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The Development of Mobile Applications for Language Learning: A Systematic Review of Theoretical Frameworks

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Abstract. This systematic review was conducted to examine theories that were adopted or considered in the development of mobile applications for language learning. It aims to provide a holistic overview of major theoretical principles that underpin each developmental study to identify trends and gaps in the synthesised literature. The studies were collected from the Scopus and Web of Science databases as they were the main sources of reputable journals. Primary searches between 2011 and 2020 revealed approximately 158 studies related to the topic under investigation. After further filtering based on the inclusion criteria and removal of duplicates, 39 studies matched the research criteria and were used for further analysis. The analysis revealed that researchers tend to choose to solve problems pertaining to vocabulary learning and learners' motivation through the development of mobile applications for language learning. They preferred to use constructivist-based theories such as situated learning and collaborative learning in guiding their development though behaviourist principles are also dominant. However, very few studies used theories related to language acquisition and learning in the design and development process. Hence, this gap should be given priority in future developmental research within the same scope as the generic learning theories may not be accurately addressing the language learning problems.

Keywords: mobile applications; theories; language learning; mobile learning; mobile development

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1. Introduction

The advancement of mobile technologies has led the shift towards ubiquitous learning, where learning can occur anytime, anywhere. Over the past decades, mobile devices are no longer confined to communication purposes but are increasingly used as an essential learning tool across all levels of education (Crompton & Burke, 2018; Heil et al., 2016; Rajendran & Md Yunus, 2021; Shin et al., 2011). The same development can be observed in language teaching, mainly in the second language and foreign-language learning contexts. As mobile-assisted language learning (MALL) becomes more prevalent, it has motivated researchers to explore various mobile technologies for the purpose of simulating authentic language learning experiences (Adams et al., 2021; Chuah, 2014), elevating the opportunities to use the target language and increasing language gains (Kukulka-Hulme, 2016; Persson & Nouri, 2018; Shadiev et al., 2020).

Studies about MALL have evolved from empirical investigations on the effectiveness of existing mobile applications to design-based research that centred on the development of mobile applications to address specific areas of concern within language learning (Botero et al., 2018; Viberg & Grönlund, 2012). Despite the encouraging development of MALL, many studies on its implementation focused on short-term pre- and post-test results (Gutiérrez-Colón et al., 2020; Hsu & Liu, 2021). Burston (2015) highlighted this shortcoming, which could be a result of poorly designed research studies. There is also a commonly cited concern about the novelty effect of introducing mobile applications to learners as it often leads to biased positive results in most of the studies reported (Björkman et al., 2019; Jenö et al., 2019). In addition, previous studies on MALL (Heil et al., 2016) were predominantly incorporating mobile applications or tools which were not intended for language learning (e.g., social media, chat, and quiz applications). Some studies investigated the usefulness and effectiveness of commercially available language learning applications such as Duolingo (Garcia, 2013; Shortt et al., 2021) and Busuu (Shibata, 2020). This trend has prompted researchers to embark on design-based or developmental research (Chuah & Kabilan, 2021) in creating applications that are more relevant to language learning, especially in recent years.

In terms of development research related to mobile applications for language learning, researchers tend to emphasise the testing of diverse technologies such as multimedia, virtual and augmented reality, conversational agents and artificial intelligence-based systems. Moreover, previous reviews on mobile-assisted language learning were focusing on factors and effects of using mobile tools. For instance, Elaish et al. (2019) reviewed 69 papers on mobile English language learning according to constructs that included types of mobile learning technologies, language learning problems, sample information, purposes and assessment methods. Most of the studies selected were in the form of investigation or review. There is an apparent need to investigate further the development process by scrutinising the fundamental theories that were selected. As reiterated by Traxler (2017), the underlying problem in mobile learning is the lack of discourse on necessary theoretical considerations as the spotlight is often on the technological aspect.

There is currently very limited systematic review driven by the need to examine theoretical underpinnings of development research on mobile applications in language learning. Most studies were on the general overview of mobile learning adoption (Crompton & Burke, 2018; Osman, 2021). Existing reviews that cover theories and models in mobile learning are limited to integration and acceptance models (Alkhezzi & Ahmed, 2020; Kumar & Chand, 2019) or the general design of mobile learning (Churchill et al., 2015), which are not specific to developmental studies. As learning theories lay the foundation for any development, examining and comparing the most commonly used theories in the selected literature from 2011 to 2020 (a decade of literature) would be beneficial as the findings could guide future development. Based on these gaps in the current related reviews and research reports, it is necessary to examine learning theories and principles that were considered in the development of mobile applications for language learning.

Hence, this systematic review aims to answer the following research questions:

- i. Which language learning problems were addressed in the studies on mobile application development for language learning?
- ii. What were the learning theories or principles used in guiding the development of mobile applications for language learning?

2. Methods

A systematic review was conducted to answer the research questions. It was based on the procedures mentioned by Khan et al. (2003) and Sarkis-Onofre et al. (2021) which followed the PRISMA review protocol. The process consisted of the following four phases:

2.1 Formulation of inclusion and exclusion criteria

In order to ensure the review covers relevant and accurate studies, this systematic review used the inclusion and exclusion criteria as shown in Table 1. These criteria were formulated in line with the aim and research questions set for this review. Each research article must have fulfilled all the criteria to be selected for further analysis.

Table 1: Inclusion and Exclusion Criteria

| Inclusion Criteria | Exclusion Criteria |
|---|--|
| <ul style="list-style-type: none"> • Explains the process of developing the mobile application for language learning/teaching (design and development) • Includes explanations on learning theories or principles in guiding development • Across all levels of education (K-12, higher education) • Article was published in peer-reviewed publications • Article was written in English • Article's full text is accessible | <ul style="list-style-type: none"> • Used commercial applications or readily available tools (e.g., Duolingo, Busuu) as this review focuses on development research • Reporting only empirical findings (e.g., pre- and post-test results) • Not related to language learning or teaching • Article was published before 2011 or after 2020. This criterion is to focus on the decade period of the related works. • Explanation on theories is too minimal and cannot be synthesised |

2.2 Development of a Search Strategy

Several key terms and combination of the terms were used and then shortlisted for better search results. The terms were “development of mobile applications”, “design of mobile applications”, “language learning”, “development studies”, “mobile learning applications”, “design-based research”, “developing mobile applications”, “language learning apps”, “mobile apps”, and “language learning applications”. Using these key terms with Boolean operators such as AND, OR, and NOT (Jahan et al., 2016) as well as the database’s filtering function, the most relevant articles were able to be shortlisted. Quotation marks were also used to find the exact phrase. The chosen strategy focused on the article title, abstract or summary, and on keywords listed in the article so that relevant articles could be filtered efficiently.

The term “learning theories” or “learning theories for mobile application design” were not added to the search process as the intention of this systematic review is to derive those theories through the analysis of reports gathered on related mobile learning applications. The review of related language learning theories, however, was done separately in formulating the coding frame for the analysis.

2.3 Identification of Relevant Publications

Two main databases (Scopus and the Web of Science) were used to identify publications according to the criteria and search strategy defined in the earlier phases. These databases were chosen as they were widely accepted as the main sources of reputable journals that have a proper review process. The abstracts of articles obtained were carefully read and evaluated for relevance. If the title was relevant but the abstract provided had very limited information, the full text was skimmed, scanned and checked according to the inclusion criteria. This identification procedure was repeated twice to ensure no pertinent articles were left out. Articles from the same project or by the same authors were also filtered and only the one with the most information was included in the analysis.

From the initial search results using keywords, 158 studies were found to meet the scope for further screening. A total of 79 did not fulfil the criteria stated in Table 1, as the majority of these studies mainly reported empirical findings with minimal details on the design and development process. Some also used existing language learning applications though the titles seem relevant. Twelve studies were excluded as they were duplicates or related to the same projects. The remaining 67 were then screened thoroughly to ensure they met all the criteria in Table 1. However, 28 of those studies had to be excluded owing to the fact that the theoretical part lacked sufficient details or was unclear. Hence, the total number of articles included for further analysis was 39. The identification and screening procedures are illustrated in Figure 1.

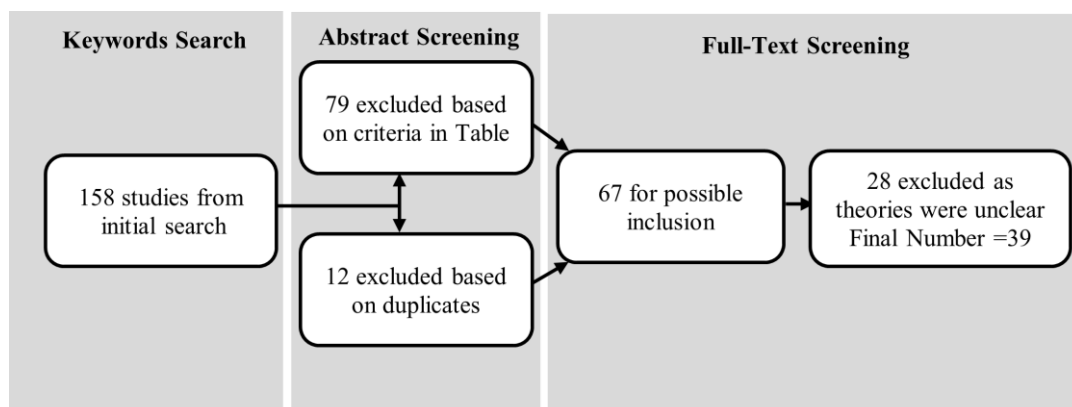


Figure 1: Procedures in Screening Relevant Publications for Review

2.4 Coding and analysis procedures

In this review, the studies were first coded for essential information, namely publication year and rate of publication, the geographical distribution of the research area, and the research context or setting. To answer the research questions (RQs) of the study, the studies were read and coded according to the qualitative data coding guidelines suggested by Linneberg and Korsgaard (2019). A deductive coding approach was employed whereby codes were pre-defined for the important elements included in the two research questions. These codes were theoretical concepts or themes derived from relevant literature. The codes were compared during the coding process, and elements that were not within this coding frame would then be added.

Table 2 shows the coding frame used in the analysis process. RQ1 covers linguistic competence and communicative competence that are accepted to be fundamental to language learning (Celce-Murcia, 2001; Larsen-Freeman & Anderson, 2013) and other related difficulties such as motivation, lack of exposure. RQ2 includes the three broad groups of learning theory (behaviourism, cognitivism and constructivism) and their sub-groups that could be in the forms of principles, models or approaches (Mowrer & Klein, 2000) as well as theories drawn from language learning, especially within second language acquisition (Mitchell et al., 2019), which are not part of the broad groups. The coding process was repeated three times to ensure reliability and validity.

Table 2: Coding Frame used for Data Analysis

| RQ1: Language Learning Problems or Difficulties | |
|--|--|
| Linguistic competence | <ul style="list-style-type: none"> • Grammar • Vocabulary • Syntax |
| Communicative competence | <ul style="list-style-type: none"> • Speaking skills • Listening skills • Reading skills • Writing skills • Interpersonal skills • Intercultural communication |

| | |
|--|--|
| Other issues | <ul style="list-style-type: none"> • Learner's motivation • Lack of authentic language learning opportunities • Lack of support/guidance |
| RQ2: Underlying Learning Theories | |
| Behaviourism | <ul style="list-style-type: none"> • Direct instruction • Programme instruction |
| Cognitivism | <ul style="list-style-type: none"> • Attribution theory • Elaboration theory • Cognitive development • Condition of learning • Information processing theory • Cognitive theory of multimedia learning |
| Constructivism | <ul style="list-style-type: none"> • Activity theory • Cognitive apprenticeship • Contextual learning • Collaborative learning • Discovery learning • Inquiry-based learning • Problem-based learning • Situated learning • Personalised learning |
| Second Language Acquisition | <ul style="list-style-type: none"> • Connectionism • Chomsky's Universal Grammar • Krashen's input hypothesis • Krashen's monitor model • Interactionist theory • Schmidt's noticing hypothesis • Halliday's systemic functional grammar (SFG) |

For research papers that do not specifically mention the theories, the underlying principles explained in the papers were extracted and analysed. The researchers then categorised them according to the most relevant theory or approach. However, it is worth noting that there were only a few of these papers and only those with evident indicators were included in the analysis. Papers that contained insufficient details on the theories were excluded during the screening phase.

3. Results and Discussion

The primary aim of this systematic review is to provide an overview of the theoretical foundation chosen by researchers in their development of mobile applications for language learning. This section reports the results obtained from the analysis of 39 relevant studies, which are also discussed in relation to pertinent literature.

3.1 Distribution of Publication within the Selected Period (2011-2020)

Figure 2 shows the distribution of research papers by year of publication within the selected ten-year period. The average number of studies reported per year is approximately four. As found by Elaish et al. (2019), studies in the area of mobile learning are dominated by the purpose of general investigation and review of

existing applications. However, the number of development research studies related to mobile learning applications for language learning shows an increasing trend, perhaps due to the greater interest in developing applications for specific group of learners.

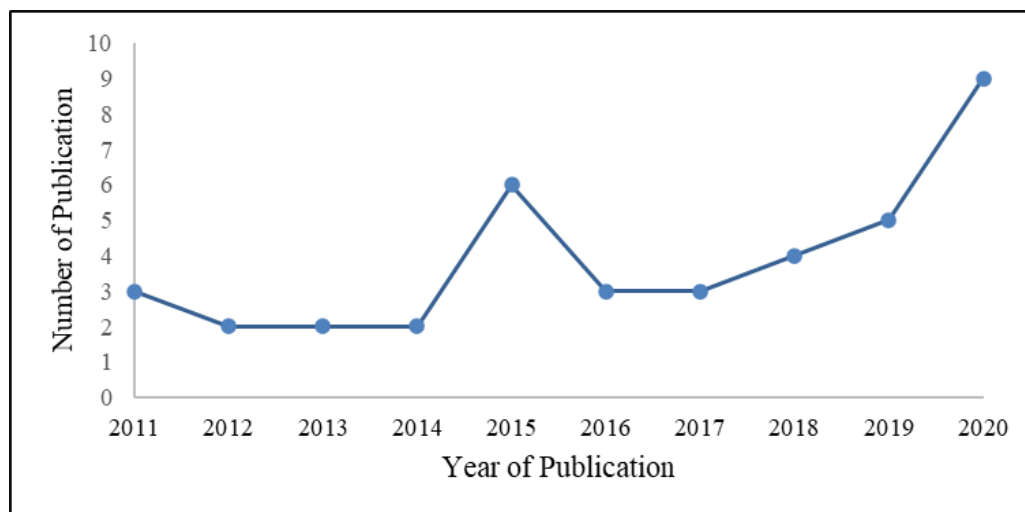


Figure 2: Number of Studies by Year of Publication

3.2 Geographical Distribution of Research Area

The studies selected for analysis covered four regions (Asia, Europe, North America and Africa) and 21 countries as shown in Figure 3. Researchers from Asia, particularly those from Taiwan, were active in reporting their developmental research related to mobile applications for language learning. They were followed by researchers in Europe. However, the selected pool of studies still managed to represent a global view of the research questions investigated in this systematic review.

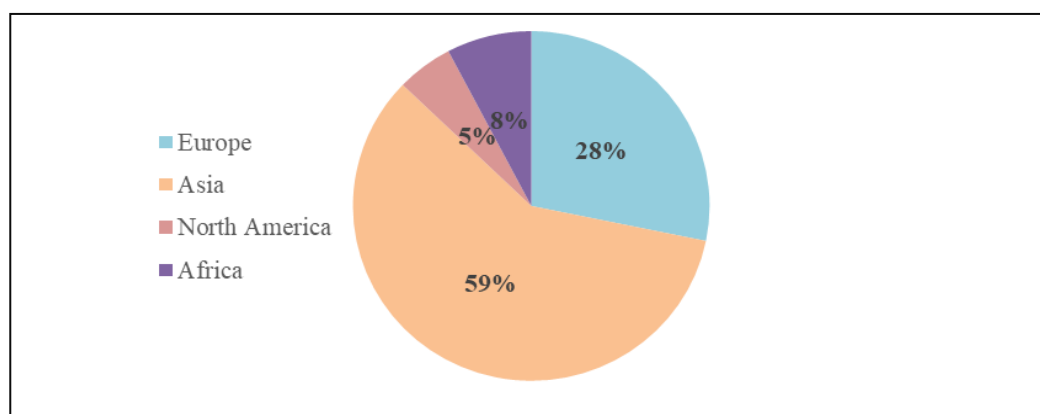


Figure 3: Geographical Distribution of Research Area of Selected Studies

3.3 Research Contexts

Figure 4 illustrates the number of publications by research contexts or settings. Similar to other systematic reviews that focused on mobile-assisted language learning, much of the development research was conducted in higher education

contexts. Nevertheless, it is interesting to note there were some development projects that were done specifically for the general public such as the one by Bradley et al. (2020), which focused on migrants. This seems to suggest that the development of mobile applications for language learning is no longer restricted to educational settings.

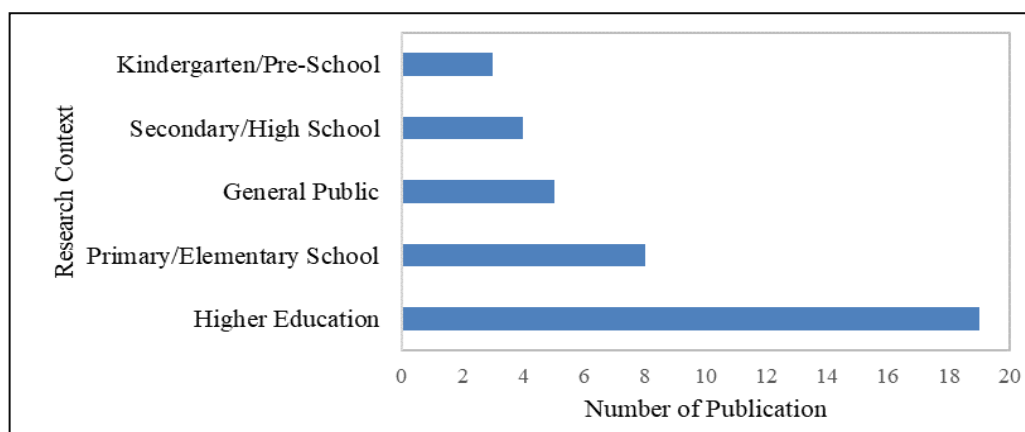


Figure 4: Number of Publications by Research Contexts

3.4 Language Learning Problems

Table 3 summarises language learning problems mentioned in the selected studies. These problems were then used as the research problems to be addressed through the development of mobile applications. The researchers in the selected studies had given more attention to developing learners' linguistic competence, especially in terms of vocabulary acquisition (n=21). As the building blocks of language, vocabulary mastery is regarded as very important and any means to promote it, including through mobile applications, is often welcome (Brahin et al., 2020; Wang & Suwanthep, 2017).

Another commonly cited problem across the selected studies is the lack of motivation among the learners to learn the target language (n=11), especially when conventional teaching strategies were used. There is also an excitement among learners to use mobile devices to increase the opportunities to learn the language by means of authentic tasks and resources (n=9). As mentioned by Hao et al. (2019), mobile applications enable learners to be engaged with language learning resources beyond the classroom. Furthermore, researchers focussed more on receptive skills (listening and reading) than productive skills since mobile applications are useful in displaying multimedia resources seamlessly. Writing skills were not the main focus of the studies, perhaps owing to the fact that it is a difficult skill to be taught via mobile applications. Li and Hegelheimer (2013) highlighted this issue when developing their application for second language writing (called Grammar Clinic), as they still focus on the grammar aspect. Only three studies mentioned the problem of intercultural communication, and they were embedded within the learning of speaking skills.

Table 3: Language Learning Problems Mentioned in the Studies

| Problems | Studies | Total |
|---|---|--------------|
| Vocabulary | Ogata et al. (2011); Veenhof et al. (2012); Lu et al. (2014); Sandberg et al. (2014); Milutinović et al. (2013); Kim and Smith (2015); Chachil et al. (2015); Kidu (2015); Rosell-Aguilar and Qian (2015); Böhm and Constantine (2016); Wang and Suwanthep (2017); Ou-Yang and Wu (2017); Rawendy et al. (2017); Wilken et al. (2018); Samur (2019); Al-Razgan and Alshaarri (2019); Jalaluddin (2020); Bradley et al. (2020); Lai et al. (2020); Brahin et al. (2020); Chen and Hsu (2020) | 21 |
| Learners' Motivation | Connolly et al. (2011); Ibáñez et al. (2011); Ogata et al. (2011); Hsu et al. (2013); Sandberg et al. (2014); Wang and Suwanthep (2017); Ou-Yang and Wu (2017); Samur (2019); Hao et al. (2019); Bradley et al. (2020); Brahin et al. (2020) | 11 |
| Listening | Ibáñez et al. (2011); Chachil et al. (2015); Rosell-Aguilar and Qian (2015); Liu et al. (2018); Wilken et al. (2018); Shadiev et al. (2018); Hao et al. (2019); Wang et al. (2019); Bourekkache dan Kazar (2020); Chen and Hsu (2020) | 10 |
| Lack of Authentic Language Learning Opportunities | Connolly et al. (2011); Ogata et al. (2011); Fallahkhair (2012); Rosell-Aguilar and Qian (2015); Wong et al. (2016); Böhm and Constantine (2016); Wang and Suwanthep (2017); Lee (2020); Hao et al. (2019) | 9 |
| Reading | Ibáñez et al. (2011); Hsu et al. (2013); Chachil et al. (2015); Mustapa et al. (2018); Shadiev et al. (2018); Hao et al. (2019); Wang et al. (2019); Bourekkache dan Kazar (2020); Chen and Hsu (2020) | 9 |
| Grammar | Ogata et al. (2011); Li and Hegelheimer (2013); Haristiani et al. (2019); Al-Razgan and Alshaarri (2019); Refat et al. (2020); Lin et al. (2020) | 6 |
| Speaking | Ibáñez et al. (2011); Lu et al. (2014); Wilken et al. (2018); Shadiev et al. (2018); Hao et al. (2019); Bourekkache dan Kazar (2020) | 6 |
| Writing | Ibáñez et al. (2011); Li and Hegelheimer (2013); Rosell-Aguilar and Qian (2015); Shadiev et al. (2018); Hao et al. (2019) | 5 |
| Intercultural Communication | Ogata et al. (2011); Ibáñez et al. (2011); Bradley et al. (2020) | 3 |

3.5 Learning Theories and Principles in Guiding Development

The outcome from the analysis on learning theories reveals that 25 of the 39 studies adopted constructivism in guiding their design and development of

mobile applications for language learning (refer to Figure 5). This finding is to be expected since 21st century learning has been extensively promoted for the past ten years. Technological advancement such as virtual and augmented reality and web-based interactive tools has also contributed to the greater acceptance of constructivist principles. However, it is noteworthy that behaviourism still has a place in the development of mobile applications, especially in vocabulary and grammar drills. The application designed by Kidu (2015), for example, is based on structural programmed instruction that teaches learners the basic vocabulary and grammatical rules of a minority language in Ethiopia. It comprises many drills and exercises to enhance memorisation of the words and rules. Clearly, it serves its intended purpose though guided by the less-popular behaviourist approach.

Apart from that, researchers were not paying much attention to adopting theories specific to language learning. Only six studies (Li & Hegelheimer, 2013; Lin et al., 2020; Mustapa et al., 2018; Moreno & Vermeulen, 2015; Shadiev et al., 2018; Wilken et al., 2018) selected theories within the scope of second language acquisition (e.g., interactionist, Halliday's systemic functional grammar and Krashen's input hypothesis). Four studies reported the use of the interactionist theory in which the communicative approach is the preferred choice among the researchers as it fits the scope of language learning.

In addition, contemporary theories related to the information age such as connectivism and challenge-based learning were not mentioned at all in the reviewed studies. This preference could mean that researchers are inclined to rely on "tried-and-tested" theories in their developmental work rather than exploring uncharted zones of newer theories. It could also be due to the general belief that newer theories (e.g., connectivism) are essentially derived from the core principles of constructivism. Nevertheless, this finding means that there is room to investigate whether the theories or principles spawned from 21st century learning could be more useful in the process of designing and developing mobile learning applications.

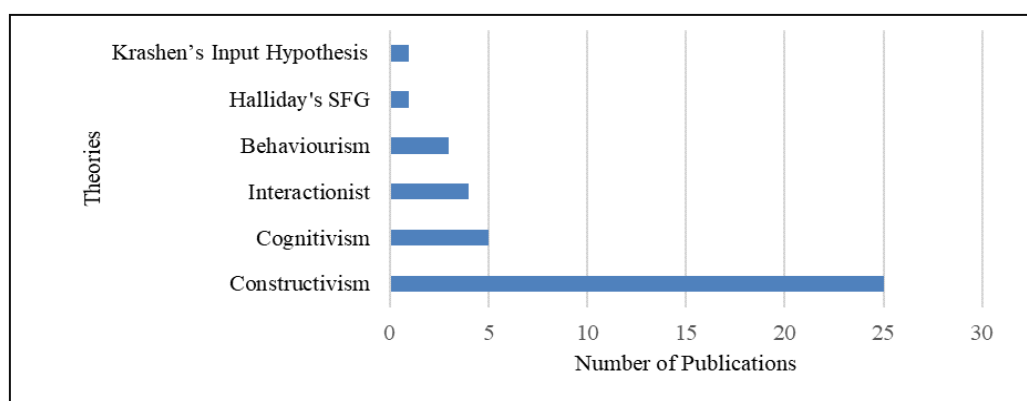


Figure 5: Frequency Count of the Theory selected to guide Design and Development

Table 4 shows the overview of the main principles or approaches adopted in each study based on the selected learning theory. Within constructivism, situated learning, contextual learning, collaborative learning and game-based learning are popular across the time period of 2011 to 2020. Activity theory and cognitive apprenticeship are rarely mentioned; however, Wang et al. (2019) and Hao et al. (2019) demonstrated how these two theories can be integrated in developing applications for language learning. For cognitivism, the information processing and mixed-modality theory are commonly used in applications that contain multimedia elements as learning resources; however, they lack interactivity. As cognitivism deals with human working memory, the principles of this theory are useful in the development of applications that emphasise meaningful memorisation of vocabulary based on a given context.

Table 4: Learning Theories and Principles Mentioned in Each Study

| No. | Study | Learning Theory | Main Principle/Approach |
|-----|--------------------------------|----------------------------|---|
| 1 | Connolly et al. (2011) | Constructivism | Situated learning |
| 2 | Ogata et al. (2011) | Constructivism | Situated learning; Metacognition |
| 3 | Ibáñez et al. (2011) | Constructivism | Situated learning; Collaborative learning |
| 4 | Fallahkhair (2012) | Constructivism | Collaborative learning |
| 5 | Veenhof et al. (2012) | Constructivism | Game-based learning |
| 6 | Li and Hegelheimer (2013) | Interactionist | SLA - Noticing hypothesis |
| 7 | Hsu et al. (2013) | Constructivism | Personalised learning; Collaborative learning |
| 8 | Lu et al. (2014) | Constructivism | Activity theory; RASE model |
| 9 | Sandberg et al. (2014) | Cognitivism | Information processing |
| 10 | Milutinović et al. (2013) | Behaviourism | Programme instructions; Drills |
| 11 | Kim and Smith (2015) | Constructivism | Situated learning |
| 12 | Chachil et al. (2015) | Constructivism | Contextual learning |
| 13 | Kidu (2015) | Behaviourism | Structural; Direct instruction |
| 14 | Rosell-Aguilar and Qian (2015) | Constructivism | Personalised learning; Game-based learning |
| 15 | Moreno and Vermeulen (2015) | Interactionist | Communicative approach; Task-based language teaching |
| 16 | Wong et al. (2016) | Constructivism | Contextual learning |
| 17 | Chang et al. (2016) | Constructivism | Inquiry-based learning; ARCS |
| 18 | Böhm and Constantine (2016) | Constructivism | Contextual learning; Personalised learning |
| 19 | Wang and Suwanthep (2017) | Constructivism | Contextual learning |
| 20 | Ou-Yang and Wu (2017) | Cognitivism | Mixed-modality |
| 21 | Rawendy et al. (2017) | Cognitivism | Information processing; Mnemonic |
| 22 | Liu et al. (2018) | Constructivism | Collaborative learning |
| 23 | Wilken et al. (2018) | Interactionist | Communicative approach |
| 24 | Mustapa et al. (2018) | Krashen's input hypothesis | Narrow reading (NR) approach |
| 25 | Shadiev et al. (2018) | Interactionist | Communicative approach; |

| | | | |
|----|--------------------------------|----------------|---|
| | | | Task-based language teaching |
| 26 | Samur (2019) | Constructivism | Game-based learning |
| 27 | Hao et al. (2019) | Constructivism | Cognitive apprenticeship |
| 28 | Haristiani et al. (2019) | Behaviourism | Programme instructions |
| 29 | Wang et al. (2019) | Constructivism | Activity theory model (Engestrom) |
| 30 | Al-Razgan and Alshaarri (2019) | Constructivism | Game-based learning |
| 31 | Jalaluddin (2020) | Cognitivism | Cognitive theory of multimedia learning |
| 32 | Bradley et al. (2020) | Constructivism | Situated learning |
| 33 | Refat et al. (2020) | Cognitivism | Information processing |
| 34 | Bourekache dan Kazar (2020) | Constructivism | Situated learning |
| 35 | Lee (2020) | Constructivism | Game-based learning; collaborative learning |
| 36 | Lai et al. (2020) | Constructivism | Contextual learning |
| 37 | Brahin et al. (2020) | Constructivism | Game-based learning |
| 38 | Chen and Hsu (2020) | Constructivism | Situated learning; Game-based learning |
| 39 | Lin et al. (2020) | Halliday's SFG | Seven functions of language development |

The findings from this systematic review seem to point toward the emerging concepts catalysed by constructivism. It is clear that as mobile technologies become more advanced, features that enable authentic learning of a target language become the key interest of mobile application developers. Related principles or approaches such as situated learning and collaborative learning are regarded to be effective in engaging learners while enhancing the mobile language learning experience.

4. Implications and Recommendations

This systematic review is restricted to studies published in journals indexed by the two databases (Scopus and Web of Science) pertaining to the development of mobile applications for language learning with a specific interest in the learning theories selected in each study. The review was limited to the articles screened according to the criteria mentioned earlier and may not cover all works published within the same scope as some could have been published in other languages or indexed by other databases. Furthermore, during the screening process, there were developmental studies that had to be removed from analysis as they did not mention the underlying theories in the published article (e.g. focusing only on the technical aspect). Despite this limitation, the results from the review have provided a sufficient overview of the popular theoretical frameworks adopted by researchers globally.

In addition, this review has also shown the emphasis on developing applications for vocabulary learning. The ubiquitous nature of mobile applications is seen as an excellent way to increase exposure to the target language by highlighting words in context (Ogata et al., 2011). There is, however, a shift of focus towards

a more holistic approach in creating applications that not only motivate learners to learn but also simulate a meaningful environment for interactions. The development works by Lin et al. (2020) and Wilken et al. (2018) are among the examples of how language learning through mobile applications can go beyond the repeated memorisation of words and grammar.

Future research could examine the choice of theoretical underpinnings and its impact on other relevant variables such as learners' satisfaction and learning gain so as to provide a clearer understanding of how a theoretical foundation can influence the outcome of development. Moreover, this systematic review also reveals that most of the studies were conducted in higher education contexts although mobile applications for language learning could benefit school students more, particularly at a younger age. This calls for researchers or developers to make school settings their priority in future developmental works to maximise the potential of MALL. During the review process, it is noted that some theories were used without proper mapping of how each design element can match the principles of the selected theory. Future research could therefore address this issue by investigating how each feature or element in the application is linked to the theoretical foundation.

5. Conclusion

This systematic review contributes to the related body of MALL research by highlighting the current trends within the development of mobile applications for language learning. It aims to address the gap in previous reviews by focusing on the theoretical underpinnings of each study. Out of the 39 studies screened for analysis, 64% (n=25) employed constructivism as their guiding theory in designing and developing mobile applications. The dominance of constructivism is anticipated; however, the lack of attempts to include theories related to language learning as well is surprising. Only six studies specifically made use of second language acquisition theories or at the very least, were guided by a general understanding of how language learning works. Since the applications were meant for language learning, it is a concern that the development process is guided only by generic pedagogical approaches such as situated learning and collaborative learning. Though these studies are beneficial in outlining how the application should function, they may not be accurately solving the problems identified in language learning. In conclusion, this systematic review has highlighted the need to document the inclusion of learning theories properly in the development of mobile applications for language learning, which can guide other researchers who intend to evaluate the most appropriate theories to be used.

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