The use of mobile learning in special education needs and disabilities (SEND) settings: state-of-the-art classification of studies

Fatima A Muazu
Faculty of Science and Technology
Bournemouth University United Kingdom
fahmad@bournemouth.ac.uk

Festus A Adedoyin
Faculty of Science and Technology
Bournemouth University United Kingdom
fadedoyin@bournemouth.ac.uk

Huseyin Dogan
Faculty of Science and Technology
Bournemouth University United Kingdom
hdogan@bournemouth.ac.uk

Nicholas Mavengere
Faculty of Science and Technology
Bournemouth University United Kingdom
nmavengere@bournemouth.ac.uk

Paul Whittington
Faculty of Science and Technology
Bournemouth University United Kingdom
whittingtonp@bournemouth.ac.uk

In developed countries, the use of mobile learning particularly has changed the delivery of teaching and learning in mainstream and special schools and evidently improved academic performance, there is still limited research on its use in underserved regions of the world. The purpose of this study is to conduct a review of existing studies on the application of mobile learning as an assistive technology in special education to enable the understanding of the depth of research in the field especially in the African context. The study adopts a systematic literature review approach to guide literature search, identification, and selection on EBSCOHOST and Scopus databases. 34 articles that were published from 2019-2024 in any language were included in this review. The review further classified these studies in terms of their years of publication, countries, aims of research, research methods and target disability the interventions were employed for. The findings revealed that there are a substantial number of studies that specifically considered the application of mobile learning in the education of special needs learners with autism spectrum disorder and intellectual disabilities and fewer studies targeted auditory, visual and communication impairments, and specific learning disabilities that included dyslexia, dyscalculia, and dysgraphia. In terms of countries/regions of research, there were more studies conducted in Asia and Europe, sub-Saharan African countries had the least representations. Quantitative research methods were the most adopted methods of research.

CCS CONCEPTS• •Human-centered computing•Human-centered computing~Human computer interaction (HCI)~HCI design and evaluation methods•Human-centered computing~Interaction design~Interaction design process and methods•Human-centered computing~Accessibility

Additional Keywords and Phrases: mobile learning impact on teaching and learning, mobile learning apps usability, mobile learning apps pedagogy, mobile learning in K-12 education

1 Introduction

There have been considerable attempts to integrate mobile learning technologies in education at various levels to achieve equal access to education by all, the use of mobile devices especially has been seen to enable ubiquitous and timeless access to learning in both formal and informal educational settings. The flexibility offered by these devices ensure that learning activities are accessible anywhere, anytime, that is regardless of geographic location of learners [1], further to the convenient access, there is also improved engagement and motivation of learners because of more personalized and interactive experiences they offer.

In special education, mobile learning is a viable tool that brings flexibility, adaptivity and personalized interactivity to potentially suit the dynamic special needs of learners with various forms of disabilities as [2].

Assistive technologies on their own have greatly improved the education of people with disabilities, these technologies can provide the required special instructional treatments that is needed by students with disabilities [3]. Nowadays, most mobile devices have integrated assistive technologies that provide accessibility like text to speech, speech recognition, special keyboards, screen readers and braille support for example [4] presented a reflective account of research on accessible mobile phones and innovative assistive applications for visually impaired people in contexts of mobile devices, public transport and smart home. Assistive technologies have changed the learning process of students with special needs and having them embedded in mobile phones has made them more affordable and especially improved availability and accessibility for people living with disabilities in underserved countries [5].

Recently, the use of artificial intelligence, immersive technologies and other emerging technologies like cloud computing have enabled mobile learning platforms to respond the extra adaptivity required by special educational needs learners in terms of both functional accessible requirements as well as learning content adaptivity. Artificial intelligence and machine learning have enabled mobile learning platforms to track, identify, and adapt learning experiences according to the learners' contextual information that includes pace of learning, learning styles, emotions, and their performance [6]. The use of immersive reality has particularly enhanced learning experiences of learners by providing concretized interpretation of abstract learning contexts. For example, the use of augmented reality-based teaching and learning provides the unique benefits of multiple learning stimulus for learners through kinesthetics specifically using mobile devices [7].

To understand the direction of research on the application of mobile learning in special educational needs and disabilities settings (SEND), several systematic reviews were published that attempt to classify the existing research based on the impact of mobile learning in special education, most used technologies and methodologies, author affiliation, outcomes of existing research, some other studies reviewed applications available for special needs learners. A systematic review of studies between 2009 and 2021 on interventions available for educating children with dyslexia revealed that mobile learning is the most preferred mode of assistive technology used for learning by dyslexic learners in Malaysia [8]. This study categorized the studies in two, phonological-based (reading, writing and multi-sensory interventions) and assistive technology-based interventions (mobile applications, tangible interactions, machine learning and automatic speech recognition). Document and content analysis in [9] presented the state-of-the-art of mobile learning in special education through the distribution of documents over the years, subject areas, document type, country or regions and the affiliation of the authors and the analysis revealed mobile learning to be an effective tool in special education.

In an attempt to evaluate technologies employed in the education of children with autism, [10] presented a review that focused on apps developed for autistic learners that classified recent research based on the ones that focus on the presenting exploring the use of mobile apps by children and teenagers with autism and ones that evaluated mobile apps developed for autistic children and teenagers. A review on the use of mobile learning for students with and without disabilities in formal and informal K-12 educational settings, most studies on mobile learning in special education affirmed its effectiveness on the teaching and learning of learners with disabilities in inclusive settings [11].

The application of mobile learning has evidently improved teaching and learning process at different levels of special education especially in developed countries, there still exists limited information on the adoption and impact of mobile learning in underserved countries of Africa. Most studies on mobile learning from the African perspective were mainly concerned about the use of mobile learning in mainstream education and understanding the perception of learners and teachers towards it [12] and barely on the design and development of mobile learning platforms. To understand the depth of research from the African continent while presenting potential areas for further research, therefore, this study will attempt to map existing body of research on mobile learning in special education to their respective regions or countries of origin through conducting a systematic review with further consideration of the following:

- The aims of the research.
- The type of intervention.
- The type of technology leveraged (immersive, AI, gamification).
- The target special need users/type of disabilities.

2 Methodology

This review adopted a systematic review approach to conduct the search, identification, and selection of relevant literature to be considered. The aim of the review is to review research available on the application of mobile learning in special education. The electronic search for the publications was conducted on Scopus and EBSCOHOST for research published from 2019 to 2024. The EBSCOHOST database offers access to articles that are of high-quality because they are mostly licensed from reputable publishers and Scopus provides a robust citation analysis metrics in addition to its broad coverage of peer-reviewed articles. The search terms used were "mobile learning", "m-learning", "special education", "special needs" and "disabilities" on both databases, and initial search results on Scopus resulted in 763 and EBSCOHOST resulted in 975 articles. The search from other sources yielded 22 documents, mainly from

tracing the citations of other articles. A total of 34 articles were considered that met the inclusion criteria and Google translate was used to translate the articles in other languages. Figure 1 summarizes the literature search, identification and selection process for this review using the PRISMA flow diagram [13].

2.1 Inclusion Criteria

1. Articles must have been published from 2019 to 2024.
2. Articles published in any language.
3. Articles that were peer reviewed including conference proceedings.
4. Specifically targeted mobile learning not eLearning.
5. Specifically referred to using mobile learning, mobile apps, and devices.

2.2 Coding Framework

1. **Potentials of mobile learning:** these were mainly studies that explored the applicability of mobile learning with establishing the potential influence the technology could have on the education of learners with disabilities and special needs.
2. **Mobile learning applications:** the studies placed in this category were mainly focused on the design and development process of mobile learning applications and platforms that are suitable to the special learning needs of learners with disabilities.
3. **Impact of mobile learning in the teaching and learning:** these were studies that measured the effectiveness of employing mobile learning technology in teaching and learning processes of learners with disabilities and special needs.
4. **Accessibility and usability:** this group of studies attempted to address accessibility and usability issues in developing for special needs learning as well as bringing to light considerations that are key to achieving accessible and usable learning applications and platforms.
5. **Perception of users**: these are studies that evaluated the perception of user towards adopting mobile learning in special educational needs settings with some highlighting factors that could possibly promote or hinder its adoption.

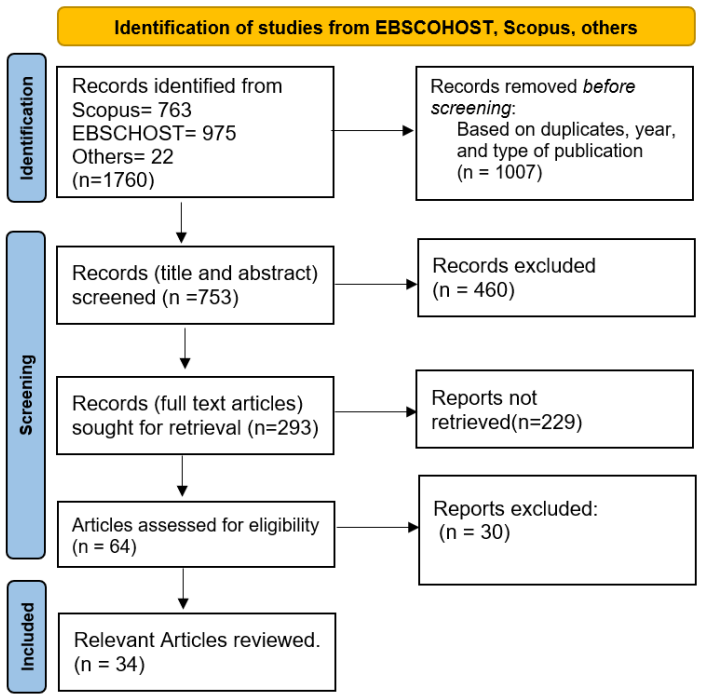

Figure 1. PRISMA Flow diagram for study selection

3 Findings and Discussion

The studies reviewed were classified according to year of publication, country/region of research, aims of research, target disability/special needs category, research methods adopted, and the techniques/technologies leveraged to provide mobile learning for special educational needs learning. A total of 4 out of the 34 articles were not written in

English, [29]; [46] in Spanish, [32] in Turkish, and [58] in German. This section analyses the findings from this systematic review through mapping each study to the above classes.

3.1 Country/Region of Research

Figure 2 shows the spread of research in mobile learning for special education across the different countries listed, majority of countries had one publication each except for India with 4, which is the highest number, then China, Cyprus, Malaysia, Turkey and the USA that equalled 3 each from the countries. Comparatively, there are several studies on the use of mobile learning in mainstream education from the countries listed above, studies on the use of mobile learning in special education are few with even fewer studies from Africa.

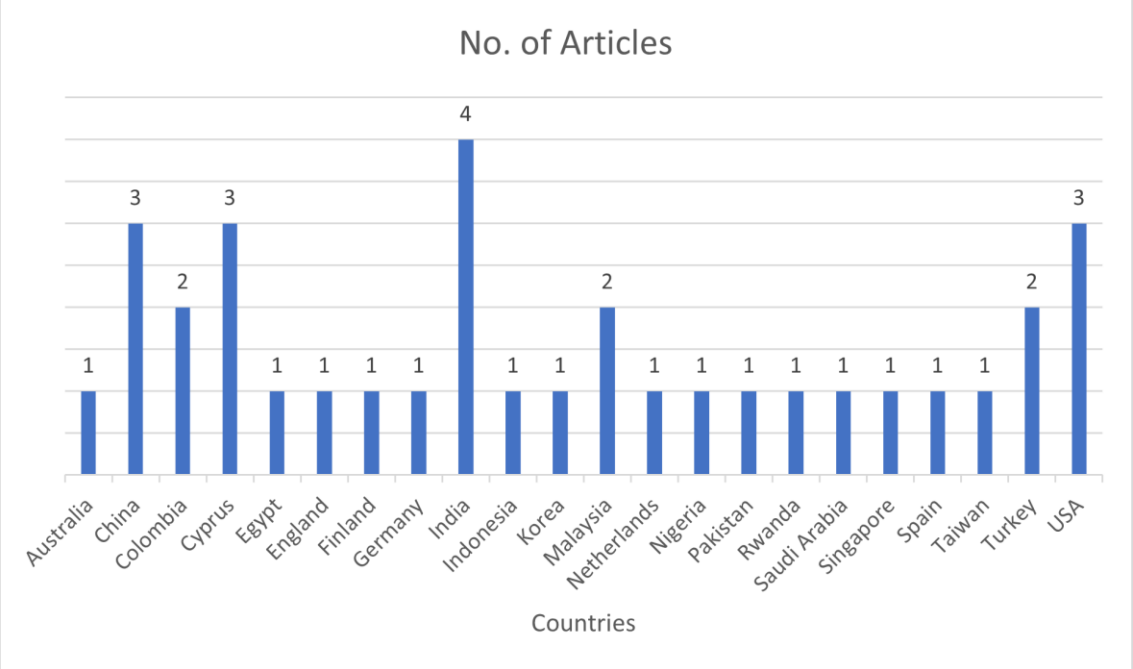

Figure 2. Articles by Countries

3.2 The Aims of Research

This section considers the classification of the articles reviewed based on the aims and objectives of the research. The studies were concerned with the investigating the potentials of mobile learning technology in special education, the design and development suitable for special needs student, understanding the perception of students, teachers, parents, and relevant stakeholders toward the adoption of mobile learning in special education, and assessing the accessibility and usability of existing mobile learning platforms for special needs learners.

3.2.1Exploring the applicability of Mobile Learning in Special Education Settings.

Table 1 presents a summary of authors, years, research methods, country and type of disabilities targeted by research on the applicability of mobile learning in special education. As applied in medicine and randomized controlled trials of medical interventions, intervention fidelity allows for determining the effectiveness of interventions. [14] developed tools to measure intervention fidelity and defined intervention fidelity to be the extent to which a planned intervention is conceived and delivered, and if the delivery method and intervention is effective in achieving the target outcome. [15] explored the use of a mobile app Map4Speech to improve intervention fidelity among special education teachers of children with autism and it was effective towards increasing it to 84-97% compared to the baseline performance of the teachers at 42-54%. The use of mobile apps not only improved intervention fidelity but also improved teaching and learning for learners with different disabilities but this was only established in preschool education. With regards to the use of mobile devices to support learners in special education schools and special education support units in mainstream schools, [16] examined existing digital pedagogical practices among teachers with respect to the integration of mobile learning approaches and findings reveal that there is a potential for special students to benefit and improves agency for teachers.

Exploring the applicability of mobile learning for children with special needs, [17] reviewed the viability of a series of popular applications for the visually impaired available on Google Play store: the text magnifier, screen reader, object recognition, GPS navigation and speech to text apps for mobile devices. These apps improved inclusion, self-sufficiency and motivation when used both in formal and informal learning environments for children with visual

impairment and [18] investigated the use of mobile devices as assistive technologies for higher education students with auditory impairments through examining their use of mobile devices and compared the attitudes of male and female students towards mobile devices in learning and there were no significant differences. [19] also investigated the use of IEP-Connect app to provide Individualized Education Plan for K-12 students with autism spectrum disorder (ASD) in inclusive settings, the study investigated principles that are crucial for the design of coordination apps for special educational planning and the perception of teachers and therapists on using the apps. Important principles to uphold include the availability of information in one place, ease of transition from old to new tools, minimal effort in collecting sharing information, maintain and share data securely, and design for extensibility [19]. The use of mobile phones to facilitate learning for children with intellectual disabilities was also supported in [20] with specific considerations to learning process, types of mobile applications used, screentime for both genders, and the opinion of mothers and teachers, the interview process revealed that most of the children could use mobile phones on their own but mainly to play games not learn, although the government has mandated the use online lessons and tests periodically, these pupils with intellectual disabilities have never used the platform because it is not inclusive. The applicability of mobile devices for improving social communication and emotional regulation for autistic pupils from the perspectives of stakeholders also yielded positive results with the use of iPads as multimodal learning tools to teachers and parents [21].

As presented in the studies, mobile learning is a viable tool that can be used to revolutionize teaching and learning in special education, the evaluations showed that there is a promising potential to achieve optimal educational performance by learners while also enabling effective delivery of teaching instructions by teachers. This is supported in [22]; [23] and [24] while presenting opportunities provided by mobile learning in different contexts of learning like [22] in computer education, [23] in nursing training and [24] in language learning.

Table 1. Studies on the evaluation of applicability of mobile learning in special education

No.	Authors	Year	Approaches/Methods	Country	Disability
1.	[15]	2019	Multiple-baseline design	SINGAPORE	ASD
2.	[17]	2021	Quantitative method	India	Visual impairment
3.	[18]	2021	Descriptive research and survey	Nigeria	Auditory impairment
4.	[19]	2022	Participatory design	UAE	ASD
5.	[21]	2023	Case study and interviews	United Kingdom	ASD
6.	[16]	2023	Survey	Australia	Special needs
7.	[20]	2024	Interviews	India	Intellectual disabilities

3.2.2Design and Development.

Table 2 presents a summary of authors, years, research methods, country and type of disabilities targeted by research on the design and development of mobile learning in special education. On the design and development of mobile learning platforms, it is significant to address the challenges faced by learners with disabilities and to determine the extent to which these platforms exacerbate these challenges. Using a dynamic difficulty adjustment approach [25] presents the design and development of a mobile game to aid vocabulary development for learners with autistic spectrum disorder through providing multisensory experiences and adapting learning based on the performance level of the learners. To improve reading and writing for children with specific learning disabilities and reduce the need for frequent physical behavioural therapy, [26] developed a word-based Android reading application designed to provide sight-word training as an intervention strategy. Leveraging on the capability of augmented reality to provide multi-stimulus learning experience for learners, [27] developed and evaluated the effectiveness of augmented reality and object recognition enabled mobile application for teaching and learning for children with autistic spectrum disorder. Furthermore, [28] developed an object recognition, augmented reality-based application for Chinese vocabulary learning for young children with autistic spectrum disorder for indoor and outdoor use.

To enhance teachers' discourse in real time and to improve the teaching-learning experience of students with auditory impairment, [29] developed a mobile application, ListenApp with synchronous voice recognition feature that improves access to and enhanced learning opportunities. The development of a mobile-based bilingual Indian sign language dictionary was presented in [30] to address the intricate challenges that impede sign language representation in print format to improve literacy among people with auditory impairment. Considering the socio-cultural constraints of autistic children in Rwanda [31] presented the design and development of a mobile application that facilitates numeracy learning for children with autism spectrum disorder. [32] developed an application that enhances mobile assisted learning for students with total vision loss which translates images and text to voice for ease of identifying objects by students.

Leveraging on artificial intelligence and augmented reality, [33] developed a mobile application that evaluates the abilities of different learners at word, phrase, and sentence levels, provide immediate feedback and coaching, and lastly, a training curriculum that is tailored to individual learners' learning patterns.

Although several studies mentioned in this category designed and developed mobile learning applications that are suitable for learners with special needs, a fundamental element of user modelling was mostly not considered. To achieve the most effective digital platforms, user-centred design [34] user modelling [35] and ontology [36] are concepts that must be considered because they align best with users individual needs.

Table 2. Research on the design and development of mobile learning in special education

No.	Authors	Year	Approaches/Methods	Country	Disability
1.	[33]	2019	Artificial intelligence	USA	Early and special education
2.	[27]	2019	Deep learning	China	ASD
3.	[28]	2019	Deep learning	China	ASD
4.	[26]	2020	Android app development, Mobile application rating scale	India	Dyslexia
5.	[31]	2021	Agile methodology, qualitative approach	Rwanda	ASD
6.	[25]	2022	Machine learning	Egypt	ASD
7.	[29]	2022	Quantitative method	Colombia	Auditory impairment
8.	[30]	2022	Quantitative method	India	Auditory impairment
9.	[32]	2023	Action research	Turkey	Visual impairment

3.2.3Evaluation of Effectiveness of Mobile learning.

Table 3 presents a summary of authors, years, research methods, country and type of disabilities targeted by research on the evaluation of effectiveness of mobile learning in special education. Combining prompt-based learning and computer assisted instruction [37] evaluated the impact of a visual prompt-based mobile learning (VPML) to improve the understanding of algebra for students with learning disabilities with focus on linear equations to which there was positive impact. In line with ensuring the universal design for learning guidelines and provide the option of supporting executive function for students with intellectual disabilities and autistic spectrum disorder, [38] evaluated the effectiveness of smartwatches for use by students with intellectual disability and autistic spectrum to self-manage appointments and learning tasks. To provide enhanced learning opportunities for students with intellectual disabilities, [39] evaluated the effectiveness of combining traditional teaching methodologies like collaborative learning and video-self modelling (VSM) with the use of learning management systems and tablets (iPads) and these increased students' motivation to complete tasks and improved their skills.

To improve maths learning experience for children with dyscalculia, [40] evaluated the effectiveness of Calculic model for designing suitable learning applications for children with dyscalculia. Furthermore, [41] evaluated the effectiveness of MathFun app that was developed based on Calculic model and the outcome showed potential benefits and improvements in learning outcomes. Mobile learning intervention HiSense APP was found effective for supporting caregivers of people with intellectual disabilities, through improving their knowledge on secure attachment, empathy, and self-efficacy in[42] and the findings ascertained the flexibility mobile learning provides towards digital education for professional caregivers. In a bid to improve the listening skills of students with intellectual disabilities, [43] explored the effectiveness of T-Mobile learning application that was integrated with listening-based and assisted picture features in teaching and the results showed that there was improved performance in students that used the application.

Harnessing the potentials of tangible mobile applications and devices to provide physical and multisensory interactions for students with specific learning disabilities (SLD), [44] explored the applicability of these tangible mobile application in providing learning assistance for students with SLD in learning cell science and was found effective. [45] conducted a comparative examination of using tablet devices vs visual cards to present simultaneous prompting for teaching spatial concept to students with intellectual disabilities, the use of the tablet mobile environment was more effective than the use of the visual cards to provide simultaneous prompting. To facilitate the reading and particularly learning of sounds (vowels and consonants) in Colombian sign language for students with hearing disabilities, [46] evaluated the effectiveness of using mobile learning application on the learning outcomes of the students which resulted in significant improvement. To alleviate the challenges of first graders with severe difficulties in reading and spelling, [47] evaluated the effectiveness of GraphoLearn reading and spelling app, the game trains the leaners with letter sounds and corresponding word reading, and then phonological skills and spellings, the app improved self-efficacy and word reading fluency for learners. [48] comparatively evaluated the use

of traditional teaching methods and assistive technologies in mobile environments to improve vocabulary development for students with intellectual disabilities.

The positive impact of mobile learning on educational achievement has also been supported in [49] in teaching and learning probability; [50] in higher education context. It is evident that mobile learning can be effectively used to improve teaching and learning experience and performance for learners with disabilities however, in the studies, the exposure of students to mobile learning interventions were mostly one-off hence, the need for longitudinal research to ascertain further, the effects on academic performance from prolonged use.

Table 3. Research on the evaluation of effectiveness of mobile learning in special education

No.	Authors	Year	Approaches/Methods	Country	Disability
1.	[42]	2019	Randomized controlled trial	Netherlands	Intellectual disability
2.	[43]	2019	Quantitative approach	Indonesia	Special needs learners
3.	[44]	2019	Multiple probe design	Turkey	Specific learning disabilities
4.	[41]	2020	Ratified Unified Process, System Usability Scale	Malaysia	Dyscalculia
5.	[40]	2020	System Usability Scale	Malaysia	Dyscalculia
6.	[47]	2020	Randomized controlled trial	Finland	Severe reading difficulty
7.	[48]	2021	Quasi-experimental design	Pakistan	Intellectual disabilities
8.	[39]	2021	Case study, focus groups	Spain	Intellectual disability
9.	[38]	2022	Multiple probe design	USA	Intellectual disability and ASD
10.	[45]	2022	Alternating treatment design	Cyprus	Intellectual disabilities
11.	[46]	2022	Experimental approach	Colombia	Auditory impairment
12.	[37]	2024	Quasi-experimental approach	Taiwan	Learning disability

3.2.4 Accessibility and Usability Evaluation.

Table 4 presents a summary of authors, years, research methods, country and type of disabilities targeted by research on the accessibility and usability of mobile learning in special education. Studies that considered the evaluation of accessibility and usability of mobile platforms are presented in this section. It is important to understand how easy it is for users with disabilities to use mobile learning platforms to achieve learning goals and their satisfaction. A combination of mobile usability model and unified theory of acceptance and use of technology was employed in [51] to evaluate the usability of mobile learning application for children with autistic spectrum disorder.

Using the web content accessibility guidelines (WCAG), [52] examined a mobile learning MOOCs platform to determine suitability for visually impaired learners, recommendations regarding the use of alternative texts for non-text contents, bypass buttons, and auto-translation and subtitle would improve accessibility of the platform. Eye-tracking experiment was employed in [53] to evaluate the interactivity of autistic children with the interface of an augmented reality mobile colouring application and findings revealed that cluttered interfaces were distracting to them, and icons and images facilitated learning for them.

From the perspective of speech language pathologist, prevalent design challenges in mobile learning platforms for children with communication impairments were evaluated and the study findings portray the significance of incorporating clinical insights into design knowledge as well as adopting user-centred approaches to design for both clinicians and the children as users [54].

Empirically basing these studies on human computer interaction design and evaluation methods would provide deeper insight into the accessibility, usability and interactive design issues and requirements of special education learners. Usability is a key element to be maintained when designing mobile applications especially for learning, according to [55] it ensures ease of use and a key determinant of success for many applications. As a tool for social and educational inclusion, accessibility empowers user with different disabilities to equally participate in teaching and learning [56].

Table 4. Research on the accessibility and usability of mobile learning in special education

No.	Authors	Year	Approaches/Methods	Country	Disability
1.	[52]	2019	Case study, heuristic walkthrough	Korea	Visual impairment
2.	[54]	2020	Mixed method	USA	Communication impairment
3.	[51]	2021	Quantitative approach	Saudi Arabia	ASD
4.	[53]	2023	Mixed method	China	ASD

3.2.5 Evaluation of Acceptance and Perceptions.

Table 5 presents a summary of authors, years, research methods, country and type of disabilities targeted by research on the perception of users of mobile learning in special education. This section presents the studies that focused on understanding the perceptions of stakeholders (students, teachers, parents, caregivers) towards the use of mobile learning technologies in special education settings. To determine the perception of special education teachers on the use of mobile gamification platforms**,** [57] examined the functional roles, affordances, and possible constraints of teaching-learning with mobile gamification interventions from the perspectives of the teachers and the findings suggest the need for individualized gamification and involvement of these special educators in the design and development phases. Most investigations about the perceptions of use of technology in education were conducted from the perspectives of teachers hence, the motivation for the study [58], that examined the perception of parents/relatives of children with specific education and learning disorders towards digital interventions in tablet devices with respect to support training applications for the caregivers.

Leveraging on several technology acceptance models like Davis and Venkatesh's Technology Acceptance Model (TAM) and Unified theory of Acceptance and Use of Technology (UTAUT), several studies have evaluated the acceptance and perception of stakeholders (students, teachers, parents) towards the adoption of mobile learning and its effectiveness in the general context of education but there is limited research in the case for these evaluations in special education contexts. Example of such studies include [59] used TAM to evaluate students' acceptance, [60] employed the UTAUT model to determine students' acceptance, and [61] evaluated teachers' acceptance using TAM.

Table 5. Research on the perception of users of mobile learning in special education

No.	Authors	Year	Approaches/Methods	Country	Disability
1.	[57]	2023	Mixed method	Cyprus	Learning disability
2.	[58]	2024	Qualitative approach	Germany	Specific learning disability

4 Conclusion and Future Research

This study presented the state-of-the-art on the research for the application of mobile learning technologies in special needs education and disabilities with a consideration of the years of publication, countries/regions of research, research purpose and methods and the types of disabilities that were considered by the studies.

Quantitative research methods were the most used approaches in the studies of mobile learning in special education that included experimental, quasi-experimental research designs, randomized controlled trials, multiple-baseline, and probe design methods. The mixed method approached used by the studies were mostly a combination of interviews and surveys and the qualitative approaches used were mainly interviews and focus groups. The most researched disability was autism spectrum disorder and intellectual disability with no specific mention of the type of intellectual disability. Other disabilities considered were intellectual disability, dyslexia, dyscalculia, auditory and visual impairments, and communication impairments.

Techniques and technologies used for providing improved learning experience and effective mobile learning intervention for learners with disabilities included artificial intelligence, machine learning and augmented reality. The most popular purpose of research on the use of mobile learning in special education setting is the evaluation of effectiveness of existing mobile applications and use of mobile devices on expected learning outcomes of special needs learners then the design and development process of mobile learning platforms suitable for the needs of special needs learners. Some studies considered the evaluation of the perception of users and stakeholders, and some attempted to evaluate the accessibility and usability of the platforms with recommendation based on the outcome of the evaluations.

Regions with the most research on the use of mobile learning in special education as revealed by this review were Asia and Europe, the least is Africa with very few representations of sub-Saharan Africa. This implies the huge digital and economic divide that exists that is mostly due to economic, infrastructural, socio-cultural and digital skills shortages that are prevalent in those regions, they are largely underserved as evident in [62] and [63] on mobile learning in Africa.

A limitation to this study was the consideration of only 2 academic databases, Scopus and EBSCOHOST. Future research direction is to consider a broader range of literature search and an evaluation of studies to determine if mobile learning in special education was merely used to replicate traditional teaching and learning practices or wholly transform these practices as presented in [64], an examination of the extent to which mobile learning enhances or transforms education with respect to educational technology integration evaluation framework of substitution, augmentation, modification and redefinition (SAMR) developed by [65]. To contribute towards the body of knowledge on research in mobile learning in the African context, future consideration will be to conduct needs assessment in Nigerian special education schools to understand the mobile learning requirements of students and to develop framework that would guide the design and development of mobile learning applications for special education.

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