

From Usability to User Experience: A Systematic Literature Review of Digital Interaction Research Across Emerging Technology Contexts

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Abstract. The rapid expansion of artificial intelligence, immersive systems, digital health, mobile applications, online learning, and smart services has shifted digital interaction research from a narrow emphasis on usability toward a broader understanding of user experience (UX). This article synthesizes 109 peer-reviewed journal articles indexed in Scopus between 2021 and 2026 to explain how usability has been conceptualized, measured, and extended across emerging technology contexts. The evidence shows that usability remains a foundational construct associated with effectiveness, efficiency, satisfaction, accessibility, learnability, and task performance. Yet contemporary UX research increasingly incorporates trust, engagement, emotion, perceived usefulness, cognitive workload, acceptance, cultural relevance, safety, inclusion, and long-term intention to use. Quantitative studies dominate the field, supported by qualitative inquiry and review-based synthesis, while theoretical perspectives span usability engineering, human-computer interaction, technology acceptance, learning design, digital health, inclusive design, responsible AI, and sociotechnical systems. Across education, healthcare, artificial intelligence, AR/VR, chatbots, digital services, and accessibility-oriented technologies, the evidence indicates that usability is necessary but not sufficient for meaningful technology use. The review therefore conceptualizes usability and UX as connected layers of digital evaluation: usability establishes whether interaction is workable, whereas UX explains whether it is meaningful, trustworthy, inclusive, engaging, and valuable in context.

Keywords: Digital Interaction; Emerging Technologies; Human Computer Interaction; Usability; User Experience.

1 Introduction

Digital interaction has become central to contemporary behavioral science, human-computer interaction, education, healthcare, public services, and technology management. Users now engage with digital systems for learning, work, communication, health services, information access, consumption, and social participation. At the same time, artificial intelligence (AI), augmented reality (AR), virtual reality (VR), chatbots, recommender systems,

mobile health applications, digital learning platforms, and smart interfaces have made the relationship between users and technologies more complex. Usability remains fundamental because it addresses whether a system can be operated effectively, efficiently, and satisfactorily. However, recent research demonstrates that successful digital interaction also depends on trust, emotion, accessibility, engagement, perceived usefulness, cognitive load, cultural relevance, safety, and continued-use intention [1], [2], [3], [4], [5].

This shift is especially visible across technology domains. In educational environments, studies of ChatGPT-supported learning, MOOCs, mobile learning, augmented-reality laboratories, gamified e-learning, and virtual-learning environments connect UX with satisfaction, motivation, engagement, cognitive load, perceived educational value, and willingness to continue using the system [1], [3], [6], [7], [8], [9], [10]. In healthcare, research on mHealth applications, patient-journey tools, smart medication packaging, digital mental-health interventions, health chatbots, and technologies for older adults associates UX with safety, acceptability, adherence, health literacy, self-management, caregiver support, and practical usefulness [11], [12], [13], [14], [15], [16], [17].

Beyond education and healthcare, accessibility, public-service platforms, cultural-heritage systems, video conferencing, eye tracking, e-commerce, and AI-based services show that digital interaction is shaped by disability, user characteristics, culture, transparency, interface design, and contextual needs [18], [19], [20], [21], [22], [23]. The literature is therefore conceptually rich but fragmented. Some studies treat usability primarily as a technical or task-based measure; others conceptualize UX as an emotional, social, cultural, cognitive, and behavioral response to technology [24], [25], [26], [27]. Quantitative research has produced scales and statistical models, but often uses cross-sectional designs, convenience samples, and context-specific instruments. Qualitative studies illuminate lived experience, accessibility barriers, workflow constraints, expectations, and contextual meanings, although their findings are frequently domain specific [28], [29], [30], [31], [32], [33].

The gap becomes more consequential as technologies become adaptive, immersive, intelligent, personalized, and socially embedded. AI systems introduce concerns about transparency, trust, explainability, bias, privacy, and responsible design [22], [23]. AR/VR environments require attention to immersion, presence, workload, embodiment, experiential learning, and comfort [7], [8], [34], [35]. Digital health and assistive systems must account for older adults, patients, caregivers, people with disabilities, and users whose needs are not adequately represented by generic usability metrics [11], [12], [16], [19]. These developments suggest that usability is the operational foundation of interaction quality, while UX extends evaluation toward meaning, inclusion, acceptance, engagement, trust, and value creation.

Accordingly, this review does not frame usability and UX as competing concepts. Instead, it treats them as connected layers of evaluation. Usability addresses whether a system is workable, accessible, learnable, efficient, and satisfactory; UX addresses whether interaction is meaningful, trustworthy, inclusive, engaging, emotionally acceptable, and contextually valuable. The article aims to map the empirical development of usability and UX studies, classify dominant methods and theoretical perspectives, compare technology domains, and identify research gaps that can guide more inclusive and sustainable digital-interaction research.

2 Research Methods

2.1 Review design and objectives

A systematic literature review was used to synthesize recent research on usability and UX across digital learning, health technology, AI, mobile applications, public services, accessibility systems, immersive technologies, recommender systems, cultural platforms, and smart interfaces. Systematic review was appropriate because the topic spans multiple disciplines, user groups, technologies, methods, and evaluation instruments. The review followed PRISMA logic for identification, screening, eligibility assessment, and inclusion [36], consistent with methodological guidance that systematic reviews can organize fragmented knowledge, identify patterns, evaluate accumulated evidence, and develop future research directions [37], [38].

2.2 Data source, search strategy, and eligibility

The search was conducted in Scopus and covered journal articles published from 2021 through 2026. The final search string combined TITLE-ABS-KEY ("usability") and TITLE-ABS-KEY ("user experience"), limited publication years to 2021-2026, and restricted results to Social Sciences, journal articles, English-language publications, journal source type, and open-access records. The initial search identified 19,812 records. Sequential refinement reduced the set to 10,858 by year, 5,349 by document type, 1,321 by subject area, 1,279 by language, 486 by usability/user-experience keywords, 479 by source type, and 279 open-access records. Of 279 full texts sought, 126 were successfully retrieved; 17 did not meet the inclusion criteria, leaving 109 articles for final analysis.

Inclusion required English-language, peer-reviewed Scopus journal articles addressing usability, UX, or both in emerging digital-interaction contexts and providing sufficient conceptual, methodological, or empirical information. Exclusion criteria covered inaccessible full texts, non-peer-reviewed material, duplicates, studies outside the focal concepts, and papers lacking sufficient methodological or conceptual clarity. Each article was coded for publication characteristics, country, technology, research problem, design, respondents, sampling, data collection, analysis, theoretical framework, constructs, usability and UX dimensions, novelty, findings, and future-research suggestions.

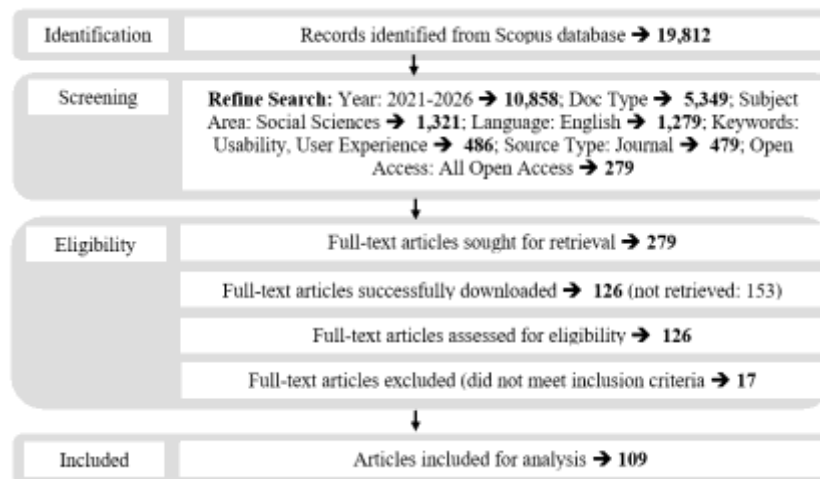


Figure 1. Stages of Systematic Literature Review – PRISMA Method

3. Results

3.1 Characteristics, publication trends, and geographical distribution

The 109 reviewed studies reveal a broad and increasingly user-centered research landscape. Studies covered digital learning, health technologies, AI, AR/VR, serious games, recommender systems, public services, accessibility-oriented technologies, cultural platforms, video conferencing, e-commerce, information visualization, and mobile systems. Although application domains differ, the studies share a common concern: digital technologies should be not only technically functional, but also usable, accessible, acceptable, trustworthy, meaningful, and valuable for intended users. Educational studies emphasized satisfaction, engagement, motivation, skill development, and educational value, while health-oriented studies linked usability and UX with safety, acceptability, adherence, caregiver support, patient engagement, and practical usefulness.

Publication volume increased markedly after 2021. The dataset contained 11 articles in 2021 and 11 in 2022, rising to 14 in 2023 and reaching 28 in 2024. It then declined to 26 in 2025 and 18 in 2026. The 2026 figure should be interpreted cautiously because the publication year was still incomplete. Geographically, the United Kingdom was the most represented location, followed by the United States, Germany, and the Netherlands. Spain also contributed substantially, while Finland and Indonesia represented the next tier. Canada, China, Italy, Malaysia, Peru, and Portugal contributed moderate numbers of studies, and a long tail of countries contributed one or a small number of papers. The distribution indicates that usability and UX are global concerns but remain unevenly represented across cultural and institutional contexts.

3.2 Methodological profile

Methodologically, the literature was dominated by quantitative research. Sixty-eight articles used quantitative designs, 33 used qualitative approaches, and eight were literature reviews. Quantitative studies involved students, learners, patients, older adults, mobile-app users, AR/VR users, chatbot users, e-commerce users, professionals, consumers, and health-technology users. Sampling included convenience, voluntary, purposive, snowball, online-panel, classroom, laboratory, experimental, and cross-sectional recruitment. Analytical techniques ranged from descriptive statistics and regression to t-tests, ANOVA/MANOVA, path analysis, SEM, PLS-SEM, reliability and validity testing, EFA/CFA, Rasch analysis, IRT, measurement invariance, usability metrics, and machine-learning performance assessment. Common instruments included SUS, UEQ, BUS, MAUQ, NPS, and CSAT.

Table 1. Research Types and Methodological Classifications

Design	n	Typical participants / units	Typical analytical approaches
Quantitative	68	Students, patients, older adults, app/AI/AR/VR users, consumers, professionals	Regression; ANOVA/MANOVA; SEM/PLS-SEM; EFA/CFA; Rasch/IRT; usability scales; model validation
Qualitative	33	End users, patients, students, teachers, designers, experts, stakeholders	Thematic/content analysis; interviews/focus groups; think-aloud; heuristic evaluation; case synthesis
Review	8	Journal articles, database records, prior empirical and conceptual studies	Systematic synthesis; PRISMA-style screening; bibliometric mapping; thematic categorization; narrative synthesis

Qualitative research provided the contextual depth often missing from standardized measures. Interviews, focus groups, observations, think-aloud sessions, heuristic evaluations, case studies, and design-based assessments were used to examine lived experience, accessibility barriers, interface problems, workflow constraints, and stakeholder interpretations. These studies typically used purposive, criterion-based, voluntary, convenience, snowball, stakeholder, expert, or case-based recruitment and relied on thematic analysis, content analysis, qualitative coding, heuristic evaluation, and narrative interpretation. The eight review studies used journal articles and indexed literature as units of analysis and employed database searching, inclusion/exclusion procedures, PRISMA-style screening, bibliometric retrieval, thematic categorization, framework development, trend analysis, and narrative synthesis. Overall, the field combines measurement-oriented empirical evaluation with context-sensitive qualitative insight and review-based consolidation.

3.3 Theoretical Patterns

The theoretical landscape is diverse but organized around recurring clusters. The most prominent cluster consists of usability, UX, human-computer interaction, and user-centered or human-centered design frameworks. These approaches focus on usability, interface quality, task completion, satisfaction, effectiveness, efficiency, ease of use, interface preference, SUS, UEQ, and ISO 9241 [1], [3], [39], [40], [41], [42], [43]. These frameworks establish the operational core of digital evaluation: users should be able to understand the interface, complete tasks, and achieve acceptable performance and satisfaction.

A second cluster draws on technology acceptance and adoption models, including TAM, UTAUT, HITAM, and related perspectives. In this stream, perceived usefulness, perceived ease of use, behavioral intention, attitude, user satisfaction, adoption readiness, social influence, and facilitating conditions explain why users accept and continue using technologies [2], [12], [16], [44], [45], [46], [47], [48], [49], [50]. These models extend usability from a design outcome into a predictor of adoption and continued use. A technically usable system may still fail if users do not consider it useful, relevant, supported, or compatible with everyday practices.

A third stream concerns conversational AI, generative AI, chatbot usability, and human-AI interaction. Research in this area extends conventional usability evaluation to information quality, response time, privacy, security, trust, transparency, accessibility, responsible design, and satisfaction [1], [4], [13], [22], [25], [51], [52], [53], [54], [55]. Intelligent systems are therefore evaluated not only for ease of interaction but also for credibility, explainability, perceived competence, and accountability.

Immersive-technology research similarly expands the evaluative frame. AR/VR and extended-reality studies examine immersion, presence, cybersickness, interaction modality, selection methods, perceived realism, engagement, and virtual-environment usability [7], [8], [34], [35], [43], [56], [57], [58], [59]. These constructs reflect embodied, perceptual, and affective processes that cannot be reduced to conventional task-completion metrics.

Domain-specific theoretical branches further connect UX with sectoral outcomes. Learning experience design and educational-technology frameworks emphasize motivation, engagement, instructional design, serious games, satisfaction, and learning performance [3], [26], [27], [60], [61], [62], [63], [64], [65], [66]. Digital-health frameworks link usability to patient engagement, acceptability, feasibility, self-management, medication adherence, clinical usability, and implementation outcomes [11], [12], [14], [28], [49], [67], [68], [69], [70], [71]. Accessibility research draws on disability studies, universal design, inclusive design, assistive technology, digital inclusion, and Universal Design for Learning [18], [19], [22], [29], [64], [65], [72], [73], [74].

Other frameworks address cognitive workload and human factors, information visualization and wayfinding, trust and responsible design, recommender systems and digital nudging, psychometric validation, and sociotechnical systems. Collectively, they show that contemporary digital interaction research retains usability as a shared foundation while broadening explanation toward cognition, emotion, risk, personalization, inclusion, organizational fit, and ethical responsibility [20], [22], [23], [45], [53], [56], [57], [75], [76], [77], [78], [79].

3.4 From task performance to multidimensional user experience

The most consistent empirical pattern is a shift from usability as task completion toward UX as a multidimensional interpretation of technology use. Earlier usability-oriented work asks whether users can complete tasks effectively, efficiently, and satisfactorily. Contemporary studies add questions of whether users trust a system, perceive it as useful, feel emotionally comfortable, experience meaningful engagement, consider it inclusive, and intend to continue using it. This does not indicate the rejection of usability. Rather, usability becomes the foundational layer on which cognitive, affective, behavioral, social, cultural, and contextual dimensions are built.

Education and learning technologies

The educational domain illustrates this transition clearly. Research on ChatGPT-supported learning, MOOCs, mobile learning, AR laboratories, virtual-learning environments, gamified courses, and serious games shows that ease of use alone is insufficient to explain educational value. Positive UX is associated with motivation, engagement, instructional clarity, cognitive workload, satisfaction, perceived usefulness, skill development, and learning performance [1], [3], [6], [7], [8], [9], [10]. A system may be technically simple yet educationally weak when it does not align with learning goals, student readiness, teacher support, or classroom practices. Educational usability must therefore be interpreted within pedagogical and institutional contexts rather than as an isolated interface property.

Digital health and vulnerable users

Digital-health research demonstrates an even stronger need for contextualized UX evaluation. Mobile health applications, patient-journey apps, medication-adherence tools, digital mental-health interventions, monitoring systems for older adults, and clinical support technologies are evaluated through safety, trust, acceptability, feasibility, adherence, health literacy, self-management, caregiver support, and clinical relevance [11], [12], [13], [14], [15], [16], [17], [28]. In these settings, poor usability can influence more than satisfaction: it can reduce confidence, disrupt care routines, impede adherence, and limit meaningful participation by patients, caregivers, and clinicians. The user population may also include older adults, people with disabilities, and users with different levels of digital and health literacy, making inclusive design central rather than optional.

AI, chatbots, and responsible interaction

AI and chatbot systems further expand the UX construct because interaction quality depends on how users interpret system intelligence and responsibility. Relevant dimensions include information quality, response quality and speed, privacy, security, transparency, trust, credibility, accessibility, and perceived competence [4], [22], [23], [25], [51], [53], [54]. Users do not assess intelligent systems solely through successful task execution. They also judge whether recommendations and responses are understandable, reliable, accountable, and aligned with expectations of fairness and privacy. As AI becomes embedded in everyday decision support, responsible design becomes part of UX rather than a separate technical consideration.

Immersive and adaptive systems

In AR/VR and immersive environments, conventional usability is extended by presence, immersion, realism, embodiment, interaction modality, workload, comfort, and cybersickness [7], [8], [34], [35], [56], [57]. Recommender systems and personalized services add context awareness, user preference, functional value, emotional value, social value, digital nudging, and perceptions of helpful versus intrusive personalization [13], [20], [52], [58], [78]. These domains demonstrate why emerging technologies require evaluative models that incorporate system performance together with subjective meaning, ethics, and context.

3.5 Contextual, cultural, and inclusive implications

The reviewed evidence consistently indicates that usability and UX are context-sensitive rather than universal. Their meanings depend on technology domain, user characteristics, institutional setting, cultural expectations, accessibility conditions, and social interpretation. A system judged usable by highly experienced users may create substantial barriers for older adults, disabled users, patients, non-expert users, or people with limited digital access. Likewise, a technically successful platform may still produce a poor UX when it conflicts with professional workflows, educational practices, health routines, cultural norms, or expectations of privacy and accountability.

Accessibility-oriented studies are particularly important because they challenge the assumption that average-user performance is an adequate indicator of interaction quality. Research on assistive technology, accessible testing, inclusive design, disability experience, universal design, and digital inclusion shows that usability must be assessed across diverse capabilities and constraints [18], [19], [29], [64], [65], [72], [73], [74]. The implication is conceptual as well as practical: an interface cannot be considered successfully usable if its effectiveness depends on excluding groups who face structural, perceptual, cognitive, linguistic, or technological barriers.

Trust, transparency, privacy, and security also have increasingly contextual and cultural meanings. These dimensions are especially salient in AI, digital health, information systems, mobile applications, and personalized services. Users consider whether a system is safe, reliable, explainable, respectful of privacy, culturally acceptable, and consistent with expectations of fairness and accountability [22], [23], [45], [53], [76], [77]. In AI and chatbots, trust is closely connected to response quality and perceived competence; in recommender systems, personalization may be experienced as valuable or intrusive depending on context. UX research must therefore treat users as socially and culturally situated actors, not merely as operators of interfaces.

3.6 Integrated propositions

The synthesis supports four analytical propositions. First, higher perceived usability is associated with stronger UX outcomes across emerging technology contexts. Effectiveness, efficiency, satisfaction, ease of use, learnability, interface quality, and task completion remain prerequisites for positive interaction. Second, acceptance-related perceptions strengthen or mediate the path from usability to continued use. TAM, UTAUT, HITAM, and related studies indicate that perceived usefulness, perceived ease of use, attitude, satisfaction, social influence, facilitating conditions, and adoption readiness help explain why technically usable systems are not always sustained in practice [2], [12], [16], [44], [46].

Third, the usability-UX relationship is contingent on domain-specific experience variables. AI requires trust, transparency, privacy, and interaction quality; AR/VR requires presence, immersion, comfort, and manageable workload; education requires motivation, engagement, instructional fit, and learning value; digital health requires safety, feasibility, adherence, self-

management, and patient engagement. The influence of usability is therefore shaped by task complexity, user characteristics, accessibility needs, and interaction environment.

Fourth, trust, accessibility, and sociotechnical fit act as critical extensions of UX. Trust is necessary where systems make recommendations, provide health-related support, or generate information. Accessibility determines whether diverse users can participate. Sociotechnical fit determines whether digital systems align with real work, learning, organizational, health, and social settings [12], [23], [56], [57], [79]. Together, these propositions support a layered model: usability explains whether interaction is workable, while UX explains whether that interaction is accepted, meaningful, inclusive, trustworthy, and valuable in context.

3.7 Research gaps

Despite rapid development, important gaps remain. Usability and UX are not always conceptually distinguished, creating overlap in measurement and interpretation. Quantitative studies often depend on cross-sectional designs, convenience samples, self-reported outcomes, and context-specific instruments, limiting causal inference and generalizability. Qualitative research provides rich contextual evidence but is difficult to compare across domains. Cultural, ethical, institutional, accessibility, and inclusion-related dimensions remain unevenly developed. The field therefore needs longitudinal, mixed-method, comparative, and context-sensitive designs, along with evaluation instruments that better represent diverse users and emerging forms of trust, engagement, accessibility, cultural relevance, and value creation.

3.8 Contribution and novelty of the synthesis

The novelty of this review lies in connecting theoretical and empirical streams that are often examined separately. Previous studies have frequently concentrated on a single domain, such as digital health, AR/VR, chatbots, learning systems, accessibility, information visualization, recommender systems, or e-commerce. The present synthesis instead compares these domains through a common usability-to-UX perspective. This makes it possible to identify what remains stable across technologies - effectiveness, efficiency, satisfaction, ease of use, accessibility, and task performance - and what becomes context specific as interaction grows more intelligent, immersive, personalized, or socially embedded.

A second contribution is methodological integration. Quantitative studies contribute psychometric validation, usability scores, technology-acceptance models, and statistical explanations of relationships among constructs. Qualitative studies reveal design barriers, workflow constraints, accessibility experiences, stakeholder interpretations, and meanings that are difficult to capture through standardized scales. Review-based studies map accumulated evidence and intellectual development. Bringing these traditions together shows that measurement and contextual interpretation are complementary rather than competing approaches. The field is strongest when system performance and user-reported outcomes are interpreted alongside the circumstances in which technology is actually used.

A third contribution is conceptual clarification. Traditional usability remains essential, but emerging technologies extend evaluation toward trust, transparency, accessibility, presence, immersion, health behavior, learning experience, cognitive workload, digital inclusion, and sociotechnical fit. The significance of these extensions differs by domain: AI requires attention to privacy, explainability, interaction quality, and trust; immersive systems require attention to embodiment, comfort, presence, and cybersickness; digital health requires safety, adherence, health literacy, and clinical relevance; accessibility-oriented systems require universal design, assistive support, and inclusion. The synthesis therefore positions usability as the foundation of

interaction quality and UX as the broader framework through which acceptance, meaning, emotion, cultural fit, trust, and value are interpreted.

Finally, the review highlights underdeveloped connections among culture, accessibility, trust, and responsible technology design. These dimensions are increasingly visible but remain unevenly distributed across the literature. Their integration is important because a system may be operationally usable yet socially inappropriate, ethically questionable, culturally misaligned, inaccessible to particular groups, or difficult to integrate into organizational routines. This broader perspective strengthens the case for context-sensitive evaluation and explains why future UX research should examine not only whether users can operate technology, but also whether they can rely on it, understand it, participate through it, and derive sustainable value from it.

4. Discussion

The review indicates that the movement from usability to UX is best understood as an expansion of evaluative scope rather than the replacement of one concept by another. Usability remains a basic requirement for successful digital systems: when interaction is difficult to learn, inefficient, confusing, inaccessible, or unsatisfactory, the overall experience is likely to deteriorate. This foundational role is evident across educational, health, AI, accessibility, and other digital contexts in which effectiveness, efficiency, satisfaction, ease of use, and interface quality remain central evaluative concerns [1], [3], [4], [11], [18], [21]. Usability therefore provides the operational conditions through which users can access, understand, and act through technology.

Emerging technologies nevertheless expose the limits of task-based evaluation. Users judge systems not only by whether they function, but also by whether they are trustworthy, inclusive, safe, engaging, and contextually valuable. In AI and chatbot research, UX is shaped by interaction and information quality, transparency, privacy, security, credibility, and trust [4], [22], [25], [53]. Immersive systems extend evaluation toward presence, realism, comfort, interaction modality, workload, and cybersickness [7], [8], [34], [35]. Digital-health studies emphasize safety, adherence, self-management, acceptability, and patient engagement [11], [14], [16], [28], whereas educational studies connect UX with motivation, engagement, cognitive load, instructional fit, and learning value [1], [3], [7], [8]. These patterns confirm that UX is multidimensional and context-sensitive.

The findings also reveal a methodological tension between measurement breadth and contextual depth. Quantitative studies have strengthened the field through usability scales, psychometric validation, regression, SEM, PLS-SEM, factor analysis, and technology-acceptance models, enabling relationships among usability, satisfaction, adoption, intention, and performance to be tested systematically [4], [9], [39], [80]. Yet standardized scores cannot fully explain accessibility barriers, emotional meanings, professional workflow constraints, cultural interpretations, or ethical concerns. Qualitative studies using interviews, focus groups, observations, think-aloud protocols, heuristic evaluation, and case analysis provide the contextual explanation needed for such issues, particularly among vulnerable users and in complex settings [28], [29], [30], [31], [32], [33].

The methodological implication is that research questions should determine how these forms of evidence are combined. Measurement is appropriate for comparison, validation, and model testing, while contextual inquiry is necessary to explain why an interaction succeeds or fails in practice. This need is especially visible in health, accessibility, and real-work settings, where implementation conditions, workflow, user capability, and institutional context shape

technology use [12], [28], [29], [79]. Longitudinal and mixed-method designs are therefore particularly promising because UX can change with learning, familiarity, trust, institutional support, system updates, and evolving expectations. Such designs can move the field beyond one-time satisfaction scores toward stronger explanations of sustained technology use.

5. Implications for Research and Practice

Theoretically, the findings support a layered conceptualization. Usability should retain a relatively clear focus on the quality of operating a system - effectiveness, efficiency, satisfaction, learnability, accessibility, task completion, and interface quality. UX should capture the broader cognitive, emotional, behavioral, social, cultural, ethical, and contextual response to interaction. This distinction reduces conceptual ambiguity while still recognizing that usability is a central antecedent or component of positive UX. Adoption theories then explain how perceived usefulness, ease of use, social influence, and facilitating conditions connect interaction quality to behavioral intention and continued use.

Methodologically, future studies should combine established instruments such as SUS, UEQ, BUS, MAUQ, NPS, and CSAT with domain-specific indicators and qualitative evidence where appropriate. Greater attention should be paid to longitudinal change, measurement invariance across user groups, cross-cultural comparability, and the consequences of using convenience samples. For AI, immersive technologies, and digital health, evaluation frameworks should incorporate trust, transparency, safety, accessibility, workload, and sociotechnical fit rather than treating them as secondary variables.

Practically, designers, developers, educators, healthcare providers, and digital-service managers should evaluate technology with two linked questions. The first is whether users can complete tasks effectively and efficiently with acceptable effort and satisfaction. The second is whether users experience the system as useful, trustworthy, inclusive, safe, engaging, and meaningful. AI and recommender systems require transparency, privacy, accountability, and responsible personalization. Digital health requires safety, health literacy, adherence, patient support, and clinical relevance. Educational technologies require instructional fit, engagement, motivation, and learning value. Public and accessibility-oriented services require inclusive design and explicit attention to diverse user capabilities. This integrated evaluation approach aligns technical quality with human and contextual value.

6. Limitations and Future Research

This review has several limitations. First, it relies on Scopus-indexed journal articles and therefore may not capture relevant evidence from other databases, conference proceedings, books, regional journals, or non-indexed publications. Second, the breadth of included technologies strengthens the comparative synthesis but also makes direct comparison difficult because education, healthcare, AI, immersive systems, public services, digital commerce, accessibility, and cultural platforms use different tasks, user groups, theoretical assumptions, and measures. Third, many primary studies rely on cross-sectional designs, self-reported data, convenience samples, and context-specific instruments, limiting strong causal conclusions about relationships between usability, UX, acceptance, and continued use.

A further limitation is conceptual heterogeneity. Some studies treat usability as a technical or functional construct, while others extend it to satisfaction, usefulness, accessibility, trust, or intention to use. UX is likewise operationalized through different combinations of emotional,

cognitive, behavioral, social, and contextual variables. This overlap makes construct comparison difficult and reinforces the need for clearer conceptual boundaries. The review also includes publications from an ongoing 2026 cycle; the apparent reduction in publication counts for 2026 may therefore reflect incomplete indexing rather than declining interest. Finally, the synthesis identifies contextual and cultural implications but does not perform a full cross-cultural comparison across countries.

Future research should address these limitations through four priorities. The first is longitudinal evaluation of how usability and UX evolve as users learn a system, develop trust, encounter updates, and integrate technology into routines. The second is cross-cultural and cross-institutional comparison to determine whether established constructs and scales operate similarly across contexts. The third is more systematic inclusion of vulnerable and underrepresented users, including older adults, people with disabilities, patients, non-expert users, and those with limited digital access. The fourth is development of integrated evaluation models for AI, immersive systems, adaptive platforms, recommender systems, and digital health that combine functional performance with trust, transparency, safety, accessibility, emotional response, cultural relevance, and sociotechnical fit.

7. Conclusion

The systematic synthesis of 109 Scopus-indexed studies shows that digital-interaction research has moved from a primary concern with system functionality toward a broader understanding of UX as multidimensional and context sensitive. Usability remains fundamental because it determines whether users can learn, operate, and complete tasks effectively, efficiently, accessibly, and satisfactorily. Yet a positive UX depends on a wider set of factors: trust, engagement, emotion, perceived usefulness, cognitive workload, accessibility, safety, acceptance, cultural relevance, learning value, health-related usefulness, social inclusion, and continued-use intention.

The main contribution of the synthesis is to clarify that usability and UX should not be positioned as separate or competing constructs. They are connected layers of digital evaluation. Usability explains whether interaction is workable; UX explains whether it is meaningful, acceptable, trustworthy, inclusive, and valuable in the user's real context. This relationship is not linear or uniform. It is shaped by theoretical assumptions, methodological choices, technology domain, user characteristics, accessibility requirements, cultural conditions, ethical expectations, and institutional settings.

For scholars, the next stage of research requires better conceptual differentiation, more rigorous longitudinal and mixed-method designs, stronger cross-cultural evidence, and greater inclusion of diverse users. For practitioners, the implication is equally clear: successful digital systems should not be judged only by task completion or interface efficiency. They should be designed and evaluated for meaningful use, responsible interaction, inclusion, trust, and sustainable value. By treating usability as the foundation and UX as the broader evaluative framework, digital-interaction research can better explain how emerging technologies are not only operated, but also experienced, interpreted, accepted, and integrated into everyday life.

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