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SYSTEMATIC REVIEW OF MOBILE-ASSISTED TASK-BASED LEARNING BASED ON WOS (2013-2022)

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ABSTRACT

Aim/Purpose	The aim of this paper is to present a systematic review of studies conducted on mobile-assisted task-based learning between 2013 to 2022. The primary objectives of the review are to elicit educational and learning contexts, research areas and foci, research trends, methodologies, data collection techniques, mobile technology used, learning outcomes, and issues in mobile-assisted task-based learning.
Background	Conventional task-based learning has evolved over the last decade with numerous researchers incorporating various mobile technologies and devices to enhance the task-based approach. This paper presents a systematic review of task-based learning, specifically with the adoption of the mobile-assisted method in delivering tasks.
Methodology	To provide viable discussions and maintain the accuracy of the review, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses protocol items were adhered to. The papers for review were sourced from ISI Web of Science within the last decade from 2013 to 2022. The outcome of screening based on the inclusive and exclusive criteria as well as from the backward search resulted in 16 papers out of 276 papers that were eventually reviewed and analyzed.
Contribution	This study is of significant value, especially during the post-pandemic period, as mobile task-based learning provides for flexibility and portability, and to date, no systematic reviews have been conducted specifically on mobile-assisted task-based learning in the last decade. This review looked at the study characteristics, educational and learning contexts, research areas and research foci, research

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	trends, methodologies, data collection techniques, mobile technology used, learning outcomes, and issues in the papers on mobile-assisted task-based learning. In addition to attributing to the existing body of knowledge, this paper provides insights for researchers, educators, as well as mobile technology developers for consideration.
Findings	Major findings are that all papers are on language learning, with English as a foreign language being the most frequently researched area, and most of the studies are conducted in higher education contexts. Informal learning has become a critical learning setting, and language proficiency and participant perceptions are the two major foci. In addition, no studies have been found to combine mobile learning and social media platforms together to promote language acquisition.
Recommendations for Practitioners	This systematic review provides practitioners with an overview of mobile technologies that have been found to be effective in the task-based approach for different educational levels and language skills. These effective mobile technologies could be considered for adoption in their respective contexts.
Recommendations for Researchers	For researchers, the time frame for a systematic review could be expanded to increase the number of papers for review. In addition, to ensure the comprehensiveness of findings, big data analysis software could be employed to analyze the research foci, research trends, and research shifts. Additional databases could be added for more extensive review.
Impact on Society	The research findings of this paper can provide benefits for researchers, educators, and mobile technology developers for them to collaboratively promote the development of mobile-assisted task-based learning.
Future Research	Future researchers could conduct in-depth empirical studies on mobile seamless learning, research with tasks that are designed based on learners' needs analysis and explore cognitive load as well as learning anxiety which are not extensively researched.

Keywords	mobile-assisted learning, mobile-assisted task-based learning, preferred reporting items for systematic reviews and meta-analyses, systematic review, task-based learning

INTRODUCTION

Conducting literature reviews has been perceived as an avenue for understanding and assessing the existing undiscovered knowledge in a certain field (Tranfield et al., 2003; Weed, 2006). Dwivedi et al. (2011), and Kim et al. (2018) noted that insights can be gained by reviewing the historical development of a certain field. According to Grant and Booth (2009), 14 types of reviews can be classified on the basis of different searching, assessing, synthesizing, and analyzing methods. It has been pointed out that limitations, such as a lack of scientific evidence and explicit research basis exist in the conventional method of literature reviews (Briner & Walshe, 2014; Noblit & Hare, 2018). Considering this, Green et al. (2008) asserted that a more comprehensive and dependable method to analyze the existing literature, which is a systematic review, ought to be employed. According to Liberati et al. (2009), and Moher et al. (2015), due to its objectivity and explicit descriptions of review steps, systematic reviews by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) minimize biases and have higher degrees of reliability and validity.

PRISMA

PRISMA, which was originally developed for the medical field by a group of 29 scholars, has been widely used in disciplines beyond the clinical medical field, including social sciences, such as psychology and education sciences to enhance transparency, and accuracy as well as reduce biases in literature reviews (Larrabee Sønderlund et al., 2019; Pahlevan-Sharif et al., 2019; Shadiev et al., 2020). Due to its adaptable nature in various fields of research, PRISMA has been endorsed by a number of editorial organizations, including the Centre for Reviews and Dissemination, Council of Science Editors, World Health Organization, and prestigious journals like The Lancet, Implementation Science, etc. (Larrabee Sønderlund et al., 2019). It is a protocol of a four-phase flow diagram (see Figure 1) to facilitate the preparation and reporting of comprehensive systematic reviews.

PRISMA was also adopted by other scholars for reviews in other fields. For instance, Pahlevan-Sharif et al. (2019) conducted a systematic review of reviews of studies in tourism and hospitality using PRISMA. They reported multiple limitations in the design, organization, and execution of systematic reviews due to a lack of clear explanation and transparency in the data collection process. Hence, they recommended the adoption or adaptation of PRISMA items to increase the reliability and validity of systematic reviews. Shadiev et al. (2020) who adopted PRISMA for an electronic search on mobile-assisted language learning in a familiar, authentic environment, provided an evidence-based protocol of PRISMA that facilitates the process of systematic reviews. Larrabee Sønderlund et al. (2019), on the other hand, carried out a systematic review using PRISMA to examine the efficacy of learning analytics interventions in higher education. In the same vein, Sarkis-Onofre et al. (2021) highlighted the merits of using PRISMA for systematic reviews and presented examples to illustrate the appropriate use of PRISMA for reporting reviews.

MOBILE-ASSISTED TASED-BASED LEARNING

New opportunities for learning have been created in the past decade due to the fast advancement of information and communication technologies (Reynolds & Anderson, 2015). Ahmad (2016) maintained that technology-assisted learning (TAL), which mainly comprises two subtypes, i.e., computer-assisted learning (CAL) and mobile-assisted learning (MAL), facilitates independent learning and authentic communication. CAL refers to "any progress in which a learner uses a computer and, as a result, improves their learning" (Beatty, 2010, p. 7). MAL is defined as utilizing portable mobile devices with wireless connections to facilitate learning (Burston, 2014). Compared with computers, mobile devices have more salient advantages, for example, they are more light, flexible with longer battery life, and commonly used touch interfaces (Gliksman, 2011).

COVID-19 inadvertently impacted the general education ecosystem and people have been reported to face isolation and in some cases depression due to the lockdown. In such circumstances, mobile and wireless technology have been employed in various fields, including computer science, engineering, education, telecommunications, automation control systems, robotics, etc., to address these issues. For instance, Udal et al. (2020) devised a mobile-based learning system to meet emergency isolation requirements. Thati et al. (2023) proposed a depression detection approach that combines mobile-sensing-based and task-based mechanisms. The findings showed that multiple modalities perform better than single data modality in distinguishing between depressed and non-depressed subjects. Ali and Payton (2021), on the other hand, explored task-based continuous authentication models by using real-world wrist-worn sensor data. To realize autonomous localization and navigation of indoor robots, Xiang et al. (2020) designed an indoor mobile robot positioning and mapping system. Mobile technology has also been used to address the challenges of language proficiency in language teaching (Chen & Chih-Cheng, 2018; Fang et al., 2021; Tragant et al., 2022).

Hence, it is obvious that MAL has been widely used to facilitate research in various fields, among which, the educational field has gained substantial attention (Miangah & Nezarat, 2012; Terras &

Ramsay, 2012). According to Ahmad (2016), MAL provides a wider educational application than conventional information due to its portability, flexibility, and availability. This study mainly focused on mobile-assisted task-based learning in the pedagogical field.

As a significant pedagogical approach, task-based learning (TBL) has gained considerable attention over the past three decades (Long, 2015). It is a process-oriented approach and has been widely used to develop learners' language skills (Aliasin et al., 2019; Ding, 2016). Although there is no unified definition of tasks, some common features have been identified, i.e., goal-oriented, meaning-focused, and communication-centered (Ellis, 2012). Due to these features, TBL is believed to be more effective than other types of learning (Long, 2016; Plews & Zhao, 2010).

Ellis (2003) highlighted that the task-based approach emphasizes classroom interactions. Other advantages of TBL include offering more chances for trying out communicative strategies and increasing input of target language (Aliasin et al., 2019; Halici Page & Mede, 2018). In addition, Samuda and Bygate (2008) maintained that TBL is a holistic approach with the overarching purpose of enhancing language development, with which Ellis (2009) concurred. Ellis (2009) noted that this approach effectively enhances students' L2 acquisition and specifically both the fluency and accuracy levels of oral production. In contrast with the conventional methods that put teachers at the center, TBL is a student-centered approach, in which teachers play the role of facilitators (Ellis, 2012; Xue, 2022).

Despite the pedagogical significance of TBL, numerous challenges, including constraints of time and space, lack of feedback, lack of authenticity, etc. (Hwang et al., 2016; Lai & Li, 2011) need to be addressed. Xue (2022) pointed out that the utmost challenge for conventional classroom teaching is a lack of authenticity due to the constraints of time and space. González-Lloret and Ortega (2014), Lai and Li (2011), and Reynolds and Anderson (2015), maintained that combing mobile technologies with TBL could help address the challenges and facilitate the implementation of pedagogic tasks. Reynolds and Anderson (2015) concurred and maintained that through mobile technology, learning can be extended beyond the conventional classroom. González-Lloret and Ortega (2014) found that the use of mobile-assisted task-based learning (M-TBL) promotes meaning-oriented and communicative-based learning, which allows learners to gain more authentic experiences as well as engaged learning. According to Mulyadi et al. (2021), and Lin et al. (2022), engagement can be improved with the assistance of mobile technologies, as learners feel less stressed and anxious in the MAL context than in a face-to-face environment. Lai and Li (2011) highlighted that the integration of technology into TBL strengthens a task-based curriculum.

In addition, Palalas (2011) pointed out that MAL enables learners to communicate synchronously and asynchronously while performing well-designed tasks. With the built-in video-recording function, M-TBL allows learners to access authentic materials in authentic contexts (Hongzhi, 2020) and facilitates collaborative as well as interactive learning (Burston, 2017). As Park and Slater (2014) asserted, combining mobile-assisted and task-based learning for enhancing language development is an important trend. Consequently, MAL is conceived as an effective means to enhance task-based learning (Lin et al., 2022).

In this review, all the selected papers which will be presented in the next sections address M-TBL. To provide an updated and comprehensive review of the latest development on M-TBL, the PRISMA checklist was used to review papers published from 2013 to 2022. The papers were reviewed according to strict inclusion and exclusion criteria, which were discussed in the next section.

The primary objectives were to elicit educational and learning contexts, research areas and foci, research trends, methodologies, data collection techniques, mobile technology used, learning outcomes, and issues in M-TBL, so as to have a comprehensive understanding of the field. Based on the research objective, the following research question is addressed:

'What are the: a) educational and learning contexts, b) research areas and research foci, c) research trends, d) methodologies, e) data collection techniques, f) mobile technology used, g) learning outcomes, and h) issues in M-TBL?'

The significance of the review is that M-TBL is still a burgeoning field that is worth exploring (Kukulska-Hulme, 2012). To date, systematic reviews have been conducted on MAL (Hsu & Liu, 2021; Kacetl & Klímová, 2019; Xue & Churchill, 2019), and on TBL (Bryfonski & McKay, 2019; Ji, 2017) independently. However, no systematic reviews have been conducted on M-TBL in the period between 2013 and 2022. This review will therefore provide a holistic picture and contribute to a greater understanding of the current state of research in the field of M-TBL by reviewing relevant papers in the last decade. The research findings will provide insights and benefits for researchers, educators, as well as mobile technology developers.

METHOD

As mentioned earlier, PRISMA, which illustrates different steps of the study selection (see Figure 1), is adopted for the systematic review. The flow diagram was adopted to summarize the selection process, and the search was performed individually.

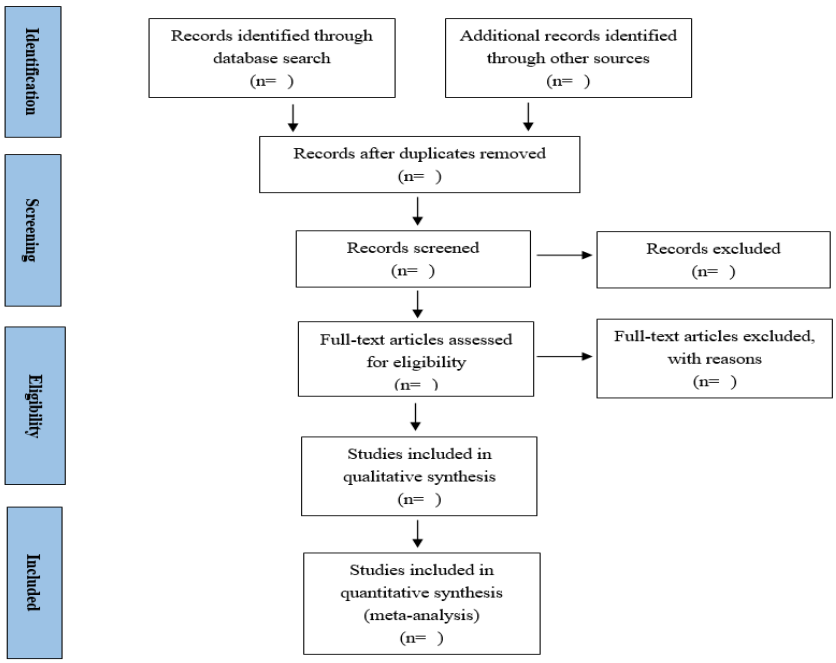

Figure 1: Flow of information through the different phases of a systematic review

Note. From "The PRISMA Statement for Reporting Systematic Reviews and Meta-analyses of Studies that Evaluate Health Care Interventions: Explanation and Elaboration", by Liberati et al., 2009, *Journal of Clinical Epidemiology*, *62*(10), p.e5. Copyright 2009 by The Authors. (Use with permission)

The ISI Web of Science (WoS) database was used as the search engine for an extensive literature search to identify the focal data, as it is deemed to be one of the most commonly cited and most reliable databases for scholars in social science research (Bergman, 2012; Xue & Churchill, 2019). Since it includes the Social Science Citation Index, the Science Citation Index, and the Arts & Humanities Citation Index papers, WoS has high-quality mobile and task-based papers with high impact factors (Hsu & Liu, 2021; Liu et al., 2016). In addition, results in this database are reproducible. As such, multiple scholars (Fu & Hwang, 2018; Hsu & Liu, 2021; Liu et al., 2016; Shadiev et al., 2020) have used WoS independently as the database to conduct their systematic reviews.

The search terms utilized to locate relevant work in the listed sources included "mobile", "mobile learning", "m-learning", "MALL", "mobile-assisted/mobile assisted", "mobile-supported/ mobile supported", "mobile-aided/mobile aided", "task-based", and "TBLT" in various combinations, which were combined or excluded with Boolean Operator "AND" and "OR" that explores "TS", i.e., "title", "abstract", "author keywords", and "keywords plus" in every published document in WoS. The search strategy is as follows:

TS=((("mobile" AND "TBLT") OR ("mobile" AND "task-based") OR ("mobile learning" AND "TBLT") OR ("mobile learning" AND "task-based") OR ("m-learning" AND "TBLT") OR ("m-learning" AND "task-based") OR ("MALL" AND "TBLT") OR ("MALL" AND "task-based") OR ("mobile-assisted" AND "TBLT") OR ("mobile-assisted" AND "task-based") OR ("mobile assisted" AND "TBLT") OR ("mobile assisted" AND "task-based") OR ("mobile-supported" AND "TBLT") OR ("mobile-supported" AND "task-based") OR ("mobile supported" AND "TBLT") OR ("mobile supported" AND "task-based") OR ("mobile-aided" AND "TBLT") OR ("mobile-aided" AND "task-based") OR ("mobile aided" AND "TBLT") OR ("mobile aided" AND "task-based")))

PRISMA suggested reporting two types of eligibility criteria, which include two characteristics, i.e., study characteristics and report characteristics (Pahlevan-Sharif et al., 2019). Inclusion or exclusion criteria (a) and (b) represent report characteristics, and criteria (c), (d), and (e) represent study characteristics. Table 1 presents the eligibility criteria, i.e., the inclusion and exclusion criteria.

Table 1: Eligibility criteria

	Inclusion Criteria	Exclusion criteria
Report Characteristics	a. Must be published in a peer-reviewed journal	a. Conference proceedings, research notes, editors' comments, book chapters, and reviews were excluded
	b. Must be written in the English language	b. Papers are written in other languages
Study Characteristics	c. Must be in the educational context	c. Papers beyond the educational context
	d. Must be full-length papers, that include empirical findings with actual data	d. Papers presenting personal opinions and theoretical argumentations without actual data
	e. Must include both mobile learning and task-based elements	e. Papers focusing on only MAL or only TBL

First, the included papers must be in the educational context for educational purposes. All other publications beyond the educational context were excluded. As of June 17, 2022, a total of 276 papers were found in the database during the initial literature search. Next, the time scope was limited, and all the papers published from 2013 up to June 2022 were searched systematically. According to Hwang and Tsai (2011), conducting a 10-year literature review is an effective way to investigate the trends in educational technology. The limitation of time scope resulted in a total of 195 papers.

Next, as seen in Table 1, one of the study characteristics of the papers is that they must be in the educational context. The 195 papers were exported to a Microsoft Excel spreadsheet to examine the titles, keywords, and abstracts to eliminate papers that were irrelevant, i.e., conducted beyond an educational context. For instance, although keywords such as "mobile" or "task" are presented in the ti-

tles or abstracts of some papers, the topics are on medication, transportation, psychology, architecture, robots, web design, and system development, among others. This resulted in the elimination of 158 irrelevant papers. The full texts of the remaining 37 relevant papers were retrieved and continued to be carefully reviewed against the eligibility criteria.

The included papers must be published in a peer-reviewed journal (Fu & Hwang, 2018; Lin & Lan, 2015), other forms of publications, such as conference proceedings, research notes, editors' comments, book chapters, and reviews were excluded. Of the 37 papers, 16 were conference proceedings, three were reviews (two on mobile learning, one on second language acquisition), and only 18 were peer-reviewed papers. Since the papers should be written in English, papers that are written in other languages are excluded. Of the 18 peer-reviewed papers, 17 were written in English, and one was written in Spanish, which is therefore excluded.

In addition, the papers under review should be full-length that include details on methodology, comprehensive discussions, and empirical findings with actual data. Of the remaining 17 papers, an additional three papers that did not meet this criterion were also excluded. With the inclusion criteria that papers must include both the components of mobile-assisted and task-based learning, two out of the 14 remaining papers were excluded as they were on neither one of the components. Eventually, after the screening based on the eligibility criteria, 12 peer-reviewed papers were first identified for data analysis.

As PRISMA recommends, a comprehensive review should include different information sources such as electronic databases, reference lists, etc. (Pahlevan-Sharif et al., 2019). In the second stage, a backward search was also conducted, i.e., the reference sections of the 12 papers were carefully examined to find any relevant studies that may have been missed. Taking into consideration that the papers in the references must be published between 2013 and 2022, as well as meet all the inclusion criteria. Four additional papers were identified for the final review. Consequently, a total of 16 papers were reviewed and analyzed for this study. The flow chart of the selection process of the systematic review is presented in Figure 2.

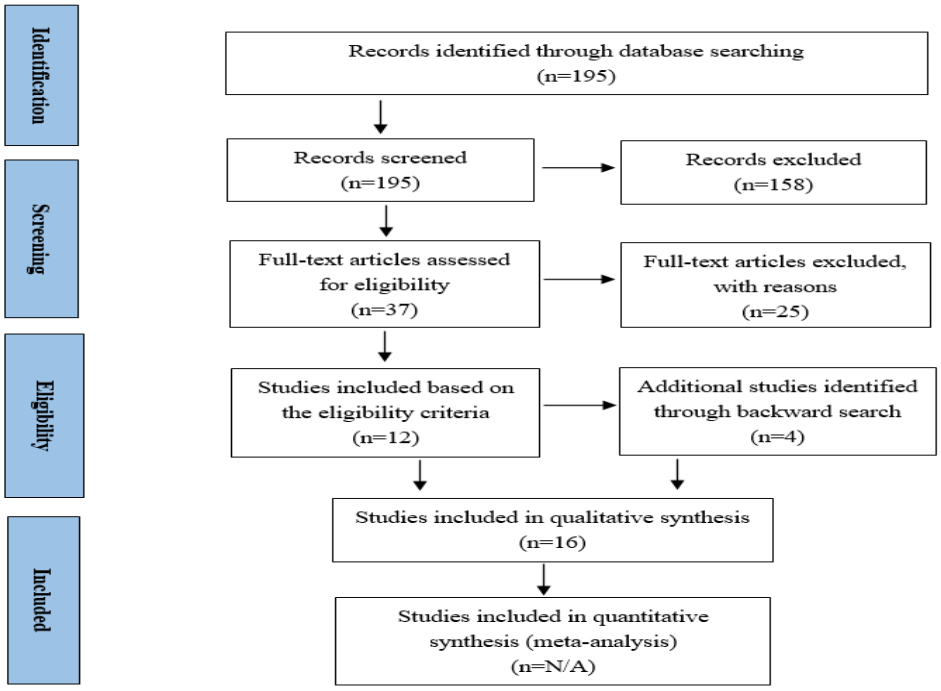

Figure 2: Flow Chart of the Selection Process

Based on "The PRISMA Statement for Reporting Systematic Reviews and Meta-analyses of Studies that Evaluate Health Care Interventions: Explanation and Elaboration", by Liberati et al., 2009, *Journal of Clinical Epidemiology*, *62*(10), p.e5.

In the third phase, the 16 papers were thoroughly perused to extract and code the data for content analysis. The excel spreadsheet was revised for data management. To be more specific, the bibliographic details of the 16 papers were carefully extracted and recorded, including educational and learning contexts, research areas and foci, research trends, methodologies, data collection techniques, mobile technology used, learning outcomes, and issues in M-TBL for comprehensive analysis.

RESULTS

As mentioned earlier, the inclusive and exclusive criteria resulted in eventually 16 out of 195 papers being eligible for the systematic review in this paper. A qualitative analysis was conducted based on the research question, and the results are presented and organized into nine main aspects: (1) study characteristics; (2) educational and learning contexts; (3) research areas and research foci; (4) research trends; (5) methodologies; (6) data collection techniques; (7) mobile technology used; (8) learning outcomes, and (9) issues in M-TBL.

STUDY CHARACTERISTICS

Of the 16 papers, 7 (43.7%) were published in the first five years (2013-2017), and 9 (56.3%) were published from 2018-2022. As the data was searched on June 17, 2022, only papers published before June 17 were identified for 2022. After reading, re-reading, and analyzing the papers thoroughly, the central aspects explored in the selected papers are summarized and attached in the Appendix.

From a geographical perspective, all 16 (93.8%) but one paper state the country in which the studies were conducted. de la Fuente (2014) did not specify the country. Three studies were conducted in Australia (n=3) and Taiwan (n=3), two studies each were in America, Canada, and South Korea, and one each in Italy, Russia, and Spain. All papers are on language learning, and 11 (68.8%) are conducted in higher education settings. In addition, different learning contexts were identified, with informal learning being a pertinent setting for students to develop their learning skills. For more details, please refer to the Appendix.

EDUCATIONAL AND LEARNING CONTEXTS

The distribution of learners' educational levels shows a tendency toward higher education. This result is consistent with Hwang and Fu's (2019) findings. They noted that the percentage of ownership of mobile devices by university students is high, which could be the main reason why higher education makes up the greatest number of papers in studies concerning M-TBL (see Table 2). Limited research is conducted among participants with other educational backgrounds. Specifically, 2 (12.5%) papers are on secondary or middle school students (Kang & Kim, 2021; Morgana & Shrestha, 2018), and another 2 (12.5%) in other institutions, i.e., the institute of culture and workplace language support (Gasparini, 2018; McLellan et al., 2021), and 1 (6.3%) paper on elementary school students (Pellerin, 2014).

Table 2: Educational and learning contexts by authors

Contexts	Subcategories	Paper
Educational Contexts	Higher Education	An (2013); Chen and Chih-Cheng (2018); de la Fuente (2014); Fang et al. (2021); Jiang and Li (2018); Lan and Lin (2016); Lim and Lee (2015); Lys (2013); Park and Slater (2014); Tong et al. (2020); Tragant et al. (2022).
	Secondary or Middle School	Kang and Kim (2021); Morgana and Shrestha (2018).
	Elementary School	Pellerin (2014).
	Other Institutions	Gasparini (2018); McLellan et al. (2021).
Learning Contexts	Both Formal and Informal	Chen and Chih-Cheng (2018); Gasparini (2018); Kang and Kim (2021); Lys (2013); Morgana and Shrestha (2018); Tong et al. (2020); Tragant et al. (2022).
	Formal	de la Fuente (2014); Fang et al. (2021); Lan and Lin (2016); Pellerin (2014).
	Informal	An (2013); Jiang and Li (2018); McLellan et al. (2021).
	Not specify	Lim and Lee (2015); Park and Slater (2014).

In terms of learning contexts, as presented in Table 2, around 50% of the studies were conducted in both formal and informal contexts. Three studies (An, 2013; Jiang & Li, 2018; McLellan et al., 2021) were conducted in only informal contexts, and four studies (de la Fuente, 2014; Fang et al., 2021; Lan & Lin, 2016; Pellerin, 2014) were conducted in formal contexts. Two studies (Lim & Lee, 2015; Park & Slater, 2014) did not specify the learning contexts: one paper (Park & Slater, 2014) discussed the needs analysis for task types in mobile learning, and the other (Lim & Lee, 2015) examined the effects of tasks on learners' interactions.

Based on the analysis, it is evident that in the development of TBL with the support of mobile devices, learning beyond the classroom setting has become a critical scenario, which motivates students to be more self-regulated and more responsible for their learning (García Botero et al., 2019).

Research Areas and Research Foci

As for the research area, all 16 papers are on language learning. English as a foreign language (EFL) (n=6) is the most frequently explored research area, followed by Chinese as a foreign language (CFL) (n=4). Other foreign languages examined included German, Spanish, French, and Italian in each paper once. Two papers reported mixed language learning, but both papers included English as a target language. One possible reason why EFL appears to be the focus is that English is a ubiquitous language in the international community, and an increasing number of learners are studying it as a compulsory course (Yu, 2017).

Mobile technologies have been found to be applied to learning different languages in task-based settings, as it makes creating the real world (Bava Harji et al., 2014), and authentic learning environments possible as well as makes learning more flexible at anytime, anywhere (Lee & Park, 2019),

which could facilitate repeated and regular task practice in the target language. Table 3 presents the research area and the related papers.

Table 3: Research area by languages and authors

Research Area	Languages	Paper
Language learning	EFL	Chen and Chih-Cheng (2018); Fang et al. (2021); Lim and Lee (2015); Morgana and Shrestha (2018); Park and Slater (2014); Tragant et al. (2022).
	CFL	An (2013); Jiang and Li (2018); Lan and Lin (2016); Tong et al. (2020)
	German	Lys (2013)
	Spanish	de la Fuente (2014)
	French	Pellerin (2014)
	Italian	Gasparini (2018)
	Dual language (English and French)	McLellan et al. (2021)
	Dual language (English and Korean)	Kang and Kim (2021)

Six research foci were found. The most common research focus was on *language proficiency* (*n*=5) and *perceptions* (*n*=5), followed by *learning differences* (*n*=3),-*evaluation* (*n*=3), *need analysis* (*n*=2), and *learning behavior* (*n*=1) (see Table 3).

Papers aimed at developing *language proficiency* examined language use in multiple skills, such as grammar, vocabulary, speaking, and writing, or specific skills, such as speaking, listening, and writing. It ought to be pointed out that most of these papers on language proficiency investigated the effects of M-TBL on speaking skills. One possible reason is that MAL facilitates instant feedback (Fang et al., 2021) as well as synchronous and asynchronous communication (Wang et al., 2016) when students perform language tasks.

The five papers (An, 2013; Chen & Chih-Cheng, 2018; Jiang & Li, 2018; Morgana & Shrestha, 2018; Tong et al., 2020) that focused on *perceptions* explored the students' and teachers' perceptions of integrating mobile technologies into task-based language learning. The students' perceptions of mobile-assisted tasks (MAT) included effectiveness and performance of tasks, as well as levels of challenges and motivation when carrying out tasks. The rationale for examining perceptions appears to be for highlighting that both teachers and students generally held positive perceptions of MAT, and the integration of mobile technologies into TBL.

Papers on *learning differences* are found to be divided into two sub-categories: learning effects and learning preferences. Lim and Lee (2015) examined the effects of different task modalities (face-to-face conversation vs. mobile chatting) and task types (convergent tasks vs. divergent tasks) on EFL learners' interactions. Lan and Lin (2016) explored different effects of learning settings (conventional classroom learning vs. mobile seamless learning) on learners' communications, interactions, and oral strategies. Pellerin (2014) on the other hand analyzed learners' preferences for different pedagogical approaches (instructional approach vs. task-based learner-centered approach).

The other research foci are *evaluation*, including evaluation of a task typology (Park & Slater, 2014), learning module (McLellan et al., 2021), and influencing factors on the quality of tasks (Kang & Kim, 2021), *need analysis,* and *learning behavior*. Need analysis included task-based need analysis (Park &

Slater, 2014), as well as linguistic and technology need analysis (McLellan et al., 2021). *Learning behavior* (student engagement, participation, spontaneous communication, and interaction) (Tragant et al., 2022) was explored to examine its connection with language proficiency. Table 4 outlines the research focus and the subcategories of the papers.

Table 4: Research focus and subcategories by authors

Research Focus	Subcategory	Paper
Perceptions	Integrating mobile technology into TBL	Chen and Chih-Cheng (2018); Morgana and Shrestha (2018); Tong et al. (2020)
	MAT	An (2013); Jiang and Li (2018)
Language proficiency	Multiple aspects (grammar, vocabulary, speaking and writing)	An (2013); Fang et al. (2021);
	Specific aspect (speaking, writing, listening)	de la Fuente (2014); Gasparini (2018); Lys (2013)
Learning differences	Learning effects	Lan and Lin (2016); Lim and Lee (2015)
	Learning preferences	Pellerin (2014)
Evaluation	Task typology Online module Influencing factors on the quality of tasks	Park and Slater (2014) McLellan et al. (2021) Kang and Kim (2021)
Need analysis	Task-based need analysis Linguistics technology need analysis	Park and Slater (2014) McLellan et al. (2021)
Learning behavior	Student engagement, participation, spontaneous communication, and interaction	Tragant et al. (2022)

RESEARCH TRENDS

There appears to be an increasing trend in researching M-TBL over the last decade. 9 (56%) out of 16 papers were published in the last five years (2018-2022). This could be due to the rapid growth of the use of smartphones, and the features of flexibility, portability, and connectivity (Lee & Park, 2019) for mobile learning, which has increased the popularity among learners to enhance their learning experiences (Chen, 2013).

The research trend shifted from research on language proficiency and learning differences in the first five years between 2013 to 2017 to a more diverse focus between 2018 and 2022, i.e., exploring students' and teachers' perceptions of tasks and MAL, overall and specific language proficiency, learner behavior, and evaluation of online module, and influencing factors on task quality. Now it appears to be more inclined towards research on cognition, such as cognitive perceptions of teachers and students.

METHODOLOGIES

The results of the methodologies adopted include participants, duration of the study, teaching and learning approaches, and research methods, which are elaborated below.

Participants

The most common research subject group is university students (*n*=11), followed by middle school students (*n*=2), participants from other institutions (*n*=2), and elementary students (*n*=1). No study has involved preschool learners. This could be due to the net generations (Meng & Chen, 2021) of university students, who, unlike younger groups, possess mobile devices and are more adept at using mobile technologies for learning.

With regards to sample size, except for one paper (Tong et al., 2020) that did not specify the sample size, the sample size in the remaining 15 papers ranged from below 20 (*n*=6), 20 to 50 (*n*=7), to more than 50 (*n*=2). It ought to be pointed out that four papers (McLellan et al., 2021; Morgana & Shrestha, 2018; Park & Slater, 2014; Tong et al., 2020) included both teacher and student participants, and 11 papers included only student participants, compared to one paper (Pellerin, 2014) that involved only teacher participants. With a relative sample size, the limitation of the studies is apparent, and therefore the findings cannot be generalized. In addition, compared to teachers, students are the more frequently explored subject group. Table 5 presents the source background information of the participants in 16 papers.

Table 5: Participants

Participants		Number
Educational levels	University students	11
	Middle school students	2
	Participants of other institutions	2
	Elementary students	1
Sample Size	Below 20	6
	20 to 50	7
	Above 50	2
	Not specify	1
Teacher/Student Participant	Only student participants	11
	Only teacher participants	1
	Both teacher and student participants	4

Duration of study

Seven papers did not report the duration of study. Of the remaining nine papers, five papers had reported a duration of more than four weeks, and of the five, two reported on studies conducted over one semester. Hwang and Fu (2019) maintained that a longer period of time keeps to the inherent natural law of language acquisition.

Teaching and learning approach

Learning activities were designed using the learner-centered approach in 15 papers. Although students were assigned learning tasks, they had more flexibility to create their own learning content. Only one paper employed a teacher-centered approach. It is believed that the teacher-centered approach is more appropriate for elementary students, as they could have limited language abilities, and students of higher levels of education, such as high school or university, should be given more flexibility in language learning (Shadiev et al., 2017). In such cases, the teachers' role is mainly to instruct,

guide, and provide scaffolding when necessary. The student-centered approach is also conducive to knowledge acquisition, and with the assistance of mobile technologies, students are able to learn in an authentic environment, which could provide interesting and diversified content (Bava Harji & Gheitanchian, 2017; Shadiev et al., 2017).

Research methods

In terms of research methods, both the quantitative (*n*=2) and qualitative (*n*=5) research methods were adopted, however, an increasing number of researchers appear to employ the mixed methods approach (*n*=9). This implies that the number of papers on mixed methods is on the rise, as the researcher would be able to triangulate the data sources, and provide a more lucid picture of participants' experiences in M-TBL.

In addition, of the 16 papers, 11 have specified the research design. Five papers (de la Fuente, 2014; Fang et al., 2021; Lan & Lin, 2016; Lim & Lee, 2015; Lys, 2013) reported on the adoption of experimental comparison-based research, with pre-and post-test scores to compare the learning outcomes. Other research designs included exploratory design (*n*=2) (Chen & Chih-Cheng, 2018; Park & Slater, 2014), action research (*n*=2) (Morgana & Shrestha, 2018; Pellerin, 2014), case study (*n*=1) (Gasparini, 2018), and longitudinal study (*n*=1) (Tragant et al., 2022). It is apparent that only a small number of studies adopted pretest-posttest experimental design with control groups. This suggests that although studies on M-TBL are emerging, it lacks empirical evidence.

Data Collection Techniques

The scholars appear to collect data by administering questionnaires (*n*=8), pretest and posttest (*n*=5), interviews (*n*=7), observation (*n*=4), and other instruments (*n*=10), including written drafts, field notes, reflective journals, meeting minutes, recordings, language textbooks, and language resources (see Table 6).

Table 6: Data collection techniques by authors

Data Collection Techniques	Papers	Number
Questionnaires	An (2013); Chen and Chih-Cheng (2018); Fang et al. (2021); Gasparini (2018); Jiang and Li (2018); Kang and Kim (2021); Morgana and Shrestha (2018); Park and Slater (2014).	8
Pretest-posttest	de la Fuente (2014); Fang et al. (2021); Lan and Lin (2016); Lim and Lee (2015); Lys (2013).	5
Interviews	An (2013); Gasparini (2018); Jiang and Li (2018); McLellan et al. (2021); Morgana and Shrestha (2018); Park and Slater (2014); Pellerin (2014).	7
Observation	McLellan et al. (2021); Morgana and Shrestha (2018); Pellerin (2014); Tong et al. (2020).	4
Other instruments (Written drafts, field notes, reflective journals, meeting minutes, recordings, language textbooks, and language resources)	An (2013); Fang et al. (2021); Kang and Kim (2021); Lan and Lin (2016); Lim and Lee (2015); Lys (2013); McLellan et al. (2021); Morgana and Shrestha (2018); Pellerin (2014); Tong et al. (2020).	10

Questionnaires were used to gather data on students' oral communication strategies (Fang et al., 2021), integration of mobile technology in a language course (An, 2013) and task designs (Gasparini, 2018), learners' perceptions of MAT (Jiang & Li, 2018), participant perceptions of using mobile technologies for language learning (Chen & Chih-Cheng, 2018; Morgana & Shrestha, 2018), and perceptions of task needs and mobile device use (Park & Slater, 2014). In addition, Kang and Kim (2021) had also used questionnaires to examine students' digital literacy, motivation, and language proficiency. As Hsu (2017) maintained pretest and posttest can be employed to illustrate the effectiveness of the intervention. As such, pretest and posttest were administered to measure and compare learners' overall language proficiencies by Fang et al. (2021), the effects of task modality and types by Lim and Lee (2015), and oral communications strategies by Lan and Lin (2016).

Interviews were used to triangulate the quantitative data in An's (2013), and Jiang and Li's (2018) studies. Morgana and Shrestha (2018), McLellan et al. (2021), and Pellerin (2014) had explored the use of mobile technology for language learning, assess task modules, and examine the shift of pedagogical approaches. Both Park and Slater (2014) and Gasparini (2018) had conducted interviews to investigate learners' needs analysis. In addition to interviews, observations were also carried out for data triangulation by McLellan et al. (2021), Morgana and Shrestha (2018), Pellerin (2014), Tong et al. (2020). Other instruments in various forms, such as written drafts, recordings etc. were used in the papers to collect qualitative data (see Table 6).

Mobile Technology Used

The types of mobile technologies used in the reviewed papers are primarily presented in two categories, i.e., mobile devices and mobile platforms. While iPads or iPods (n=4), and smartphones (n=3) are the most widely used mobile devices, one paper (Park & Slater, 2014) did not specify the type of mobile device that was adopted. The two kinds of platforms used are mobile learning platforms and social media platforms (see Table 7).

Table 7: Mobile technologies used

Mobile Technologies Used			
Mobile Devices	iPads/iPods	de la Fuente (2014); Lys (2013); Morgana and Shrestha (2018); Pellerin (2014).	
	Smartphones	Chen and Chih-Cheng (2018); Fang et al. (2021); Kang and Kim (2021).	
Mobile Platforms	Mobile learning platforms	ChinesePod	An (2013)
		MOSE	Lan and Lin (2016)
		KineMaster	Kang and Kim (2021)
		Moodle	McLellan et al. (2021)
	Social media platforms	Kakao Talk	Lim and Lee (2015)
		WeChat	Jiang and Li (2018); Tong et al. (2020)
		WhatsApp	Gasparini (2018); Tragant et al. (2022)

As seen in Table 7, platforms used included the ChinesePod, an in-depth portable designed for the learning of Chinese Mandarin, KineMaster, a mobile video editor application, and Moodle, a learning platform or course management system. The social media platforms, on the other hand, mainly consist of WeChat, WhatsApp, and Kakao Talk, which have various functions, including video chat, community building, material sharing, etc., and are widely used in instant messaging applications among students. WeChat is mainly used in China, and Kakao Talk is one of the most widely used mobile social software in Korea (Lim & Lee, 2015). Lan and Lin (2016) used a mobile seamless learning platform known as MOSE, which the authors developed to test its effects on CFL learning.

In general, mobile technologies were reported to be useful for both formal and informal learning, facilitating overall language proficiency, student-centered collaborative learning, and autonomous learning.

However, although studies have been found to explore the use of social media platforms, or mobile learning platforms to enhance language learning, essentially no study has integrated the two types of platforms in combination to explore their effects on language acquisition.

Learning Outcomes

Learning outcomes were illustrated through *language proficiency*, *affective factors*, and *technology or approach evaluation*.

With regards to outcomes in terms of *language proficiency*, all the studies showed positive results, which indicates the potential of M-TBL in enhancing language acquisition and language performance in speaking, listening, writing, and vocabulary. However, mixed results are reported on grammar. According to Fang et al. (2021), the mobile-supported task-based approach had facilitating effects in promoting vocabulary learning, conversation comprehension, and the use of fluency and accuracy-oriented strategies for speaking, but not evidently in grammar learning. On the contrary, An (2013) reported favorable learning outcomes of MAT on grammar and vocabulary use. Enhanced integrated language skills, such as vocabulary and writing skills were also reported by Chen and Chih-Cheng (2018). Lys (2013), and Morgana and Shrestha (2018) stressed the enhancing functions of M-TBL on speaking and listening skills.

General perceptions or attitudes, and psychological states (including interest, engagement, enjoyment, satisfaction, confidence, and independence) were reported as the two learning outcomes that affected affective factors. In terms of perceptions or attitudes, while Jiang and Li (2018), McLellan et al. (2021), and Chen and Chih-Cheng (2018) reported positive attitudes among learners towards task design and task implementation, An (2013) found that learners held mixed perceptions on the same tasks. Teachers perceived improvements in student work, especially in the case of collaborative tasks (Morgana & Shrestha, 2018). On the other hand, in terms of psychological states, students' enjoyment and satisfaction were found after they had completed the tasks with native speakers through WeChat, which also boosted their confidence (Jiang & Li, 2018). In addition, students were more engaged and independent with assignments in their schoolwork with the assistance of mobile devices (Morgana & Shrestha, 2018), and it is perceived to be more interesting to employ instant messaging for whole-class communication (Tragant et al., 2022). One study conducted by Pellerin (2014) examined metacognition and conscious awareness.

With respect to *technology or approach evaluation*, comparisons between a control group and an experimental group were made. As for *technology evaluation*, thematic data analysis by Tong et al. (2020) on WeChat-supported tasks revealed two overarching themes, i.e., holistic of the implementation model and dynamic of teachers' active motivation. Park and Slater (2014) reported that teachers seemed to be less familiar with mobile devices than their students in the context of language education. According to Gasparini (2018), the majority of the students in their study felt comfortable and thought using WhatsApp for language learning is beneficial. In terms of the *evaluation of approach*, interaction is a

commonly examined variable in Lim and Lee's (2015), Lys's (2013), and Tragant et al.'s (2022) papers. They assumed that the mobile-supported task-based learning approach enhanced interactions.

Comparisons of different groups were also made by de la Fuente (2014), Lim and Lee (2015), and Lan and Lin (2016). de la Fuente (2014) argued that mobile-assisted language learning group is a superior medium to promote noticing and comprehension when compared with the instructor-manipulated language learning group. Lan and Lin (2016) observed that learners in the mobile seamless group made significantly fewer mistakes when performing language tasks than learners in the conventional context group. In addition, the mobile learning group depended less on their first language for communication and had more peer cooperation. Surprisingly, Lim and Lee (2015) found that though learners in the mobile chatting group performed tasks more easily, they continued to prefer the face-to-face mode. Detailed information on the learning outcomes is presented in the table in the Appendix.

Issues in Mobile-assisted Task-based Learning

Several issues were identified in the reviewed papers. Firstly, small sample size (n=11) was the most frequently reported issue. The use of small samples, which would restrict the generalizability of the findings to a larger population, is acknowledged by scholars. Secondly, short-term investigation (n=5) was the next most frequently reported issue. Studies on a short-term basis may limit the findings and the results may differ from long-term treatments (Chen, 2013). The control group was absent in two papers (Lim & Lee, 2015; Lys, 2013), and therefore the certainty of the effectiveness of the treatment is compromised as there is no comparison. Next, specific contextualization, i.e., limit to private schools or to a certain type of mobile technology, was pointed out in two papers (An, 2013; Morgana & Shrestha, 2018) as an issue that can limit the generalization of the findings. Tong et al. (2020) reported that reliance on teachers' perspectives is a major issue, as subjective reflections limited the generalizability of findings. In addition, lacking in-depth investigations constitute another issue. For instance, Lan and Lin (2016) maintained that more thorough investigations should be carried out on adopting mobile seamless learning for the process of second language acquisition, and Lim and Lee (2015) proposed having more comprehensive investigations on modified tasks and topics.

Limitations

The 16 reviewed papers were selected by following stringent eligibility criteria and processes. Although the review offered relevant insights and formed a suitable basis for analysis, it is not without limitations. Three limitations are acknowledged for this review. First, the reviewed papers were searched from the WoS database, and papers from other databases such as Scopus, Google Scholar, ProQuest, etc. that may be relevant to the review scope are excluded. Second, only peer-reviewed journal papers were included, and other forms, such as book chapters, proceeding papers, dissertations, and government reports were excluded. Thus, we cannot claim that these publications represent a totally comprehensive selection. Another limitation is that the scope of the review which was limited to only the pedagogical field employed specific search terms and a 10-year time frame. Explicit keywords incorporating both mobile-assisted and task-based learning were searched. This may potentially exclude papers that contain the key elements but are not explicitly labeled as such. In addition, the review only encompassed papers in the past ten years, which may limit the number of papers for review.

Conclusions and Discussions

This paper presents a systematic exploration of M-TBL. Guided by the research question, major aspects, including educational and learning contexts, research areas and foci, research trends, methodologies, data collection techniques, mobile technology used, learning outcomes, and issues in M-TBL, were examined based on the 16 papers published between 2013 and 2022 and from WoS. This paper

is significant as it provides an overview of the scholarly work over the last decade on M-TBL which continues to be a burgeoning field that is worth exploring (Mulyadi et al., 2021).

With the lockdowns and quarantine rules imposed due to COVID-19, schools resorted to virtual classrooms and unprepared teachers noticeably faced challenges in delivering lessons in the virtual world. The M-TBL is an approach using mobile devices that can be reckoned on as a means and tool to effectively engage students virtually in a meaningful and supportive peer learning environment, thus negating the isolation phenomena.

To date, no systematic reviews have been found on M-TBL, this review adds to the existing body of knowledge and provides references for scholars interested in this field. The synthesis of the papers revealed the following results which attribute to new knowledge gained on M-TBL studies:

1. All 16 papers are on language learning, with EFL being the most frequently researched area, and the majority of the studies were conducted in Australia and Taiwan in higher education contexts.
2. Compared to teachers, students are the more frequently explored subject group, and the learner-centered approach is mainly adopted in learning activities.
3. Informal learning has become a critical learning setting, and language proficiency and participant perceptions are the two major research foci.
4. There is an obvious increase in M-TBL studies as well as in cognitive perceptions in the past decade.
5. Major data collection techniques include questionnaires, pretests and posttests, interviews, observations, and other instruments, such as written drafts, reflective journals, recordings, etc.
6. Although the mixed methods approach has been more widely adopted for the purpose of triangulation, the number of studies that employed pretest-posttest experimental designs is limited.
7. As for the use of mobile technology, iPad or iPods and smartphones are the most widely employed mobile devices. Mobile learning platforms and social media platforms are found to be the two common mobile platforms. However, as mentioned earlier, no studies have combined these two platforms to enhance language acquisition.
8. Learning outcomes reported in the 16 papers focused on language proficiency, affective factors, and technology or approach evaluation.
9. Several issues, such as small sample size, short-term investigation, and lack of a control group, have been identified when examining the effects of M-TBL.

This paper highlights the call for in-depth empirical studies on mobile seamless learning and tasks designed based on learners' needs analysis. When investigating affective perceptions and psychological states, limited attention also appears to be given to cognitive load and learning anxiety. As mentioned earlier, this paper clearly highlights that no studies in the last decade have combined mobile learning platforms and social media platforms together to enhance language acquisition. Future research could be conducted in the research gaps presented in this paper.

IMPLICATIONS FOR FUTURE RESEARCH

This review provided pertinent insights based on a thorough analysis of studies on M-TBL from 2013 to 2022. Implications are made in this section for researchers, educators, as well as mobile technology developers.

For researchers, the time frame for a systematic review could be expanded to increase the number of papers for review. To ensure the comprehensiveness of findings, big data analysis software, such as Citespace, Science of Science (Sci2) Tool, VOSViewer, etc. can be employed to analyze the research foci, research trends, and research shifts. The research field can be expanded to include fields other than pedagogy, and additional databases, such as Scopus, Google Scholar, and ScienceDirect could be added for more extensive review. For educators, this systematic review provides an overview of mobile technologies that have been found to be effective in the task-based approach for different educa-

tional levels and language skills. These effective mobile technologies could be considered for adoption in their respective contexts. With insights into the existing effective platforms and applications reported in this paper, mobile technology developers could enhance, develop and/or design improved or new effective mobile learning platforms or applications for task-based learning. In addition, in this period of post-pandemic where mobile-assisted learning is evidently fast evolving and becoming more robust, researchers, educators, and mobile technology developers should pay more attention to M-TBL as an avenue to better promote the advancement in the educational field and more broadly, in other fields of science and social science.

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APPENDIX: SUMMARY OF THE 16 PAPERS REVIEWED

Study	Research Area	Research Foci	Educational and learning context	Methodology				MTU	Data Collection Techniques	Outcomes	Issues
				PA	Setting	TU	Research Method				
Fang et al. (2021)	EFL	LP	HE + FL	EG (36), CG (30)	Taiwan	3 weeks	Mixed (experimental)	Smartphone application	pre-post test & Qt; field notes	Development in vocabulary and reading, but not in grammar.	Short term, Cx
An (2013)	CFL	LP & Pc	HE + IF	49 students	AUS	1 semester	Quali	ChinesePod	interview, draft, videos; Qt	Enhanced language use, and various student perceptions.	Small sample, Cx
Jiang and Li (2018)	CFL	Pc	HE + IF	15 students	AUS	1 semester	Mixed	WeChat	Qt & interview	Positive development in affective factors.	Small sample
Chen and Chih-Cheng (2018)	EFL	Pc	HE + FL & IF	20 learners	Taiwan	5 weeks	Mixed (exploratory design)	Smartphone	Qt & open-ended question	Positive attitudes and enhanced language skills	Small sample
Tong et al. (2020)	CFL	Pc	HE + FL & IF	3 teachers	AUS	n/a	Quali	WeChat	Journal, minutes, observation	Holistic & dynamic process.	no CG
Morgana and Shrestha (2018)	EFL	Pc	MS + FL & IF	2 teachers and 43 students	Italy	n/a	Mixed (action research)	iPad	Observation, interview; Qt	Improvement in speaking and listening with more independent learning.	Cx, short term, no CG
Park and Slater (2014)	EFL	Need analysis & evaluation	HE + n/a	23 teachers and 76 students	US	2 weeks	Mixed (exploratory sequential)	Not specific	Interview & Qt	Teachers are less familiar than students with mobile devices.	n/a
Kang and Kim (2021)	English and Korean	Evaluation	MS + FL & IF	48 students	Korea	8 days	Mixed	KineMaster	Essay writing & Qt	Promoting English writing.	n/a
de la Fuente (2014)	Spanish	LP	HE + FL	20 learners	n/a	n/a	Quanti (experimental)	iPods	Pretest task	More favorable than IMLL	Short term, small sample
McLellan et al. (2021)	English and French	Need analysis & evaluation	OI + IF	4 teachers and 4 learners	CA	n/a	Quali	Moodle	Script; observation & interview	Positive perception by participants	Small sample, short term

Study	Research Area	Research Foci	Educational and learning context	Methodology				MTU	Data Collection Techniques	Outcomes	Issues
				PA	Setting	TU	Research Method				
Gasparini (2018)	Italian	LP	OI + FL & IF	12 students	Russia	n/a	Mixed (case study)	WhatsApp	Interview & Qt	Positive and beneficial using WhatsApp for language learning.	Small sample
Tragant et al. (2022)	EFL	Learning behavior	HE + FL & IF	23 students	Spain	5 weeks	Quali (longitudinal study)	WhatsApp	Descriptive analysis	Positive affective factors, and enhance interaction.	Small sample
Lim and Lee (2015)	EFL	Learning difference	HE + n/a	16 students	Korea	n/a	Mixed	Kakao Talk	Qt; script & transcript	Enhance interaction	Small sample, new tasks
Lys (2013)	German	LP	HE + FL & IF	13 students	US	9 weeks	Quanti (experimental)	iPads	Online survey	Improve listening, speaking and interactions.	Small sample, no CG
Pellerin (2014)	French	Learning difference	EM + FL	16 teachers	CA	n/a	Quali (action research)	iPods and tablets	Observation, artifacts and interview	Promote learner autonomy, raise metacognition and self-regulation.	Small sample
Lan and Lin (2016)	CFL	Learning difference	HE + FL	34 learners	Taiwan	4 weeks	Mixed (experimental)	MOSE (self-developed)	Quanti test and recordings	Students in EG making fewer errors, using less first language, and offering more cooperation.	Short term, not in depth

Notes

n/a: the information is not available in the studies; EFL: English as a foreign language; CFL: Chinese as a foreign language; LP: language proficiency; Pc: perception; FL: formal learning; IF: informal learning; HE: higher education; EM: elementary; MS: middle school; OI: other institution; MTU: mobile technology used; PA: participant; TD: time duration; Quali: qualitative; Quanti: quantitative; EG: experimental group; CG: control group; Qt: questionnaire; Cx: contextualization; Australia: AUS; America: US; Canada: CA

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