A Systematic Review of Mobile Learning Trends in Supporting the Mastery of Spelling

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Abstract—Teaching and learning to spell forms the basis for mastering English Language. The emerging mobile learning trends in the current 21st century education is useful in teaching and learning spelling. However, there were limited reviews about them. As such, a systematic review was conducted to provide an up-to-date synthesis on the mobile learning trends in supporting the mastery of spelling from year 2012 to year 2022. This review adhered to Preferred Reporting Items for Systematic Reviews and Meta-Analyses which is also known as the PRISMA guideline. Three databases were involved: Web of Science, Scopus and Educational Resources Information Centre. After a rigorous screening process, a total of 19 articles fitted its objectives. Firstly, significant findings from the studies portrayed the use of four platforms in mobile learning trends in supporting the mastery of spelling namely mobile apps, spell-checker apps, word prediction apps and text messaging apps. Secondly, the primary level of education was more dominant in the related studies than the secondary and tertiary levels. Thirdly, it emphasized more on the students with a lower prevalence on teachers and both teachers and students as the respondents in the associated studies. This paper contributes to systematically reviewing 19 eligible related studies through a step-by-step protocol of identification, screening, eligibility and included as in the PRISMA guideline to establish quality review. It benefits both the English Language teachers and students in utilizing various mobile learning platforms to support the mastery of spelling at all levels of education. It aspires to foreground the paucity in this topic in which more substantial studies are required to address the research gaps. The goal is to impose effective and practical strategies to advance mobile learning trends in supporting the mastery of spelling.

Keywords—English language, 21st century education, mobile learning trends, mastery of spelling, systematic review

1 Introduction

English Language mastery is essential because it is a global lingua franca [1]. In line with this, [2] asserted the importance of writing sentences with correct spelling because communication through writing is emphasised in 21st-century teaching and learning. Concedingly, [3] embraced the idea of 21st-century teaching and learning

which uses Information and Communication Technology (ICT) whereby teachers can boost the perceptions of Generation Z students. Furthermore, the coincidence of the COVID-19 pandemic also resulted in the emergence of mobile technologies in education [4], [5], [6].

Previously, the mastery of spelling through traditional means has been stigmatized as monotonous [4]. Thereafter, the researchers acknowledged the importance of mobile learning trends in supporting the mastery of spelling. This is to further progress in English Language, yet the related reviews are scarce. Comparatively, many mobile learning platforms are available, but it is difficult to distinguish the effective ones before they are being utilized and reported in the studies. It is imperative to know the types of mobile learning platforms which act as the medium to support the mastery of spelling in teaching and learning of English Language [7]. Further exploration could be done to assess their potential.

It is essential to determine the emphasis on any particular education levels of the respondents in language-related educational studies, as suggested by [8] to observe their differential implications, particularly in relation to this review. Besides, the respondents involved in the studies are sometimes not explicitly acknowledged as users of mobile learning platforms. [8] postulated that it is important to gain deeper insights into the role of the teachers and students in simultaneously recognizing mobile learning trends in supporting the mastery of spelling.

Considering the above burgeoning issues, this systematic literature review is proposed purposefully to display alternatives to traditional English Language lessons. It reviewed 19 related articles in detail pertaining to this study which have been derived from three databases (Web of Science (WoS), Scopus and Educational Resources Information Centre (ERIC)) through a rigorous process according to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. This review hopes to benefit both the teachers and students by identifying the research gaps in this review. Hence, the aim is to review the studies on the mobile learning trends in supporting the mastery of spelling with three research questions as follows:

- RQ1: What mobile learning platforms are used in the mobile learning trends in supporting the mastery of spelling?
- RQ2: What are the education levels of the respondents in the mobile learning trends in supporting the mastery of spelling?
- RQ3: Who are the respondents involved in the mobile learning trends in supporting the mastery of spelling?

2 Literature review

Spelling mastery is essential for developing literacy and mastering other English Language skills [9]. The earlier research by [10] indicated that spelling is related to reading, writing, vocabulary and reading comprehension. Admittingly, it is vital to construct sentences with accurate spelling because language learning in the 21st century entails communication in writing [2]. Students must have a strong command of English spelling as writing clarity depends on its accuracy. Thus, the teachers must

assist their students in developing spelling repositories. The following subsections will delve into the related works of this study.

2.1 Mobile learning trends in English language classrooms

Mobile learning is part of Mobile-assisted Language Learning (MALL) that has advanced with a growing number of studies that explore its various uses, both in and out of formal language classes [11], [12], [8]. Interestingly, mobile learning constitutes the prominent and popular form of 21st century student-centered learning applications worldwide [13]. These applications generally provide a framework for peer learning and reviews. Examples include WhatsApp [14], Telegram [15], Google Classroom [4], Duolingo [16], Kahoot [17] and Kaizala [18]. Additionally, [19] suggested that Spelling Master, Kids Spelling Learning, Grammarly, Ultimate English Spelling Quiz and Spelling Master are mobile learning applications that can also be used for language teaching and learning, particularly spelling.

[20] proposed that teachers who regularly utilize Education 4.0 technologies must examine new digital literacy of mobile learning. It is to ensure that students could participate in meaningful practice. This is due to the adaptability of mobile learning in enhancing students' learning to spell as opposed to the conventional method of rote memorization [21]. Also, it is necessary to choose appropriate mobile learning platforms for teaching and learning [22]. [23] and [24] appraised that mobile learning provides opportunities for students to perform online activities. Lessons can resume without the physical presence of the teachers and students.

Through teaching spelling via mobile learning, [4] postulated that English Language teachers enable their students to engage safely and freely in cyberspace, thus eliminating inferiorities in spelling errors. Hence, this generates a low filter teaching and learning environment that allows input according to Krashen's Affective Filter Hypothesis [25]. However, numerous mobile learning platforms which have the potential to contribute to teachers and students at all education levels of language teaching and learning remain unexplored [26].

[4] and [27] expressed that the learners will be immersed in a productive language environment by engaging themselves with mobile learning. They can interact and learn alongside with other users, adopting a student-centered strategy. Accordingly, mobile learning has become an emerging trend, especially during the lockdowns due to the COVID-19 pandemic [28] and continues to be relevant in the current post-COVID-19 pandemic situation. Also, the fourth educational goal of Sustainable Development Goal (SDG) expected mobile learning to provide quality education [29].

2.2 Mobile learning trends in supporting the mastery of spelling

Notably, a genuine link between teaching and learning approaches and mobile learning is critical in attracting teachers to teach spelling and students' interest in learning to spell [23], [30]. In other words, teaching spelling to the students who are the Generation Z millennials [31] through acknowledging a learner-centered model coalescing with the popularity of mobile learning trends is a worthwhile effort if put

into the English Language teachers' pedagogical practice. Although mobile learning in language education is not novel, there are still lacking studies mainly on the usage of mobile learning in supporting the mastery of spelling at various education levels, be it primary, secondary or tertiary level of education. This becomes a concern because spelling forms the basis of language learning [4], [9].

Evidently, [32] and [33], in their respective findings, illustrated positive relationships between texting on mobile phones and spelling improvement in school-aged children. Texting on mobile phones allows for implicit learning of spelling. Parallel to this, [34], [35], [36], [37], [38], [39], [36] posited that spell-checker could analyse and correct misspellings in a text. Interestingly, spell-checker provided better assistance during the students' current learning compared to enabling them to produce productive outcomes at the cognitive level [35], [37]. They catered to on-the-spot support but do not leave a long-term impact for students to spell effectively. Apart from that, [41] shared that word prediction application is capable of giving basic spelling support in developing quality writing among bilingual primary school students. It exhibited that spelling is the catalyst for effective writing.

In the earlier research involving mobile learning applications, [42] revealed the effectiveness of a mobile LINE application for college students in their English spelling learning experiences. [43] then highlighted that gamified and repetitive spelling practices through a mobile application, 'EDUBUZZ kids' assisted the students in learning spelling. Likewise, the research by [15] disclosed how their students' ability to spell compound noun words improved after the spelling quiz intervention using Telegram Autobot, a mobile learning application. Evidently, Generation Z students are inclined toward using mobile learning to master spelling.

Following, [4] conducted an intervention using Google Classroom application comprising individual and group activities on primary school ESL students who showed progress in their spelling. The researchers discovered that virtual platforms could be used academically to improve students' spelling abilities. Consonantly, [44] also found that hybrid teaching and learning have been emphasized in the emergence of the COVID-19 pandemic. According to Krashen's Affective Filter Hypothesis, teaching and learning become effective when they generate a low filter and conducive environment [25].

However, it becomes a concern because most of the studies are one-sided as they emphasized more on students [8] compared to focusing on teachers or both teachers and students. Despite this, it is imperative to justify that teachers are the key agents in the disposition of knowledge [45]. Admittingly, the related past studies clearly illustrated the successes of the spelling interventions with the mobile learning trends upon which future research could further be carried out to fill the related gaps for the benefits of both teachers and students in expanding mobile learning trends in supporting the mastery of spelling.

3 Methodology

This systematic review complied with the PRISMA guidelines which involved four steps: identification, screening, eligibility, and included (with iterations), as illustrated in Figure 1. Researchers have widely utilised PRISMA due to its extensiveness and flexibility in various studies. Following is the systematic review process of this study.

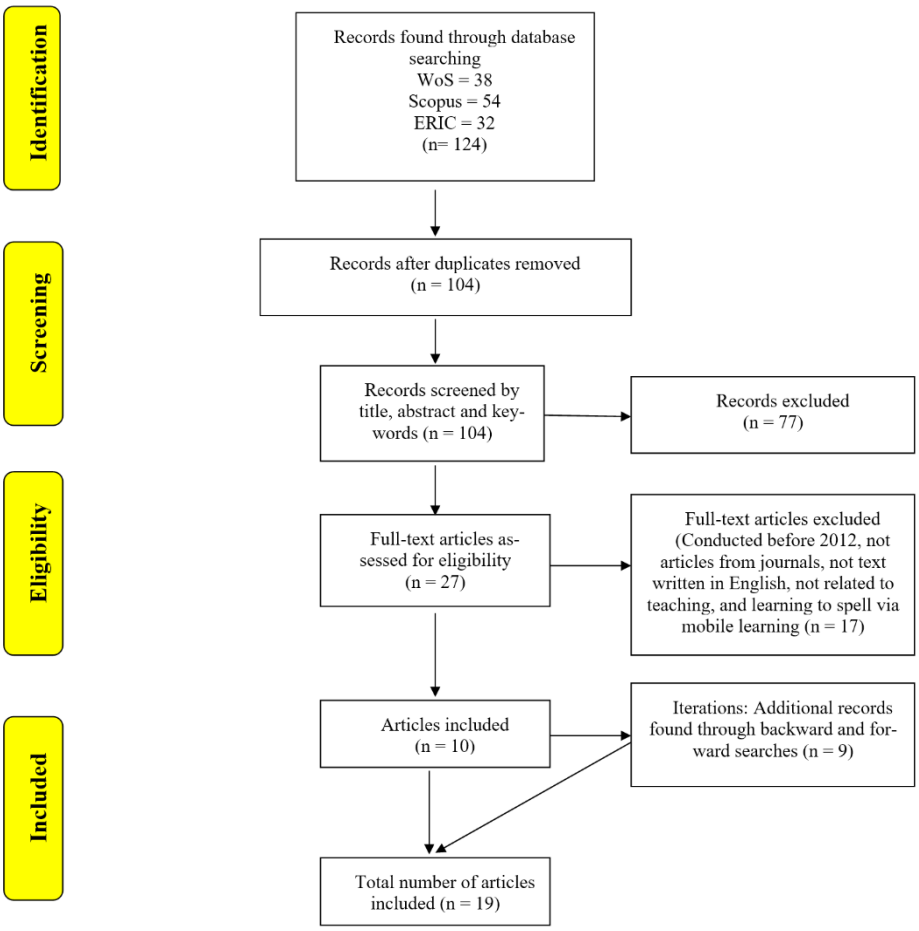

Fig. 1. PRISMA systematic review adapted from [46]

3.1 Identification

The identification process is the initial step in the systematic review. WoS, Scopus and ERIC were chosen as the databases to fulfill the research purpose of this study. The key phrases used in this review were chosen carefully to describe the concepts being examined accurately. Words related to teaching and learning to spell via mobile

learning were inserted. Table 1 displays the search string utilized for each database according to the context of this study.

Table 1. Search String utilised in this study

Database	Search String
Web of Science (WoS)	TS= (("mobile learn*" OR "mobile app*" OR "mobile device*" OR "mobile phone*" OR "mobile tech*" OR "m-learning" OR "tech*" OR "mobile assisted language learning" OR "MALL") AND ("teach* spell*" OR "spell instruct*" OR "spell educat*" OR "learn* spell*" OR "master* spell*" OR "*writ* spell*"))
Scopus	TITLE-ABS-KEY (("mobile learn*" OR "mobile app*" OR "mobile device*" OR "mobile phone*" OR "mobile tech*" OR "m-learning" OR "tech*" OR "mobile assisted language learning" OR "MALL") AND ("teach* spell*" OR "spell instruct*" OR "spell educat*" OR "learn* spell*" OR "master* spell*" OR "*writ* spell*"))
ERIC	handheld devices AND educational technology AND spelling

*: Search String

3.2 Screening and eligibility

The screening procedure commenced after the articles were identified, with the initial step being to eliminate duplicate articles found in more than a database. The initial screening stage removed 20 duplicate articles, leaving 104 articles eligible for further screening. They were then evaluated according to their titles, abstracts, and keywords, based on the belief that these studies should be published between 2012 and 2022, journals articles, interventions focusing on the English language and related to teaching and learning to spell via mobile learning. The screening approach excluded 77 articles due to their lack of relevance to this study's research objectives. Following the exclusions, the remaining 27 articles were assessed using the criteria for inclusion and exclusion as illustrated in Table 2.

Table 2. Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Studies published between 2012 and 2022 (ten-year period)	Studies published before 2012
Studies from journals, articles, and book	Proceedings of conferences, reviews, book chapters, and reports
Interventions focused on English Language	Interventions do not focus on English Language
Related to mobile learning trends in supporting the mastery of spelling	Not related to mobile learning trends in supporting the mastery of spelling

Journal articles were considered to be high-quality research [47]. They were included in this review after scanning the relevant full-text articles for eligibility verification. However, [47] advised on excluding proceedings of conferences and book chapters because they were less extensive. Also, due to the absence of a peer-review procedure, technical reports and online presentations were excluded from this review. After rigorous selection based on the criteria for inclusion and exclusion, 10 articles were identified as possibly appropriate for inclusion. Parallel to this, [48] stated that a

ten-year reference could be used to determine the number of years for literature search in a systematic review. This is the rationale as to why the researchers chose to review studies published between 2012 to 2022, which is a ten-year period.

3.3 Included

The research purposes of the articles were associated with teaching and learning to spell via mobile learning. The included articles were summarised in Table 3. There were 10 articles chosen through database selection (2 from WoS, 2 from Scopus, 2 available in both WoS and Scopus, 4 from ERIC) and another 9 selected through literature selection (backward and forward searches) which summed up to a total of 19 articles reviewed in this study. The selection of these databases was based on the quality of their publications.

Table 3. Summary of the selected studies

Study	Database	Aim	Sample(s)	Research Methodology	Finding(s)
1. Va'squez et al. (2016)	WoS	To determine how the technology which facilitate formative assessment in spelling could influence learning.	Participating students in this Design-Based Research study comprised two phases: -Phase 1: 44 second graders, aged between 7 and 8 -Phase 2: 46 third graders, aged between 8 and 9.	Design-Based Research	Results revealed that while teaching spelling to primary school students, a self-paced formative assessment strategy utilising tablets is more effective than a similar strategy utilising an interpersonal computer.
2. Mudassir et al. (2020)	WoS	To determine whether students at Quaid-e-Awam University of Science and Technology use spell-checker in their work (spelling).	52 university students	Quasi-Experiment	The study demonstrated that spell-checker are beneficial to students on a superficial level but less in delivering productive results on a cognitive level.
3.Shokri & Abdolmanafi-Rokni (2014)	Scopus	To examine the effect of technology on EFL students' spelling.	40 out of 58 students (native speakers of Persian, aged 14 to 15) in two third-grade classes at Sama Middle school in Aliabad Katool, Iran.	Experimental	The experimental group outperformed the control group in the post-test and delayed post-test. This finding portrayed the efficacy of games on spelling retention.

4. Lau & Mohamad (2021)	Scopus	To determine the efficacy of Google Classroom for spelling mastery among primary school ESL students during the Movement Control Order (MCO) due to the COVID-19 pandemic.	30 Year Four (aged ten years old) mixed proficiency primary school ESL students.	Case Study	The participants displayed: -Significant improvement in spelling -Positive perceptions of using Google Classroom in mastering spelling.
5. Brown & Allmond (2021)	WoS, Scopus	To investigate how a group of first grade emergent bilinguals use word prediction application as a basic spelling support to develop digital essays over a period of a year.	17 first grade emergent bilingual students, aged between 6 and 7.	Grounded study	The results exhibited basic spelling support, extended written responses and allowed for reading practices. This digital tool enhanced the meaning-making procedure of emergent bilingual writers.
6. Westwood (2018)	WoS, SCOPUS	To focus on current topics in teaching students to spell and how spelling abilities develop.	Teachers and students (general)	Review	-In most countries, declining spelling standards are thought to be due to insufficient guidance that relied too heavily on incidental learning. - Evidence suggested digital technology can aid in the improvement of poor spellers.
7. Wray (2015)	ERIC	To investigate teachers' perspectives on the impact of texting on students' reading development.	27 primary school teachers.	Qualitative	-The majority of the teachers believed that texting and technology use benefit their students' literacy. -The teachers were concerned about the consequences of textism but many other factors mitigated their concerns. -None of them attributed the decline in student literacy only to the usage of textism.
8. Po et al. (2017)	ERIC	To compare students' performances and determine how effective spelling aids are in detecting and correcting misspelled words.	88 university ESL students, aged between 18 and 24.	Experimental	-Improved accidental spelling acquisition is linked to the amount of time spent looking for the proper words. -In computer-based spell-checker, convenience and effort could be regarded as the factors influencing incidental spelling learning.

9. Moser et al. (2017)	ERIC	To examine the effectiveness of word structure practice using application software with fourth-grade readers.	29 fourth-grade primary school students	Quasi-Experiment	Pre- and post-treatment assessments showed improvement in spelling, favouring the intervention group of students.
10. Ngesi et al. (2018)	ERIC	To investigate the potential for mobile phones to enhance students' access to learning materials outside of school.	44 secondary school Grade 9 students	Case Study	-Some students believed that SMS would impair their language and spelling because of its informal writing style. -When students realised they were using these platforms for educational reasons, the conventional rules of formal writing applied (complete sentences, punctuation marks, correct spelling of most words, acceptable grammar and proper sentence use).
11. Wood, C. et al. (2012)	Literature selection: Backward and forward searching	To report the effect of text messaging on the literacy skills of 9-10 year old children.	114 children, aged 9-10 years old	Experimental	The usage of textism in text messaging by children correlated positively with better literacy skills, particularly spelling.
12. Verheijen, L. (2013)	Literature selection: Backward and forward search	To examine empirical data released over the past decade to evaluate whether instant messaging had a beneficial or detrimental impact on literacy.	Users of text and instant messaging	Review	The study indicated that literacy levels may correspond differentially with: -texting frequency, textism, and textism knowledge -for reading, writing and spelling -for formal and informal writing Different study designs and populations may have contributed to the contradictory findings.
13. Rimbar (2017)	Literature selection: Backward and forward search	To investigate if students internalise error correction provided by the spell-checker in word processors.	30 Form 1 secondary school students	Quasi-experimental	-The spell-checker assisted the students to revise their spelling on dictation exercises but their spelling errors are still visible. -Although spell-checker can assist in eliminating surface errors, they have limited influence on spelling error correction at cognitive level.

14.Alasmari & Alamri (2019)	Literature selection: Backward and forward search	To examine how spell- checker in MS Word treats mis-spellings made by Saudi learners of English as a foreign language.	The study analysed 401 errors made by 25 female intermediate-level English learners at a Saudi university.	Experimental	-Participants made wrong choices of word spelling in context, influenced by order of words on suggested list. -Another factor was the capitalisation of the first letter, whereby the spell-checker in MS Word treated these misspelt words as proper nouns. All alternative suggestions began with capital letters.
15. Bakar et al. (2019)	Literature selection: Backward and forward search	To determine the effectiveness of Telegram Autobot Quiz in improving students' spelling abilities for complex nouns.	30 Year 5 primary school students	Action Research	-Spelling improvement after the intervention -Students expressed favourable thoughts about the application of Telegram Autobot Quiz.
16. Lau & Mohamad (2020)	Literature selection: Backward and forward search	To provide a literature review on the difficulties faced by the primary school ESL kids in learning to spell and strategies for overcoming these difficulties through technological means during the COVID-19 pandemic.	Primary school ESL students	Review	-Inadequate spelling knowledge, interference from their mother tongues, spelling confusion and other obstacles hindered primary school ESL students' language learning. -During the COVID-19 pandemic, the actions taken to help primary school ESL students learn to spell through technological means were supported by findings from many studies.
17. Alsadoon, R. (2021)	Literature selection: Backward and forward search	To examine learners' perceptions of the frequent usage of spelling tools (spell-checker and auto-correctors) on social media and smartphones.	84 Saudi EFL university learners	Quantitative Survey	The results indicated that spell-checkers are preferable to auto-correctors.
18. McCarthy et al. (2022)	Literature selection: Backward and forward search	To examine the extent of spell-checker in supporting writing and revision compared to providing writing strategy feedback.	119 high school students	Case study	-Spelling feedback contributed significant gains after revision on five subscales (i.e., mechanics, word selection, voice, conclusion and organisation) -Spelling feedback revealed complementary benefits, leading to improvement in essay quality.

19. Wong et al. (2022)	Literature selection: Backward and forward search	To assess the impact of a mobile spell-checker on academic writing by Malaysian pre-university students and their attitudes toward it.	99 pre-university students	Quantitative Survey	The use of a mobile spell-checker for academic writing yielded positive outcomes. The mobile spell-checker has also received a lot of positive feedback.

3.4 Iteration

Through a backward and forward search, an additional of 9 related studies were discovered. The researcher undertook a backward and forward search to gather a complete list of linked material to this review [49]. The researcher discovered relevant studies by looking backward through the articles that had referenced this review, as suggested by [50]. Following, a forward search was also undertaken by screening for the relevant title for this review (based on the 10 selected articles from the three databases during the inclusion and exclusion steps mentioned above), identified via search engine, specifically, Google Scholar, also advised by [51]. There was a total of 19 studies included in this research.

4 Results

All the articles were saved in Mendeley, a citation management programme. The major themes were determined using thematic analyses in response to the research questions as follows:

- RQ1: What mobile learning platforms are used in the mobile learning trends in supporting the mastery of spelling?
- RQ2: What are the education levels of the respondents in the mobile learning trends in supporting the mastery of spelling?
- RQ3: Who are the respondents involved in the mobile learning trends in supporting the mastery of spelling?

This review contextually examined the articles by organising the themes according to the research questions. The themes for the first research question were categorised based on the four types of mobile learning platforms applied in the selected studies: mobile apps, spell-checker apps, word prediction apps and text messaging apps. For the second research question, the education levels of the respondents were grouped into primary, secondary and tertiary levels. Lastly, for the third research question, the respondents involved were categorised into teachers, students and both teachers and students. The findings from the selected articles were discussed in the following section.

4.1 Platforms used in the mobile learning trends in supporting the mastery of spelling

Mobile learning platforms are classified into (1) mobile apps, (2) spell-checker apps, (3) word prediction apps and (4) text messaging apps in this systematic review. These classifications were deduced based on the literature of the 19 selected articles. It is important to look at studies focusing on the platforms used in mobile learning trends to support spelling mastery. Table 4 illustrates the types of mobile learning platforms of the reviewed studies.

Table 4. Types of platforms used in the mobile learning trends in supporting the mastery of spelling

Mobile learning Platforms	Examples
Mobile apps	Games Shokri & Abdolmanafi-Rokni (2014) Telegram Autobot Quiz Bakar et al. (2019) Various mobile apps Lau & Mohamad (2020) Google Classroom Lau & Mohamad (2021)
Spell-checker apps	Spell-checker Po et al. (2017); Rimbar (2017); Alasmari & Alamri (2019); Mudassir et al. (2020); Alsadoon (2021); McCarthy et al. (2022); Wong et al. (2022)
Word prediction apps	Word prediction Brown & Allmond (2021)
Text messaging apps	Instant messaging Verheijen (2013) Texting app Wood et al. (2012); Wray (2015) SMS Ngesi et al. (2018) Mxit Ngesi et al. (2018)
Not specified	Va´squez et al. (2016); Moser et al. (2017); Westwood (2018)

As illustrated in Table 4, the study by [52] utilised games to compare the level of spelling retention among secondary school students in the experimental and control groups. The experimental group outperformed the control group in the post-test and delayed post-test. This finding exhibited the efficacy of games on spelling retention. Besides, [15] used a mobile app, Telegram Autobot Quiz which has improved the primary school students' spelling ability in compound noun words whereby the students gave constructive feedback on its utilisation. Likewise, [59] reviewed multiple research findings that initiated using various mobile apps to address the obstacles that

primary school ESL students encountered in learning to spell during COVID-19 pandemic.

On another note, [4] were inspired to use the mobile app, namely, Google Classroom, in its spelling intervention for individual and group spelling tasks among the learners. The results exhibited that they developed positive perceptions of using Google Classroom to improve their spelling and achieve better post-test scores than the pre-test for spelling [4].

Besides the mobile app, another mobile learning platform is the spell-checker app which was utilised in seven studies [34], [35], [36], [37], [38], [39], [40]. In the study by [34], the researchers discovered the convenience offered by the spell-checker, whereby it increased the learners' effort in searching for the right words, resulting in improved learning of incidental spelling. The study by [35] revealed that spell-checker eliminated spelling errors but have minimal influence on correcting errors at the cognitive level. Next, [36] commented that despite using spell-checker, students still make mistakes because of the wrong choice of the suggested spelling of words to suit the context and capitalisation errors as being treated as proper nouns.

[37] stated that spell-checker is helpful as it saves time while correcting spelling mistakes and errors. [38] evaluated the students' opinions of the continuous usage of spell-checker and auto-corrector on social media and smartphones in which the spell-checker was their preferred choice. [39] opined that the feedback from spell-checker is a complementary benefit in ensuring better essay quality among high school students. Similarly, [40] discovered mobile spell-checker for academic writing produced positive results with many favourable responses.

Following, in the study by [52], the word prediction app provided substantial support in basic spelling ability to enhance the meaning-making process of emergent bilingual students. Following, four studies highlighted text messaging apps, namely, the studies by [53] on instant messaging, [54] and [32] on texting apps, plus [33] on SMS and Mxit, respectively. [53] identified that the literacy scores corresponded significantly with the frequency of texting, textism and awareness of textism when texting is used for reading, writing, spelling or formal and informal writing.

Also, [54] discovered that textism in text messaging by children correlated positively with their literacy skill development, particularly spelling. Moreover, from the teachers' point of view, they felt that the advantages of textism outweighed its disadvantages for children's literacy development [32]. Comparatively, [33] reported that despite the prevalence of informal language in SMS and Mxit communication, students were aware of and adhered to formal writing requirements.

On the other hand, there were four studies which did not specifically mention the type of apps they used [55], [56], [57]. [55] indicated that a self-paced formative assessment technique utilising tablet is more effective than a similar strategy using an interpersonal computer when teaching primary school students how to spell. [56] examined the efficacy of word structure practice through an application software in which it assisted with spelling and text reading. Through the coordinated application of decoding skills and orthographic knowledge, the students could recognise words effortlessly [56]. Similarly, [57] reviewed evidence whereby digital technology, such

as social media (also part of mobile learning) could assist poor spellers in improving their spelling.

Overall, these mobile learning platforms helped in providing quality education to achieve the fourth educational goal of SDG [29]. The majority of the studies focused on the use of spell-checker apps in supporting the teaching and learning of spelling with the least used app is the word prediction app. This is because spell-checker apps have been long-existing and becomes a popular choice in correcting spelling mistakes and errors [58], particularly when it comes to teaching and learning spelling. Also, as evidenced by [26] there are still many mobile learning platforms that have the potential for language learning yet remain unexplored.

4.2 Education levels of the respondents in the mobile learning trends in supporting the mastery of spelling

In the second research question, the education levels of the respondents in the mobile learning trends in supporting the mastery of spelling were examined. The education levels of the respondents included primary, secondary and tertiary education. Kindergarten is also part of the education level but it is not included since there were no kindergarten-related articles in this review. Ambiguously, the respondents' education levels in two articles were not specified but lay on a broad spectrum. Table 5 illustrates the education levels of the respondents in the mobile learning trends in supporting the mastery of spelling.

Table 5. Education levels of the respondents in the mobile learning trends in supporting the mastery of spelling

Education Level	Study
Primary	Wood et al. (2012); Wray (2015); Va´squez et al. (2016); Moser et al. (2017); Bakar et al. (2019); Lau & Mohamad (2020); Brown & Allmond (2021); Lau & Mohamad (2021)
Secondary	Shokri & Abdolmanafi-Rokni (2014); Rimbar (2017); Ngesi et al. (2018); McCarthy et al. (2022)
Tertiary	Po et al. (2017); Alasmari & Alamri (2019); Mudassir et al. (2020); Alsadoon (2021); Wong et al. (2022)
Not specified	Verheijen (2013); Westwood (2018)

The articles in Table 5 were categorised according to the education levels of respondents in teaching and learning to spell via mobile learning. Interestingly, eight studies highlighted the primary education level [54], [32], [55], [56], [15], [59], [41], [54] reported that primary school students improved their literacy skills, especially spelling, through text messaging. On another note, in a research on primary school teachers' perspectives on the impact of texting on children's literacy development, [32] commented that technologies such as mobile learning were not fully utilised due to the teachers' concerns on the effect of textism in the media on the learners' literacy development.

Comparatively, [55] appraised that a self-paced formative assessment technique utilising tablet is more effective than similar strategy using an interpersonal computer when teaching spelling to primary school students. Parallel to this, [56] stated that through the coordinated application of decoding ability and orthographic knowledge, primary school students could instantly identify words after word structure practice using the application software.

Believingly, the studies by [15], [59] and [4] found that the primary school students who are also known as Generation Z millennials are inclined to learn using technology particularly, mobile learning as discussed in this systematic review. Similarly, [41] discovered that the first-grade emergent bilinguals could use word prediction application as a basic spelling support to assist their language learning progression.

Following, the studies by [52], [35], [33], and [39] focused on the secondary education level. [52] revealed that in their study towards third-grade middle school students through games, the experimental group achieved higher efficacy than the control group in terms of spelling retention. On the other hand, [35] identified in their study that although spell-checker was useful in correcting on-the-spot errors of secondary school students, they have limitations in error corrections at the cognitive level. Comparatively, according to [33], the Grade 9 learners argued that they continued to follow the formal writing rules and spelling despite corruption from the texting language and spelling from SMS and Mxit. [39] opined that spell-checker contributed to a complementary benefit in improving the high school students' essay quality.

In addition, there were five studies assessing the tertiary education level [34], [36], [37], [38], [40]. The study by [34] expressed that the tertiary-level learners made an effort to search for the right words, leading to improved incidental learning of spelling. Also, [36] examined how MS Word spell-checker treated misspellings made by intermediate-level English learners at a Saudi university. [37] later discovered that a spell-checker was helpful for the tertiary level students from Quaid-e-Awam University for their tasks but ineffective in impacting their daily spelling of words. [38] evaluated the tertiary students' opinions in which the spell-checker was their preferred choice for their continuous usage on social media and smartphones. Similarly, [40] discovered mobile spell-checker for academic writing among the pre-university students produced positive results and responses.

On another note, the study by [53] and [57] did not specify the education level of respondents in the mobile learning trends in supporting the mastery of spelling. Based on the reviews of all the articles for the second research question, it could be observed that most of them emphasised the primary education level. This is because teaching and learning to spell forms the basis of language learning [4], [9] particularly, during the initial language learning stage compared to the secondary and tertiary education level of respondents.

4.3 Respondents involved in the mobile learning trends in supporting the mastery of spelling

The third research question addressed the respondents involved in the mobile learning trends in supporting the mastery of spelling. It is crucial to know who were the respondents involved in the studies, namely, the teachers, students or both the teachers and students. Table 6 exhibits a detailed data representation.

Table 6. The respondents involved in the mobile learning trends in supporting the mastery of spelling

Respondents	Study
Teachers	Wray (2015)
Students	Wood et al. (2012); Verheijen (2013); Shokri & Abdolmanafi-Rokni (2014); Va´squez et al. (2016); Po et al. (2017); Moser et al. (2017); Rimbar (2017); Ngesi et al. (2018); Bakar et al. (2019); Alasmari & Alamri (2019); Mudassir et al. (2020); Lau & Mohamad (2020); Alsadoon (2021); Brown & Allmond (2021); Lau & Mohamad (2021); Wong et al. (2022); McCarthy et al. (2022)
Teacher and students	Westwood (2018)

Based on Table 6, only one article highlighted teachers as the respondents [32] while 17 other articles involved students as the respondents [54], [53], [52], [55], [34], [56], [35], [33], [15], [36], [37], [59], [38], [41], [4], [40], [39]. In fact, only an article involved both teachers and students as the respondents in the study [57]. Throughout the third research question, it could be observed that most articles emphasised on students as the respondents.

5 Discussion

Comprehensibly, teaching and learning spelling via various mobile learning platforms are remarkably beneficial for mastering English Language, as also opined by [4]. These platforms act as a medium to transfer spelling knowledge via mobile learning as emphasized in 21st century education [3]. The findings from the studies portrayed the use of four platforms in the mobile learning trends in supporting the mastery of spelling, namely, mobile apps, spell-checker apps, word prediction apps and text messaging apps. These applications generally provide a framework for peer learning and reviews.

Furthermore, according to [31] and [60], Generation Z millennials are the digital natives of technology and will learn best in a technology-based environment. However, there are still numerous mobile learning platforms accessible to teachers and students at all education levels of language teaching and learning remain unexplored [26].

Spelling mastery is crucial as it is always associated with early literacy and better retention of other language skills starting from primary education. This explains why most of the studies in this review highlighted on the primary level of education com-

pared to the secondary and tertiary levels of education. Even so, there is still a paucity in mobile learning usage in supporting spelling mastery at various education levels, be it primary, secondary or tertiary. This becomes a concern because spelling forms the basis of language learning [4], [9].

In this systematic review, most studies focused on the students as the respondents instead of the teachers or both teachers and students, despite teachers being the front-liners [45] in transmitting spelling knowledge to their students. There should be an urgency in filling the gap on more studies related to teachers or both teachers and students in the context of mobile learning trends in supporting the mastery of spelling which could be explored in separate studies in future. These would be advantageous for both the English Language teachers and students, as highlighted by [29] in providing quality education to fulfill the fourth educational goal of SDG.

6 Conclusion

This systematic review has examined the articles on the mobile learning trends in supporting the mastery of spelling in which the lack of reviews on it has been addressed. It systematically identified related studies by adhering to Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline. Three databases were utilised, namely, Web of Science (WoS), Scopus and Educational Resources Information Centre (ERIC). 10 articles were extracted out of 124 following which literature selections through backward and forward searches were also performed with 9 additional articles thus, resulting in a total of 19 articles being reviewed in this study.

Among the shortcomings in this review were the limited studies related to the mobile learning trends in supporting the mastery of spelling. It could be further explored, especially on the various mobile learning platforms, different education levels and the respondents involved in future related studies. It also did not venture into spelling integration with other language skill studies. Admittingly, insufficient resources were available for a small range of studies involving spelling knowledge in other language skill studies. It could further examine the mobile learning trends in supporting the mastery of spelling to improve other language skills, namely, listening, speaking, reading, and writing.

On the positive note, this review contributed to systematically review 19 related studies through a step-by-step protocol of identification, screening, eligibility and included as in the PRISMA guideline in ensuring a quality review is established. The findings from this review filled the knowledge gap through numerous studies which identified the utilisation of various mobile learning platforms, different education levels and types of respondents which would benefit both English Language teachers and students in utilising various mobile learning platforms in supporting the mastery of spelling at all levels of education. It aspires to foreground more substantial studies to address the research gaps identified in the current review.

In conclusion, a genuine link between teaching and learning approaches and mobile learning is critical in attracting teachers to teach spelling and students' interest in

learning to spell [23], [30]. In other words, teaching spelling to the students who are the Generation Z millennials [31] through acknowledging a learner-centered model coalescing with the popularity of mobile learning trends is a worthwhile effort if put into the English Language teachers' pedagogical practice. The ultimate goal is to impose effective and practical strategies to advance the mobile learning trends in supporting the mastery of spelling.

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