# Mixed Methods Study: Integrating Mobile Games in Teaching English Vocabulary in Formal Saudi Education

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## Abstract

The purpose of this study is to investigate the potential and effects of using mobile device games on learning English as a Foreign Language (EFL) vocabulary in a Saudi female public high school. Although English has been taught in Saudia Arabia since 1958, the learning outcomes have not been satisfactory, hence the imperative to research new teaching methods. After conducting pilot studies of five mobile games with teachers and students, The English Bee, an original game specifically designed for this research project, was. selected. The study comprised two participant cohorts: one taught through The English Bee, the other a control group taught by traditional methods. It employed a mixed methodology of a number of collection techniques for both qualitative and quantitative data, namely, pre- and post-tests, focus group discussions, interviews and reflective essays. The results show that using mobile game helps to improve students' achievements in learning EFL vocabulary, in terms of both the spelling of words and pronunciation recognition, as well as in enhancing their positive attitudes towards learning a foreign language. These results will assist other researchers, developers and educationalists worldwide, in choosing or programming games for learning both English and other foreign languages.

**Keywords:** Mobile learning, Mobile games, Vocabulary learning, Mixed methods design, EFL, ELearning

## 1. Introduction

Learning a second or foreign language has become a necessity due to the globalisation and competitive nature of the world today. Therefore, it is important to study at least one foreign language. Today, English has become the worldwide language for financial, political and historical reasons. That is, it is today the main international language of communication (Alkhuli, 2006; Ur Rahman and Alhaisoni, 2013). Since English acquisition as a Foreign Language (EFL) has become essential, it is crucial to provide help to students with their EFL learning.

Teaching English can be a challenge for both educators and learners themselves (Hashemi and Azizinezhad, 2011; Khan, 2011). For learners, formal instruction can be difficult and even counterproductive; now, a body of research shows that both teachers and learners benefit from less formal teaching methods, and students' tensions in learning language can be reduced (Wan, 2017). Because learning vocabulary is generally perceived by students as a challenge, making it a 'fun' activity is one of the important priorities for teachers (Vale and Feunteun, 1995). In fact, as Allen states: "Words should be enjoyed, and the study of words should bring no less joy" (1999, p. 69).

Kim (1995) argues that not all learning must be serious and formal. Through games, learners can learn a language and enjoy themselves at the same time. Using games can create a relaxed atmosphere, as well as provide a non-threatening classroom environment that enables students to learn and enjoy their classes at the same time. That is, through playing games students can acquire language vocabulary, which is a central dimension of language learning (Hashemi and Azizinezhad, 2011; Cameron, 2001; Nunan and Carter, 2001). This study proposes the use of the mobile game, which is defined broadly as "a video game played on mobile devices" (Liang and Yeh, 2011, p.188), for teaching English vocabulary in Saudi formal schools.

## 2. Literature review

### 2.1. EFL in Saudi Arabia

McKay (2006) defined foreign language learning as the process of learning a language that is rarely heard or used outside the classroom, thus studying and using English in Saudi Arabia is considered to be using a foreign language (Javid, Farooq and Gulzar, 2012; Ur Rahman and Alhaisoni, 2013). The educational system in Saudi Arabia currently gives the

teaching of English a high priority and one of the Saudi Government's efforts toward education in general, and teaching English in particular, is its endeavour to integrate technology at all school levels (Saqlain, Al-Qarni and Ghadi, 2013).

Despite the extensive efforts that have been made in designing curricula, preparing teachers and equipping the classes, the outcomes of students are still not satisfactory (Javid, Farooq and Gulzar, 2012; Ur Rahman and Alhaisoni, 2013). This poor performance may be a result of four major constraints, as explored in the study of Al-Seghayer (2014) "beliefs, components of curriculum, and pedagogical and administrative constraints" (p.17).

## 2.2. Theoretical framework

Learning a foreign language using mobile games in this study is explained as a cognitive process that relies on the Cognitivism theory of learning as Learning language is a complicated task that needs much mental processing, as well as an appropriate source of input (VanPatten, 2004). This study argues that this cognitive approach provides a deeper view of the role of mental abilities in language learning, and thus a more productive, explanatory theoretical framework. Learning a language is a complicated internal task that needs information to be processed at a high level of cognitive ability (VanPatten, 2004) and learning vocabulary in particular requires cognitive skills, such as "comparing and contrasting" the foreign language vocabulary with their first language vocabulary (Yoshida, 2010). Learning vocabulary comprises a number of processes, which are considered to be cognitive strategies, such as identification of meaning, relating word meanings and identifying the structure of words (Harmon *et al.,* 2010). In addition to these cognitive strategies, learning vocabulary demands that learners interpret their knowledge of the new words using their previous knowledge, and this activity is also considered an aspect of cognitive ability (*ibid.*).

## 2.3. Learning Foreign/ Second language vocabulary

Vocabulary is considered by Folse (2004) to be the most important component in any language. In foreign language learning, vocabulary is considered to be the most important part of that process (Ahmadi, Ismail and Abdullah, 2012). Cameron (2001) emphasised that learning a foreign language means "starting from vocabulary and discourse" (p. 241). The status of learning vocabulary as an essential part of learning a foreign language relies upon its importance for the successful use of that language, as well as upon its role in speaking or writing proficiency (Schmitt, 2008; Alhaysony, 2012). Foreign language vocabulary is a major source for foreign language learners (Orosz, 2009). Moreover, "developing foreign

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language resources and skills occurs through the building of vocabulary" (ibid., p. 241). According to Richards and Rodgers (2001), the belief in a "lexical approach" to language teaching is the belief that words are the building blocks of language and communication, not grammar or some other approach of planning and teaching. However, learning vocabulary was not considered as an essential part of learning a foreign language until recently, and the focus was, instead, on the extensive learning of grammar (Ahmadi, Ismail and Abdullah, 2012; Wu, 2012; Folse, 2004).

### 2.4. Integrating technology, mobile games, in EFL classes

Looking for new teaching interventions that adopt the current era's features and can confront learners' challenges in learning EFL is essential for educators and researchers alike (Kiryakova, Angelova and Yordanova, 2014). This study proposes exploring a less formal teaching method for EFL learners which, it is argued, creates a positive attitude and motivates learners to learn. Learners usually prefer playing rather than the formal way of learning and this subjective readiness can be harnessed for successful teaching. Bearing in mind the nature of life today and how technology is dominating all aspects of it, this researcher looked for a specific technology to investigate that would suit both teachers and learners and, at the same time, fulfil the objectives of learning. Although integrating technology, including mobiles, with education is not something new, educational systems are still facing mobile integration, as opposed to desktop, with some resistance. Mobile integration, especially the integration of mobile games, has been largely overlooked in teaching and learning processes. Yet technology entered the field of learning and teaching in the same way as into any other field in our contemporary life. So, one reason for integrating technology in learning is that linking schools' education to real-life experiences is a pressing need (Wagner, 2005); also, learners usually consider school learning "as irrelevant to their personal and real-life needs and interests" (Jo-An and Reigeluth, 2011, p.54).

A fundamental concern in integrating technology is which type of technology is appropriate for efficient interaction in classrooms (Zhao *et al.,* 2002). Adopting new and smaller devices than personal computers, like mobiles, is becoming critical to learning environments (Raven, Qalawee and Atroshi, 2016). Today, with the great number of people using mobile phones (Ally, 2007; Rego, 2015), it is reasonable to integrate mobiles into most of our daily activities, including learning.

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The implementation of mobiles in foreign language learning has been justified for a variety of reasons. As learning a foreign language is a long and continuous process, it is important to expand the time and place of the 'classroom' to enable students to have contact with the targeted language as much as possible (Rego, 2015). Using mobiles in foreign language classes "can work more effectively if the student has the opportunity to access learning content along his day" (Rego, 2015, p.3). This study aims to rationalise the field of mobile learning by investigating two key factors: student centred and game-based learning. That is, the suggested learning approach is student-centred, which allows students to practise and play the game outside the classroom. Further, this study argues for a content-based context rather than using the designed game to simply create and raise the students' motivation. In summary, if using mobiles in learning is to dominate the current research field, it is necessary to more fully explore the uses of its application (El-Hussein and Cronje, 2010). Games are among the most rapidly spreading applications among users, especially young users, which raises this study's key question: whether the use of mobile games is of benefit to teaching language students.

In terms of the foreign language learning context, various studies investigated using mobile games, with varying results. For example, a study was conducted by Ulfa (2012) to investigate the effectiveness of using mobile games on vocabulary acquisition in an Indonesian educational institution. The study adopted the experimental/control group design, with the results favouring the experimental group that used mobile games. Although this study offered a view on mobile effectiveness in the acquisition of foreign language vocabulary, the study's design may be criticised on several levels. One major criticism is that it overlooked the individual differences between participants in the two groups (experimental/control), since distributing the students into two groups without eliminating all of the affective variables — such as individual differences between the two groups, class context — may affect the experiment's results. Furthermore, this study's procedures, methodology and the techniques used to generate the results were not clearly enough described, making it difficult for another researcher to replicate the study.

To the best of the researcher's knowledge, then, the use of mobile games specifically in teaching foreign language vocabulary has not yet been addressed. In particular, a study that compares one group of participants' learning outcomes using mobile games with the same group using traditional teaching methods, has not been conducted.

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## 2.5. Post-script: Play and learning

Play is a biological drive like any other biological drive, such as for food or sleep, and is part of human culture (Rego, 2015; Brown and Vaughan, 2010). The general argument is that playing can be used to facilitate educational aims, such as teaching foreign language vocabulary. Specifically, this study argues that the educational policies in Saudi schools today devalue the importance of play in learning situations, especially in classrooms, and view using games and play as time fillers (Singer, Golinkoff and Hirsh-Pasek, 2006; Brown and Vaughan, 2010). The damaging situation in our schools today is that learners' ability to relax and have fun is constrained (Singer, Golinkoff and Hirsh-Pasek, 2006). The main goal of integrating games in education is to create engagement for learning among learners, as well as to motivate both learners and teachers in the learning process (Brophy, 2015). Furthermore, engagement improves interaction and the understanding of the learning activities (*ibid.*).

Learning a foreign language can be difficult, thus, relaxation and a comfortable situation are essential in a foreign language class (Vale and Feunteun, 1995). According to Vale and Feunteun (1995), a relaxing environment will make learners feel at ease with their peers and, accordingly, this will encourage them to share their ideas. When they feel comfortable in a language class, learners gain the confidence to react to their peers and take risks in front of one another (Vale and Feunteun, 1995). In addition, fear of the teacher will be reduced in such an atmosphere (ibid). For Macedonia (2005), classrooms provide an ideal setting for language games because players and a minimum of control are needed in language games. In addition, it becomes an excellent part of language learning when games are designed in a productive way (Ur, 1996).

This study suggests that practising language can be enhanced through using games, as games provide an opportunity for students to interact and to use language outside the classroom (Wright, Betteridge and Buckby, 2006). Accordingly, the following questions guided this paper:

1. To what extent, if any, does the mobile game help students to learn the written form of words (spelling)?

2. To what extent, if any, does the mobile game help learners to connect the phonetic form of these words to the written form?

In summary, practising an activity such as games in the classroom, which is related to learners' personal experiences, makes learning meaningful (Pittenger and Gooding, 1971), and leads to mastery, for it helps to overcome learning obstacles; even difficult or boring subjects can be taught using games, when the involvement of play elements creates fun (Brown, 2007; Elkind, 2007). Moreover, this study argues that despite a considerable body of research in the fields of foreign language learning and serious games, as well as mobile learning, no exploration of the use of mobile games in learning foreign language vocabulary specifically, with respect to both written and spoken forms, has yet emerged.

## 3. Methodology

Given the unique context of this research project, namely working within an all-female Saudi high school, it was essential to think carefully about the best methodology to explore these questions. The study finally settled on a complex, mixed-method approach. Both quantitative (numerical data) and qualitative data (text data) were collected to yield the results. A mixed methods approach can be defined roughly as the combination of the two major research approaches: quantitative and qualitative (Johnson, Onwuegbuzie and Turner, 2007; Lisle, 2011; Creswell, 2003; Teddlie and Yu, 2007).

### 3.1. Design

The human phenomenon under investigation in this present study is the cognitive process of foreign language learning through playing mobile games, hence the sequential exploratory mixed methods model, to give it its full description (Creswell and Clark, 2011). In a sequential exploratory design, qualitative data is collected first, followed by the quantitative data (Creswell *et al.,* 2008). In the current study, qualitative and quantitative data are mixed in the discussion phase to answer the research questions. According to Creswell (2002), the exploratory sequential design is popular when designing an instrument, as in the first qualitative phase in this study (see below). Of course, every design has its limitations, with exploratory sequential design being no exception. This design requires "extensive data collection as well as the time required for this process is long" (*ibid.,* p.544). In this study, the term is used to indicate that there were three research phases, each deploying different methodologies (hence the description of a 'mixed-methods' approach): phase one was a number of focus group discussions conducted with a cohort of students and teachers; the second phase describes the test/retest application — in other words, a 'test run' — as well as the actual intervention, experimentation and testing; the third phase involved gathering

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feedback from the participants involved. Thus, the first phase is qualitative, the second permits quantitative analysis, and third is again qualitative.

### 3.2. Research Intervention: Choosing and designing the current study

Completing the game design was not easy, as it took a great deal of time to find a qualified programmer as well as the best design. The first phase was reviewing a number of existing English learning mobile games, which were chosen according to their popularity (number of downloads or recommended apps), their availability and their price. Goals like teaching the written form of the words, teaching the spoken form of the words, positives and negatives were examined in these games.

The chosen game, The English Bee, is in 2D, rich in colour and full of animation and vibrant sounds to attract students. This game makes good use of flash animation. Discussions with students and teachers throughout focus group discussions, before the data collection implementation, showed that they preferred the Bee character above other proposed characters. In Arabic and Islamic societies, the bee is a valued and appreciated figure, thus the character is culturally and contextually appropriate to this specific research project. The English Bee game takes place in a garden where there are twelve honey hives, which represent the targeted words at the starting screen of the game. The player starts with the first one and can move to the next word when finishing the task. The player's goal is to help the Bee in getting the crown. When the player manages to finish the task without losing any of the Bee's three hearts, she can get the crown for the Bee.

### 3.3. Data collection and analysis

As mentioned above, the present study is a mixed methods study and, according to Sandelowski (2000), this type of study "expands" the understanding of a social phenomenon. A 'method' is defined by Greene and Caracelli (1997) as "a procedure for gathering or analysing data", and this information can be "quantifiable" or "qualitative" (p.7). The current study involved collecting both types of data, Qualitative and Quantitative, with each type collected using different, specific methods and instruments during the three phases. To collect Qualitative data, interviews, focus groups and reflective essays were used. Quantitative data were collected using pre- and post-tests.

### 3.3.1. Quantitative data collection instrument: The pre- post-test

Pre- post-tests are common in educational research, when "changes in educational outcomes resulting from modifications to the learning process are often a focus of research"

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(Dugard and Todman, 1995, p.181). The tests consisted of two different tasks. As pointed out by McKay (2006), spelling assessments can be conducted separately from other language skills. The tests came in two separate sheets to prevent students from using the words given in task (B) to answer task (1), which would have resulted in incorrect measurement of the learning outcomes. Reliability was ensured by applying a test-retest technique, which is one of the standard techniques used to ensure test reliability and consistency (Hendrickson, Massey and Cronan, 1993; Gaur and Gaur, 2009; Bashir, Afzal and Azeem, 2008). The test-retest technique involves applying the same test to the same group of participants with a delay between them, and then correlating the results. This eliminates any confusion due to participant differences (Hendrickson Massey and Cronan, 1993; Gaur and Gaur, 2009). The researcher applied the technique to an external sample of students consisting of 12 students to avoid giving the participating sample group any prior knowledge of the tests. After applying the test on the pilot group participants, two techniques were applied to the results in order to measure reliability: firstly, the test re-test technique; secondly, Cronbach's Alpha was also measured.

The researcher validated the tool (tests) by submitting it to three EFL professors who share an interest in the study's objectives. This is called the face validity test and is conducted by presenting the instrument to professionals and "actual subjects", and then analysing their comments qualitatively (*ibid*., p.32).

### 3.3.2. Qualitative data collection and analysis

Qualitative data does not rely on numbers and statistics (Bashir, Afzal and Azeem, 2008). A qualitative data collection method was applied in phases of this study: focus group/interviews like the example above, and reflective essays. Self-reflective essays provided the study with several advantages, as they provide the researcher with all learners' reactions, which is ideal for shy or potentially uncooperative participants.

Document analysis was adopted to analyse the data collected from the students' reflective essays. One reason for this choice is to ''achieve more comprehensible analysis'' (Altheide *et al.,* 2010). Another is that document analysis gives deep insight into the qualitative nature of the written documents (Cardno, Rosales-Anderson and McDonald, 2017).

### 3.4. Sample and population of the Study

The current study used an "identical relationship" (Onwuegbuzie and Collins, 2007, p.292), in which one group of the sample study was assigned to both quantitative and qualitative data

collection phases. There were several reasons for including the same participants in both types of inquiries. The first reason is that to encompass all the dimensions of the study, it is better to obtain all types of data (quan-qual) from the same participants. Furthermore, this approach excludes exterior factors that might affect the data, such as individual learning differences. A group of 33 Second Level students in one Saudi school were chosen. The school was selected because of its handy geographical location in the city, which enabled speedy and constant data collection throughout the study's relatively long period of implementation.

## 4. Results and discussion

To reiterate the research objectives: in the face of poor historical learning outcomes, this study sought to explore using mobile games as a serious teaching method in Saudi female classes learning EFL vocabulary in one typical public high school by addressing the following questions: To what extent, if any, does the mobile game help students to learn the written form of words (spelling)? To what extent, if any, does the mobile game help learners to connect the phonetic form of these words to the written form? This section discusses the results.

### 4.1 Quantitative results

### 4.1.1. Pre-test

The pre-tests were applied before learning certain words in the standard curriculum: pre-test 1 before studying Module 3 using the regular method, and pre-test 2 before studying Module 4 using the mobile game. Each test has two parts, that is, two axes, and the results were measured using the Paired Samples T.test. Paired T.test is used to measure the differences (the means) between two samples (dependent variables) for one group of participants (Xu *et al.,* 2017), thus it was applied here to checked students' pre-knowledge in both Modules 3 and 4. The results between the first pre-test and second pre-test were as follows; the pre-knowledge of the written form of words in Module 3 was *mean=2.88, Std. Deviation=1.4*1, and the pre-knowledge of the written form of words in Module 4 was *mean=2.67, Std. Deviation=1.53*, which means that there were no statistically significant differences between the average scores of the students' achievements in both modules. The pre-knowledge of the link between the spoken and the written forms of the words in Module 3 was *mean=2.49, Std. Deviation=1.75* and the pre-knowledge of the link between the spoken and the written forms of the words in Module 4 was *mean= 3.24, Std. Deviation= 1.85*, which means that there were no statistically significant differences between the average scores of the students' achievements in both

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modules. These results indicate the convergence of the levels of students in the study sample in each of the third and fourth units at the level of each of the two axes of the tests.

### 4.1.2. Post-test

This test measured students' achievement in the first task (Task A), which reflects students' learning of the written form of the words (the words' spelling). The difference between the two methods of teaching (Module 3: the traditional method; and Module 4, the mobile game integration) were measured through students' scores as follows in Table 2:

| Axis | Module | N | Mean | Std. Deviation | Df | T value | Sig. (2 tailed) |
|---|---|---|---|---|---|---|---|
| Words' spelling | Module (3) | 33 | 6.03 | 1.63 | 32 | 9.53 | 0.00** |
| | Module (4) | 33 | 9.42 | 1.64 | | | |

Table 2: Calculation of the differences between the averages of the students' scores in modules 3 and 4 at the level of the first axis in the post-test using the T-test of the two paired samples

*P- Value (0.05), ** P- Value (0.01)

It is clear from the table above that there are statistically significant differences in the (words' spelling) achievement at the level of 0.01 between the average scores of students in Modules 3 and 4. These differences were in favour of the arithmetic mean of the average scores of students' achievements in Module 4, rather than the arithmetic mean of the students' scores in module 3 (6.03). This difference indicates the improvement in the students' learning of the new words' spelling using mobile games in the post-test.

In order to answer the first research question and to identify the effectiveness of using mobile games in learning, the spelling of the new words, the Eta Squared $\eta 2$ was tested and the result was as follows:

$$\text{Eta squared } \eta 2 \text{ Equation } \eta 2 = \frac{t^2}{t^2 + df}$$

*where t is the value calculated in the T test, df represents the degrees of freedom*

$$\eta 2 = \frac{(9.53)^2}{(9.53)^2 + 32} = \frac{90.82}{90.82 + 32} = 0.74$$

The value of Eta Squared $\eta 2$ is 0.74, which shows that using the mobile game in learning to teach words' spelling appears to be effective.

The second part of the first question addresses the effectiveness of using mobile games in enhancing students' ability to link the written forms of words to the phonetic (spoken) form of the words. To answer this question, the average scores of the students in Modules 3 and 4 of the second axis in the post-test (Task B) were compared using the Paired Samples T.Test, as follows in Table 3:

| Axis | Module | N | Mean | Std. Deviation | df | T value | Sig. (2 tailed) |
|---|---|---|---|---|---|---|---|
| Linking the written form to spoken form of words | Module (3) | 33 | 4.85 | 1.23 | 32 | 9.01 | 0.00** |
| | Module (4) | 33 | 8.85 | 2.00 | | | |

*Table 3: The differences between the averages of the students' scores in Modules 3 and 4 at the level of the second axis in the post-test using the T.Test of the paired samples*

* P- Value (0.05), ** P- Value (0.01).

The table above shows that there are statistically significant differences on the axis of Task B between the post-test (Module 3 and Module 4) at a level of 0.01 between the averages of the students' scores in Module 3 and the averages of the students' scores in Module 4. These differences were in favour of the arithmetic average of the students' scores in the post-test of Module 4 (8.85), whereas the mean of students' scores in the post-test of Module 3 was 4.85. To discover how effective the mobile game is in linking the written form of the words to their spoken form, the Eta Squared η2 was tested and the result was as follows:

$$\text{Eta squared } \eta2 \text{ Equation } \eta2 = \frac{t^2}{t^2 + df}$$

*where t is the value calculated in the T test, df represents the degrees of freedom*

$$\eta2 = \frac{(9.01)^2}{(9.01)^2 + 32} = \frac{90.01}{90.01 + 32} = 0.72$$

From the result of the squared ETA (0.72), the effectiveness of using mobile game in enhancing the achievement of students in linking the written form of the words to the phonetic equivalent is improved statistically.

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### 4.2. Qualitative results

Qualitative data were in both English and Arabic languages. English language featured in focus group and interview interactions with teachers and administrators, in particular during the design phase. However, students preferred to use Arabic to express their opinions in their reflective essays. The distribution and collection of reflective essays occurred throughout the study's implementation to collect as much as possible of students' experiences. Of 33 distributed forms, 22 essays were collected.

A majority of students showed a very positive attitude towards using mobile devices in learning, especially mobile games. The experience was quite new for them, and some of them mentioned that this was their first time using mobile games in formal learning. The problem of non-native English teachers appeared in the data: Arabic-speaking teachers are affected by the Arabic language syntax, where there are not as many vowels as in English. Students prefer to learn the pronunciation of words from a game or from a native speaker source, rather than learning from an Arabic-speaking teacher. Another comment was that teachers might make mistakes sometimes, whereas in the mobile game the native-speaker pronunciation is recorded and is correct. The students emphasised in their reflective essays that the game helped them to learn both spelling and pronunciation. One of the students, Student 10, wrote in her essay that, "Some teachers would explain the whole lesson in Arabic and this way we spent only 5 or 10 minutes a week in learning English" (all translations by researcher). Another student, Student 21, wrote that:

> I hear the same word pronounced by a teacher and I hear it differently by another teacher and then I hear it differently again by my classmate, actually I do not know what to do to learn good English with no pronunciation mistakes!!

Furthermore, the mobile game learning experience placed less pressure on students, with two referring to that experience as free of peer pressure and embarrassment. They preferred to learn in a friendly atmosphere, where they could make mistakes without being embarrassed. One of the students, Student 20, wrote, "I can repeat words and sentences on my mobile for several times without boring anyone". The burden-free tasks, where students do not have to lose grades or self-confidence when making mistakes, provide students with a feeling of security. They can repeat the game's tasks as much as they like, unlike traditional ways of learning, where they try to avoid making mistakes to avoid losing grades. Student 18 wrote, "I don't feel embarrassed when I make mistakes while playing mobile games". Another

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student, Student 6, wrote, "We can save money by using one device for all the subjects in a context that is free from pressure and embarrassment".

Participants showed their awareness of anytime-anywhere learning. Student 4 wrote, "I like using mobiles in learning, I can use it anytime anywhere, which makes learning easier". This type of learning enables them to be in any preferred learning context, which enables them to choose the place and time of learning, as Student 1 wrote, "I like to study by using my mobile because I can use it when I am staying with my family or when I am having my dinner; it keeps me busy from using my accounts in social media!". In total, 13 students preferred to have learning material at anytime and anywhere, in order to practise the language at a time and place convenient to themselves; one of the students (Student 22) wrote, "Yesterday, I played the game as my father was driving us to the mall. It's a great thing that you can hold your phone anywhere and complete your game without the need to lock yourself in your room trying to memorise the lessons for the exam"; another student wrote "what makes it good for me is that I can play it anytime day or night or even when I am staying with my family".

### 4.3. Discussion

The discussion that follows in this section helps situate the findings and analysis of the results in relation to previous studies, the academic field of EFL as a whole, and the theoretical framework of Cognitivism.

### 4.3.1. Repetition and Competition

The game was designed in this study to function as setting problem solving tasks. Although repetition was employed to allow students to practise those problem-solving tasks, it was not the sole pedagogical driver. For, according to Cook (1991) and Huebener (1965), repetition alone is not effective; the key element of positive repetition is that it come with practice and drills that entail cognitive processing like problem-solving to move the learned knowledge from short-term memory to long-term memory. The problem-solving tasks helped students to create competition among themselves, as they practised at home before coming to class in order to beat each other.

Although the game was not designed for competitive activities, this outcome is considered positive; as noted by Prakash and Rao (2015), when designing a game, competition is a pedagogy that does not frustrate players and motivates players to keep playing. Competition helped students in raising their motivation to play the game and learn, rather than from explicitly creating teacher-centred knowledge or peer-sourced knowledge— either the words'

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spelling knowledge or the link between the spoken and written forms — as learning occurred while students were playing the game, and the interaction took place between students and the devices rather than between students and their colleagues.

### 4.3. 2 Spelling and Linking Forms

Results of both quantitative and qualitative data showed increased achievement in students' learning of targeted words' spelling. With respect to this question, and by examining the results of the pre- and post-tests, it was found that using mobile game appears to be effective. It helped students to achieve better results in the post-tests in the learning module in which the mobile game was used. As the total score that can be achieved is 12, the results showed that there was a statistically significant difference between students' achievements in the post-test for Module 3 using the traditional method (the Mean of students' scores was 6.03), and the post-test of Module 4 using the mobile game (the Mean of students' scores was 9.42).

Knowing the sounds and linking them later to their written forms enhances students' ability to read correctly, and then this is reflected in their writing skills, as language skills are connected and related to each other. The statistics of the pre-post-tests showed that using the mobile game helped them to recognise and identify the words' phonetic representations better than the traditional method. One of the students, Student 13, expressed the difficulty of identifying the phonetic form of the words, as she wrote in her reflective essay that, "I used to write down the nearest Arabic phonetic equivalents for words to help knowing what letter this is and how should I pronounce these letters". This difficulty might be a result of the dissimilarity between the phonological and orthographic representations of words, which causes confusion among students.

Moreover, the dissimilarity between the L1 and L2 adds to this confusion (Hayes-Harb, Nicol and Barker, 2010). The importance of knowing the written form and linking it later to the spoken form lies in its role later in writing and reading competencies, as the lack of a wide vocabulary repertoire is the basis of the difficulty that students face in writing (Al-Jarf, 2006). Furthermore, the difficulty in knowing the phonetic representations may lead to difficulty in reading and writing (Anthony and Francis, 2005). According to Kwong and Brachman (2014), there is a relationship between what students hear and what they write, as the spoken form of words also affects learners' writing abilities. Therefore, it is argued that to enhance students' writing and reading skills, their awareness of the phonological representations should be

improved and enhanced (Anthony and Francis, 2005). The results here indicate that mobile games achieve this objective.

### 4.3. 3 the Role of Cognitivism

Finally, the process of linking both forms, phonetic to written, is a cognitive ability, as students build the relationship between these two forms by practising both forms in an engaging activity. This finding is consistent with what was considered by many researchers (Anthony *et al*., 2002, Anthony and Francis, 2002), that identifying the sounds of words is a cognitive ability that is dynamic.

Furthermore, the proposed game in this study succeeded in not distracting students from the educational activity, as it did not include any gratuitous or unrelated goals. This absence of distraction, as noted by Brophy (2015), is one of the conditions when implementing mobile games in learning. Statistical as well as the qualitative data provided by participants revealed the effectiveness of the mobile game in learning how to spell words, and to identify their phonological representations. As the association created between the two forms was strong, the retention of vocabulary was easier, as noted by Cook (1991). In summary, qualitative data collected from students' reflective essays were consistent with the quantitative results, and both showed students' engagement in learning through playing the mobile game.

### 5.  Recommendations

Despite the fact that the Saudi Ministry of Education is currently putting significant effort and finance into the field of education and technology integration in particular, the results show a deficiency in integrating mobile games in classes, as mobile learning is a newcomer to the Saudi educational system. Change is always difficult, and there is thus resistance to its inclusion at several levels. Therefore, a decision that comes from the heart of this centralised system seems to be the only way at the moment of obtaining the authorisation to adopt this new method. Obtaining that official authorisation will motivate teachers, Principals and educational supervisors. In other words, it is the responsibility of the educational system in KSA to encourage and motivate all stakeholders in order to accelerate the adoption of new teaching methods, especially mobile games.

It is also recommended that the Ministry of Education establish a section within the Department that works as a link between game designers and developers to facilitate the process, or even to create a programming section in the Ministry that deals with programming requests. This section can ensure that the programmed game is generalisable to all educational

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administrations in Saudi Arabia and, consequently, all the schools can have access to the designed games. Moreover, games can be programmed to cover all learning subjects, rather than English alone.

The findings also show the importance of professional development programmes for teachers in the introduction of any new intervention methods. Therefore, introducing training workshops that address successful experiments in mobile game adoption and new teaching practices will be fruitful in escalating teachers' performance to higher levels. Workshops should include students, parents and all related parties in the educational process. It is recommended, as well, that teachers not restrict themselves within their traditional teaching practices, but must continually update their views and practices, and adopt new experiments from all over the world.

In conclusion, this study's findings suggest that using mobile games in learning EFL vocabulary appears to be effective. In the view of this researcher, mobile learning, especially mobile games, is the future for teaching and instructional methods, a movement that cannot be stopped, slowed or avoided. Thus, there is a need to 'ride the wave'; including these methods in Saudi curriculum design is not a luxury, it is a necessity.

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