeful tasks, accessible content, interaction, formative feedback, and assessment. A technology can therefore be present without becoming pedagogically consequential.

A second problem is fragmentation across adoption and implementation research. Acceptance studies commonly concentrate on individual-level predictors such as usefulness, ease, attitude, or social influence, while implementation studies emphasize teacher readiness, institutional support, infrastructure, or policy. Outcome studies, in turn, often examine a specific application or learning activity. Without an integrated lens, it is difficult to explain why a highly accepted mobile technology may still produce weak learning outcomes or why a modestly rated tool can be effective when instructional alignment is strong.

A third problem concerns uneven distribution of benefits. Mobile learning can lower the barriers to accessing course materials and communication, but it can also reproduce inequalities when students have different levels of connectivity, data affordability, device quality, digital literacy, or home study support. Equity is therefore not an external issue. It is part of the conditions under which adoption and effective use occur.

Finally, evidence before 2020 was expanding rapidly but remained methodologically diverse. Quantitative acceptance models, qualitative studies of learner experience, systematic reviews, policy analyses, and intervention studies measured different constructs. A useful synthesis must preserve those differences rather than treating intention, use, engagement, satisfaction, and achievement as interchangeable.

Table 1. Adoption versus effective use of mobile learning.

Dimension	Adoption-focused view	Effective-use view	Implication
Primary question	Will the user adopt?	How is the technology used educationally?	Adoption is an entry condition, not the endpoint.
Core variables	Usefulness, ease, attitude, norms	Task alignment, interaction, feedback, orchestration	Pedagogy converts affordances into learning.
Main actors	Primarily students/users	Students, teachers, institutions	Effective use is socio-technical.
Main risks	Low intention or resistance	Distraction, weak design, inequity, unreliable access	Implementation requires contextual support.

3. Research Questions

RQ1. What individual, social, technological, and contextual factors most strongly influence adoption of mobile learning technologies in higher education?

RQ2. How do students and educators actually use mobile technologies for communication, collaboration, content access, feedback, assessment, and self-regulated learning?

RQ3. What evidence exists that mobile learning improves engagement, achievement, retention, flexibility, or other educational outcomes?

RQ4. Which pedagogical, institutional, infrastructural, and equity conditions moderate the effectiveness of mobile learning?

RQ5. What integrated framework can explain the transition from access and acceptance to sustained, pedagogically effective mobile learning?

4. Literature Review

4.1. Mobile learning in higher education

Mobile learning is generally characterized by mobility, connectivity, portability, and the possibility of learning across locations and times. In higher education, these affordances can support course communication, resource access, collaborative activity, language learning, assessment, and continuous study. Krull and Duart (2017) found that mobile-learning research in higher education had expanded across a range of purposes and devices, while Sundgren (2017) showed how bring-your-own-device practices could blur boundaries of time and place. The attraction of mobile learning is therefore not simply smaller hardware; it is the possibility of extending the learning environment beyond fixed classroom and computer-lab boundaries.

At the same time, mobile learning is not pedagogically neutral. Pedro et al. (2018) caution that ubiquitous access can create distraction and multitasking, while teachers must act as media orchestrators. Khan et al. (2019) found that students in Bangladesh did not describe mobile learning in a single way; rather, they saw mobile devices as tools for communication, management of learning materials, effective learning, collaboration, and idea development. These findings support a definition of mobile learning as a flexible learning ecology rather than a single app or device.

4.2. Adoption theories and determinants

TAM remains one of the most common explanations for mobile-learning acceptance because it links perceived usefulness and perceived ease of use with attitude and behavioral intention. Aburub and Alnawas (2019) showed that perceived ease of use and cognitive gratification were especially influential in their integrated model, whereas usefulness and hedonic gratification had smaller effects and personal integrative gratification was not significant. Chuchu and Ndoro (2019) similarly used a TAM-derived model to study determinants of mobile-app adoption in higher education. UTAUT broadens the explanation by considering performance expectancy, effort expectancy, social influence, and facilitating conditions. Almaiah et al. (2019) applied UTAUT to higher-education students and demonstrated the relevance of contextual factors around mobile-learning acceptance. Kaliisa and Miller (2017) also used UTAUT in a comparative study of Uganda and Australia, showing that the meaning of mobile use differs across developed and developing contexts and that student use may remain pedagogically limited even when devices are commonly available.

TPB adds attitudinal, normative, and control beliefs. Raza et al. (2018) found positive effects of attitudinal beliefs, subjective norms, and perceived behavioral control on m-learning adoption in Pakistan. This reinforces the importance of social and self-efficacy dimensions that may be underrepresented in purely utilitarian acceptance models.

Uses-and-gratifications perspectives highlight why users may engage with mobile technologies for cognitive, social, hedonic, or integrative purposes. The combined TAM and U&G approach used by Aburub and Alnawas (2019) illustrates the value of integrating functional and experiential motivations. Across these theoretical traditions, the literature suggests that usefulness is necessary but not sufficient. Adoption is shaped by the interaction of perceived value, ease, social context, user confidence, and enabling conditions.

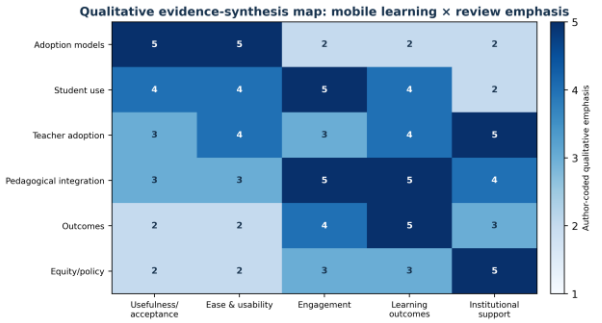

Figure 3. Qualitative evidence-synthesis map of major mobile-learning themes.

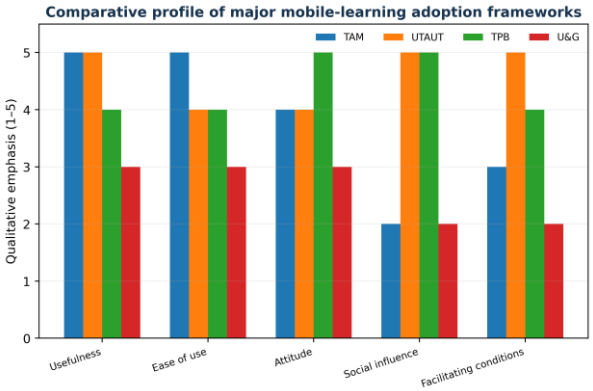

Figure 4. Comparative qualitative profile of major adoption frameworks.

4.3. Student adoption and patterns of use

Student adoption studies consistently show a difference between intention and actual learning behavior. Almaiah et al. (2019), Azizi and Khatony (2019), and Chuchu and Ndoro (2019) all examine acceptance or intention, but their constructs do not by themselves establish whether mobile applications are integrated into learning tasks. The distinction becomes especially clear when compared with phenomenographic and qualitative work. Khan et al. (2019) found multiple conceptions of mobile learning, indicating that the same device can function as a communication tool for one student and as a collaborative or knowledge-building tool for another.

Mobile use can also be shaped by disciplinary context. Suner et al. (2019), examining undergraduate dental students, documented specific usage habits and attitudes, while Chen (2015) explored college students' experiences and acceptance of mobile English learning in Taiwan. These studies suggest that perceived fit between technology and subject matter matters. Mobile learning is more likely to be meaningful when the mobile format supports the epistemic activities of the discipline rather than simply transferring desktop content to a smaller screen.

Eppard et al. (2019) found that participants in a UAE higher-education setting considered mobile learning useful, particularly for ubiquitous learning, while also identifying challenges to integration. Alsaif (2018) similarly reported positive perceptions of affordability and communication but identified distraction and limited functions as barriers. Together, these studies indicate that perceived convenience and access are important benefits, but they coexist with concerns about distraction, limited functionality, and the need for purposeful instructional design.

4.4. Teacher adoption and pedagogical integration

Effective mobile learning depends on teachers because the educational value of a mobile device is mediated by task design, assessment, feedback, and classroom orchestration. Dolawattha et al. (2019) proposed an impact model for teacher adoption that incorporated usefulness, interactivity, motivation, attitude, facilitating conditions, and ease of use. The model is important because it shifts attention from student acceptance alone toward the educator's role in sustaining mobile learning.

Pedro et al. (2018) argue that mobile technology can change classroom dynamics through multitasking and attention demands, making teacher orchestration central. Sarrab et al. (2018) likewise propose that mobile-learning development should be grounded in educational requirements spanning learning design and software quality. The implication is that usability cannot substitute for pedagogy; an easy-to-use app can still be instructionally weak if it does not support meaningful learning activity.

García-Martínez et al. (2019) reviewed mobile-device applications for learning and teacher professionalization and identified both learning benefits and changes in teacher roles. Their synthesis points to a move from teacher-centered delivery toward facilitation, coordination, and support. This transformation also requires professional development, technical support, and institutional encouragement.

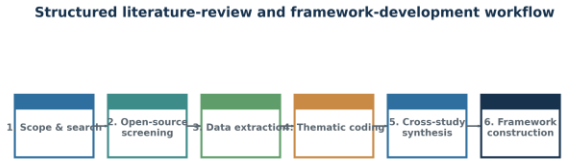

Figure 5. Structured literature-review and framework-development workflow.

4.5. Effective use and learning outcomes

The evidence for outcomes is positive but not uniform. Klimova (2019) reported that personalized smartphone-supported foreign-language learning could improve university students' performance in vocabulary and phrase learning. Pechenkina et al. (2017) showed that a gamified mobile application could support engagement, retention, and academic achievement. These studies suggest that mobile technology can contribute to measurable outcomes when the intervention creates repeated, targeted learning opportunities.

Mobile learning can also improve learning through process variables rather than immediate test scores. Studies reviewed by García-Martínez et al. (2019) emphasize flexibility, student-centered learning, and communication. Khan et al. (2019) identify collaborative learning and idea development as distinct uses, while Sundgren (2017) highlights how mobile access can extend learning across time and place.

The critical-review literature cautions against assuming that all mobile use is beneficial. Pedro et al. (2018) emphasize distraction and multitasking, and Alsaif (2018) reports similar concerns. The most defensible interpretation is therefore conditional: mobile learning improves outcomes when mobile affordances are linked to deliberate tasks, meaningful interaction, timely feedback, and opportunities for self-regulation.

4.6. Infrastructure, policy, and digital equity

Access is a prerequisite for mobile learning, but equitable access involves more than owning a smartphone. Infrastructure includes network reliability, data affordability, platform compatibility, charging, technical support, and access to suitable applications. Kaliisa and Picard (2019) argue that African higher education lacks mature mobile-learning policy frameworks and call for institutional and national policies that support inclusive implementation.

Equity also involves differences in digital literacy and pedagogical support. A mobile app may be technically available but difficult to use for students with weaker digital skills or for teachers without training. Sarrab et al. (2018) therefore emphasize requirements and quality, while Alrasheedi et al. (2015) identify a broad set of implementation success factors across countries. The equity dimension should be treated as part of system effectiveness because unequal conditions can determine who benefits from the same technology.

Policy and institutional support matter because mobile learning can shift costs and responsibilities. Students may bear data costs, teachers may need to redesign materials, and institutions may need to address privacy and interoperability. The evidence suggests that sustainable adoption requires coordinated support rather than a device-first procurement approach.

5. Critical Synthesis

Across the 27-paper corpus, the most consistent finding is that adoption is a layered process. Functional value matters, but adoption is strengthened when users also find technologies easy to use, socially acceptable, and practically supported. TAM, UTAUT, TPB, and U&G studies capture different parts of this process. Their variation across countries and populations explains why no single predictor should be treated as universally dominant.

A second synthesis is the separation between adoption and effective use. Student intention does not automatically lead to pedagogical integration, and regular device use does not necessarily produce deeper learning. The studies that connect mobile use to learning outcomes typically introduce a specific learning design: personalized vocabulary practice (Klimova, 2019), gamified study activity (Pechenkina et al., 2017), or structured mobile learning in a course or professional context.

A third synthesis concerns context. Infrastructure, teacher readiness, policy, and equity shape the strength of the adoption-to-use relationship. Comparative and African-context studies are particularly useful because they expose the limitations of treating mobile learning as context-free. Kaliisa and Miller (2017) show differences between Uganda and Australia, while Kaliisa and Picard (2019) highlight policy gaps that can constrain adoption at institutional and national levels.

Finally, the literature suggests that the most promising model is not 'adoption causes achievement' but a mediated and moderated pathway. Technology conditions influence acceptance and actual use; actual use becomes educationally valuable through pedagogical integration, interaction, feedback, and learner self-regulation; and the resulting learning processes influence outcomes. Contextual conditions such as infrastructure, teacher readiness, institutional support, and equity moderate each transition.

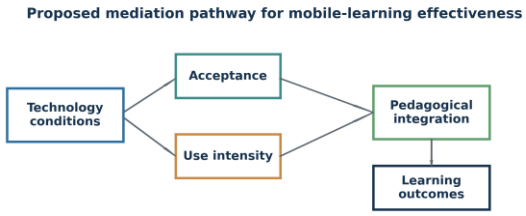

Figure 6. Proposed mediation pathway from technology conditions to learning outcomes.

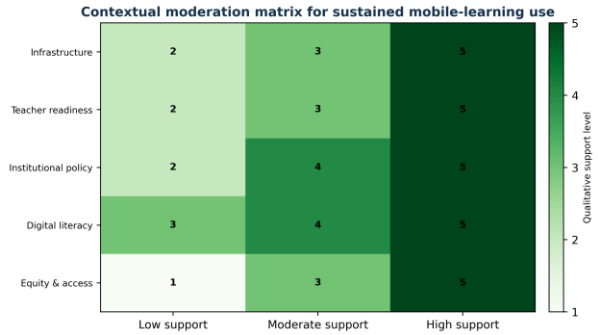

Figure 7. Contextual moderation matrix for sustained mobile-learning use.

6. Research Gap

The first gap is conceptual integration. Many pre-2020 studies focus on acceptance or intention, while fewer connect acceptance to actual pedagogical use and learning outcomes within one model. A framework that stops at intention cannot explain effective use.

The second gap is longitudinal evidence. Much adoption research captures a single point in time, whereas effective use is a process that may change as students gain experience, teachers adapt tasks, and institutions improve support. The corpus suggests a need for more studies that follow mobile learning from initial adoption through sustained use.

The third gap is comparative contextual evidence. Studies from Jordan, Iran, Pakistan, Bangladesh, Uganda, Australia, the UAE, Malta, Taiwan, and other settings demonstrate contextual variability, but systematic cross-country comparisons remain limited.

The fourth gap is measurement of effective use. Researchers often measure intention, attitudes, satisfaction, or frequency of use. Fewer studies distinguish superficial activity from productive mobile learning. Future studies should combine adoption measures with task-level evidence, interaction data, achievement measures, and teacher observations.

The fifth gap is equity-aware implementation. Policy and infrastructure receive attention, particularly in

developing contexts, but more work is needed to integrate equity variables directly into adoption and effectiveness models. Mobile learning can widen opportunity gaps when students differ in data access, device quality, digital literacy, or learning support.

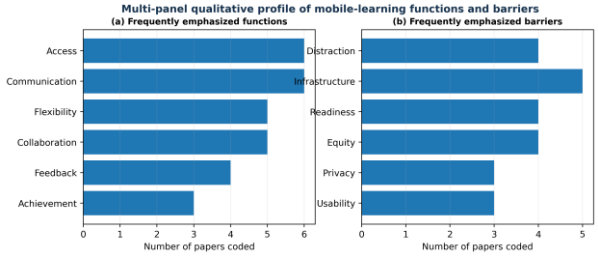

Figure 8. Multi-panel qualitative profile of mobile-learning functions and barriers.

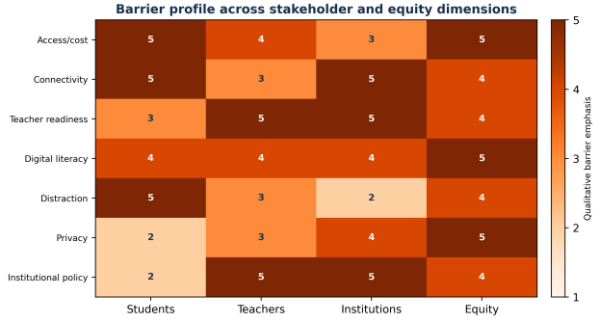

Figure 9. Barrier profile across stakeholder and equity dimensions

Table 2. Research gaps identified from the pre-2020 evidence base..

Research gap	What the pre-2020 literature shows	Priority for future studies
Acceptance–use gap	Many studies predict intention; fewer observe sustained pedagogical use.	Combine intention, usage, task, and outcome measures.
Longitudinal gap	Cross-sectional evidence dominates.	Track adoption and use across semesters or years.
Context gap	Country and institutional differences are visible but fragmented.	Use comparative multi-context designs.
Effective-use gap	Frequency and satisfaction are easier to measure than instructional quality.	Measure task alignment, interaction, feedback, and learner regulation.
Equity gap	Access and infrastructure are recurring concerns.	Embed affordability, accessibility, and digital-literacy variables.

7. Conceptual Framework

The proposed framework treats mobile learning adoption and effective use as a sequence of linked stages. The first layer contains enabling conditions: device access, connectivity, affordability, usability, and digital literacy. These conditions shape whether students and educators can realistically engage with mobile systems.

The second layer contains acceptance determinants. Perceived usefulness, ease of use, attitude, social influence, perceived behavioral control, gratification, and facilitating conditions shape intention and willingness to adopt. These factors are best understood as a family of influences rather than a universal ranking.

The third layer is actual adoption and sustained use. This includes initial uptake, frequency and continuity of use, and the integration of mobile tools into course routines. The distinction matters because a technology can be accepted without being used regularly.

The fourth layer is pedagogical integration. Here the technology is connected to learning objectives, content, communication, collaboration, practice, assessment, feedback, and self-regulation. This is the point at which mobile affordances become educational mechanisms.

The fifth layer contains outcomes such as engagement, flexibility, collaboration, retention, achievement, and learning satisfaction. Contextual moderators surround the entire pathway: teacher readiness, infrastructure, institutional support, policy, privacy, accessibility, and equity. The framework therefore rejects a direct 'mobile technology → achievement' assumption and instead emphasizes a mediated and moderated pathway.

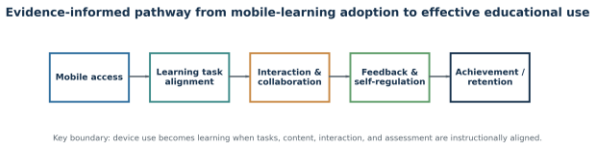

Figure 10. Evidence-informed pathway from mobile-learning adoption to effective educational use.

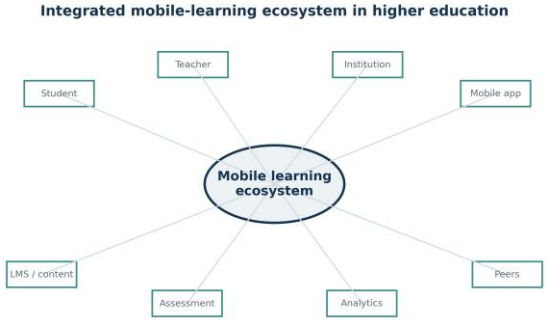

Figure 11. Integrated mobile-learning ecosystem in higher education.

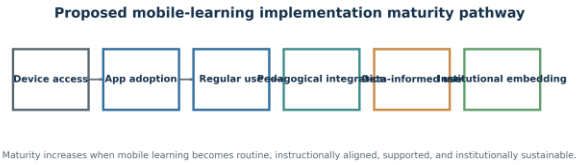

Figure 12. Proposed mobile-learning implementation maturity pathway.

8. Methodology

This study uses a structured integrative literature review and conceptual synthesis. The evidence base was restricted to papers published before 2020 and was intentionally focused on open-access or freely accessible sources so that the review could be reproduced through public or institutional repositories. Twenty-seven studies were retained for synthesis.

Studies were included when they addressed mobile learning in higher education and provided evidence relevant to adoption, acceptance, actual use, pedagogical integration, learning outcomes, barriers, policy, or implementation conditions. The corpus includes

quantitative acceptance models, qualitative studies, systematic reviews, policy analyses, educational-requirement models, and intervention studies. Papers focused solely on non-educational mobile technology were excluded.

The synthesis used four stages. First, studies were classified by focus: adoption determinants, learner use, teacher adoption, effective-use mechanisms, outcomes, and contextual conditions. Second, constructs and findings were grouped into common themes. Third, evidence was compared across theoretical traditions and geographic contexts. Fourth, the recurring mechanisms were organized into the integrated adoption-to-effective-use framework.

Because the review corpus was deliberately bounded by the pre-2020 and open-access criteria, it should not be interpreted as a formal PRISMA systematic review with a database-wide exhaustive count. The objective is a transparent integrative synthesis of the selected accessible evidence rather than a claim of statistical completeness.

Table 3. Evidence categories in the integrative review.

Category	Included evidence	Primary analytic purpose
Adoption determinants	TAM, UTAUT, TPB, U&G, acceptance models	Identify predictors of intention and use.
Learner conceptions and use	Qualitative and comparative studies	Describe how mobile devices are actually used.
Teacher adoption	Teacher-focused models and implementation studies	Identify readiness and orchestration conditions.
Outcomes	Intervention and achievement studies	Assess engagement, retention, and learning outcomes.
Implementation and policy	Reviews, requirements, policy and equity studies	Identify infrastructure, governance, and equity conditions.

9. Synthesized Findings

9.1. Adoption determinants

Perceived usefulness is one of the most persistent adoption determinants across the corpus. Students are more likely to adopt mobile learning when they believe it improves access, productivity, learning flexibility, or performance. Ease of use is similarly important because mobile systems that require substantial effort or technical confidence can reduce willingness to engage. Aburub and Alnawas (2019), Almaiah et al. (2019), and Chuchu and Ndoro (2019) provide convergent support for these functional determinants.

Social and control beliefs also matter. Raza et al. (2018) show that subjective norms and perceived behavioral control contribute to adoption, while UTAUT-oriented work emphasizes social influence and facilitating conditions. This suggests that adoption is partly relational: students respond not only to the technology itself but also to expectations from peers, teachers, and institutions.

Gratification and motivation add a user-experience dimension. Aburub and Alnawas (2019) found cognitive gratification particularly influential, suggesting that users may adopt when mobile learning satisfies needs for information, learning support, or intellectual engagement. These findings support a multidimensional adoption model rather than a purely functional one.

9.2. Effective-use mechanisms

Communication and collaboration are recurring uses. Khan et al. (2019) found that students use mobile devices for communication and collaborative learning, while Camilleri and Camilleri (2019) discuss acceptance and use of mobile learning applications in higher education. Mobile tools can support rapid peer and teacher communication, distribution of materials, and group coordination.

Flexibility is another major affordance. Sundgren (2017) shows how bring-your-own-device practices can blur time and place in higher education, while Klimova (2019) demonstrates how a smartphone app can embed language practice into continuous assessment. Flexibility becomes educationally valuable when the additional access is connected to meaningful practice rather than simply increasing the volume of content consumption.

Feedback and self-regulation represent a further mechanism. Mobile devices can deliver reminders, practice tasks, formative feedback, and opportunities to revisit materials. The effectiveness of this mechanism depends on design: notifications and micro-learning are most useful when they support retrieval, reflection, or action rather than adding distraction.

9.3. Learning outcomes

The outcome evidence is promising but heterogeneous. Klimova (2019) provides direct evidence of improved university-student performance using personalized smartphone-supported language learning. Pechenkina et al. (2017) report positive effects associated with a gamified mobile application on engagement, retention, and academic achievement. García-Martínez et al. (2019) synthesize multiple studies and report broad learning benefits associated with mobile-device use.

Outcome differences reflect instructional design. An application that only reproduces static readings may add convenience without changing learning quality. In contrast, apps that provide personalized practice, repeated retrieval, feedback, communication, or collaborative activity can change the learner's activity structure. This supports the adoption-to-effective-use model developed in this review.

9.4. Teacher and institutional conditions

Teacher readiness is essential because mobile learning requires decisions about content chunking, communication norms, assessment, privacy, and classroom management. Dolawattha et al. (2019) directly model teacher adoption, while Pedro et al. (2018) emphasize orchestration and attention. Effective use therefore depends on teacher competence as much as student willingness.

Institutional conditions include connectivity, platform compatibility, technical support, policy, and professional

development. Eppard et al. (2019), Kaliisa and Picard (2019), and Sarrab et al. (2018) each highlight different aspects of implementation support. These findings point toward an institutional responsibility to create reliable conditions rather than shifting all implementation burdens to individual lecturers and students.

9.5. Barriers and equity

Distraction is one of the most recurring barriers, especially when the mobile device is simultaneously a social-media and entertainment platform. Pedro et al. (2018) frame multitasking as a core pedagogical challenge, while Alsaif (2018) reports distraction among student-perceived barriers.

Infrastructure and affordability also matter. Mobile learning is often assumed to be inexpensive because many learners already own devices, but data plans, network reliability, battery life, platform compatibility, and device quality create hidden costs. Kaliisa and Picard (2019) and Alrasheedi et al. (2015) demonstrate why implementation success should include contextual and infrastructural factors.

Privacy, accessibility, and digital-literacy issues should be considered part of quality rather than compliance. A sustainable mobile-learning system must protect learner data, support accessible design, and provide training for students and teachers.

Table 4. Cross-study synthesis of major findings.

Evidence theme	Representative studies	Synthesis
Usefulness and ease	Aburub & Alnawas; Almaiah et al.; Chuchu & Ndoro	Consistent predictors of acceptance and intention.
Social/control factors	Raza et al.; Almaiah et al.	Norms, control, and facilitating conditions shape adoption.
Teacher readiness	Dolawattha et al.; Pedro et al.; García-Martínez et al.	Teacher competence and orchestration determine integration.
Learning outcomes	Klimova; Pechenkina et al.; García-Martínez et al.	Positive effects appear when mobile use is instructionally targeted.
Infrastructure/equity	Kaliisa & Picard; Alrasheedi et al.; Eppard et al.	Contextual support conditions the distribution of benefits.
Distraction/usability	Pedro et al.; Alsaif; Eppard et al.	Unstructured use can reduce educational effectiveness.

10. Discussion

The evidence supports a shift from an adoption-centered view to an effective-use perspective. Adoption models are valuable because they explain why users decide to accept or reject mobile learning. However, they do not fully explain what happens after adoption. The educational value of mobile technology emerges when students use it for meaningful learning activities and when teachers create environments in which mobile affordances support course goals.

The review also suggests that mobile learning is best understood as a socio-technical system. Students, teachers, institutions, devices, platforms, connectivity, and policies interact. This helps explain the context-dependent results reported across countries. A mobile-learning strategy that works in a highly connected university may require different designs in a resource-constrained environment.

A third implication is that effective use should be measured at the activity level. Instead of relying only on intention, satisfaction, or frequency of use, future evaluations should ask what students actually do with the technology: communicate, retrieve information, collaborate, practice, receive feedback, create content, or solve problems. These activity-level measures can connect adoption with learning mechanisms.

Finally, the review reinforces an equity principle. Because mobile technologies are often treated as broadly accessible, institutions may overlook data costs, device differences, accessibility, privacy, and digital literacy. Sustainable mobile learning requires an explicit equity and governance layer in addition to the pedagogical layer.

11. Practical Implications

For higher-education institutions, mobile-learning initiatives should begin with learning needs rather than device procurement. Institutions should define which learning problems mobile technologies are intended to solve, then align platforms, support, and evaluation with those goals.

For lecturers, effective mobile learning means designing tasks that make meaningful use of mobility. Examples include short practice cycles, collaborative problem solving, field-based data collection, peer feedback, formative assessment, and communication that extends learning beyond class.

For students, adoption should be supported by digital-literacy guidance, clear expectations for mobile use, and strategies for self-regulation and distraction management.

For policy makers and educational leaders, equity, privacy, accessibility, and data affordability should be integrated into mobile-learning planning. A mobile strategy is sustainable only when the conditions for participation are broadly available.

Table 5. Stakeholder implications for effective mobile learning.

Stakeholder	Priority action	Success indicator
Institution	Provide infrastructure, policy, support, and professional development	Reliable use with equitable access.
Lecturer	Align mobile tasks with learning objectives and assessment	Higher-quality learning activity, not merely higher usage.
Student	Develop self-regulation and digital-literacy practices	Sustained, purposeful mobile use.
Technology provider	Improve usability, interoperability, privacy, and accessibility	Low friction and trustworthy adoption.
Policy maker	Address affordability, inclusion, and governance	Reduced access and implementation disparities.

12. Conclusion

Mobile learning technologies offer higher education a flexible way to extend access, communication, collaboration, feedback, and practice. The pre-2020 evidence base shows that adoption is influenced by perceived usefulness, ease of use, attitudes, social influence, facilitating conditions, and user motivations. However, adoption alone does not guarantee meaningful learning.

The strongest conclusion is therefore conditional. Mobile learning becomes effective when technology affordances are converted into pedagogical opportunities through task alignment, interaction, feedback, self-regulation, and teacher orchestration. Infrastructure, institutional

support, digital literacy, policy, privacy, and equity moderate this process.

The integrated framework proposed in this review distinguishes five stages: enabling conditions, acceptance, adoption, pedagogical integration, and learning outcomes. This model provides a more useful explanation of effective mobile learning than a direct technology-to-achievement assumption. Future research should strengthen longitudinal evidence, compare contexts, measure activity-level use, and integrate equity-aware indicators into adoption models.

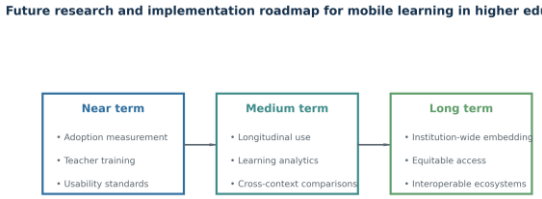

Figure 13. Future research and implementation roadmap for mobile learning in higher education.

Table 6. Proposed research framework and future research agenda.

Research area	Current need	Suggested direction
Longitudinal adoption	Limited sustained-use evidence	Track cohorts across semesters.
Pedagogical integration	Often inferred rather than measured	Observe tasks, interaction, and assessment.
Cross-context comparison	Fragmented evidence	Compare institutions and resource conditions.
Equity	Access variables inconsistently modeled	Integrate affordability, accessibility, and digital literacy.
Outcome measurement	Often satisfaction or intention	Combine engagement, retention, and achievement indicators.

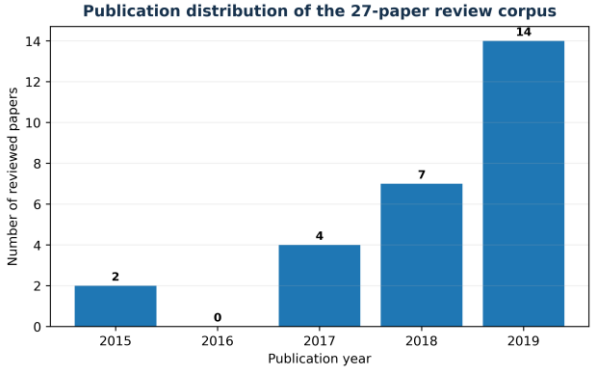

Figure 14. Publication distribution of the 27-paper pre-2020 review corpus.

References

Aburub, F., & Alnawas, I. (2019). A new integrated model to explore factors that influence adoption of mobile learning in higher education: An empirical investigation. Education and Information Technologies, 24, 2145–2158. https://doi.org/10.1007/s10639-019-09862-x

Almaiah, M. A., Alamri, M. M., & Al-Rahmi, W. (2019). Applying the UTAUT model to explain the students' acceptance of mobile learning system in higher education. IEEE Access, 7, 174673–174686. https://doi.org/10.1109/ACCESS.2019.2957206

Alrasheedi, M., Capretz, L. F., & Raza, A. (2015). A systematic review of the critical factors for success of mobile learning in higher education (university students' perspective). Journal of Educational Computing Research, 52(2), 257–276. https://doi.org/10.1177/0735633115571928

Alsaif, G. A. (2018). Benefits and barriers toward effectiveness of mobile learning from students' perspective in the higher education. Journal of Educational and Psychological Sciences, 2(15), 139–156. https://doi.org/10.26389/AJSRP.G280318

Azizi, S. M., & Khatony, A. (2019). Investigating factors affecting medical sciences students' intention to adopt mobile learning. BMC Medical Education, 19, 381. https://doi.org/10.1186/s12909-019-1831-4

Batmetan, J. R., & Palilingan, V. R. (2018). Higher education students' behaviour to adopt mobile learning. IOP Conference Series: Materials Science and Engineering, 306, 012067. https://doi.org/10.1088/1757-899X/306/1/012067

Camilleri, M. A., & Camilleri, A. C. (2019). The acceptance and use of mobile learning applications in higher education. In A. Pfennig & K. C. Chen (Eds.), Proceedings of the 3rd International Conference on Education and eLearning (ICEEL2019). https://doi.org/10.1145/3371647.3372205

Chen, K. T.-C. (2015). Exploring college students' usage experiences, perceptions and acceptance of mobile English learning in Taiwan. The International Technology Management Review, 5(4), 162–171. https://doi.org/10.2991/itmr.2015.5.4.1

Chuchu, T., & Ndoro, T. (2019). An examination of the determinants of the adoption of mobile applications as learning tools for higher education students. International Journal of Interactive Mobile Technologies, 13(3), 53–67. https://doi.org/10.3991/ijim.v13i03.10195

Dolawattha, D. D. M., Pramadasa, H. K. S., & Jayaweera, P. M. (2019). The impact model: Teachers' mobile learning adoption in higher education. International Journal of Education and Development Using Information and Communication Technology, 15(4), 71–88.

Eppard, J., Hojeij, Z., Ozdemir-Ayber, P., Rodjan-Helder, M., & Baroudi, S. (2019). Using mobile learning tools in higher education: A UAE case. International Journal of Interactive Mobile Technologies, 13(11), 51–69. https://doi.org/10.3991/ijim.v13i11.10823

García Boteró, G. A., Questier, F., Cincinnato, S., He, T., & Zhu, C. (2018). Acceptance and usage of mobile assisted language learning by higher education students. Journal of Computing in Higher Education, 30, 426–451. https://doi.org/10.1007/s12528-018-9177-1

García-Martínez, I., Fernández-Batanero, J. M., Cobos Sanchiz, D., & Luque de la Rosa, A. (2019). Using mobile devices for improving learning outcomes and teachers' professionalization. Sustainability, 11(24), 6917. https://doi.org/10.3390/su11246917

Han, I. (2019). Investigating lecturers' reasons for adoption of mobile learning in higher education: A case study. In Proceedings of the 2019 ASCILITE Conference. https://doi.org/10.14742/apubs.2019.308

Kaliisa, R., & Miller, J. (2017). Mobile learning in higher education: A comparative analysis of developed and developing country contexts. British Journal of Educational Technology, 50(2), 546–561. https://doi.org/10.1111/bjet.12583

Kaliisa, R., & Picard, M. (2017). A systematic review on mobile learning in higher education: The African perspective. Turkish Online Journal of Educational Technology, 16(1), 1–18.

Kaliisa, R., & Picard, M. (2019). Mobile learning policy and practice in Africa: Towards inclusive and equitable access to higher education. Australasian Journal of Educational Technology, 35(6), 1–14. https://doi.org/10.14742/ajet.5562

Khan, M. S. H., Benadjih, O. A., Kettunen, J., & Gregory, S. (2019). A phenomenographic research study of students' conceptions of mobile learning: An example from higher education. SAGE Open, 9(3), 1–12. https://doi.org/10.1177/2158244019861457

Klimova, B. (2019). Impact of mobile learning on students' achievement results. Education Sciences, 9(2), 90. https://doi.org/10.3390/educsci9020090

Krull, G., & Duart, J. M. (2017). Research trends in mobile learning in higher education: A systematic review of articles (2011–2015). The International Review of Research in Open and Distributed Learning, 18(7), 1–23. https://doi.org/10.19173/irrodl.v18i7.2893

Kühnl, M., Seiler, L., Honal, A., & Ifenthaler, D. (2018). Mobile learning analytics in higher education: Usability testing and evaluation of an app prototype. Interactive Technology and Smart Education, 15(4), 332–347. https://doi.org/10.1108/ITSE-04-2018-0024

Pechenkina, E., Laurence, D., Oates, G., Eldridge, D., & Hunter, D. (2017). Using a gamified mobile app to increase student engagement, retention and academic achievement. International Journal of Educational Technology in Higher Education, 14, 31. https://doi.org/10.1186/s41239-017-0069-7

Pedro, L. F. M. G., Barbosa, C. M. M. de O., & Santos, C. M. das N. (2018). A critical review of mobile learning integration in formal educational contexts. International Journal of Educational Technology in Higher Education, 15, 10. https://doi.org/10.1186/s41239-018-0091-4

Raza, S. A., Umer, A., Qazi, W., & Makhdoom, M. (2018). The effects of attitudinal, normative, and control beliefs on M-learning adoption among the students of higher education in Pakistan. Journal of Educational Computing Research, 56(4), 563–588. https://doi.org/10.1177/0735633117715941

Sarrab, M., Al-Shihi, H., Al-Manthari, B., & Bourdoucen, H. (2018). Toward educational requirements model for mobile learning development and adoption in higher education. TechTrends, 62, 635–646. https://doi.org/10.1007/s11528-018-0331-4

Sundgren, M. (2017). Blurring time and place in higher education with bring your own device applications: A literature review. Education and Information Technologies, 22, 3081–3119. https://doi.org/10.1007/s10639-017-9576-3

Suner, A., Yilmaz, Y., & Pişkin, B. (2019). Mobile learning in dentistry: Usage habits, attitudes and perceptions of undergraduate students. PeerJ, 7, e7391. https://doi.org/10.7717/peerj.7391