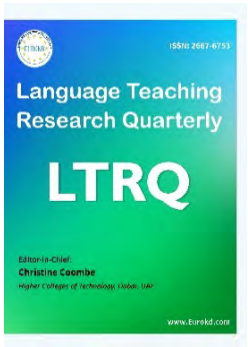

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An Investigation of Reading Memory and Cognitive Strategies through Internet-Connected Smartphones on Pre-university Students' EFL Reading Comprehension

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Abstract

The sources of knowledge have diversified and increased due to the widespread use of the Internet and smartphones. However, this diversity requires learners to know how to deal with and obtain knowledge and the extent of their credibility and usefulness. Subsequently, they must learn language learning strategies, including Memory Strategies (MSs) and Cognitive Strategies (CSs). This study scrutinizes the employment of reading MSs and CSs mediated by selected applications and tools of Internet-Connected Smartphones (ICSs) among Saudi undergraduates in an English as a Foreign Language (EFL) reading context. The study followed a quasi-experimental research design with two groups. The data was collected through a questionnaire and an achievement test. While the control group used the traditional methods of learning, the experimental group utilized their ICSs to employ reading MSs and CSs in the online learning mode after they received the necessary training. The study showed that students improved their performance in Reading Comprehension (RC) and use of reading MSs and CSs compared to their peers in the control group. The researcher recommends conducting workshops to train students on effectively employing MSs and CSs through ICSs to learn EFL reading skills.

Keywords: *Reading Memory, Cognitive Strategies, Internet-Connected Smartphones, Reading Comprehension, Online Mode of Learning*

Introduction

The widespread of the Internet and smartphones has made sources of knowledge available, regardless of place and time. In addition, it has not confined knowledge to the teacher and textbooks. However, knowledge availability without good management may be a disadvantage for learners. In Saudi Arabia, the RC performance of EFL students falls below the expected standard, with many students struggling to understand and engage with reading texts (Rahman

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& Alhaisoni, 2013). As a result, their ability to communicate and interact in a foreign language is significantly hindered (Alrabai, 2014; Al-Shumaimeri, 2003). Several factors contribute to these low levels of reading skills, including lack of motivation, insufficient exposure to the language, constraints on time and space for reading, limited practice both inside and outside the classroom, inappropriate learning materials, and inadequate training in reading strategies (RSs) (Al-Qahtani, 2016; Nezami, 2012; Tamer, 2013). To fill in such an existing gap, the use of reading MSs and CSs can be employed via ICSs to improve EFL students' learning of reading skills. In light of the literature, the current study attempted to improve EFL students' reading skills using MSs and CSs mediated by ICSs. Therefore, it is hoped that this study will contribute to providing new ways of learning to improve EFL learners' reading skills. The current study aims to fulfil the objectives below:

- to identify the degree of using reading MSs and CSs mediated by ICSs in the EFL reading context.
- to measure the effect of smartphone-mediated reading MSs and CSs on the learners' RC in the EFL context.

Review of Literature

Reading Strategies

Since the 1970s, RSs have gained considerable importance due to their crucial role in foreign language learning and acquisition (Thampradit, 2006). These strategies can enhance the interaction between the text and the reader, aiding in task comprehension through textual cues and guiding what to do when comprehension fails (Block, 1986, as cited in Li, 2010). Essentially, RSs are mechanisms used to understand a text. Readers use a variety of RSs to improve their comprehension, and clear guidance on how to use these strategies enhances the reading performance of language learners (Chen et al., 2021; Okasha, 2020; Yu et al., 2022). The reading process is viewed as a comprehension process where readers employ various strategies such as guessing, making predictions, previewing, inferring, skimming, and scanning to read effectively (Grabe, 1991). Abbott (2006, p. 637) defines RSs as "the mental operations or comprehension processes that readers select and apply to make sense of what they read." Anderson (1991) argues that strategic reading involves both knowledge of strategies and their application. Guthrie and Wigfield (1999) assert that comprehension is not accidental; little to no comprehension is achieved if learners do not know how to understand the text and grasp its intended message. Li (2010) characterizes RSs as purposeful and conscious techniques aimed at improving RC. Carrell (1998) notes that RSs are interesting because they involve the reader's interaction with the text, contributing to overall comprehension. In summary, RSs are the tools and techniques readers use to decode and understand any text.

Cognitive Strategies

Several researchers have defined CSs, highlighting their importance in language learning. Oxford (1990) described CSs as the ways in which learners manipulate or transform the target language, enabling them to understand and produce new language through various methods. Similarly, Weinstein and Hume (1998) defined CSs as the behaviors and thoughts learners use in their learning process to organize, store, and utilize information for future use. Bachman

and Palmer (2010, p. 56) described them as "the mental processes directly related to information processing to obtain, store, retrieve, and use information in learning or assessment settings."

CSs are universally recognized as crucial for effective learning, involving the processes of organizing, storing, retrieving, and using information. These strategies encompass both behaviors and thoughts that aid learners in managing and applying knowledge. Oxford (1990) emphasizes the active manipulation of language to understand and produce it, focusing specifically on language learning. In contrast, Weinstein and Hume (1998) provide a broader definition, highlighting the application of CSs to various learning processes and the future use of information. Bachman and Palmer (2010) offer a detailed breakdown of the mental processes involved, underscoring their relevance in both learning and assessment contexts. Despite these different emphases, all definitions converge on the importance of CSs in enhancing effective learning and information processing.

CSs encompass four sub-strategies: receiving and sending messages, analyzing and reasoning, and creating structure for input and output (Oxford, 1990, p. 43). Practicing involves learners applying what they have learned inside or outside the classroom through repetition, recombination, and practicing in natural contexts (Oxford, 1990, p. 43). Receiving and sending messages strategies include skimming to find the main idea, scanning for supporting details, and using available resources to comprehend and reflect in the second/foreign language (Oxford, 1990). Analysis and reasoning strategies help learners think logically about grammatical rules and vocabulary in the second/foreign language and include deduction, analysis of expressions, translation, and transfer. Creating structure for input and output involves managing new information through note-taking, summarizing, and highlighting to enhance understanding (Oxford, 1990, p. 45).

CSs are crucial for language learners to master the target language. According to Ghafournia and Afghari (2013), learners of a second/foreign language use CSs to relate new knowledge to previous knowledge, aiding in the restructuring of information. These cognitive processes help students complete assignments by making connections between linguistic knowledge and the world. Oxford (2013, p. 46) stated that CSs "aid the learner in putting together, consolidating, elaborating, and transforming knowledge of the language and culture." They are used to process information in the brain during second/foreign language learning and to create cognitive frameworks (Oxford, 2008, p. 52). Without CSs, learners may struggle to process information and learn the target language. Oxford argued that CSs help learners organize and classify information in the second/foreign language while reading, allowing them to demonstrate their comprehension practically.

In summary, CSs are essential for learning the target language as they form the core of language learning. These strategies enable learners to combine, group, analyze, and synthesize words, phrases, and sentences, thus enhancing their language acquisition and comprehension skills.

Memory Strategies

The acquisition of a second/foreign language requires learners to organize information effectively for easy recall. MSs are powerful tools that aid in storing and retrieving information as needed. When learning a second/foreign language, learners must memorize and recall

vocabulary, patterns, grammar rules, and more to expand their knowledge base, which enhances both comprehension and production (Oxford, 1990, p. 58). This process necessitates the use of strategies that assist in encoding and retrieving knowledge. Four sets of language MSs can help learners become more proficient in storing and retrieving information: creating mental linkages, applying images and sounds, reviewing well, and employing action (Oxford, 1990, p. 38).

Mental linkage strategies, such as grouping, associating, and placing new words into context, are particularly helpful for classifying and reclassifying language material into meaningful units, either mentally or in writing. This reduces the number of separate elements, making the material easier to remember (Oxford, 1990, p. 40). Association strategies involve "relating new information to concepts already in memory" (Oxford, 1990, p. 41), which improves comprehension and facilitates easier recall (Oxford, 1990, p. 60). For associations to be effective, they must be meaningful and logical. Placing new vocabulary in context is among the most important strategies for remembering new information, as it helps learners better remember the meaning and usage of words (Oxford, 1990, p. 60).

Language MSs also include using images, keywords, semantic mapping, and representing sounds in memory to aid in recalling new material (Oxford, 1990, p. 41). Imagery (visualization), whether mental or on paper, helps in associating new words with visualized pictures or symbols, representing objects, locations, or mental concepts. Semantic maps arrange new words in diagrams or pictures, including the main concept and related words, aiding in memory and comprehension of new expressions, especially in reading activities (Oxford, 1990, pp. 61-62).

Using keywords involves combining a sound and an image to help learners easily remember what they hear or read in the second/foreign language (Oxford, 1990, p. 62). Learners can use auditory and visual links to remember new words, and the relationship between words in the second/foreign language and the source language can aid in remembering new vocabulary. Concrete and abstract associations can also help in remembering words. Additionally, learners can remember new information based on sound by associating it with existing knowledge in either the target or source language (Oxford, 1990, p. 42).

To effectively use language MSs, learners need to review newly acquired information in the target language regularly (Oxford, 1990, p. 42). Structured revision, such as reviewing at carefully spaced intervals, helps learners retain new knowledge. Learners can set a timetable to review new information based on minutes, hours, days, and so on, revisiting learned material while also learning new material (Oxford, 1990, p. 42).

In addition, learners can reinforce memory by linking abstract words to physical sensations. Mechanical techniques, such as writing new vocabulary words on flashcards, pieces of paper, or memos, and then exchanging them with another person once memorized, can also aid in learning.

A number of studies in traditional learning context has examined the use of reading MSs and CSs in the EFL reading context. The strategies were connected with some variables such as RC (Aghaie & Zhang, 2012; Aroo, 2019; Assiri, 2014; Bruen, 2020; Cabrejas & Chavez, 2018; Hui et al., 2022; Khezrlou, 2012; Maiwen, 2020; Marzuki et al., 2018; Par, 2020; Sua, 2021; Suyitno, 2017; Thu et al., 2019; Zakaria et al., 2019), learners' proficiency (Ali & Yunus, 2013; Ghafournia & Afghari, 2013; Gustanti & Ayu, 2021; Mosalli et al., 2022; Paris

& Myers, 1981), learning styles (Rojalai, 2021), and the level of use and awareness (Islam, 2019; Manalang, 2020; Mustajab, 2020; Osuji, 2017; Ratna, 2014; Sahan, 2012). However, little recent research has examined reading MSs and CSs utilizing technology. Ghonsooly and Seyyedrezaie (2014) showed that Iranian EFL university students indicated no significant difference between pre-test and post-test RC scores of EFL students who were exposed to web-based instruction. Lin et al. (2017), who investigated cognitive and metacognitive strategies in online learning courses, reported that learners who used more online learning strategies felt more achievement and perceived progress. Cheng (2019) found that skilled foreign language learners who were active in live chats would usually or almost always draw their attention to relevant information, clarify the purposes of reading, identify the importance of the reading passages, take on corrective measures, and recover from distractions when they read online in foreign languages.

Internet and Mobile Technology in EFL Reading Learning

Technology such as the Internet and smartphones have been proved to be effective tools for EFL reading learning online and offline (Lin et al., 2017; Cheng, 2019). The technology of ICSs has opened the various resources of knowledge for teachers and students at their convenience in terms of time and place. Smartphones can prove advantageous for EFL instructors and teachers in reading classrooms, especially when tasks are structured to provide passive students with options for reading materials, encourage collaborative engagement, and offer challenging opportunities (Khojah & Thomas, 2021). Mobile technology offers exciting possibilities for language learning. It allows for effective learning by breaking down activities into smaller units, provides various instructional modes such as individualized and informal learning, and makes learning accessible regardless of location or time constraints. This enables learners to extend their language learning beyond traditional settings like classrooms and laboratories (Chinnery, 2006; Cooney & Keogh, 2007; Cote et al., 2014; Huizenga et al., 2009; Sathe & Waltje, 2009).

In addition, mobile has been found to have a crucial role in the use of RSs. Mardiah and Safitri (2023) demonstrated that students utilize specific critical RSs when engaging with digital academic texts. They find strategies such as rereading the text, note-taking and annotating, looking up keywords, making personal connections, connecting ideas within the text, and comparing different ideas highly beneficial. However, students encountered distractions such as notifications and hyperlinks while applying these strategies. In addition, Gao and Shen (2021) showed that a mobile technology-assisted environment influenced changes in Chinese EFL learners' adoption of learning strategies. These differed in type and frequency from those used in a teacher-led, examination-oriented classroom. Metacognitive and commitment control strategies were the most frequently employed

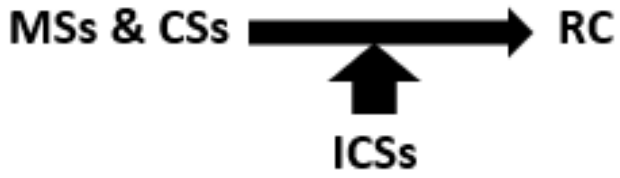
Moreover, the reading medium (mobile) is closely linked to reading proficiency and the effective use of RSs, both of which affect RC (Yu et al., 2022). Smartphones play a crucial role in enhancing reading skills among language learners, as evidenced by various studies. Al-Shehri (2011) and Chun (2006) emphasized that smartphones offer learners opportunities to improve reading skills independently and receive instant feedback through engagement with authentic materials. Hazaea and Alzubi (2016) noted that smartphones also aid in vocabulary, grammar, and pronunciation learning. Cho et al. (2018) found that mobile devices have a

moderate effect on EFL learners' acquisition and achievement, varying based on the test type and study source. Li (2022) demonstrated the effectiveness of Mobile-Assisted Language Learning (MALL) applications for EFL/ESL RC compared to conventional approaches. Tümen Akyıldız and Çelik (2022) showed that consistently delivering reading tasks through WhatsApp can positively influence students' English reading achievement and attitudes. Additionally, Azad and Kamarei (2021) discovered that Mobile-Assisted Language Learning (MALL) positively impacts EFL learners' RC and vocabulary skills. Hakiki et al. (2022) revealed how internet-based reading through blogs influences students' RC. Al-Jarf (2022) found that integrating mobile fiction apps enhances students' RC, literary appreciation, and text analysis skills, while increasing their engagement in reading and literary analysis. These studies collectively underscore the significant role of smartphones in improving various aspects of reading skills among language learners.

Given the evolving nature of young learners and the ubiquitous presence of the internet and smartphones, which are increasingly integrated into education, this study proposes that EFL learners who receive instruction on MSs and CSs and employ them using ICSs will enhance their use of reading MSs and CSs, thereby improving their comprehension performance in EFL reading. Therefore, this study will investigate the use of MSs and CSs through smartphones as well as comprehension performance among Saudi students in reading context. The theoretical framework will be synthesized as follows:

Figure 1

Theoretical Framework of the Study



Reading MSs and CSs are the learners' manipulation or transformation of the target language, which enable them to understand and produce new language by many different means. Reading MSs and CSs are employed by learners to improve a second/foreign language learning (Oxford, 1990). Reading MSs and CSs can be facilitated through smartphones that enable learners get access and engage with materials at any place and any time (Pegrum, 2014). The learners' application of reading MSs and CSs mediated by ICSs is expected to lead to greater RC. The study will attempt the following research questions:

RQ1: What is the degree of EFL students' use of reading MSs and CSs mediated by ICSs in an EFL context?

RQ2: What is the effect of smartphone-mediated reading MSs and CSs on the learners' RC in an EFL context?

Methodology

In this quasi-experimental research design, a training strategy is implemented to teach learners how to use MSs and CSs with specific tools and smartphone applications in online learning.

The objectives are to enhance their utilization of reading MSs and CSs, and consequently improve RC in the context of English as a Foreign Language (EFL) reading.

Population and Sample of the Study

The study took place at a university in the southwest region of Saudi Arabia and focused on students enrolled in the Preparatory Year Program. For students in the science stream in Saudi Arabia, the Preparatory Year program serves as a crucial bridge between high school and college. It focuses on enhancing students' fundamental knowledge and abilities, facilitating their transition into the academic environment of the university in the specialized colleges of medicine, engineering, and computer sciences, pharmacy, and nursing. The curriculum is specifically designed to meet university requirements, offering intensive courses in computer science, math, communication skills, and English. In addition, the program provides psychological preparation through counseling sessions to help students adjust to university life. To adhere to cultural norms, the program often features gender-segregated classrooms, creating a comfortable learning atmosphere. However, this segregation can lead to communication challenges between the male and female sections, particularly affecting collaborative tasks. Nevertheless, the Preparatory Year curriculum is essential for preparing students both academically and psychologically for the rigors of higher education, with the ultimate goal of ensuring their success in university studies.

In the Preparatory Year, classes are gender-segregated, with male teachers instructing male students and female teachers instructing female students. Due to communication difficulties with the female section, the study specifically targeted the male section. For the study, a purposive sampling technique was used to select two intact reading classes, totaling 60 students, as the experimental and control groups. The participants were homogeneous in terms of gender (all male), science stream at high school, age (18-22), mother tongue (Arabic language), English education background (seven years), level (level 1), placement test (pre-intermediate), and subject (Reading Skills). Ethical approval was obtained from the university's Ethical Approval Committee, and student consent forms were obtained prior to participation.

Data Collection

Two quantitative instruments were used to collect data: a questionnaire on language cognitive and memory strategies and a test on learners' comprehension performance in the context of EFL reading. The questionnaire, adapted from Oxford's (1992) inventory of language learning strategies, comprised 28 sub-strategies covering CSs (16 items) and MSs (12 items). It was tailored for the online delivery of the reading course and the use of Internet-connected smartphone applications. Participants rated their responses on a five-point Likert scale, ranging from "Never" (1) to "Always" (5).

Additionally, the study utilized the reading achievement test from the English Department as the second midterm test to assess students' reading skills post-intervention. Both the questionnaire and the test were administered to both the experimental and control groups.

Data analysis was conducted using SPSS version 23. Descriptive statistics, including means, standard deviations, and percentages, were used to analyze the questionnaire data. The independent sample t-test was employed to determine statistically significant differences

between the means of the experimental and control groups. Furthermore, Eta-squared was calculated to assess the effect size of the program on students' RC performance.

Validity and Reliability

The questionnaire and test tools are considered valid for the following reasons. Oxford's (1992) inventory of language learning strategies is very famous and was applied in many EFL contexts all over the world. Second, the test is prepared and reviewed by the committee of examination in the Department of English at Preparatory Year. As for reliability, the study tools were piloted to an exploratory sample of (n= 20 students) from outside of the main study, Cronbach Alpha's equation was computed to calculate the questionnaire reliability. Also, the test reliability was extracted using Kuder-Richardson's formula. Table 1 shows the results of analysis.

Table 1

Reliability of the Questionnaire (Reading MSs and CSs) and Achievement Test

N	Questionnaire	No. participants	No. of items	Reliability - Cronbach's Alpha	Achievement test	No. participants	Reliability -Kuder-Richardson	Split half reliability coefficient-Gutman
1	MSs	20	12	0.78	Reading	20	0.85	0.89
2	CSs	20	16	0.86				
7	Overall	20	28	0.90				

As shown in Table 1, the total score of the questionnaire's reliability coefficient was 0.90. Also, the test reliability received a reliability coefficient of 0.85 and 0.89 using Kuder-Richardson's and Gutman's equations consecutively. These results indicate the tools are reliable and can achieve the study objectives. In practical terms, these high reliability values suggest that the tools employed in the study yield consistent and stable results over time and across different samples. This contributes to the overall robustness of the study by ensuring that the data collected is dependable and trustworthy. Researchers can have confidence that the tools used are effectively measuring the variables of interest, thus enhancing the validity of the study's findings.

Intervention

An intervention program was conducted for the experimental group to teach them how to use reading MSs and CSs with Internet-connected smartphone applications in online learning via Blackboard. The teacher-observer of the experimental group led the program, which involved four hours of training per week in the first week of the semester, totaling four sessions. The training was based on Oxford's (1990) model, which includes seven steps for strategy use training: determining learners' needs and resources, assigning strategies, considering the expected advantages and motivation, preparing training activities and materials, conducting the training, and evaluating the process. The program used tasks and activities from the textbook Basic Reading Power 1 and other materials to teach the identified strategies. The

activities were designed to help students apply these strategies effectively in the context of EFL reading.

During the training sessions, the experimental group used their own ICSs to apply reading MSs and CSs in EFL reading. They received guidance on utilizing smartphone applications effectively for learning EFL reading skills. Training sessions also covered the use of specific smartphone applications. Participants utilized features such as WhatsApp, flashcards, discussion forums, internet search engines, dictionaries, camera, recorders, and notes both inside and outside the classroom. Blackboard was used as a platform to support the application of reading MSs and CSs and to assess the participants' RC. The training emphasized the use of smartphone applications like WhatsApp, flashcards, internet search engines, chat, discussion, e-dictionaries, camera, recorders, and notes to facilitate the application of reading MSs and CSs in EFL reading.

The activities conducted in the training program were based on the textbook "Basic Reading Power 1" and Oxford (1990). The section on MSs included several activities. Initially, students were given a list of words (car, bus, train, and plane) to categorize into meaningful groups using their smartphone notes. They were also asked to use verbs (invent, collect, learn) in sentences by using internet search engines or dictionaries. Additionally, students received a list of words with similar sounds (pain, chain, train, drain) and were instructed to represent them in a picture with the help of internet search engines. Moreover, they were given a list of words (teachers, students, classrooms, and cafeteria) to link under a general topic using internet search engines and a camera. Furthermore, they used their smartphone dictionaries to remember a list of words (light, sky, lie, fly, dry, high) based on their similar rhyme. Students were requested to categorize another list of words (car, bus, train, and plane) into meaningful groups using smartphone notes. Additionally, they were asked to act out some words (dance, wave, point, jump, and clap) using internet search engines or a camera. They were also requested to use their smartphone notes to jot down new words from a passage for periodic review. Finally, they were given a list of words (bread-bakery, plane-airport, book-library) to remember based on their location, using internet search engines.

CSs comprised various activities during the training sessions. These activities included practicing words with similar endings (e.g., mosque, boutique, cheque) using dictionaries and engaging in conversational patterns such as 'Good morning' and 'Hello'. Students were also trained in reading, recording, and listening to a list of words (e.g., refugees, collection, evil, retire). Furthermore, they were given a short paragraph about air pollution from a newspaper to read and asked to take notes using their e-notes, as well as a reading passage on Saudi food where they checked the meaning of new vocabulary using internet and e-dictionaries. Additionally, they were required to find Arabic equivalents for words (e.g., house, television, supermarket, lift, coffee) using Arabic language internet search engines on their smartphones. They attempted to guess the meaning of words (e.g., delegation, addiction, dedication, dictation, action) and used dictionaries to understand new words (e.g., renew, preview, replay, react, redo) based on their parts of speech. They also used translators to translate sentences into Arabic using Google translate and translated expressions (e.g., blood bank) into Arabic. Flashcards were utilized to memorize and learn the meaning of new words. Finally, they used their M-notes to take notes about a reading passage's topic and main idea and summarized it.

Following the completion of the training program, the experimental group utilized smartphone tools and applications to apply MSs and CSs in learning reading for eight weeks. At the end of week eight, students in both the experimental and control groups took the reading achievement test and responded to the questionnaire.

Results

Reading Memory and Cognitive Strategies

Table 2 presents the results of the data analysis collected from the reading MSs and CSs questionnaire after the intervention for both the experimental and control groups. The table shows the participants' means and standard deviations following the interventional program. It is important to note that the results are presented based on the scores of the experimental group, with a comparison to the scores of the control group. In addition, the table provides a summary of the variance between the two groups' scores in the use of reading MSs and CSs after the intervention.

Table 2

Analysis Results Reading MSs and CSs Questionnaire (Post-Intervention)

Domain	Group	No.	Mean	Standard deviation	Frequency	Percentage of use
CSs	Experimental	30	3.96	.326	Often	79%
	Control	30	3.26	.363	Sometimes	65%
MSs	Experimental	30	3.78	.588	Often	76%
	Control	30	3.07	.423	Sometimes	61%
Total	Experimental	30	3.87	.345	Often	77%
	Control	30	3.17	.350	Sometimes	63%

Table 2 shows variations in the use of reading MSs and CSs between the experimental and control groups (M=3.87, 3.17, SD=0.345, 0.350 respectively). Participants in the experimental group, who received the intervention, demonstrated higher utilization of these strategies compared to the control group. The experimental group employed reading MSs and CSs more consistently through Internet-connected smartphone applications in the online learning mode via Blackboard, while the control group showed less consistent use of these strategies for learning. To assess the statistical significance of the differences between the two groups post-intervention, an independent t-test was conducted, with the results presented in Table 3.

According to Table 3, the use of reading MSs and CSs significantly favored the experimental group, which utilized Internet-connected smartphone applications via Blackboard to employ these strategies in the reading course (M=3.80, SD=0.363): t(58)=7.280, p=.000. The participants in the experimental group outperformed the control group in using both language MSs (M=3.78, SD=0.588): t(58)=5.263, p=.000, and CSs (M=3.96, SD=0.326): t(58)=7.801, p=.000.

Table 3

Independent T-test Analysis of Reading MSs and CSs Questionnaire

Reading MSs and CSs	Group	N	Mean	St. Deviation	t	df	Sig. (2-tailed)	Mean Difference (MD)	Interpretation
MSs	Experimental	30	3.78	.588	5.263	58	.000	.704	Use of MS
	Control	30	3.07	.423					Sig. in favor of the experimental group
CSs	Experimental	30	3.96	.326	7.801	58	.000	.700	Use of CS
	Control	30	3.26	.363					Sig. in favor of the experimental group
Total	Experimental	30	3.80	.363	7.280	58	.000	.630	Overall use
	Control	30	3.17	.297					Sig. in favor of the experimental group

Reading Achievement Test

The data collected from the reading achievement tests of both groups were analyzed using an independent sample t-test to determine if there were statistical differences between the means of the experimental and control groups. Additionally, Eta-squared was used to measure the effect size of the interventional program. The results are presented in Table 4.

Table 4

Eta-squared Results

Total degree of the test	Group	No.	Means	Standard deviations	t	df	Sig.	Eta-squared	Effect size
	Experimental	30	24.30	4.018	5.563	58	.000	0.35	High
	Control	30	19.77	1.942					

Table 4 indicates statistically significant differences, at the 0.05 level, between the means of the scores of the experimental and control groups on the total test score, favoring the experimental group. Furthermore, the program had a large effect on the experimental group compared to the control group after the intervention. These results suggest that the intervention implemented for the experimental group resulted in significant improvements in test scores compared to the control group, with a large effect size indicating a substantial impact of the intervention.

Discussion

The main findings can be summarized as follows: The use of reading MSs and CSs varied between the experimental and control groups, with participants in the experimental group outperforming those in the control group. The experimental group often employed these strategies through Internet-connected smartphone applications in the online learning mode via Blackboard, while the control group only sometimes used them for learning reading. Several factors contributed to the differences in the use of reading memory and cognitive techniques

between the experimental and control groups. First, the result can be attributed to the implemented training program that included training students on using MSs and CSs in learning reading skills using Internet sources and smartphone applications. Second, the experimental group likely found it easier to use these tactics compared to the control group due to their access to smartphone applications connected to the Internet. The accessibility and simplicity of these technologies may have encouraged more consistent use among the experimental group. In addition, the interactive nature of these programs and the novelty of using technology for educational purposes may have motivated students to actively employ memory and cognitive techniques. Finally, the difference in approach may have been influenced by the design of the online learning mode through Blackboard. It is possible that the experimental group received more detailed instructions or guidance on how to apply these strategies in the online learning environment (Patra et al., 2022).

Moreover, students need these strategies to deal appropriately with the tremendous amount of information they are exposed to via the Internet. They needed these strategies to check and learn how to get the required information. With recent developments and changes in modes of learning and the widespread of technology, thus making teachers and textbooks only one source of knowledge, teachers have to change their teaching ways and roles. They need to move from teaching what knowledge to teaching how to get knowledge. In this context, the cognitive processes and strategies necessary for understanding a single printed text differ from those required for comprehending multiple sources and dimensions of information in a digital environment (Cho et al., 2018).

The findings are consistent with prior research emphasizing the importance of implementing learning strategies in the EFL context (Islam, 2019; Manalang, 2020; Ratna, 2014). However, the result does not match that of Osuji (2017), who reported that ESL Nigerian students had a medium use level for RSs and that of Yu et al.'s (2022) study, which found that participants' use of RSs with mobile phones was less effective compared to their use with paper. The variation is results can be attributed to students' levels of study, different RSs among studies, and contexts of studies.

The proposed theories and approaches to foreign language learning strategies support the current results of the study. According to Wenden (1987) and Oxford (1990), foreign language learning strategies help learners engage in naturalistic situations using meaningful, contextualized language. These strategies also assist learners in becoming self-directed and expand the teacher's role from a direct instructor and the only source of information to a mediator or coordinator. Additionally, learners employ foreign language learning strategies to solve problems, accomplish tasks, or achieve goals. In short, the appropriate employment of foreign language learning strategies contributes to the learners' competence and self-directed learning and encourages them to take charge of their learning, learn on their own, and make them confident in solving the problems that learners face during their second/foreign language learning.

Moreover, statistically significant differences were found between the means of the scores of the experimental and control groups on the total score of the achievement test, favoring the experimental group. In addition, the program's effect size was large for the experimental group compared to the control group after the implementation of the intervention. Students who were trained in MSs and CSs through Internet-connected smartphone applications in an online mode

of learning improved their RC based on the results reported from their test scores. It can be said that students' improvement level of the reading test scores may be attributed to the use of MSs and CSs and the Internet and mobile technology. The current result is supported by that of Suci et al.'s (2022) study, which uncovered a limited correlation between students' perceptions of Telegram usage and their RC due to the lack of reading strategy guidance provided by the teacher prior to the treatment. In addition, this result accords with previous research that highlights the role RSs on EFL students' reading performance. With the different mode of learning, the result agrees with those of (Aroo, 2019; Bruen, 2020; Cabrejas & Chavez, 2018; Hui et al., 2022; Khezrlou, 2012; Lin et al., 2017; Marzuki et al., 2018; Sua, 2021; Suyitno, 2017; Thu et al., 2019; Zakaria et al., 2019). However, the present result does not align with that of Assiri (2014), who found that the use of both metacognitive and CSs had small to medium effects on reading performance. Also, Maiwen (2020) showed difficulties in understanding reading texts even after studying CSs. These variations in results could be attributed to different learning environments, education backgrounds, study level, and various interventional programs.

The current results implicate the importance of MSs and CSs in improving students' language learning and achievement levels in the EFL reading context. Also, the technologies of the Internet and smartphones would enhance the learning of those strategies to improve their reading learning experience. In addition, the study suggests that the traditional roles of teachers must change to new roles that meet the requirements of this era, in which knowledge has become available for all at any time and place. Teachers need to be facilitators of knowledge; they need to teach students not the knowledge itself but how to get and verify knowledge amid the tremendous sources of information.

Conclusion

The present study contributes to the theoretical field by proposing a framework that involves reading MSs and CSs specifically tailored for EFL reading skills through ICSs. This framework aims to enhance EFL learners' performance in RC within an EFL reading context. The participants improved their reading MSs and CSs using Internet-connected smartphone applications via Blackboard. Also, they highly boosted their achievement level in reading. The generalization of the results of the current study is limited to the context of the study (Saudi Arabia), gender (male), sample, mode of learning (online), EFL skill (reading), and indications of validity or reliability of the study tools. The researcher recommends that teachers of EFL reading skills benefit from the implemented program (reading MSs and CSs mediated by the Internet and smartphones) in the current study to empower their students' capabilities to boost and improve their learning performance. Stakeholders can also use the current study to build on their plans to revolutionize education amid the rapid changes in the technologies of the Internet, smartphones, artificial intelligence, etc. Future studies may focus on using specific innovative applications based on artificial intelligence like generative AI tools mediated by MSs and CSs to help improve EFL learners' reading abilities.

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