The Effect of a Reading Application on the Reading Comprehension and Reading Self-Efficacy of Language Learners

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Abstract

Mobile technology is now being widely used to assist language learning and teaching. This study was designed and conducted to investigate the impact of a reading application on Iranian EFL learners’ reading comprehension and reading self-efficacy. To this end, 56 EFL learners of a private institute in Iran were selected and assigned to one experimental and one control group. The learners in the experimental group read 10 passages independently using the reading application to help them find meanings and understand the text. The learners in the control group carried out the same process with the same reading passages with the teacher assisting them with the comprehension of vocabulary and the passage. The learners in both groups were given a reading test from Preliminary English Test (PET) and The Reading Self-efficacy Scale both before and after the treatment. The results of one-way between-groups MANOVA revealed that independent reading using the reading application positively and

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significantly affected the learners’ reading comprehension and reading self-efficacy. The results of this study can be explained through the cognitive theory of multimedia learning and have implications for teachers and students in improving reading and self-efficacy.

**Keywords:** Reading applications, Reading comprehension, Reading self-efficacy, Vocabulary, Mobile assisted language learning

**Introduction**

Reading which is essential to learning a foreign language (Chi, Kuo, & Peng, 2007) involves the interaction of a reader and text ensuing in word recognition and text comprehension (Luo & Sun, 2018). For foreign language learners of English, reading is the processes used to decode the passage (Hazaea & Alzubi, 2016). Traditionally, learning a foreign language may involve a considerable amount of reading. This reading is usually carried out in a classroom with a teacher who mediates between the individual and the reading material. Information may be lost in this interaction between learners and their reading material, influencing a learner’s overall reading comprehension (Chen, Chen, & Sun, 2010). This method of instruction plays an important role in the loss of information; therefore, a number of researchers have suggested alternative methods, such as the use of computers in reading activities (Reitsma, 1988). Technological devices are able to provide learners with ubiquitous learning support and reading practice (Chinnery, 2006).

Technology may benefit the teacher in the classroom allowing more time to be expended on students who are in need of assistance. Language learners can be supplied with a reading application to assist them in reading and understanding texts. Reading applications have features such as note-taking capabilities, discussion forums, animated illustrations, sound effects, lexical and picture dictionaries, translations, and read-aloud options aimed at facilitating reading comprehension. Such applications are designed to assist students to read independently and with pleasure (Van Horne, Russell, & Schuh, 2016). The independence that these applications afford learners may affect their self-efficacy as they can influence the learners’ trust and belief in their own ability. Unfortunately, technology is rarely used for learning purposes in Iran (Dashtestani, 2016) even though it is able to afford a platform for learner agency and self-direction under the guidance of a teacher (Kukulsk-Hulme & Viberg, 2017). Therefore, this study attempted to enquire if using reading applications can effectively enhance the reading comprehension and self-efficacy of language learners.

**Review of Literature**

Mayer’s (2014) cognitive theory of multimedia learning accounts for the significance and influence of multimedia presentation such as using technology in language learning. This theory concentrates on how people learn from multi-
media presentations (Mayer, 2014) and how learners endeavour to construct meaningful relationships between words and pictures, processing them in the long-term memory. The cognitive theory of multimedia learning is based on three postulations: dual channels, limited capacity, and active processing. The dual channel assumption is composed of a pictorial and a verbal channel, suggesting that the verbal channel processes information through the ears and eyes with the visual channel obtaining information through the eyes. The limited capacity assumption explains the limitation in the amount of material that can be processed leading to information being managed in two different channels: words in the verbal mental model and images in the visual mental model. Meaningful learning in this theory occurs when students process information in both channels (Hsieh, 2019; Mayer, 2010). Consequently, when words and pictures are selected and organized into comprehensible pictorial and verbal models and integrated with each other on the basis of prior knowledge, learning has occurred. This active process is realized when verbal and pictorial representations are simultaneously in the working memory. Utilizing multimedia, the comprehension of new words is facilitated by integrating words and images into corresponding verbal and visual stimuli which will, in turn, result in improved comprehension of textual material. The simultaneous display of verbal and visual materials will reduce the chances of cognitive overload (Mayer & Fiorella, 2014).

“The multimedia learning model suggests that abstract representations of meaning, information, and text model networks are not essential (e.g. semantic propositions, conceptual schemata); rather, comprehension is built directly from linguistic and visual input” (Paivio, 2007, p. 30) which work together to improve reading comprehension abilities (Sadoski & Paivio, 2004). This type of comprehension comprises learning with the assistance of words, pictures, audios, and videos (Tsai, 2017). Tseng (2018) stated that learning through technology can be motivating because of the enjoyable learning environment it creates for the learners. Furthermore, Kongsuebchart and Suppasetseroee (2018) claimed that technology is a tool that encourages and permits students to learn language, whether in or out of class.

Mobile-assisted language learning, the use of mobile technologies in language learning, offers numerous applications to users (Kukulska-Hulme, 2018). A number of these applications promise to teach reading, increase students' engagement in reading, promote reading comprehension, and improve reading skills (Soe, Koki, & Chang, 2000). Along with systematic and explicit instruction through teacher-directed group activities in vocabulary, mobile applications prove valuable in improving reading comprehension (Cheung & Slavin, 2013). The use of mobile technology with appropriate guidance enhances language learning (Ezra & Cohen, 2018; Liu, Chen, & Hwang, 2018) and its use in the classroom saves time, enabling teachers and learners to form new and effective habits (Kukulska-Hulme, 2018). The understanding of words and propositions, elaborating and drawing inferences which create a mental representation, results in improved reading comprehension (Zhang & Koda, 2018).
Originally, applications were successfully designed to facilitate the study of grammar and vocabulary (Kukulske-Hulme, 2018) with reports on applications effectively working on grammar (Samuels, 2003) and verb conjugations (Castaneda & Cho, 2016). Stockwell (2007) reports on an application offering an individual profile for each learner, delivering vocabulary activities based on the areas the learner found difficult. E-book reader applications with dictionaries are supportive of incidental vocabulary learning (Fisher et al., 2009). Lin (2014) established that using a tablet for reading purposes yielded improved results where students outperformed counterparts who were not using this device for learning.

Computer-mediated text glosses aid learners in enhanced performance on measures of second language (L2) reading comprehension (Abraham, 2008). The combination of target words with verbal definitions and visual representations is more effective than solely using a textual definition for comprehension. Since dual glossing provides additional exposure, students tend to select this mode of learning (Ramezanali & Faez, 2019). Words which are encoded both visually and verbally were better retained than words with mere visual information. This is because words coded in dual channels provide two different retrieval paths, enabling learners to build two types of recall cues in memory (Al-Seghayer, 2001). Levy (2009) stated that in numerous vocabulary building tools, when a word is clicked on, the learner is presented with the definition, audio pronunciation, and translation. These dictionaries are available online allowing the user to click a word as many times as necessary. The opportunity given to the learner to look up the word as many times as required with enhanced exposure leads to higher chances of recalling the meaning of that word in the future (Montero Perez, Peters, & Desmet, 2018).

In traditional classes the teacher regulates the flow of information, whereas when using computers, the control is divided between the users (Liu & Hwang, 2010), technologies (Sharples, Taylor, & Vavoula, 2005), and teachers. Learning materials and resources become accessible to the learners at their own will and in their free time. This exposure develops, reinforces, and consolidates learning of the material (Hsieh, Wu, & Marek, 2017). Learners achieve a degree of freedom and independence in learning (Sharples et al., 2005). They will be able to listen to the audio of pronunciations numerous times, check the meaning of words as many times as required, and read the text repeatedly. Furthermore, Park, Yang, and Hsieh (2014) have found that L2 readers are able to plan their own online reading and determine whether they need lexical and/or content support. Hsu, Hwang and Chang (2013) posit that using mobile technology, learners become independent and are able to take advantage of personalized reading material. The learners are able to take ownership of their learning activities (Agbatogun, 2014) and engage in those activities which they personally find meaningful, contextual, and situated (Shadiev, Hwang, & Huang, 2017). Mobile technology can thus be modified to suit varying needs of students (Pegrum, 2016) which may be different among individuals (Pegrum, 2014). Soe et al. (2000) established that technology can assist in developing an individualized approach to teaching reading in the classroom so that the numerous needs
of all students will be met. Therefore, as Levy (2018) states, technology allows students to become independent of the teacher and learn autonomously, which is possible both inside and outside of the classroom. One of mobile learning’s many characteristics is the easy alignment with personal needs of the learners (Kukulske-Hulme, 2018) and can be used by learners at all hours and ubiquitously (Lai & Zheng, 2018).

Computer applications are used by language learners, who are influenced by affective factors (Horwitz, 2010) believed to be central to human life (Oxford, 2011). According to Chastain (1988), “of all the learner variables, the most significant are those related to the learners’ emotions, attitudes, and personalities... Optimum growth is enhanced by helping each student achieve a feeling of self-worth, success, and acceptance in the class social structure” (p. 181). Regarding self-beliefs, Bandura asserts that “what people think, believe, and feel affects how they behave” (1989, p. 25) and self-efficacy is defined as the learners’ belief and trust in their abilities (Bandura, 1978). Oxford (2011) states that learners require affective strategies to deal with low self-efficacy which is connected to agency, that is, “belief in one’s control over outcomes or being the cause of an effect” (p. 70). Bandura (1986) has thus made an attempt to show that individual actions and motivation the learners possess about their capabilities are critical elements. Self-efficacy was classified in the domain of psychology and considered to play an important part in learning (Bandura, 1978). A wealth of studies advocate the fact that self-efficacy is one of the influential self-beliefs without which learners cannot perform an activity or a task effectively and confidently (Bandura, 1978, 1986, 1997; Oxford, 2011; Schunk & Pajares, 2001; Zheng, Young, Brewer, & Wagner, 2009); fortunately, self-efficacy can be developed (Chamot, Barnhardt, El-Dinary, & Robbins, 1999).

Self-efficacy and academic achievement influence each other (Arslan, 2013). Self-efficacy beliefs and perceptions function as the basis for motivation which, in turn, affect the learners’ effort (Bandura, 1986, 1997) and predict achievement outcomes (Bandura, 1997; Pajares, 1996; Schunk, 1995). The learners’ sources of self-efficacy are considered important in academic achievement (Bandura, 1978, 1995; Pajares, 1996; Pajares, Johnson, & Usher, 2007). Bandura and Adams (1977) claim that various tactics change and modify self-efficacy beliefs, and “the more dependable the sources of efficacy information the greater are the changes in self-efficacy” (Bandura & Adams, 1977, p. 288). In other words, teachers need to pay more attention to the learners’ self-efficacy sources in order to enhance their self-efficacy and bring success to academic contexts.

Bandura (1997) claimed that learners have the tendency to establish their self-efficacy perceptions through four major sources of information: mastery experience, vicarious experience, verbal persuasions, and physiological states. Mastery experience is associated with the learners’ own performance (Arslan, 2012; Bandura, 1997). It is reinforced by success and diminished by failure, especially at the outset of learning when frustration occurs many times (Bandura, 1995). The second source is vicarious experience in which the learners
may further be affected by other students’ achievements which play the role of models and offer a criterion for evaluating ones’ competences (Bandura, 1995). If the learners do not perform well in one task, they are liable to observe others’ accomplishments and failures, use models, and form their self-efficacy beliefs by comparing themselves with their peers (Pajares et al., 2007). The next source is verbal persuasions in which the learners may also establish and develop their self-efficacy through others’ verbal persuasions which will be effective specifically if they are given positive judgments (Pajares et al, 2007) which is especially true for children (Bandura, 1997). Conversely, the learners’ self-worth may be eradicated if they receive negative assessments (Bandura, 1995). Finally, physiological states are the learners’ evaluation of their self-efficacy through physiological states they undergo when they are thinking and planning a task. The effects of emotional states such as anxiety, stress, arousal, and mood in raising and reducing ones’ self-efficacy have been revealed to be of utmost importance (Pajares et al.).

Mobile learning can play a significant role in assisting comprehension and retention of vocabulary, which may suffer due to the limitations of working memory, by freeing up these finite cognitive resources (Chun, 2006). The understanding of vocabulary items is indispensable to conveying meanings; therefore, it is necessary to find ways to engage students in understanding and learning vocabulary in order to improve reading comprehension (Şahin Kızıl & Savran, 2018). Another factor which is influential in reading comprehension is the learners’ beliefs about their ability. A number of studies have focused on the improvement of self-efficacy as a result of instruction (Henderson, Huang, Grant, & Henderson, 2012; Kissau, 2012; Wu & Yang, 2016); however, none have considered the role of such instruction through computer applications. Consequently, the present study attempted to use a reading application to investigate whether one can effectively improve reading comprehension and self-efficacy of language learners. First, the researchers endeavoured to find out if the reading application is able to produce significantly improved results in the reading comprehension of learners. Second, they examined whether this application was able to increase the self-efficacy of the learners as it is a tool which increases the control of the learners over how they study (Oxford, 2011) i.e., their self-efficacy. The results of this study can be of importance to teachers as they may be able to use a reading application in the classroom to aid in teaching, freeing up their time to spend on other activities. Learners can also make use of an application while learning, as it will both help them in comprehension and may increase their self-efficacy. Consequently, it is hypothesized that by using a reading application learners may be able to improve their reading comprehension and reading self-efficacy. Therefore, the following research questions were posed:

Does using a reading application positively affect the learners’ reading comprehension?

Does using a reading application affect the learners’ reading self-efficacy?
**Method**

**Participants**

Two intermediate classes were chosen at a private institute in Tehran and the participants were assigned to two groups. The students totalled to 63; however, after initial homogeneity tests, seven were removed from the study. Hence, 56 Iranian female EFL learners took part in the present quasi-experimental study. One group was named the teacher group (n=28) and the other the independent group (n=28). The participants were 17-20 years old.

**Instruments**

A reading comprehension test was administered to both groups. A test of reading from the Preliminary English Test (PET) was selected and administered as pretest and posttest. The test included five parts, comprising 35 questions. The reliability was tested by piloting with 50 EFL learners studying English at the same level in the same institute, yielding a Cronbach's alpha of 0.82.

The reading self-efficacy questionnaire used in this study was taken from Piercey (2013). The components of The Sources of Reading Self-Efficacy Scale were mastery experience, social persuasion, vicarious experience, and physiological state. The six-point Likert scale of the sources of reading self-efficacy ranged from *definitely false* (1) to *definitely true* (6). The reliability of the questionnaire was over 0.73. For the sake of the present study, the researchers piloted the questionnaire among 60 EFL learners similar to the ones studied, and Cronbach’s alpha of the components was indicated to be higher than 0.78.

*Read & Write for Google Chrome* was the reading application used in this study. This is a Google feature designed to facilitate reading and writing. It offers word meanings, images, translations for words and stretches of language, and also a read aloud option. These features form a platform for presenting information in both the visual and verbal mode embodying the dual channels as put forward by the cognitive theory of multimedia learning. Blake (2016) claims that, in CALL, dictionary lookups are widely used and in some occasions, utilized to finish reading assignments. This reading application meets this need as it gives the user instant access to dictionary meanings. This Google application has access to applications and histories of the learner and can later display information in line with the individual learner’s needs (Pegrum, 2016). Evidently, this application is designed for both reading and writing; however, in this study those features relevant to reading comprehension were used. Henceforward this application shall be referred to as Read & Write. The students used this application on their mobile devices.

The application employed in this study can be seen in Figure 1. The dictionary showing the meaning of words and the picture dictionary illustrating the meaning are also presented. Moreover, this application is equipped with a text-to-speech option which can be very useful for language learners.
The study started with the administration of a PET test and the Reading Self-efficacy questionnaire to homogenize the two groups. After that, the instruction began. The readings from the learners' textbook were taught as part of the course syllabus. One group was the teacher group in which reading was taught by the teacher and, if students did not understand any words, phrases, or sentences, they would be translated by the teacher. However, in the independent group, the students were asked to search for the meanings of words, phrases, or sentences on the Read & Write which they had all installed on their mobile devices. The students in the independent group were fully instructed on how to use Read & Write in the first session. In the independent group, the teacher was present in the classroom but left the comprehension of the passage to the students. If they had problems and could not establish the meaning, the instruction was repeated so that they themselves found what they were looking for. After the students read the text and found the meanings of all words, phrases, or sentences that they did not know, the teacher would proceed with the lesson as usual. As the lesson proceeded, the teacher ensured that the students had understood the passage correctly. In each lesson, the focus was on the comprehension of the text which included the comprehension of the vocabulary items. This procedure was performed for 10 sessions with 10 reading passages which were identical for both groups. The passages were part of the textbook used at the institute. After 10 sessions of treatment, PET and The Sources of Reading Self-efficacy Scale were administered to both groups as posttest. The test and questionnaires were scored and analyzed.
Results and Discussion

In order to find the answer to the first research question, a pretest was administered to measure the reading comprehension of the participants.

Table 1.
Descriptive Statistics on Reading Comprehension Pretest

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading Pretest</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Independent</td>
<td>28</td>
<td>15.79</td>
<td>1.83</td>
<td>.34</td>
</tr>
<tr>
<td>Teacher</td>
<td>28</td>
<td>15.32</td>
<td>1.88</td>
<td>.35</td>
</tr>
</tbody>
</table>

As can be seen in Table 1, the mean of the independent group is 15.79 and the mean of the teacher group is 15.32 at the very beginning of the study. The standard deviations of the two groups are 1.83 and 1.88, respectively. A t-test was carried out to ensure that the two groups were not significantly different at the outset of the study. Table 2 displays the results.

Table 2.
Independent Samples T-Test of Reading Comprehension Pretest

<table>
<thead>
<tr>
<th></th>
<th>Levene's Test for Equality of Variances</th>
<th>t-test for Equality of Means</th>
<th>95% Confidence Interval of the Difference</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>F</td>
<td>Sig.</td>
<td>T</td>
</tr>
<tr>
<td>Equal variances</td>
<td>.16</td>
<td>.68</td>
<td>93</td>
</tr>
<tr>
<td>assumed</td>
<td></td>
<td></td>
<td>54</td>
</tr>
</tbody>
</table>

As Table 2 illustrates, the two groups were homogeneous in terms of reading comprehension ability before the treatment. There was no significant difference in the scores of the independent group (M = 15.79, SD = 1.83) and the teacher group (M = 15.32, SD = 1.88; t (54) = 0.93, p = 0.35, two-tailed). The magnitude of the differences in the means (mean difference = 0.47, 95% CI -0.53 to 1.46) was very small (eta squared = 0.01). These results clearly illustrate that the reading ability of the groups was similar at the beginning of the study.

In order to answer the first research question and find out whether the treatment had any significant effect on the reading comprehension of the experimental group, a one-way between-groups multivariate analysis of variance was conducted. Reading comprehension was measured using the PET test. On this test, reading comprehension is divided into five dependent variables: main idea, specific information, scanning, detailed comprehension, and lexico-structural patterns. The independent variable of the study was the groups taken...
ing part in the study: independent group and teacher group. Preliminary assumption testing was conducted to examine normality, linearity, univariate and multivariate outliers, homogeneity of variance covariance matrices, and multicollinearity, but no violations were reported. Descriptive statistics on the components of the reading comprehension posttest are displayed in Table 3.

### Table 3.
Descriptive Statistics on the Reading Comprehension Test

<table>
<thead>
<tr>
<th>Dependent Variable</th>
<th>Groups</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Lower Bound</td>
</tr>
<tr>
<td>Main</td>
<td>Independent</td>
<td>3.25</td>
<td>.18</td>
<td>2.87</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>2.25</td>
<td>.18</td>
<td>1.87</td>
</tr>
<tr>
<td>Specific</td>
<td>Independent</td>
<td>1.28</td>
<td>.13</td>
<td>1.01</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>.85</td>
<td>.13</td>
<td>.58</td>
</tr>
<tr>
<td>Scanning</td>
<td>Independent</td>
<td>5.78</td>
<td>.20</td>
<td>5.37</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>4.67</td>
<td>.20</td>
<td>4.27</td>
</tr>
<tr>
<td>Detailed Comprehension</td>
<td>Independent</td>
<td>3.21</td>
<td>.19</td>
<td>2.83</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>2.32</td>
<td>.19</td>
<td>1.94</td>
</tr>
<tr>
<td>Lexicostructural Patterns</td>
<td>Independent</td>
<td>4.67</td>
<td>.18</td>
<td>4.31</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>3.53</td>
<td>.18</td>
<td>3.17</td>
</tr>
</tbody>
</table>

The information in Table 3 illustrates the mean scores for the five components of reading comprehension which were all lower for the teacher group than for the independent group. This demonstrates that the use of the reading application has improved reading comprehension. Next, the equality of variance was tested using Levene’s test and the results are presented in Table 4.

### Table 4.
Levene’s Test of Equality of Error Variances

<table>
<thead>
<tr>
<th></th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main</td>
<td>.71</td>
</tr>
<tr>
<td>Specific</td>
<td>.78</td>
</tr>
<tr>
<td>Scanning</td>
<td>.14</td>
</tr>
<tr>
<td>Detailed Comprehension</td>
<td>.05</td>
</tr>
<tr>
<td>Lexico-structural Patterns</td>
<td>.78</td>
</tr>
</tbody>
</table>

On the basis of the results presented in Table 4 and that there is no significance value <0.05, it is safe to conclude that the dependent variable has not violated the assumption of equality. Consequently, it is possible to set the significance level at 0.05.

The next stage is to find out whether there is a statistically significant difference among the linear combination of the dependent variables; i.e., reading comprehension. The researchers performed the multivariate tests and the results can be seen in Table 5.
Next, the two groups were compared on the components of reading comprehension to see where the differences lay or where the differences were more pronounced.

Table 6.
Tests of between Subject Effects for the Reading Comprehension Posttest

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent Variable</th>
<th>F</th>
<th>Sig</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>Main</td>
<td>14.40</td>
<td>.00</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td>Specific</td>
<td>5.11</td>
<td>.02</td>
<td>.08</td>
</tr>
<tr>
<td></td>
<td>Scanning</td>
<td>14.75</td>
<td>.00</td>
<td>.21</td>
</tr>
<tr>
<td></td>
<td>Detailed Comprehension</td>
<td>10.99</td>
<td>.00</td>
<td>.16</td>
</tr>
<tr>
<td></td>
<td>Lexico-structural Patterns</td>
<td>20.12</td>
<td>.00</td>
<td>.27</td>
</tr>
</tbody>
</table>

When the results for the dependent variables were considered separately, using a Bonferroni adjusted alpha level of 0.01, four variables reached statistical significance; Main, F (1, 54) = 14.40, p = 0.00, partial eta squared = 0.21; Scanning, F (1, 54) = 14.75, p = 0.00, partial eta squared = 0.21; Detailed Comprehension, F (1, 54) = 10.99, p = 0.00, partial eta squared = 0.16; Lexico-structural Patterns, F (1, 54) = 20.12, p = 0.00, partial eta squared = 0.27. The dependent variable Specific, F (1, 54) = 5.11, p = 0.02, partial eta squared = 0.08 did not demonstrate a statistical significance with the new alpha level.

The dependent variable 'Specific' defined as "reading multiple texts for specific information and detailed comprehension" (Cambridge, 2007, p. 9) did not display a statistical difference. This may be because neither group focused on detail, and this was not a variable that could be enhanced by technology alone.

As previously mentioned, the use of technology must be explained (Winne, 2010); therefore, if students are not instructed on how to use the technology at their disposal to read for specific information from multiple texts and to focus on detailed comprehension, they will not be able to do so with or without technology. It is also interesting to observe that the lowest eta squared (0.16) of the variables reaching a significant difference belongs to 'Detailed Comprehension' which also focuses on the details and is defined as "reading for detailed comprehension; understanding attitude, opinion and writer purpose. Reading for
gist, inference and global meaning" (Cambridge, p. 9). Thus, attention to detail is a factor which may affect the results, whether using technology or not.

The variables 'Main' defined as “reading real-world notices and other short texts for the main message” (Cambridge, 2007, p. 9), and 'Scanning' described as "processing a factual text. Scanning for specific information while disregarding redundant material" (Cambridge, p. 9) have both displayed significant differences accounting for 21% of the variance. Thus, each reveals that technology is helpful for the comprehension of the main points and specific information.

Finally, the dependent variable 'Lexico-structural patterns' defined as “understanding of vocabulary and grammar in a short text, and understanding the lexico-structural patterns in the text” (Cambridge, 2007, p. 9) was also explored and found to display the highest eta squared, accounting for 27% of the variance. This demonstrates that vocabulary was learned significantly better in the independent group using the application which could again be explained through the cognitive multimedia theory of learning. The structural patterns were also better learned as a result of the easy access to parts of speech provided by the application. In addition, in Iran, when a foreign language is learned, the focus is commonly on learning grammar and vocabulary; therefore, the students may have used the application at their disposal to focus on what they perceived as important.

These results show that the reading comprehension of learners has improved when they used this reading application, which may be due to motivation factors or the ubiquitous nature of the device which can be used anywhere and everywhere (Scott & Beadle, 2014; Motteram, 2013). Davis, Bagozzi, and Warshaw (1989) explain that the ease of use and perceived usefulness of technology are the main factors of the actual usage of technology. However, the effect of control given to the learner along with a convenient tool, the reading application, that the learners could use any way they wanted may also have helped enhance reading comprehension. As Wei, Siriyothin, and Lian (2018) found, students prefer to work autonomously and this independent method of learning led to more success than studying passively at the lead and command of the teacher. Therefore, the reading application which is easy to use and designed to help language learners work independently has yielded beneficial results in terms of the learners’ reading comprehension. In another study, Caldwell (2018) claimed that ICT has a positive effect on education and on how teachers are able to help learners become autonomous and motivated to learn the language of their own accord. This gives learners control of their own learning by allowing them to learn at their own pace, in their own time, and more independently (Kongsuebchart & Suppasetseeree, 2018).

The use of multimedia in this study shows that learners who are able to actively choose ways to find word meaning and learn vocabulary (i.e., pictorial vs. verbal) may be more successful in reading comprehension. Based on the cognitive theory of multimedia learning (Mayer, 2014), this may be due to the dual mode channel in which the application worked. The learners were exposed to both pictorial and verbal information for words, whereas students who only
learned from the teacher were not exposed to both verbal and pictorial images simultaneously. This is further expressed and supported in a study carried out by Tseng (2018) who found that image-based vocabulary exercises enhance vocabulary learning. Torut and Torut (2002) also found that a multimedia learning design could strongly affect the learners’ attitudes and achievement outcome in reading. In another study, Banditvilai (2000) revealed that an Internet-based reading program, which also includes the dual channels, could powerfully influence the learners’ reading ability.

A very important characteristic of mobile learning is the easy alignment with personal needs of the learners (Kukulksa-Hulme, 2018) and its use at all hours and everywhere (Lai & Zheng, 2018). Therefore, these results may have also been influenced by the learning opportunities outside the class that mobile learning is able to offer the learners. Specifically, in this study, as the mobile application is part of Google Chrome, the learners may be presented with material similar to that which they have studied in the classroom, consolidating what they have learned.

In order to answer the second research question, data were gathered from the participants related to reading self-efficacy based on a Likert scale. The results of the pretest are shown in Table 7.

Table 7.  
Descriptive Statistics on Reading Self-Efficacy Scale  

<table>
<thead>
<tr>
<th>Groups</th>
<th>N</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Independent</td>
<td>28</td>
<td>103.25</td>
<td>14.29</td>
<td>2.70</td>
</tr>
<tr>
<td>Teacher</td>
<td>28</td>
<td>101.75</td>
<td>10.32</td>
<td>1.95</td>
</tr>
</tbody>
</table>

The descriptive statistics in Table 7 illustrates that the mean score for the experimental group (M=103.25) and the control group (M=101.75) are very close. A t-test was carried out to ensure the homogeneity of the two groups in terms of reading self-efficacy.

Table 8.  
Independent Samples T-Test of Self-Efficacy Pretest  

<table>
<thead>
<tr>
<th>Levene’s test for equality of variances</th>
<th>t-test for equality of means</th>
</tr>
</thead>
<tbody>
<tr>
<td>F</td>
<td>Sig.</td>
</tr>
<tr>
<td>---</td>
<td>------</td>
</tr>
<tr>
<td>Equal variances assumed</td>
<td>1.62 .20</td>
</tr>
<tr>
<td>Equal variances not assumed</td>
<td>.45</td>
</tr>
</tbody>
</table>
According to Table 8, it can be claimed that the two groups were homogeneous in terms of self-efficacy beliefs before the treatment. There was no significant difference in the reading self-efficacy scores for the independent group (M=103.25, SD=14.29) and teacher group (M=101.76, SD=10.32; t (54)=0.45, p=0.20) on the pretest.

After the 10 sessions of treatment with Read & Write was completed, The Sources of Reading Self-efficacy Scale was administered. A one-way between-groups multivariate analysis of variance was conducted on the scores to find out if independent reading using an application could affect reading self-efficacy and its related components. Four self-efficacy components were used as dependent variables and the independent and teacher groups functioned as independent variables. Preliminary assumption testing was performed to examine normality, linearity, univariate and multivariate outliers, homogeneity of variance covariance matrices, and multicollinearity, but no violations were found. Descriptive statistics on the components of the reading self-efficacy test are displayed in Table 9.

Table 9. Descriptive Statistics on the Components of Self-Efficacy Beliefs

<table>
<thead>
<tr>
<th>Dependent variable</th>
<th>Groups</th>
<th>Mean</th>
<th>Std. Error</th>
<th>95% Confidence interval</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mastery</td>
<td>Independent</td>
<td>28.59</td>
<td>.47</td>
<td>27.63</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>26.91</td>
<td>.47</td>
<td>25.96</td>
</tr>
<tr>
<td>Social</td>
<td>Independent</td>
<td>28.95</td>
<td>.63</td>
<td>27.67</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>25.83</td>
<td>.63</td>
<td>24.55</td>
</tr>
<tr>
<td>Vicarious</td>
<td>Independent</td>
<td>33.04</td>
<td>.72</td>
<td>31.58</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>30.24</td>
<td>.72</td>
<td>28.78</td>
</tr>
<tr>
<td>Physiological</td>
<td>Independent</td>
<td>18.63</td>
<td>.58</td>
<td>17.45</td>
</tr>
<tr>
<td></td>
<td>Teacher</td>
<td>22.47</td>
<td>.58</td>
<td>21.29</td>
</tr>
</tbody>
</table>

Table 9 shows that the mean values attained from the questionnaire of reading self-efficacy are higher for ‘mastery,' ‘social,' and ‘vicarious' components in the independent group, but the component ‘physiological' shows a higher value in the teacher group acting in a different direction. Physiological states show a lower value, illustrating less anxiety and stress in the independent group leading to better learning (Bandura & Adams, 1977) demonstrating that this variable has improved in this group as well even though its improvement functions in the opposite direction.

In order to discover if using an application would better improve reading self-efficacy than teacher instruction, multivariate tests were performed. Table 10 displays a statistically significant difference on the combined dependent variables of the learners' reading self-efficacy between the independent and
teacher group on the posttest, F (2, 54)=10.98, p=00; Wilks’ Lambda=0.47, partial eta squared=0.52 illustrating that the independent group was able to significantly outperform the teacher group.

### Table 10.
**Multivariate Tests of the Components of Self-Efficacy Beliefs**

<table>
<thead>
<tr>
<th>Effect</th>
<th>Value</th>
<th>F</th>
<th>Df</th>
<th>Error df</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self</td>
<td>Wilks’ Lambda</td>
<td>.47</td>
<td>13.59</td>
<td>4.00</td>
<td>50.00</td>
<td>.00</td>
</tr>
<tr>
<td>Groups</td>
<td>Wilks’ Lambda</td>
<td>.53</td>
<td>10.98</td>
<td>4.00</td>
<td>50.00</td>
<td>.00</td>
</tr>
</tbody>
</table>

The researchers also attempted to find out how the treatment had affected the components of this construct. The results are illustrated in Table 11.

### Table 11.
**The Effect of the Components of Self-Efficacy**

<table>
<thead>
<tr>
<th>Source</th>
<th>Dependent variable</th>
<th>F</th>
<th>Sig.</th>
<th>Partial Eta Squared</th>
</tr>
</thead>
<tbody>
<tr>
<td>Groups</td>
<td>Mastery</td>
<td>5.44</td>
<td>.02</td>
<td>.09</td>
</tr>
<tr>
<td>Social</td>
<td>10.35</td>
<td>.00</td>
<td></td>
<td>.16</td>
</tr>
<tr>
<td>Vicarious</td>
<td>6.42</td>
<td>.01</td>
<td></td>
<td>.10</td>
</tr>
<tr>
<td>Physiological</td>
<td>18.57</td>
<td>.00</td>
<td></td>
<td>.25</td>
</tr>
</tbody>
</table>

According to Table 11, the groups revealed a significant difference on reading self-efficacy components as well. An alpha of 0.01 was established after dividing the original alpha of 0.05 by the number of the dependent variables. As evident from Table 9 and the significance and partial eta columns in Table 11, the learners' physiological states of reading self-efficacy was significantly affected due to the higher value reported. Social learning theory claims that “reducing physiological arousal improves performance by raising efficacy expectations” (Bandura & Adams, 1977, p. 289). Physiological states, namely anxiety, may act as a major and powerful part in the learners’ academic achievement specifically for complicated subjects (Anderson & Betz, 2001) and lower levels of physiological states can raise self-efficacy beliefs and predict success (Bandura & Adams, 1977). Physiological states and mastery experience are able to predict the self-efficacy perceptions of highly accomplished learners (Arslan, 2013).

The results show that using Read & Write affected the learners’ reading self-efficacy positively. Therefore, it can be surmised that instructing students on using an application and allowing them to carry out this knowledge independently in order to comprehend a reading passage influence and enhance their self-efficacy. It could be that, in this process, learners learn to trust and believe in their own abilities (Bandura, 1997) and develop a sense of agency and control over what is done and as a result attain higher degrees of self-efficacy compared to learners who are receivers of information from a teacher.
and do not have the power to act or to control their own learning. As a powerful and dominant self-belief, self-efficacy is capable of affecting all aspects of human life. Decades of research confirms that self-efficacy and achievement outcomes are closely connected (Bandura, 1997; Pajares, 1996; Schunk, 1995) and strongly correlated with effective application and exercise of strategies (Schunk & Gunn, 1986; Pintrich & De Groot, 1990; Schunk, 1995). Self-efficacious students are also known to exhibit greater performance monitoring and persist longer while problem solving than do their less efficacious peers (Bouffard-Bouchard, Parent, & Larivee, 1991) illustrating the fact that self-efficacy and academic achievement are closely related. Zarei and Hashemipour (2015) found that CALL/Web-based instruction on EFL learners’ in Iran significantly improved their general and academic self-efficacy, while Castagnaro (2012) reported a strong relationship between self-efficacy and application of technology in learning settings in Southern California. Similarly, Alzubi, Singh, and Hazaea (2019) found that engaging reading strategies using smartphones promotes the learners’ motivation and self-efficacy in a foreign language context.

Conclusion

This research has found that the judicious use of a reading application improves the learners’ reading comprehension. The reading application was used by students and improved their reading comprehension. The highest degree of variance was accorded to ‘Lexico-structural Patterns’ showing that this component was improved not only by using technology but also probably by what the students focus on the most as well. Usually, in school, teachers concentrate on grammar and vocabulary, sensitizing students to these components of language. The use of Read & Write also resulted in higher reading self-efficacy with a significant lowering of stress and anxiety which went hand in hand to enhance reading comprehension. This study was limited to intermediate learners in 10 sessions, which can narrow its generalizability. The results of this study imply that this application may be used in classrooms to help learners improve their reading comprehension. Additionally, teachers can also use mobile applications as a teaching aid in their classes and teach their students how to use them, which may result in higher self-efficacy as the student learns how to learn and read independently. In future studies, it would be interesting to examine the effect of using the reading application without the presence of a teacher. In any case, using a mobile application is able to influence learning and the freedom of users.

Acknowledgments

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