

Empirical Studies on Mobile-Assisted Language Learning in China: A Review of Selected Research

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Abstract: *Mobile assisted language learning (MALL) has recently aroused the attention of educators and researchers worldwide with the popularity of mobile devices. Chinese educators have made committed efforts to innovate teaching methods by integrating mobile technology into regular language courses. Nevertheless, these tireless efforts were mainly documented in Chinese, failing to reach a wider international relationship. This paper thus offers a comprehensive analysis and synthesis of MALL studies published from 2015 to 2020 in leading mainland Chinese journals. Thirty six studies from CSSCI journals were examined in terms of theoretical frameworks, methodologies, emerging themes as well as the key findings. The results indicated that diverse theories or pedagogical frameworks were applied to inform their studies but there were still a significant number of studies failing to specify any theories. Regarding methodologies, researchers tended to prefer the mixed research designs by providing both quantitative and qualitative data. Furthermore, the three major themes were identified, including learning outcomes, learning processes as well as technology acceptance and perceptions. The positive effects of MALL were largely reported from different perspectives although limitations still exist. Based on the results, implications for educators and suggestions for further MALL studies were provided in the end.*

Keywords: *Mobile technologies, Mobile assisted language learning, Empirical studies, China*

1. Introduction

In the past decade, mobile technologies have been widely applied by educators for they can offer users “personalized information, adaptive assistance and instant social interaction platforms” [1][2]. An increasing number of relevant studies have been reported worldwide, showing the great potential and amazing prospects of the application of mobile technologies in the field of education. In these studies, the technology-supported learning approaches are usually named as mobile or ubiquitous learning [3], and they are conducted in a wide range of developed and developing countries.

According to the review conducted by Hwang & Tsai [3] and Krull & Duart [4], the countries with the most number of mobile learning studies represented are United States followed by United Kingdom. Other countries, such as Singapore and Thailand, have also contributed a lot. In Taiwan, such studies are increasingly reported in recent years since nation-wide funding programs are promoted for encouraging schools to integrate mobile technology in their regular courses [5]. In mainland China, numerous schools have also carried out a series of reforms by implementing mobile learning inside and outside of the language classrooms. Chinese teachers have been making a great deal of efforts to leverage the affordances of mobile assisted language learning (MALL) for improving learners’ learning efficiency. However, these tireless efforts are mainly documented in Chinese, failing to reach a wider international readership, and are thus not adequately recognized. Therefore, despite the limited space for this paper, it is of great necessity to take stock of these recent studies to ‘do justice to the efforts and perseverance that Chinese teachers and researchers have exerted’ [6].

This paper intends to investigate the research status of MALL published in leading mainland Chinese journals from 2015 to 2020, revealing what empirical studies have been carried out and how they have been conducted in Chinese context. It would be helpful not only for researchers in relevant fields to select good topics for further research, but also for educators to integrate mobile devices effectively in second or foreign language classes.

2. Literature review

Mobile learning has been defined from different perspectives. Some researchers emphasized the implementation of mobile technologies, while some others highlighted the mobility of learners or learning contents. There is so far no agreed definition of it, however, this short and brief one as “using mobile technologies to facilitate learning” is widely accepted. Recently another broader one seems more popular, which is ‘learning anywhere and at any time’ [3]. Despite different perspectives, these definitions show some common features of mobile learning such as flexibility, continuity, adaptively, and accessibility [7]. Thus, following Loewen et al. [7] and Hou & Aryadoust [8], the present study defined MALL as a flexible, continuing, adaptive language learning process in which language learners get easy access to delivered learning content aided by portable devices.

In the past ten years, several review studies concerning MALL have been conducted. Hwang and Tsai [3] reviewed the mobile learning papers published in six major technology-based learning SSCI journals from 2001 to 2010. This paper mainly did a trend analysis of research sample groups, research learning domains and major contributing countries by comparing the publications in the first and second 5 years. By adopting the same approach, Hwang and Fu [9] reviewed MALL studies published from 2007 to 2016 in ten SSCI journals, analyzing trends of language and learner types, learning outcomes as well as adopted research method, sample size, and treatment duration. The findings indicated that studies in the first five years focused on improving learners’ language learning skills, while the second five years tend to consider learners’ higher-order thinking or competence in MALL activities. It was also found studies in the second stage tend to adopt mixed methods and longer treatment periods in terms of research method. In another review about MALL studies from 2000 to 2012, Duman, et al. [10] reported that quantitative research methods were more generally adopted, followed by qualitative methods.

Focusing on learning outcomes, Burston’s [11] conducted a meta-analysis of 291 MALL studies published from 1994-2012. By eliminating studies with serious design shortcomings, it’s found that just 19 studies can reliably serve as a basis for determining the learning outcomes of mobile-based language applications. Among these studies, 15 reported positive results, which primarily focused on reading, listening and speaking. No significant differences were reported in the rest 4 studies focusing on vocabulary. However, in Hwang and Fu’s [9] review, the effectiveness of mobile learning in terms of vocabulary, speaking, writing and pronunciation was generally confirmed by most of the studies. Particularly, no negative results were found among the measurements of learning effects for vocabulary.

Recently, Hou and Aryadoust [8] reviewed the methodological quality of 77 quantitative MALL studies by investigating the applications of statistical techniques and instrument reliability and validity. It was reported that the majority of MALL studies adopted statistical techniques within the domain of General linear model (GLM). In addition, more than half of these studies provided no evidence of reliability investigation and only 19.48% of the reviewed studies explored the validity of the instrument appropriately.

It can be found that the existing review papers generally fall into two major categories. The first is trend analysis, and the second focuses on investigating methodological quality or reliability of experimental designs. These studies add to the scholarly understanding on the use of mobile learning across all grades and subjects in educational settings. However, most of these studies focus on papers published in English, while those published in other languages, such as Chinese, go unnoticed. In fact, in China, government-funded programs are initiated to encourage educators to implement mobile technology in mainstream educational setting. Educators are increasingly enthusiastic about using MALL methodologies in Foreign Language classes, especially after the COVID-19 outbreak. The comprehensive analysis of educators’ efforts in MALL research in China may shed light on the studies in the context of similarly developing countries and trigger more empirical MALL studies in these countries. Therefore, the present review focuses on the empirical studies published in major Chinese Social Science Index (CSSCI) journals of educational technology, revealing the unique features and trends of MALL studies in the context of China.

3. Methodology

3.1. Research questions

The systematic review was guided by the following questions to provide an impartial syntheses and interpretation of the findings.

RQ1. What are the theoretical or pedagogical frameworks to inform MALL studies?

RQ2. What are the characteristics of the research designs in terms of research contexts and participants, mobile devices or applications, research methods, sample sizes and treatment duration?

RQ3. What research themes have been addressed and what are the synthesized findings?

3.2. Research procedure

To identify eligible studies to be included in this systematic review, the researchers have taken the following four steps.

Step 1: Identifying relevant keywords or subject words

The following keywords and subject words were used to search for the eligible literature:

- 1) Mobile learning related keywords, including mobile, mobile learning, mobile assisted language learning, MALL;
- 2) Mobile device or technology related keywords, including mobile device, mobile technology, mobile application, mobile phone, smart phone, tablet PC, iPad, WeChat;
- 3) Language learning related keywords, including language, language learning, English, English learning, listening, speaking, reading, writing, translation, vocabulary, grammar.

The search terms include the keywords “mobile learning related” OR “mobile device or technology related” AND “language learning related”.

Step 2: Conducting literature search

The database used for the searches was China National Knowledge Infrastructure (CNKI). To locate high-quality studies, the review focused on articles published in Chinese Social Sciences Citation Index (CSSCI) journals, which were well-acknowledged as the most influential and authoritative in China. The three above sets of keywords, and combinations thereof, were used to search. To avoid omission, manual searches of major journals of educational technology and e-learning were also conducted one by one, including Technology Enhanced Foreign Language Education, Modern Educational Technology, Distance Education in China, Foreign Languages and Their Teaching, Foreign Language Education, Foreign Language World, China Educational Technology, E-education Research, Open Education Research.

After a preliminary search of literature on the database using the combination of keywords in Step 1, 89 publications were retrieved.

Step 3: Evaluating the literature by using inclusion and exclusion criteria

By reading the article abstracts and then carefully going through the methodological descriptions in each article, eligible articles were selected to meet the following inclusion and exclusion criteria:

Inclusion criteria:

- 1) The articles had to be published between 2015 and 2020;
- 2) The full text of the articles was available;
- 3) The articles focused on foreign or second language learning;
- 4) Mobile technologies or mobile devices should be used as the learning tool in the articles;
- 5) The articles adopted an empirical experiment design with a clear description of data collection procedure.
- 6) The articles were reported in Chinese.

Exclusion criteria:

- 1) The articles were literature reviews or commentaries;
- 2) The articles provided no quantitative or qualitative data to support the conclusion.
- 3) The articles focused on native language learning.
- 4) The articles were written in other languages.

To ensure the inclusion of eligible studies, manual reference list was also checked. After checking and filtering the lists of articles based on aforementioned criteria, a total of 36 studies were finally identified.

Step 4: Coding the literature

In line with the research questions of this study, categories and subcategories were coded and analyzed. These categories include (a) author; (b) publication year; (c) journal; (d) theoretical frameworks; (e) context and participants; (f) mobile devices/application; (g) methodologies including methods, data collection instruments, sample size and treatment duration; (h) research themes.

4. Results

The 36 articles were thoroughly examined and the results concerning the research questions were presented with assistance of tables. Table 1 presented the list of the journals and the number of identified articles from each journal. Technology Enhanced Foreign Language Education was the leading journal, publishing about 42% of the total number of articles. Modern Educational Technology and Distance Education in China published the same number of studies, occupying 14% respectively. The synthesized findings, regarding theoretical frameworks, context and participants, research methods, mobile devices/application, data collection, treatment duration and research focus, are analyzed and discussed in the following section.

Table 1: Distribution of Empirical studies

NO	Journal title in English	Journal Base (Institutions)	Number
1	<i>Technology Enhanced Foreign Language Education</i>	Shanghai International Studies University	15
2	<i>Modern Educational Technology</i>	Tsinghua University	5
3	<i>Distance Education in China</i>	The Open University of China	5
4	<i>Foreign Languages and Their Teaching</i>	Dalian University of Foreign Language	2
5	<i>Foreign Language Education</i>	Xi'an International Studies University	2
6	<i>Foreign Language World</i>	Shanghai International Studies University	2
7	<i>China Educational Technology</i>	National Center for Educational Technology	2
8	<i>E-education Research</i>	Northwest Normal University	2
9	<i>Open Education Research</i>	Shanghai Open University	1
Total			36

4.1. Theoretical foundation or frameworks

As an emerging research field, MALL has rich content and diverse forms. A wide range of theoretical frameworks were proposed to support MALL studies, but most of them were only in a limited number of papers. There were also 33% of these studies that didn't specify any theoretical foundation.

Based on the review concerning MALL studies from 2020 to 2012, Duman, et.al [10] generally divided the theoretical frameworks into three categories, including learning approaches, multimedia design and learning approaches and technology-oriented approaches. In this review, it was found that researchers recently tend to use more diverse theories. Similar to Duman, et.al's [10] findings, MALL studies were largely informed by the grand theories of learning, including constructivist learning theory, situated learning theory and socio-cultural theory. 9 (25%) studies were based on learning approaches such as collaborative learning, interactive learning, and informal learning. Constructivist learning theory presumes that knowledge is not transmitted passively but constructed by learners actively in the process of interacting with learning environment, including learning resources, teachers, peers and medium. With a learner-centered characteristic, mobile learning can fully support learners' personalized active learning. In addition, a unique feature of mobile learning is the interactive function offered by mobile devices or applications, such as WeChat. Earlier studies were usually informed by this theory. For instance, Wang and Dai [12] constructed a WeChat-Based interactive mobile translation teaching model, emphasizing learners' active interaction with the learning environment to construct their knowledge and enhance translation skills. Socio-culturalism, emphasizing a person's cognitive development is largely influenced by the surrounding culture, is another theory preferred by researchers [13, 14]. In mobile learning, learners can get development in linguistics as well as cognitive aspect by interacting with peers, teachers, social media, etc.

Compared with Duman, et.al.'s [10] review, the number of studies employing technology-oriented approaches increased, up to 19%, whereas studies adopting multimedia design and learning approaches were found much less than before. More studies explored learner acceptance and perceptions of mobile learning, which were mainly based on the technology acceptance model (TAM), the unified theory of acceptance and use of technology (UTAUT) or the extended model of UTAUT. For instance, Zeng [15] examined the user acceptance of mobile learning and the key influencing factors under the guidance of UTAUT 2 model proposed by Venkatesh et al. [16]. Aside from the above theories, researchers also drew on theories such as the theory of community, multiple intelligence theory to inform their research design. For instance, guided by the theory of Community, Wang, Wang and Yin [17] (2017) integrated social APP to construct a translation teaching model of mobile learning community consisted of learners, teachers and social tutors.

4.2. Research designs

4.2.1. Context and Participants

The vast majority of these studies were conducted in higher education context, which constituted the largest proportion (94%). Of the remaining two studies, one was carried out in elementary school and the other was in middle school context. As for the participants, 97% studies targeted English as a foreign language (EFL) students and only one study concerned about Japanese as a foreign language students.

As indicated in Table 2, the most common research subject group was university students (94.4%), while elementary school students (2.8%) and middle school students (2.8%) are just in the minority. This result is different from the review reported by Lai [2], who stated that elementary school students constituted the largest proportion of research subject group in MALL studies. The differences may lie in the different research contexts in the two reviews. In Lai's [2] review, these studies were from the top 100 highly cited papers in SSCI journals with participants from diverse research contexts, whereas this review mainly focused on participants in Chinese context. In China, a majority of elementary or middle school students are not allowed to use mobile devices in their schools or classrooms, while this limitation is not found in many other countries. In addition, teachers in elementary schools usually have heavy teaching assignments and publishing their research in influential journals such as CSSCI is not a compulsory task. This may partly account for the reason why studies relevant to elementary school students were seldom reported.

One possible reason why university students has become the most common research group is that they all have their own mobile devices and they have necessary skills and capabilities for learning compared with younger students. Another reason may be due to the requirements for university teachers. It is almost a must for them to conduct researches and publish their research findings in well-recognized journals. However, among the studies targeting university students, there is only one research related to vocational school students, indicating that vocational school students have received the attention, but more researches on vocational school students should be conducted in future studies. Imbalanced distribution of research subjects suggests that researches on primary, secondary and vocational students should be investigated.

Table 2: Types of research participants in the research articles

Participants	Number of studies	Percentage
Elementary school students	1	3%
Middle school students	1	3%
University students	34	94%

4.2.2. Types of mobile devices

Table 3 shows types of mobile devices used in reviewed articles. As indicated in this table, the predominant mobile devices were smart phones (n=21), which were widely used both inside and outside of the classroom. This correlates with research by Crompton & Burke [18] in which they reported mobile phones were the most frequently used devices. Tablet PC was the second most frequently reported type of device (n=4), and the least used devices were electronic dictionary (n=1) and iPad (n=1). Besides, 15 articles did not state which mobile devices they used. It could be found that limited mobile devices were used in China. These data also reveals that a wide variety of devices could be used in mobile learning studies in future studies.

Table 3: Types of mobile devices in the research articles

Mobile devices	Number
Smart phone	21
Tablet PC	4
Electronic dictionary	1
iPad	1
Not stated	15

* More than one mobile device is used in one research.

Regarding the mobile applications, WeChat was the most commonly used one, employed by 33% of these studies. Developed by Tencent in 2011, WeChat has gradually become the most popular applications in China due to the multiple functions including platform function, communicative function and social networking function. These functions provide strong support for the implementation and development of MALL, especially the communicative function which greatly facilitates the interaction between teachers and students. For instance, researchers constructed WeChat-based interactive mobile translation teaching model [12] and designed WeChat-assisted flipped classroom [19] to enhance learners' language skills. Besides WeChat, other types of apps were also applied by researchers, such as Baicizhan, Elevate. However, these apps were adopted much less frequently, with just one or two studies involving the use of them.

4.2.3. Research methods

Table 4 presents research methods employed in the reviewed 36 studies. According to the classification of Wen and Lin [20], the research methods are divided into three categories: quantitative method, qualitative method and mixed research. Quantitative method involves quantitation of data, and its subcategories include research design, statistic techniques, and a number of independent variables. Qualitative research refers not to non-quantitative studies in general, but only to those data-driven studies adopting systematic data collection and analysis techniques [21] [22]. Mixed research adopts both quantitative and qualitative method.

Table 4: Methodologies of the research articles

Research methods	Number	Percentage
Quantitative method	16	44.44%
Qualitative method	3	8.33%
Mixed research	17	47.22%

Among the research methods presented in the following Table, the number of mixed research designs ranked first (17 studies, 47.22%), followed by quantitative research designs (16 studies, 44.44%). And just several studies (8.33%) adopted a uniquely qualitative approach. This result is similar to findings in other reviews concerning MALL studies [9] [10], which indicated that there was a recent tendency toward the adoption of mixed designs to gain a deeper understanding of MALL activities. It was found that the qualitative analysis in the mixed research was mainly in the form of open-ended questionnaires or interviews, which intended to triangulate the reliability of the results to some extent. Similar to Hou and Aryadoust's [8] findings, many studies were found without any evidence about evaluation of reliability and validity.

Concerning data collection instruments, it could be found that researchers used a variety of ways to obtain mobile learning data. Most studies used more than one way to collect data. The most frequently employed method was questionnaire, with 81% studies involving the use of it, and the second was interview, followed by tests, and then by recordings. There is only one study collecting data from learners' diaries.

4.2.4. Sample sizes

As for sample sizes, as shown in Table 5, it was found that studies using large size samples ranked first, the research adopting medium to large samples was in the second position, and just a few studies (5.56%) used small size samples. This result is opposite to Hwang & Fu's [9] findings concerning studies in 2007-2016, which stated that studies using small size samples constituted the largest proportion. This may be due to the different research topics and data collection methods. By means of online questionnaires, it is relatively easier to obtain data from a large sample. It should be pointed out that the 14 studies adopting large samples were all survey research in the form of questionnaires. As a whole, in recent years, there is a tendency for researchers to use large samples for analysis.

Table 5: Sample size of the research articles

	Small (<30)	Medium (30-50)	Medium to large (51-100)	large (>100)	Not specified	Total
Number	2	7	12	14	1	36
Percentage	5.56%	19.44%	33.33%	38.89%	2.78%	100%

4.2.5. Treatment duration

As regards to treatment duration, as shown in Table 6, 38.89% studies did not report the time, revealing the methodologically shortcomings of the research designs. Among the remaining studies, the duration of most of the treatments was between 9 weeks and 4 months (intermediate term) and 22.22% studies were carried out within 8 weeks. Compared with the findings in [9] [11] which reported that most studies had short treatment durations, the percentage of studies with intermediate term durations have increased. It indicated that researchers in Chinese context gradually concentrated more on longer-term effects, devoting much longer to examining the learning outcome of MALL activities. Nevertheless, the study with more than 4 months' intervention just occupied 2.78%, indicating the need for studies with longer treatment duration since the development and acquisition of language skills cannot be realized within short time periods.

Table 6: Treatment duration of the research articles

	Short term (≤ 8 weeks)	Intermediate term (9 weeks- 4 months)	Long term (>4 months)	Not specified	Total
Number	8	13	1	14	36
Percentage	22.22%	36.11%	2.78%	38.89%	100%

4.3. Research themes

It was found that a wide range of topics were covered among these MALL studies.

In terms of their different research focus, these studies can be roughly categories into three themes: 1) Learning outcomes; 2) Learning processes; 3) Technology acceptance and Learners' perceptions. There are some overlapping between them since some studies concerned more than one aspects.

4.3.1. Learning outcomes

Among the 36 studies, 21 (58%) focused on learning outcomes or gains of MALL activities, which were mainly evaluated by the acquisition of different skills, including vocabulary acquisition, listening, speaking, reading, writing, translation integrated skills and higher-order competence. However, there was no study concerning grammar. The results were generally positive although limitations were also mentioned.

Vocabulary. Similar to Hwang & Fu's [9] and Duman, et.al's [10] findings, this study also found that vocabulary was the most commonly addressed topic among these language skills. 7 studies were relevant to vocabulary acquisition and more than half involved the use of vocabulary app or software. Two studies concerned the use of mobile games. Almost all studies confirmed the positive effects of MALL on vocabulary learning although they were conducted from different perspectives. According to Su and Su [23] and Ling, Wang & Wang [24], mobile games are believed to be more effective in expanding learners' vocabulary and improving vocabulary use due to their attractiveness and entertainment function. However, Ling, Wang & Wang [24] also pointed out that learners failed to use appropriate learning strategies well. To further improve the effectiveness of MALL, teachers are suggested to offer more guidance in the selection of mobile learning resources.

Listening/speaking skills. Listening or speaking skills constituted the second largest proportion of these studies. Six studies focused on the effects of MALL on learners' listening or oral performance. The findings generally revealed the positive effects on oral English, such as increasing number of sentences [25] and promoting learners' accuracy and fluency [26]. In terms of listening, learners' ability was enhanced but no significant improvement was found.

Translation/writing skills. Translation and writing skills also attracted researchers' attention since these are usually regarded as demanding skills for Chinese foreign language learners. Three studies focused on translation and one concerned writing. These studies mainly adopted the pre- and post- test design to evaluate the effects through learners' translation or writing products and sometimes

questionnaires were also addressed to examine the effectiveness from learners' perspective.

Reading competency. There is only one research [27] concerning reading skills by applying WeChat public platform, demonstrating the positive effects on English majors' reading abilities. To maximize the effectiveness, it is recommended that the reading materials should be carefully designed based on students' needs, and appropriate guidance about reading techniques since big and long materials are not suitable for mobile learning.

Integrated skills. In a study of middle school students conducted by Wu [28], WeChat platform was applied to improve students' integrated skills including listening, speaking, reading and writing, and positive results about learner participation and improvements in language learning were detected through students' response in questionnaires. However, no statistics about learning gains were reported. While in Fan et al.s' [19] study, statistical evidence about language learning achievements were detected.

Higher-order competence. In Li and Wang's [29] study, a flipped classroom Model was constructed. Data from students' reflective journals, interviews and scores recorded by the mobile learning platform revealed that this model was of great significance in the development of lifelong learning since it promotes learner autonomy and other higher-order competence or thinking skills.

Although varied in focus, these studies generally showed the positive results, including optimizing educational resources, increasing learners' interests and efficiency in learning, engaging learners in active discussion, boosting confidence and reducing anxiety, promoting learner autonomy and being conducive to lifelong learning.

4.3.2. Learning processes

With advancements in information technology, it is possible for researchers to observe and analyze the learning process through utilizing learner's interaction data recorded by the mobile learning management system and tracking learners' actual use of mobile technologies. Thus researchers were increasingly enthusiastic about the exploration of MALL learning processes and thus empirical researches were conducted to examine learners' learning characteristics, information literacy, learning behavior and strategies as well as learning engagement. 7 studies (19%) fell into this category. These studies usually collected data through interactive dialogues, comments, questionnaires, semi-structured interviews, log files, diaries or journals, etc.

Learners' learning characteristics. Earlier studies mainly focused on the learning characteristics. For instance, in a study of university students by Weng [30], the characteristics and efficiency of collaborative MALL was examined by adopting content analysis and time series analysis method. This study mainly analyzed the participation patterns, collaboration patterns, and collaboration effectiveness of Collaborative-MALL, revealing the effectiveness of MALL in promoting participation, generating far more in-task output and encouraging more in-depth collaborations. In Zeng and Yu's [13] study, different communication patterns in the interaction process were compared by collecting data from interactive recordings and questionnaires. It was found that synchronous mobile-based communication produced more language-related-episodes (LRE) than traditional face-to-face communication.

Learners' Information literacy. The recent large-scale utility of mobile technologies calls for the broader "multi-literacies", such as information literacy. It is thus necessary to investigate learners' information literacy. He, He and Liu's [31] investigation about English majors indicated that learners had strong awareness and substantial knowledge of information technology under mobile learning background, but their information literacy and operational capacity remained to be improved.

Learning behavior and strategies. Based on lag sequential analysis, Li, Zhao and Liu [32] explored mobile English learning behavior, indicating that no significant correlation was found between the sequence of behavior and the final grades. Additionally, students with higher scores or higher levels of regulation have stronger learning initiative and more learning strategies. While in the study by Hui, Zhang and Li [33], concerning tertiary students' motivation regulation strategies in mobile learning environment, it was found that the adopted strategies were mainly influenced by grades, gender and majors.

Learning engagement. Engagement, defined by Skinner and Pitzer [34], is "constructive, enthusiastic, willing, emotionally positive and cognitively focused participation with learning activities". Philp & Duchesne [35] pointed out the four dimensions of engagement including cognitive, behavioral, emotional and constructs. Two studies concerned learners' engagement from different perspectives. Chen [36] explored the changes and the influencing factors of university students' engagement in a smartphone-integration project. It was found that smart phones can improve students' behavioral,

cognitive and emotional engagement. In another study involving 300 university students by Jing [37], different types of engagement, the subjective characteristics of the students, and the influencing factors of their engagement were examined. The findings indicated that learners generally showed habitual engagement in behavior, featuring both positive and negative cognitions and relatively positive emotional experience. Furthermore, the influencing factors mainly included motivation, self-efficacy, structure of resources and policies as well as their self-adaption and self-regulation in the process of social synergy, self-driven interaction and creative construction.

4.3.3. Learners' technology acceptance and perceptions

In educational contexts, mobile technology cannot realize its pedagogical potential if learners are not willing to use it. In addition, how individual students perceive and adopt MALL will directly influence the effectiveness of it. Thus many researchers turned to investigate learners' technology acceptance and perceptions of MALL applications as well as the influencing factors. Eight studies (22%) fell into this category.

Technology acceptance. Learners' technology acceptance is largely informed by the pedagogical framework TAM or the extended version of UTAUT. For instance, it was under the guidance of TAM that Zhan and Zhang [38] have examined issues such as usability and applicability of the designed software, finding that learners generally showed a positive attitude toward it. In Meng, Liu & He's [39] study, UTAUT model was utilized to measure college students' acceptance of MALL. It was found that learners generally had a higher overall acceptance of it, and the direct influencing factors are perceived interest, performance expectations and self-management. Based on UTAUT2 model by Venkatesh et al. in 2012, Zeng [15] evaluated Japanese learners' technology acceptance. The results indicated that users of different grades, majors, foreign language proficiency, learning experience and using experience have significant differences in terms of use behavior, social influence, facilitating conditions of start-up, habit and the behavioral intention. Yang, et.al. [40] investigated the usability of an assisted English learning system named M-oral and the survey results of the user experience indicated users' positive attitude toward it due to the strong operation and high availability.

Influencing factors. A study of non-English majors by Xi, Wang and Zhang [41] suggested that multiple intelligence factors such as linguistic intelligence and musical intelligence might affect acceptance and involvement of MALL. In another study concerning vocational college students by Weng and Wu [42] indicated that technology acceptance, learner autonomy and academic scores are the main factors to influence the effectiveness of MALL. However, the study by Xu and Zhang's [43] reported that the flow experience, perceived mobility and service quality have significant effects on the continuous use intention of learning users. The content quality of online learning has an indirect impact on user behavior through the flow experience. Additionally, it's found that learners' behavior was also influenced by whether the platform is paid or not. Different from these results, Alsharida and Hammood [44] reported that self-efficacy was the most frequent factor affecting m-learning after reviewing studies published on the use of TAM in m-learning context. The differences may be partly due to the different research samples and the different research contexts.

Learners' perceptions. Many researchers have examined learners' perceptions of MALL while investigating learning outcomes or processes. However, these studies just took it as a small part of the whole research design but not as the focus. There was just one study focusing exclusively on learner' perceptible features of MALL. By analyzing 3090 elicited metaphors from 6 universities, Meng, Ma & Yue [45] found that learners' perceptions fell into 4 categories, including completely positive, positive, neutral, and negative. There was positive correlation between their perceptions and their actual learning behaviors including invested time, learning autonomy, specific learning activities and self-regulation.

5. Discussion

In response to the first research question, the results show that researchers tend to base their research on diverse theoretical frameworks and many studies are not based on one theory. Constructivist learning theory is usually applied to guide the activities in which learners actively construct new ideas or concepts in the process of interacting with peers, teachers and resources, and situated learning theory is adopted to inform activities that facilitate learning in an authentic context and culture. Collaborative learning theory mainly guided activities that promote learning through social interaction. Some studies [19] [24] [25] designed a variety of activities based on more than one theory.

However, it was found that a significant number did not specify any theoretical framework or

foundation to underpin the research. This is considered as a major problem in research studies concentrating on instructional technology [10, 46]. One possible reason for it may be the lack of mature conceptual frameworks for mobile learning and theoretical models specific to the newly emerging field. Also, some journals in China don't have strict requirements for theoretical description but emphasize the sharing of teaching or learning practice. It seems acceptable to some researchers that the application of mobile technology in language education can be proceeding without a theoretical support. Nevertheless, to better inform curriculum initiatives and guide teaching practices, conceptual studies are still needed to construct theories specific to MALL.

Regarding the methodologies in these studies, researchers recently tend to adopt mixed methods by collecting both quantitative and qualitative evidence so as to make the results more sound and convincing. Besides statistical analysis, research instruments such as open-ended questionnaires and semi-structured interviews are largely used to further explore the reasons for the significant difference in statistics. In publication field, it seems quantitative studies are more preferred since a single qualitative method is usually regarded as lack of objectivity. Thus the number of studies adopting quantitative methods is significantly larger than that of those using a single qualitative method. As for research contexts, there is a lack of diversity. Studies concerning elementary and middle school education context are too limited. Follow-up studies are needed to explore primary and middle school students under the premise of not harming their eyesight, since they are now also skilled users of mobile technologies. The sample sizes are larger than the previous studies, which may be due to the large number of survey studies collecting data through questionnaires. Many studies evaluate the outcomes through the self-reported questionnaires or interviews, lacking quantitative evidence to confirm the learning gains. Additionally, as stated by Gao, Liao and Li [47], influenced by prevalent cultural practices within the Chinese academy community, publications in mainland Chinese journals are relatively shorter, without a detailed description of the methodologies used. This limitation may, to some extent, prevent proper evaluation of the methodologies.

Concerning the last research question, learning outcomes are found to be a dominant theme in the literature under analysis. Papers in this category mainly explore the effects of MALL implementation on language skills. It's found that these skills are primarily enhanced through the construction of new teaching models or the innovation of teaching methods. In the past years, the Ministry of Education in China has continuously emphasized the shift in focus from quantity to quality by releasing several official documents and the integration of mobile technology has been promoted as part of curriculum reforms at all educational levels, especially in higher education context. An increasing number of educators have displayed great enthusiasm for the reform of teaching model by fully utilizing mobile technologies, such as interactive mobile translation teaching model [12][17], flipped classroom model [19][29], blended teaching model for oral English presentation [48]. These teaching models generally emphasized the combination of online and offline learning, formal and informal learning or inside and outside of classroom learning. In these models, MALL programs are mainly used to complement the face-to-face learning methods. Despite that the positive influence of MALL on language skills were overwhelmingly reported, it should be noted that this is not the case for every individual student. There are also problems reported such as being distracted by irrelevant information, being overwhelmed by too many resources, etc. Additionally, there is a lack of studies focusing on higher-order thinking skills or competence.

In studies concerning learning processes, attention is increasingly being turned to learning engagement by tracking and analyzing learners' behavior. Nevertheless, little attention has been paid to teachers in terms of their engagement and information literacy. Furthermore, in studies focusing on technology acceptance and learner perceptions, the focus are usually on learners while teachers are generally ignored. Thus there is also an urgent need to investigate technology acceptance from teachers' perspective which may directly influence their effective guidance on students since teachers also play significant roles in the successful implementation of MALL.

6. Conclusion

This review provides a comprehensive analysis and synthesis of 36 empirical MALL studies published from 2015 to 2020 in leading mainland Chinese journals. The results indicated that diverse theories or pedagogical frameworks were applied to inform their studies but there were still a significant number of studies failing to specify any theories. Regarding methodologies, researchers tended to prefer the mixed research designs by providing both quantitative and qualitative data but there is a lack of diversity in data collection instruments to make the study more reliable. Furthermore, the three major themes were identified, including learning outcomes, learning processes as well as technology

acceptance and perceptions. The positive effects of MALL were largely reported from different perspectives although limitations still exist, including the lack of professional guidance in the learning process, low efficiency when discussing textual logic and coherence, being easily distracted from irrelevant information, being overwhelmed by too many resources.

This finding offers pedagogical suggestions for educators or practitioners to implement MALL more effectively. Firstly, appropriate guidance should be provided timely so as to reduce learners' anxiety and ensure the learning efficiency. Secondly, the mobile learning content should be carefully designed after fully considering the suitability of mobile devices and mobile teaching methods. Finally, it's necessary to make the best of information technologies to improve the interactive and communication functions on mobile programs and engage students in learning function instead of playing games.

For future researchers, MALL studies can be explored further in the following areas. Firstly, there is a need for solid theoretical bases or pedagogical frameworks specific to MALL so as to establish a connection between theory and practice. In addition, conducting methodologically sound and statistically reliable studies that account for more than just language skills will be beneficial to the realization of pedagogical potential of innovative MALL implementations. Furthermore, future attention can be turned to studies exploring teachers' engagement, information technology literacy as well as technology acceptance.

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