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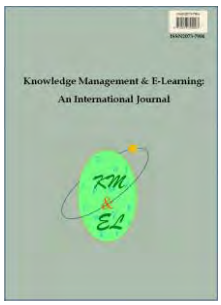

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Mobile-assisted learning of Chinese as a second/foreign language abroad: A systematic literature review of studies between 2010 and 2022

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Abstract: Although Chinese has become one of the most influential second/foreign languages in the world, teaching Chinese as a foreign/second language (CSL/CFL) abroad faces great challenges. M-learning and mobile-assisted language learning (MALL) display great advantages to facilitate second language learning, including CSL/CFL. However, most research was related to English as a second language (ESL) learning. Although mobile-assisted CSL/CFL learning has developed rapidly and steadily, most of these studies were conducted in mainland China and published in Chinese, which was very difficult for non-Chinese speakers to understand. Therefore, researchers should make more efforts to study mobile-assisted CSL/CFL learning abroad. With this in mind, a systematic literature review was conducted to determine the status and trends of this topic. Considering the inclusion and exclusion criteria, 28 articles published between 2010 and 2022 were selected from Scopus and WoS databases. Publication information, research methodology, participant characteristics, mobile technologies, and research findings were summarized and reported accordingly. This review also addressed the limitations of previous research, based on which the related researchers and practitioners could make more efforts to focus on the weaknesses of mobile-assisted CSL/CFL learning.

Keywords: m-Learning; Mobile assisted language learning; Chinese as a foreign language; Chinese as a second language; Systematic review

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Dr. Mohd Shahril Nizam Shaharom obtained his Ph.D. in Instructional Technology from the Faculty of Education, Universiti Malaya (2014) and his Master of Multimedia Education from the University of Technology Malaysia (2006). Currently, he works as a senior lecturer at the Faculty of Education in Universiti Malaya. His expertise in technology and instructional design, especially in designing (and developing) e-learning, MOOC, multimedia education/development, e-commerce, and photography/graphic design.

1. Introduction

It is an undeniable fact that Chinese (Mandarin Chinese in this review) is increasingly becoming one of the most widely used languages that people learn as a foreign/second language (Gong et al., 2018; Gong et al., 2020b). However, learning CSL/CFL abroad poses greater challenges than learning CSL/CFL in mainland China due to the lack of an authentic language environment. Since mobile technologies are able to create an authentic language environment to some extent and allow learners to interact with native speakers, they are increasingly used in formal and informal learning (Wang & Devitt, 2022), including using of mobile technologies to support CSL/CFL learning.

In the recent decade, some systematic literature reviews, meta-analyses, and bibliometric analyses have been carried out to analyse the status, trends, and challenges regarding MALL, mobile-assisted ESL, and CSL/CFL learning. These reviews indicated that mobile technologies have been widely used and were very effective to enhance language learning (Duman et al., 2015; Shadiev et al., 2017). However, most of these studies were related to ESL (Shadiev et al., 2017; Hwang & Fu, 2018; Zhou, 2020; Zain & Bowles, 2021), so mobile-assisted CSL/CFL should be paid more attention. Some of them focused only on selected SSCI-indexed journals (Duman et al., 2015; Shadiev et al., 2017), neglecting other high-quality journals. Some of them focused on all types of computer-based technologies (Macaro et al., 2012; Wang & Devitt, 2022), which were only partially related to MALL. Some of them were conducted in 2015 or before (Macaro et al., 2012; Duman et al., 2015), so the results were outdated. This systematic literature review was conducted based on these previous reviews to address the issues mentioned above.

A 5-year time span may reflect the research status, but it is not long enough to identify the research trends, a 10-year time span is a better choice (Hwang & Tsai, 2011). However, Gong et al. (2018) found that the number of articles on CSL/CFL published in international journals increased dramatically since 2010 and steadily increased thereafter, the starting year of the current review was set to 2010 instead of 2012. Therefore, to provide a more comprehensive picture and ensure the quality of research in mobile-

assisted CSL/CFL learning, the articles published in the Scopus and WoS databases between 2010 and 2022 are examined.

The following sections/subsections present the details of the systematic review process and describe the results analyzed from the 28 reviewed articles. Specifically, the publication information, research methodology, mobile technologies, participant characteristics, and research findings are reported accordingly, based on which the following research questions were proposed:

1. What are the publication information (journal, publication year, and country/region) in the field of mobile-assisted CSL/CFL from 2010 to 2022?
2. What are the research methodologies (theoretical foundations/frameworks, research design, data collection instrument, data analysis methods, treatment duration, and sample size) in the field of mobile assisted CSL/CFL from 2010 to 2022?
3. What are the characteristics of participants (education level, Chinese proficiency, and learning context) in the field of mobile-assisted CSL/CFL from 2010 to 2022?
4. What are the commonly used mobile technologies (mobile devices, operating systems, and mobile applications) in the field of mobile-assisted CSL/CFL from 2010 to 2022?
5. What are the research findings (research foci, affordances of mobile-assisted CSL/CFL, and challenges and solutions) in the field of mobile-assisted CSL/CFL from 2010 to 2022?

2. Method

To comprehensively identify the research status and trends of mobile-assisted CSL/CFL, this study chose systematic review instead of meta-analysis because the systematic review can include and synthesize both quantitative and qualitative research (Wang & Devitt, 2022). Booth et al. (2022) defined it as a type of research synthesis that aims to systematically search, evaluate, and synthesize based on research evidence and reduce bias through the use of strategies.

The PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyzes) protocol, which includes a 27-item checklist and a 4-phase flowchart, was used to improve the transparency and reliability of this systematic review due to its comprehensiveness in contrast to other common protocols. Besides, it is widely used in different disciplines and provides the opportunity to achieve greater consistency between reviews (Pahlevan Sharif et al., 2019). As recommended by Pahlevan Sharif et al. (2019), the protocol, which aimed to construct the analysis method and inclusion and exclusion criteria, was developed in advance with reference to several relevant review articles.

2.1. Search strategy

The articles in this review were searched in the Scopus and Web of Science (WoS) databases. Because the journals indexed in these two databases have satisfactory quality and the published articles have undergone rigorous peer review processes (Gong et al., 2018; Zhou, 2020). The search terms were (“mobile learning” OR “m-learning” OR “m

learning" OR "mobile* language learning" OR "MALL" OR "mobile application" OR "mobile tech") AND ("Chinese language" OR "Mandarin" OR "Chinese as a second language" OR "Chinese as a foreign language" OR "CSL" OR "CFL"). The search was conducted on January 16, 2023. The results were exported and managed in Excel worksheets.

2.2. Inclusion and exclusion criteria

The inclusion and exclusion criteria were established to narrow and guide the selection of articles. In general, research should be conducted outside mainland China, therefore those conducted in mainland China were excluded. The topics should be related to mobile-assisted CSL/CFL learning, indicating that research regarding other types of computer-based technologies that facilitate CSL/CFL learning and mobile-assisted Chinese as a first language learning was not included. Research should focus on learners' perspectives, which means research regarding teachers' perspectives were excluded. Articles should be published in English in international journals between 2010 and 2022. Therefore, articles written in another language and/or published in mainland Chinese journals and articles that were not published within this time span were not considered. In addition, only academic articles that have undergone rigorous peer review and are based on empirical data will be considered. Thus, theses, dissertations, conference reports, letters, responses, editorials, commentaries, book chapters, and book reviews, etc. were excluded. Furthermore, research should be based on empirical m-learning/MALL experiences and supported by data. Therefore, research that had no data support, such as theoretical discussions, literature reviews, and application development was not included.

2.3. Data collecting and filtering process

The screening process involved two main steps. In the first step, the titles and abstracts were used to determine the relevance of these articles. Only the titles and abstracts of articles that were clearly relevant to the topic of this review could be considered for the next step, which was full-text screening.

As shown in Fig. 1, the initial search of the Scopus database yielded 447 records. Of these, 17 records that were not from 2010-2022, 183 records that were not academic articles, and three records that were not in English were removed. Based on the inclusion and exclusion criteria, further screening processes were performed. After screening the titles and abstracts of the remaining 244 records, only 55 records remained to perform the full-text screening. A similar data screening was performed on the WoS database. There were 22 and 10 records that met the inclusion criteria in the Scopus and WoS databases respectively. However, because there were four duplicate records, 28 articles were included in this review.

2.4. Coding schemes and data extraction

The coding schemes were developed and predetermined based on previous reviews. While there were five main categories, including publication information, research methodology, respondent characteristics, mobile technologies, and research findings, only those coding schemes that were directly cited from previous reviews were provided in this review due to space limitations. Specifically, the research design included quantitative, qualitative, and mixed research design. The treatment duration included five groups, namely one or more sessions, short-term (less than 10 weeks), intermediate-term

(11 weeks to 4 months), long-term (more than 4 months), and not specified. The sample size consisted of five groups, namely small ($n < 30$), medium ($30 < n \leq 50$), medium to large ($51 < n \leq 100$), large (> 100), and not specified. The education level included five groups, namely preschool, primary/elementary school, secondary school, higher/tertiary education, and not specified. These four coding schemes were based on the review conducted by Hwang and Fu (2018). The Chinese proficiency was based on the review conducted by Wang and Devitt (2022), including beginner, intermediate, advanced, mixed, and not specified. The learning context was based on the review conducted by Hwang and Wu (2014), including indoor, outdoor, mixed (indoor and outdoor), and not specified.

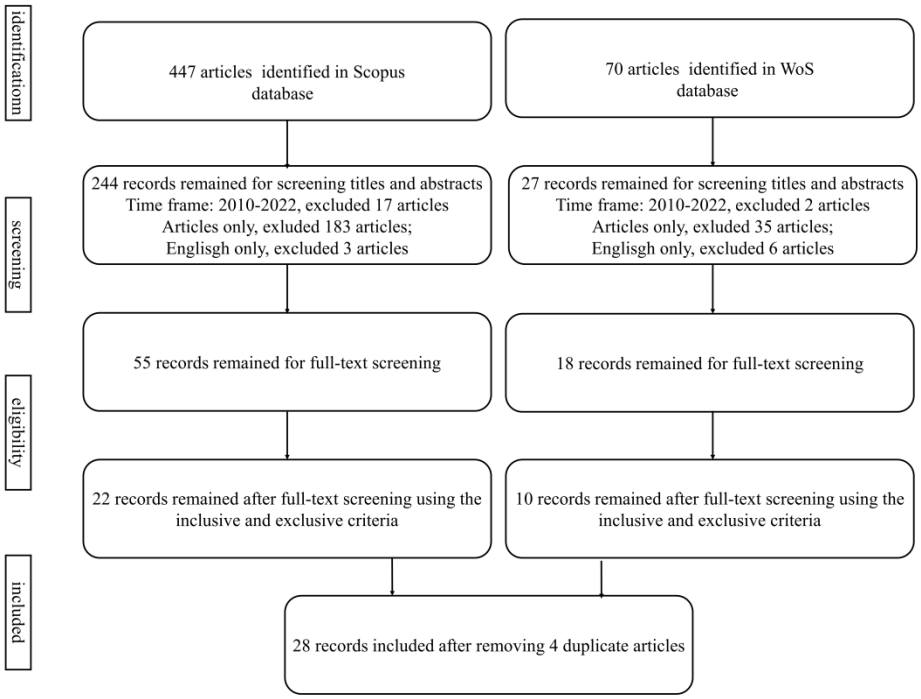

Fig. 1. Database searching procedures and results

2.5. Data analysis

Similar to Zhou (2020), two data analysis methods, i.e., thematic analysis and frequency analysis, were used to analyze the data. The first analysis method is usually used to sort large amounts of data into several general themes, which allows flexible interpretation and easy access. The second analysis method was used to determine the frequency of occurrence of each feature.

3. Research findings and discussions

The remaining 28 articles were reviewed and analyzed according to the coding schemes. The research results are displayed in the order of the corresponding research questions.

3.1. Question 1

The distribution of reviewed articles was quite dispersed. There were 22 journals involved in this review. Among them, ET&S and IJMLO published the most articles. Each of them published four articles. Each of the other 20 journals (IJAAS, KM&EL, LL, IJACSA, TPE, ILE, Future Internet, CALL, Innov. Lang. Learn. Teach, RPTEL, Univers. J. Educ. Res., JALT, iJIM, IJITEE, Comput. Educ., e-FLT, JCAL, LLT, EMI, and IEEE TLT) published only one article. Although some of these journals, such as CALL, ET&S, LLT, JCAL, ILE, and IEEE TLT, had been included in previous literature reviews (Shadiev et al., 2017; Gong et al., 2018), none of them mainly focused on mobile CSL/CFL research. Compared with the numerous research topics and results published in Chinese journals, the overseas CSL/CFL published in international journals still have much room to be worked on. It is an emerging research field (Gong et al., 2018).

Fig. 2 shows the distribution situation of the 28 articles based on the year of publication, indicating that the number of articles on mobile-assisted CSL/CFL varied from one to four between 2010 and 2022. There was no obvious increasing trend in this research field. This finding is in contrast to Gong et al. (2018), who indicated that the number of articles on CSL/CFL published in international journals increased dramatically from 2010 and steadily increased thereafter. Shadiev et al. (2017) also found that mobile-assisted CSL/CFL increased steadily from 2008 to March 2016. Gong et al. (2018) explained that because some researchers in and outside mainland China are not proficient in both English and Chinese and therefore cannot fully share their research contributions, the majority of articles in mainland China were published in Chinese. Overseas CSL/CFL was still an emerging research field. Therefore, more attention should be paid to overseas mobile-assisted CSL/CFL.

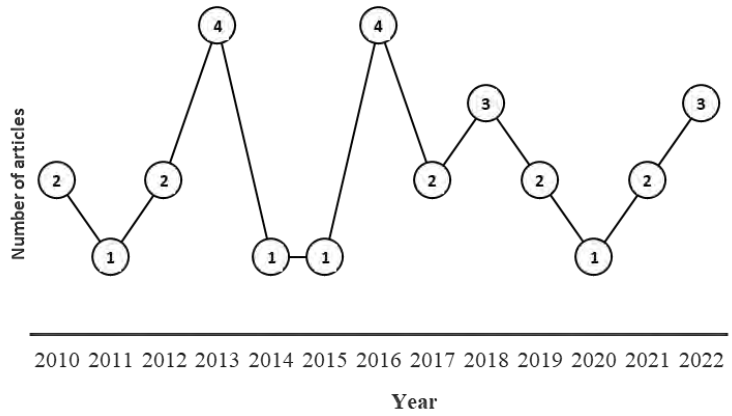

Fig. 2. Number of articles published between 2010 and 2022

The researches in this review were conducted in nine countries/regions. Singapore ranked first (n = 11), followed by Malaysia (n = 6), America (n = 3), Taiwan (China) (n = 2), Israel (n = 2), Hong Kong (China) (n = 1), UK (n = 1), Japan (n = 1), and New Zealand (n = 1). Lan and Lin (2016) explained that many foreign learners learn Mandarin in China, Taiwan (China) and Singapore because it is one of the dominant languages in these countries/regions.

This result is also consistent with the findings of Gong et al. (2018), who found that researchers from Singapore, Taiwan, and Hong Kong who have Chinese origins and

are proficient in both Chinese and English contributed the most to overseas CSL/CFL learning. Similarly, Gong et al. (2020a) pointed out that although there are some relatively positive research results published in English, most of them are from Malaysians, Singaporeans, and Taiwanese who are proficient in both Chinese and English.

Table 1
Theories and approaches applied in the reviewed articles

Theories/approaches	Application in the articles	Frequency
Language acquisition theory	Language Acquisition Theory (Wong et al., 2017), Second Language Acquisition Theory (Lan & Lin, 2016; Lin et al., 2016), Input Hypothesis (Boticki et al., 2012; Lin et al., 2016), Output Hypothesis (Lin et al., 2016; Chua & Soon, 2021), Interaction Hypothesis (Lin et al., 2016)	8
Collaborative/ cooperative learning	Boticki et al. (2012); Boticki et al. (2013); Wong et al. (2013); Wong et al. (2017); Chua and Soon (2021)	5
Seamless language learning	Wong et al. (2010); Wong and Looi (2010); Wong et al. (2012)	3
Social constructivism theories	Wong et al. (2010); Lin et al. (2016); Cohen and Ezra (2018)	3
Behaviourist	Wong and Looi (2010); Ying and Wah (2016)	2
Task-based instruction	Chua and Soon (2021); Xie and Buckingham (2021)	2
Information process theory	Boticki et al. (2012); Luo (2022)	2
Connectionism	Boticki et al. (2012); Chua and Soon (2021)	2
Cognitive load theory	Kan and Ito (2020)	1
Micro-learning	Luo (2022)	1
Ebbinghaus' forgetting curve theory	Luo (2022)	1
Communicative teaching language	Chua and Soon (2021)	1
Zone of proximal development	Chua and Soon (2021)	1
Situated cognition	Chua and Soon (2021)	1
Contextualised learning	Ezra and Cohen (2018)	1
Generative learning	Yang and Xie (2013)	1
Bloom's taxonomy	Boticki et al. (2012)	1
Not specified	Chan et al. (2011); Wong (2013); Lu et al. (2014); Wong et al. (2015); Chai et al. (2016); Chee et al. (2017); Qian et al. (2018); Abdullah et al. (2019); Lim et al. (2019); Wai et al. (2022); Zhou and Li (2022)	11

3.2. Question 2

Duman et al. (2015) stated the importance of finding solid theoretical foundations/frameworks to enhance the links between theories and practice. Therefore, the theoretical foundations/frameworks were reviewed in this review. Table 1 shows that

the most frequently used theories were language acquisition theory and branches of this theory, including second language acquisition theory, input hypothesis, output hypothesis, and interaction hypothesis, which were mentioned a total of eight times. The second most frequently used theories and approaches were collaborative/cooperative learning (n = 5), followed by seamless language learning (n = 3) and social constructivism theories (n = 3).

Behaviourist, task-based instruction, information process theory, and connectionism were mentioned twice. Besides, cognitive load theory, micro-learning, Ebbinghaus' forgetting curve theory, communicative teaching language, zone of proximal development, situated cognition, contextualized learning, generative learning, and Bloom's taxonomy were each mentioned once. It should be noticed that in 11 articles, the theoretical foundations/frameworks of the research were not indicated.

This finding could be supported by some previous reviews. For instance, Duman et al. (2015), Zain and Bowles (2021), and Wang and Devitt (2022) reviewed the theories/approaches used to support MALL, mobile-assisted ESL, and computer-mediated CSL/CFL learning respectively. They found that although there were diverse theories and approaches applied in the computer/mobile-assisted language learning contexts, some studies did not specify the theoretical foundations/frameworks. This is probably because MALL is a relatively emerging research field, the commonly accepted theories and approaches have not yet been established (Duman et al., 2015).

The research design was classified in this review based on Chua (2016), which were mainly separated into quantitative and qualitative research designs depending on the data collection methods in the articles. When both quantitative and qualitative data were collected in the articles, they were classified as mixed research designs. Although some articles did not mention the type of research design, they were categorized in this review based on Chua (2016). Even though some articles mentioned that they used quantitative research design but also collected qualitative data, they are categorized as mixed research design in this review.

In this case, mixed research design (n = 14, 43%) was the most frequently used research method, followed by qualitative (n = 9, 32%) and quantitative research design (n = 7, 25%). This result is consistent with that of Wang and Devitt (2022), who reported that of the 68 articles in their review, the most frequently used research design was in the same order as in this review. Although the order in this review was slightly different from Duman et al. (2015) and Hwang and Fu (2018), both indicated that mixed research methods are a trend. Hwang and Fu (2018) explained that this is because researchers have begun to pay more attention to exploring, describing, and explaining MALL.

Specifically, among the 28 reviewed articles, survey, case study, field study, design-based research, and action research were adopted by mixed research design to combine with other types of data collection methods. Qualitative research designs mainly included action research, design-based research, and case study, which normally used interviews, observations, and artifacts, etc. to collect data. Quantitative research designs mainly used quasi-experimental designs or used surveys and questionnaires to collect data.

Fig. 3 shows the types of data collection methods used in the 28 reviewed articles, according to which survey/questionnaire was the most commonly used data collection method (n = 17). The interview was the second most commonly used data collection method (n = 16), including focus group interviews, structured interviews, and semi-structured interviews. The third most frequently used data collection method was artifacts (n = 12), including photos, screenshots, online discussions, and journals/diaries.

The fourth most frequently used data collection method was test (n = 11), followed by audio/video recordings (n = 7), observations (n = 5), field notes (n = 4), software logs (n = 4), and reflection (n = 1). Specifically, all the mentioned types of data collection methods were used in the mixed research design articles. Qualitative research designs mainly used interviews (n = 8), artifacts (n = 4), and observations (n = 3) to collect data, while quantitative research designs mainly used questionnaires/surveys (n = 7) and tests (n = 5) to collect data.

Regarding this issue, Chang et al. (2022) listed the three most commonly used data collection methods, i.e., test, questionnaire, and observation while reviewing concept mapping technology applied in K12 education contexts between 2001 and 2020. They also stated that interviews became more prevalent between 2011 and 2020. Although the finding of the current review was slightly different of Chang et al. (2022) due to the different topics and the inclusion/exclusion criteria, it cannot be denied that various types of methods could be and should be used to collect data.

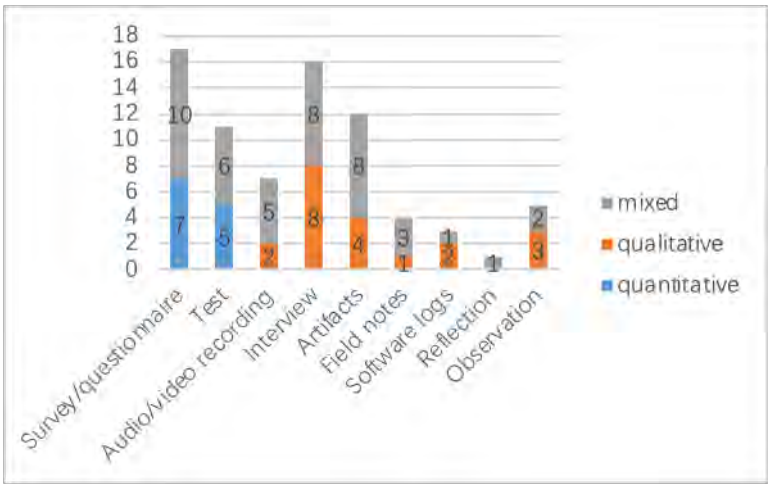

Fig. 3. Data collection methods of the reviewed articles

As for data analysis methods, descriptive analysis (n = 18) was the most frequently used method, followed by ANOVA (n = 4), paired samples t-test (n = 3), and content analysis (n = 3). Specifically, descriptive analysis mainly reported statistics such as frequency, percentage, mean, and standard deviation. ANOVA included one-way and two-way ANOVA.

The other types of data analysis methods, including Chi-square analysis, EFA, multivariate analysis, CFA, SEM, independent samples t-test, box-and-whisker chart, skewness and kurtosis analysis, Mann-Whitney U test, mixed model analysis, and Pearson correlation analysis were used only once. In the four articles where the data analysis methods were not specified, narrative analysis was mainly used to present the research findings. This result could be supported by Chang et al. (2022), which stated that the three most frequently used data analysis methods were descriptive analysis, ANOVA, and t-tests. This result was also supported by Wang and Devitt (2022), who pointed out that most quantitative research uses only descriptive statistics to explain phenomena rather than inferential statistics to test hypotheses.

Regarding the treatment duration, apart from the nine articles (32%) in which treatment duration was not specified, short-term duration (n = 11, 39%) was most

frequently adopted by the 28 reviewed articles, followed by long-term duration (n = 5, 18%), one or more sessions (n = 2, 7%), and intermediate-term (n = 1, 4%). As explained by Hwang and Fu (2018), these results suggest that the researchers followed the inherent law of language learning by devoting a relatively longer time to examining the outcomes of MALL. Although this result is not entirely consistent with one of the previous reviews, it could be supported to some extent by Hwang and Fu (2018) and Wang and Devitt (2022), who also found that short-term duration was most commonly used by the articles in their reviews.

Concerning the sample size, all 28 articles specified the sample size of their research. Medium sample size (n = 16, 57%) was most frequently used by these articles, followed by small sample size (n = 7, 25%) and medium to large sample size (n = 3, 11%). The two articles (7%) which adopted large sample size used questionnaires to collect data, which is consistent with the conclusion of Hwang and Fu (2018), who also found that the articles that used a large sample were mostly survey research.

This result could also be confirmed to some extent by Wang and Devitt (2022). They noted that in their review, most studies used a small to medium sample ($10 < n \leq 50$) and explained that this was because respondents were recruited from specific CSL/CFL courses. However, Hwang and Fu (2018) pointed out that in their review, most studies used a small sample size followed by a medium sample size, which is slightly different from the current result, possibly due to the relatively vague classification of sample size.

3.3. Question 3

As for the education level, apart from the two articles which did not specify the education level of the respondents, the number of articles that included higher/tertiary education and primary/primary education respondents was 14 and 12 respectively. Secondary and preschool students were not included as respondents in any of the articles in this review. This finding is consistent with Hwang and Fu (2018) and Wang and Devitt (2022), who found that higher education attracted the most attention, followed by primary/elementary education. Hwang and Fu (2018) also pointed out that more and more studies included primary school students as respondents.

Apart from 11 articles that did not specify the respondents' Chinese proficiency, the number of articles that recruited respondents with mixed levels and beginner levels were 11 and 6 respectively. Wang and Devitt (2022) reached a similar conclusion, namely that most of the articles in their review recruited learners with mixed levels and beginners as respondents.

Besides, it was found that none of the reviewed articles recruited intermediate or advanced-level learners as respondents. However, Wang and Devitt (2022) found that learners with intermediate and advanced levels were included as respondents while reviewing 68 articles regarding computer-mediated CSL/CFL between 2008 and 2022. This is because the current review only focused on mobile-assisted CSL/CFL learning, which was a sub-division of computer-mediated CSL/CFL learning.

Moreover, only four articles indicated the benchmark used to measure learners' Chinese proficiency, including the college-hosted Mandarin Chinese Ability Test (Lin et al., 2016; Zhou & Li, 2022), the Common European Framework of Reference (Xie & Buckingham, 2021), and Hanyu Shuiping Kaoshi (Ezra & Cohen, 2018), which is consistent with the findings of Wang and Devitt (2022), who found that few articles in their review indicated the benchmark used to measure learners' Chinese proficiency.

Regarding learning context, the overseas mobile-assisted CSL/CFL language learning activities mostly occurred in mixed contexts (n = 9, 32%), followed by indoor/classroom contexts (n = 7, 25%) and outdoor/outside classroom contexts (n = 6, 22%). Another 6 (21%) research did not specify the learning context. The time span of the current review was from 2010 to 2022, indicating that during this period, mixed learning contexts dominated in overseas mobile-assisted CSL/CFL learning. This result is consistent with that of Hwang and Wu (2014). Besides, they explained that because mobile devices could support ubiquitous and seamless learning, the number of publications regarding m-learning being used both indoors and outdoors increased between 2008 and 2012.

3.4. Question 4

Fig. 4 shows that eight articles did not specify the adopted mobile devices. The most frequently adopted mobile devices between 2010 and 2022 were mobile phones/smartphones (n = 13), followed by tablets (n = 3), handhelds (n = 2), iPad (n = 1), and iPod Touch (n = 1). Regarding other mobile devices, Chan et al. (2011) indicated that respondents in their study could use laptops, notebooks, and MP3 players. Lin et al. (2016) indicated that respondents could use their own mobile devices or the ASUS Pad TF101 provided by the researchers. This finding could be supported by Hwang and Wu (2014), Duman et al. (2015), and Shadiev et al. (2017), who found that the most commonly used mobile devices to facilitate CSL and other language learning were smartphones/cellphones and PDAs.

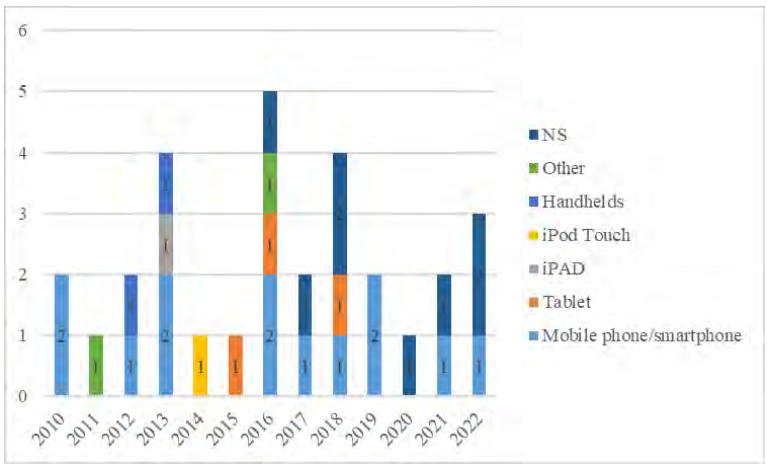

Fig. 4. Mobile devices used by the reviewed articles

Other than the above-mentioned mobile devices, other types of mobile technologies such as humanoid robots and interactive television were also used to facilitate language learning (Shadiev et al., 2017). As Duman et al. (2015) described, as mobile technologies have evolved, the definition of mobile devices has also expanded. Therefore, learners should be provided with different types of mobile devices, content delivery platforms, and multimedia presentations to reflect, interact, communicate, and collaborate anytime and anywhere.

Regarding operating systems, Wong and Looi (2010), Wong et al. (2010), and Wong et al. (2012) mentioned that they adopted Windows Mobile. Chee et al. (2017) and

Luo (2022) said that they adopted Android and iOS. Although only these five articles mentioned the operating systems they used, it could be seen that the Windows Mobile operating system was mainly used before 2015, while the Android and iOS operating systems were mainly used after 2015.

Since there are various types of operating systems, it is very important that the mobile apps are compatible, otherwise, it might affect the learners' usage experience. For instance, Zhou and Li (2022) pointed out that the Xiezi app used by respondents might encounter problems with the Android operating system. Therefore, several respondents had to use the traditional paper-based method to practice the writing of Chinese characters.

Table 2
Mobile apps/platforms used in the reviewed articles

Mobile apps/platforms	Source	Frequency
Communication Basic Mandarin Apps (App-MFol)*	Ying and Wah (2016)	1
Mobile seamless learning platform (MOSE)	Lan and Lin (2016)	1
Xiezi app	Zhou and Li (2022)	1
Camera of the phone	Wong et al. (2010); Wong and Looi (2010); Wong et al. (2012); Wong (2013); Xie and Buckingham (2021);	5
Mandanrin App	Wai et al. (2022)	1
Chinese-PP app*	Wong et al. (2013); Wong et al. (2015); Wong et al. (2017); Boticki et al. (2012); Boticki et al. (2013)	5
MyCLOUD	Wong et al. (2012); Wong et al. (2015); Chai et al. (2016);	3
Wiki	Wong et al. (2010); Wong and Looi (2010); Wong et al. (2012); Wong (2013)	4
NHK's tone leaning application	Kan and Ito (2020)	1
'Chinese Characters First Steps' app	Qian et al. (2018)	1
Mobile Language Learning System*	Lin et al. (2016)	1
iChineseExercise*	Luo (2022)	1
'Learn Chinese Mandarin	Chee et al. (2017)	1
ChineseSkill	Chee et al. (2017)	1
Podcast	Chan et al. (2011)	1
Wordpress app	Yang and Xie (2013)	1
Chinese character app*	Lu et al. (2014)	1

Note. * Represents self-developed apps/platforms

Table 2 shows that camera of phones (n = 5), Chinese-PP app (n = 5), Wiki (n = 4), and MyCLOUD (a cloud-based platform, n = 3) were most frequently used by the 28 reviewed articles to facilitate CSL/CFL learning. Similarly, Wang and Devitt (2022) reported that asynchronous text-based platforms such as forums and wikis were most commonly used between 2008 and 2012, which provided learners with more time and space to participate in collaborative activities. Persson and Nouri (2018) mentioned that cameras are widely used to take pictures of learning materials, make flashcards, and scan QR codes to facilitate learning second languages, which could also support the current research finding.

Other than the apps/platforms mentioned in this review, the previous reviews such as Hwang and Wu (2014) stated that the number of researchers who used sensing technologies-based applications, e.g., RFID, GPS, and QR code is gradually increasing (Hwang & Wu, 2014). Besides, social media (e.g., Facebook and Twitter), social networks (e.g., WeChat and WhatsApp), and video conferencing apps (e.g., Skype and Blackboard Collaborate) have also been widely used to facilitate language learning (Zain & Bowles, 2021; Wang & Devitt, 2022).

Moreover, in this review, some of the mobile apps/platforms, such as the Chinese-PP app and Chinese character app, were particularly mentioned in the articles that they were developed by the research teams, indicating that language experts could collaborate with software developers and instructors to develop and evaluate more mobile apps that entertain learners' specific needs to enhance CSL/CFL learning.

3.5. Question 5

The classification of research foci is mainly based on Duman et al. (2015) and Chang et al. (2022). Fig. 5 shows that most research focused on investigating Chinese proficiency. The top three topics were improving Chinese characters (n = 9), vocabulary (n = 6), and speaking skills (n = 3) using mobile technologies, followed by pronunciation (n = 1) and reading skills (n = 1). However, there was no study that addressed Chinese grammar, writing, and listening skills, or improvement of general Chinese skills, which should be considered more in future studies.

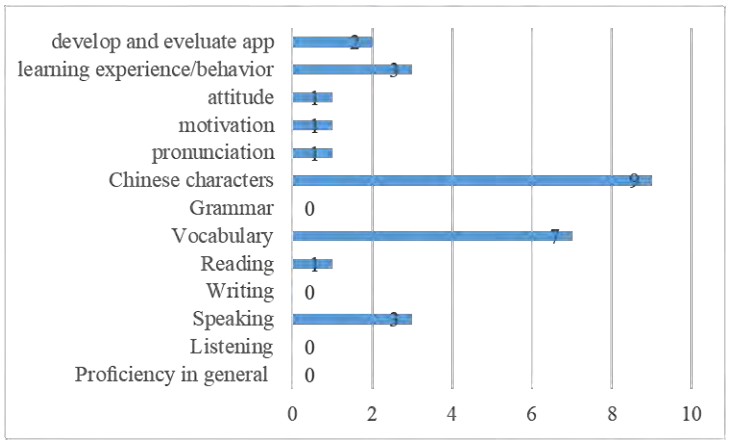

Fig. 5. Research foci of the reviewed articles

Previous reviews, such as Shadiev et al. (2017), Hwang and Fu (2018), Lyu and Qi (2020), Zhou (2020), Zain and Bowles (2021), and Wang and Devitt (2022) found that language proficiency was one of the main research foci regarding computer/mobile mediated CSL/ESL learning, which could support the current research finding. Besides, Shadiev et al. (2017) and Hwang and Fu (2018) found that MALL generally had a positive effect on improving learners' language proficiency.

Learner behavior was one of the common research foci of using MALL in authentic contexts (Shadiev et al., 2017). In the current review, three articles were found that focused on learner experiences/learning behaviors. Specifically, Cohen and Ezra (2018) and Ezra and Cohen (2018) used structured interviews to collect data from 53

CSL learners at universities in Taiwan (China) and Israel to create a contextualized MALL framework. Abdullah et al. (2019) used a questionnaire to investigate CSL learners' adoption, learning experiences, and satisfaction with mobile apps.

Moreover, two articles, namely Chan et al. (2011) and Chai et al. (2016), focused on investigating learners' perceptions and motivation toward mobile-assisted CSL/CFL learning and achieved positive research findings, that were similar to the conclusions of Shadiev et al. (2017) and Hwang and Fu (2018), who found that language learners had overall positive feelings/attitudes such as satisfaction, interest/motivation, and confidence/self-efficacy.

Other than that, this review found two articles, namely Ying and Wah (2016) and Wai et al. (2022) focused on developing and examining the effectiveness of mobile apps-assisted CSL/CFL learning, which was rarely addressed as a research topic in previous reviews. In the review conducted by Hwang and Fu (2018), some researchers also conducted questionnaires and interviews to collect data on MALL learners' higher-order skills, such as critical thinking skills and problem-solving skills, which was not discovered in the current review and leaves a big gap for future studies.

The affordances of MALL have been described by many previous reviews, such as Shadiev et al. (2017), Zhou (2020), and Wang and Devitt (2022). Similarly, the affordances of mobile-assisted CSL/CFL learning were summarized (see Table 3), according to which most of the affordances focused on the learners' perspectives, except for Boticki et al. (2013) and Lu et al. (2014), who stated that MALL could reduce teachers' workload, which concerned teachers' perspectives. Since MALL, as Hwang and Fu (2018) stated, provides affordances for teachers and learners, MALL is promising and should be widely used.

Hwang and Fu (2018) stated that language learners may encounter some difficulties when participating in MALL activities. As Wang and Devitt (2022) noted, the technical problems of mobile apps, e.g., they are not compatible with all operating systems and delay response (Zhou & Li, 2022), are inconvenient to type, copy, and paste (Yang & Xie, 2013), the inappropriate design/requirements of the apps, e.g., the activities are too repetitive or time-limited, do not meet learners' needs, or are costly (Yang & Xie, 2013; Zhou & Li, 2022), and the incompetent skills and overload of learners' cognitive knowledge (Chan et al., 2011; Abdullah et al., 2019), could negatively affect learners' engagement.

Therefore, some researchers in this review provided suggestions to address the above challenges. For instance, guide learners more and provide them with a series of long-term learning activities based on their level and needs (Yang & Xie, 2013; Lu et al., 2014; Chua & Soon, 2021), introduce them more to the culture (Chan et al., 2011), encourage learners to use combined input methods (Zhou & Li, 2022), and encourage them to think and collaborate rather than giving direct instructions (Boticki et al., 2013). Previous reviews, such as Wang and Devitt (2022), also indicated that learners should be provided with target training. Hwang and Wu (2014) emphasized that to decrease cognitive load, learners should not be provided with additional learning content that could be obtained from the real world.

Table 3
Affordances of mobile assisted CSL/CFL learning

Affordance	Source
Improve learners' language proficiency	Chan et al. (2011); Wong et al. (2012), Lin et al. (2016); Ying and Wah (2016); Chee et al. (2017); Wong et al. (2017); Lim et al. (2019); Kan and Ito (2020); Chua and Soon (2021); Luo (2022); Wai et al. (2022)
Bridge the formal and informal learning, create seamless learning contexts, and complement the conventional Chinese learning	Wong (2013); Wong et al. (2015); Chai et al. (2016); Lan and Lin (2016); Wai et al. (2022)
Enhance and balance peers' competition/collaboration/interaction by posting, commenting, and correcting peers artifacts	Wong and Looi (2010); Wong et al. (2010); Wong et al. (2013); Yang and Xie (2013); Lan and Lin (2016)
Demonstrate the Chinese stroke order, pronunciation, meaning, translation, etc.	Zhou and Li (2022)
Provide instant assessment and feedback	Xie and Buckingham (2021); Luo (2022); Zhou and Li (2022)
Increase learners' motivation, interest, confidence, willingness, and engagement, etc.	Chan et al. (2011); Wong (2013); Yang and Xie (2013); Lu et al. (2014); Wong et al. (2015); Chee et al. (2017); Wai et al. (2022)
Enhance learners' social-cognitive skills, critical thinking skills, and problem-solving skills	Wong et al. (2012); Wai et al. (2022)
Combine technology-supported interaction and face-to-face interaction	Wong et al. (2013)
Obtain various types of online learning resources	Wong (2013); Lan and Lin (2016)
Connect language learning with daily experiences	Wong and Looi (2010); Wong et al. (2010); Wong et al. (2015)
Interact with native speakers to complete designated tasks	Chua and Soon (2021)
Improve learners' after-class self-directed learning	Wong et al. (2012)
Reduce teaching workload	Boticki et al. (2013); Lu et al. (2014)

4. Conclusions and recommendations for future studies

Regarding publication information on mobile-assisted CSL/CFL learning, the distribution of reviewed articles was quite uneven, suggesting that there are no international journals that mainly focus on this research area. Besides, there was no obvious upward trend in this research area, suggesting that more attention should be paid to overseas mobile-assisted CSL/CFL. The research in this review was mainly conducted in Singapore, Malaysia, and Taiwan (China), where Chinese is one of the dominant languages. To overcome the language barriers and boost research in this area, cross-border collaboration among researchers and/or institutions could be a solution (Gong et al. 2018).

In terms of research methodology, various theories, and approaches have been applied in this field. Mixed research design, short-term duration, and medium sample size were most frequent. Various methods were used for data collection. Descriptive analysis

was the most commonly used method for data analysis. In this regard, Hwang and Fu (2018) recommend a longer treatment duration, larger sample size, and mixed research methods. Besides, the theoretical foundations/frameworks should be elaborated to pave the way for their research. Moreover, more advanced data analysis methods should be used to improve the generalizability of their research findings.

Regarding the respondent characteristics, the majority of respondents were selected from tertiary and primary education. As Wang and Devitt (2022) stated, there is an obvious research gap to include younger learners in computer/mobile-mediated CSL/CFL learning, including in the field of mobile-assisted CSL/CFL learning. Besides, more attention should also be paid to secondary learners. Most learners in these reviewed articles were CSL/CFL beginners or had a mixed level, and none of them had an intermediate or advanced level. Moreover, few articles identified the benchmark for measuring learners' CSL/CFL level. Therefore, it is suggested that future studies better specify learners' Chinese proficiency and benchmarks, and focus more on intermediate and advanced learners. Most activities were conducted in mixed learning contexts, followed by indoor/classroom and outdoor/outside classroom. Regarding this issue, Hwang and Fu (2018) noted that more attention should be paid to adults who learned outside the school environment.

Concerning mobile technologies, this review found that the most commonly used mobile devices were mobile phones/smartphones, followed by tablets and handhelds. Although the compatibility of mobile applications with different operating systems is very important, not too many articles specified the operating systems used. The most commonly used mobile applications were cameras of phones, Wiki, and a self-developed mobile app, i.e., the Chinese-PP app. Future studies could use different types of mobile devices and different types of mobile apps, or even develop mobile apps to facilitate overseas CSL/CFL learning. They should pay attention to the compatibility of mobile apps with different operating systems.

Pertaining to the research findings of the reviewed articles, the majority of them focused on investigating Chinese proficiency, followed by learners' learning experience/behavior, and perception/motivation. Future studies should pay more attention to various research foci, such as the higher-order thinking skills recommended by Hwang and Fu (2018). Besides, although mobile-assisted CSL/CFL learning has many advantages, future studies should highlight the potential challenges for learners, recommend appropriate apps for learners, and provide them with sufficient training.

5. Limitations of the review

First, to narrow down the selection of articles, only those that satisfied the inclusion criteria were included in this review, which as a result excluding lots of articles, such as those published in other databases or in other types of publications (e.g., chapters, proceedings. etc.) or not within the time span. Consequently, future reviews could adjust their inclusion criteria to provide a more comprehensive picture of overseas mobile-assisted CSL/CFL learning.

Second, although the search strategy, research protocol, and coding schemes of this systematic review referenced several previous reviews and were revised during data collection to cover most research details, due to the inevitable subjectivity of a single researcher, some articles may not be included in the review despite meeting the criteria. Therefore, future studies should involve two or more independent researchers to classify and analyze the data.

Author Statement

The authors declare that there is no conflict of interest.

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References

Abdullah, N. A. C., Tajuddin A. J. A., & Soon, G. Y. (2019). Mandarin students' perceptions of smartphone applications in Mandarin learning. *Universal Journal of Educational Research*, 7(9A), 61–70. https://doi.org/10.13189/ujer.2019.071608

Booth, A., Sutton, A., Clowes, M., & James, M. S. (2022). *Systematic approaches to a successful literature review* (3rd ed.). Sage publication.

Boticki, I., Lung Hsiang Wong, & Chee-Kit Looi. (2013). Designing technology for content-independent collaborative mobile learning. *IEEE Transactions on Learning Technologies*, *6*(1), 14–24. https://doi.org/10.1109/TLT.2012.8

Boticki, I., Wong, L. H., & Looi, C. K. (2012). Experiences in implementing and using a technological framework for mobile collaborative learning of mathematics and Chinese. *International Journal of Mobile Learning and Organisation*, *6*(1), 79–93. https://doi.org/10.1504/IJMLO.2012.046884

Chai, C. S., Wong, L. H., & King, R. B. (2016). Surveying and modelling students' motivation and learning strategies for mobile-assisted seamless Chinese language learning. *Educational Technology & Society*, *19*(3), 170–180.

Chan, W. M., Chi, S. W., Chin, K. N., & Lin, C. Y. (2011). Students' perceptions of and attitudes towards podcast-based learning: A comparison of two language podcast projects. *Electronic Journal of Foreign Language Teaching*, *8*(1), 312–335.

Chang, C.-C., Hwang, G.-J., & Tu, Y.-F. (2022). Concept mapping in technology-supported K-12 education: A systematic review of selected SSCI publications from 2001 to 2020. *Journal of Educational Computing Research*, *60*(7), 1637–1662. https://doi.org/10.1177/07356331211073798

Chee, K. N., Yahaya, N., & Ibrahim, N. H. (2017). Effectiveness of mobile learning application in improving reading skills in Chinese language and towards post-attitudes. *International Journal of Mobile Learning and Organisation*, *11*(3), 210–225. https://doi.org/10.1504/IJMLO.2017.085347

Chua, N. A., & Soon, G. Y. (2021). Performing communicative language teaching in Mandarin mobile learning. *International Journal of Interactive Mobile Technologies (iJIM)*, *15*(05), 87–99. https://doi.org/10.3991/ijim.v15i05.20899

Chua, Y. P. (2016). *Mastering research methods* (2nd ed.). McGraw-Hill Education.

Cohen, A., & Ezra, O. (2018). Development of a contextualised MALL research framework based on L2 Chinese empirical study. *Computer Assisted Language Learning*, *31*(7), 764–789. https://doi.org/10.1080/09588221.2018.1449756

Duman, G., Orhon, G., & Gedik, N. (2015). Research trends in mobile assisted language learning from 2000 to 2012. *ReCALL*, *27*(2), 197–216. https://doi.org/10.1017/S0958344014000287

Ezra, O., & Cohen, A. (2018). Contextualised MALL: L2 Chinese students in target and

non-target country. *Computers & Education*, *125*, 158–174. https://doi.org/10.1016/j.compedu.2018.06.011

Gong, Y. F., Gao, X. A., & Lyu, B. (2020). Teaching Chinese as a second or foreign language to non-Chinese learners in mainland China (2014–2018). *Language Teaching*, *53*(1), 44–62. https://doi.org/10.1017/S0261444819000387

Gong, Y., Lai, C., & Gao, X. (2020). The teaching and learning of Chinese as a second or foreign language: The current situation and future directions. *Frontiers of Education in China*, *15*(1), 1–13. https://doi.org/10.1007/s11516-020-0001-0

Gong, Y., Lyu, B., & Gao, X. (2018). Research on teaching Chinese as a second or foreign language in and outside mainland China: A bibliometric analysis. *The Asia-Pacific Education Researcher*, *27*(4), 277–289. https://doi.org/10.1007/s40299-018-0385-2

Hwang, G.-J., & Tsai, C.-C. (2011). Research trends in mobile and ubiquitous learning: A review of publications in selected journals from 2001 to 2010. *British Journal of Educational Technology*, *42*(4), E65–E70. https://doi.org/10.1111/j.1467-8535.2011.01183.x

Hwang, G. J., & Wu, P. H. (2014). Applications, impacts and trends of mobile technology-enhanced learning: A review of 2008-2012 publications in selected SSCI journals. *International Journal of Mobile Learning and Organisation*, *8*(2), 83–95. https://doi.org/10.1504/IJMLO.2014.062346

Hwang, G.-J., & Fu, Q.-K. (2018). Trends in the research design and application of mobile language learning: A review of 2007–2016 publications in selected SSCI journals. *Interactive Learning Environments*, *27*(4), 567–581. https://doi.org/10.1080/10494820.2018.1486861

Kan, M. S., & Ito, A. (2020). Language cognition and pronunciation training using applications. *Future Internet*, *12*(3): 42. https://doi.org/10.3390/fi12030042

Lan, Y. J., & Lin, Y. T. (2016). Mobile seamless technology enhanced CSL oral communication. *Educational Technology & Society*, *19*(3), 335–350.

Lim, C. K., Tan, K. L., Isak, A. B., & Hambira, N. (2019). Learning Chinese characters via stroke-based mobile game in education. *International Journal of Innovative Technology and Exploring Engineering*, *8*(8S), 112–118.

Lin, Y. T., Kao, C. L., & Lan, Y. J. (2016). The effects of mobile learning on students' oral performance in Mandarin Chinese and their attitudes. *International Journal of Mobile Learning and Organisation*, *10*(1/2), 78. https://doi.org/10.1504/IJMLO.2016.076191

Lu, J., Meng, S., & Tam, V. (2014). Learning Chinese characters via mobile technology in a primary school classroom. *Educational Media International*, *51*(3), 166–184. https://doi.org/10.1080/09523987.2014.968448

Luo, L. (2022). Novel micro-learning-based mobile-assisted language app for Mandarin Chinese. *Journal of Applied Learning and Teaching*, *5*(1), 35–42. https://doi.org/10.37074/jalt.2022.5.s1.5

Lyu, B., & Qi, X. (2020). A review of research on technology-assisted teaching and learning of Chinese as a second or foreign language from 2008 to 2018. *Frontiers of Education in China*, *15*(1), 142–163. https://doi.org/10.1007/s11516-020-0006-8

Macaro, E., Handley, Z., & Walter, C. (2012). A systematic review of CALL in English as a second language: Focus on primary and secondary education. *Language Teaching*, *45*(1), 1–43. https://doi.org/10.1017/S0261444811000395

Novel micro-learning-based mobile-assisted language app for Mandarin Chinese. (2022). *Journal of Applied Learning & Teaching*, *5*(SI1), 35–42. https://doi.org/10.37074/jalt.2022.5.s1.5

Pahlevan Sharif, S., Mura, P., & Wijesinghe, S. N. R. (2019). Systematic reviews in Asia: Introducing the "PRISMA" protocol to tourism and hospitality scholars. In S. Rezaei

(Ed.), *Quantitative Tourism Research in Asia* (pp. 13–33). Springer Nature Singapore. https://doi.org/10.1007/978-981-13-2463-5_2

Persson, V., & Nouri, J. (2018). A systematic review of second language learning with mobile technologies. *International Journal of Emerging Technologies in Learning (iJET)*, *13*(02), 188–210. https://doi.org/10.3991/ijet.v13i02.8094

Qian, K., Owen, N., & Bax, S. (2018). Researching mobile-assisted Chinese-character learning strategies among adult distance learners. *Innovation in Language Learning and Teaching*, *12*(1), 56–71. https://doi.org/10.1080/17501229.2018.1418633

Shadiev, R., Hwang, W.-Y., & Huang, Y.-M. (2017). Review of research on mobile language learning in authentic environments. *Computer Assisted Language Learning*, *30*(3/4), 284–303. https://doi.org/10.1080/09588221.2017.1308383

Wai, S. Y., WaiShiang, C., Phang, P., Lam, K.-C., Phang, E., & Jali, N. B. (2022). Goal question metric as an interdisciplinary tool for assessing mobile learning application. *International Journal of Advanced Computer Science and Applications*, *13*(5), 146–152. https://doi.org/10.14569/IJACSA.2022.0130518

Wang, M., & Devitt, A. (2022). A systematic review of computer-mediated communications in Chinese as a foreign language from 2008 to 2022: Research contexts, theoretical foundations and methodology, affordances and limitations. *Language Teaching Research*. https://doi.org/10.1177/13621688221132475

Wong, L. H., Chai, C. S., Chin, C. K., Hsieh, Y. F., & Liu, M. (2012). Towards a seamless language learning framework mediated by the ubiquitous technology. *International Journal of Mobile Learning and Organisation*, *6*(2), 156–171. https://doi.org/10.1504/IJMLO.2012.047599

Wong, L., & Looi, C. (2010). Vocabulary learning by mobile-assisted authentic content creation and social meaning-making: Two case studies. *Journal of Computer Assisted Learning*, *26*(5), 421–433. https://doi.org/10.1111/j.1365-2729.2010.00357.x

Wong, L.-H. (2013). Enculturating self-directed learners through a facilitated seamless learning process framework. *Technology, Pedagogy and Education*, *22*(3), 319–338. https://doi.org/10.1080/1475939X.2013.778447

Wong, L.-H., Chai, C. S., Aw, G. P., & King, R. B. (2015). Enculturating seamless language learning through artifact creation and social interaction process. *Interactive Learning Environments*, *23*(2), 130–157. https://doi.org/10.1080/10494820.2015.1016534

Wong, L.-H., Chin, C.-K., Tan, C.-L., & Liu, M. (2010). Students' personal and social meaning making in a Chinese idiom mobile learning environment. *Educational Technology & Society*, *13*(4), 15–26.

Wong, L.-H., Hsu, C.-K., Sun, J., & Boticki, I. (2013). How flexible grouping affects the collaborative patterns in a mobile-assisted Chinese character learning game? *Educational Technology & Society*, *16*(2), 174–187.

Wong, L.-H., Looi, C.-K., & Boticki, I. (2017). Improving the design of a mCSCL Chinese character forming game with a distributed scaffolding design framework. *Research and Practice in Technology Enhanced Learning*, *12*(1): 27. https://doi.org/10.1186/s41039-017-0066-4

Xie, Y., & Buckingham, L. (2021). The linguistic landscape and materials development: Learning Chinese in Auckland. *Linguistic Landscape. An International Journal*, *7*(3), 285–313. https://doi.org/10.1075/ll.20016.buc

Yang, C., & Xie, Y. (2013). Learning Chinese idioms through iPads. *Language Learning & Technology*, *17*(2), 12–22.

Ying, L. C., & Wah, F. P. (2016). App-MFoL mobile application development for learning mandarin as a foreign language. *International Journal of Advanced and Applied Sciences*, *3*(11), 47–51. https://doi.org/10.21833/ijaas.2016.11.009

Zain, D. S. M., & Bowles, F. A. (2021). Mobile-assisted language learning (MALL) for higher education instructional practices in EFL/ESL contexts: A recent review of literature. *Computer Assisted Language Learning Electronic Journal*, *22*(1), 282–307.

Zhou, W. (2020). Mobile assisted Chinese learning as a foreign language: An overview of publications between 2007 and 2019. *Frontiers of Education in China*, *15*(1), 164–181. https://doi.org/10.1007/s11516-020-0007-7

Zhou, W., & Li, X. (2022). Investigation of a Chinese character writing app: Learners' perspectives. *Knowledge Management & E-Learning*, *14*(1), 15–29. https://doi.org/10.34105/j.kmel.2022.14.002