

**THE RELATIONSHIP BETWEEN READING STRATEGY USE AND  
READING COMPREHENSION AS MEDIATED BY READING RATE:  
THE CASE OF EYE MOVEMENT TRAINING  
BY RAPID SERIAL VISUAL PRESENTATION (RSVP)**

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**Abstract**

The purpose of the current study was to examine the relationship between reading strategy use and reading comprehension as mediated by reading rate amongst advanced EFL students who received eye movement training by Rapid Visual Presentation (RSVP) technology. Seventy-two EFL learners participated in the study and received instruction for enhancing their reading speed via Reading Trainer Application for twelve consecutive weeks. Their entry-level of reading strategies awareness was assessed by the Metacognitive Awareness of Reading Strategies Inventory prior to and after the study. Their reading comprehension was assessed by International English System Test before and after the study. Their reading rate was also recorded prior to and after the study. Modelling the relationship between strategy use and reading comprehension as mediated by reading rate was tested prior to the study and the findings showed that the model was not statistically significant. The model was reassessed after the experiment and the results lent credence to the fact that eye training via RSVP for speed reading led to a mediating role for reading rate in the relationship between strategy use and reading comprehension. The results support the fact that reading rate is a contributory factor in understanding reading passages and integrating speed reading training using the-state-of-the-art technologies into reading instruction should be considered in EFL reading courses.

**Keywords:** RSVP; eye movement; reading; rate; comprehension; cognitive strategy; MALL

**1. Introduction**

The 21st-century is consistent with rapid developments in computer technologies as though it has received substantial attention in different branches of education (Korucu & Alkan, 2011). As lies the case with many other disciplines, language learning has delved into numerous

chances to boost pedagogy efficiency by integrating various sorts of technologies into the language classroom (Rahimi & Babaei, 2020).

Myriads of studies admit the importance of Technology-Enhanced Language Learning (TELL) as a means in language acquisition (Jarvis & Achilleos, 2013), and some research suggested that learners employing TELL surpassed the ones undergoing traditional training. (e.g., Constantinescu, 2007; Hoopingarner, 2009; Grgurovic, Chapelle & Shelley, 2013). Lately, the integration of mobile tools into education within and beyond the class walls is incrementally escalating at such an incredible pace that conducting investigations on its advantages and disadvantages in the academia has substantially gained in importance (Economides & Grousopoulou, 2009; Engel & Green, 2011).

Mobile learning (M-learning), a modern means to fill the absence of early distance learning systems (Korucu & Alkan, 2011), is defined as cooperative and technology-based learning in which learners are actively involved in motivating and real-world learning assignments through cooperating with portable devices, personal digital assistants (PDAs), and cellphones (Behera, 2013; Mehdipour & Zerehkafi, 2013; Ozuorcun & Tabak, 2012; Soleimani, Ismail & Mustafa, 2014). In such a framework, mobile-assisted language learning (MALL), as a subcategory of M-learning and Computer-Assisted Language Learning (CALL), proposes a modern approach to language learning, assisted or boosted via the employment of compact cellphones, in which both traditional and distance learning are endorsed (Wang, 2004; Kukulska-Hulme, 2013).

Mobile technologies hold the vision of supporting foreign language learning and adding a greater extent of merit to education by progressively acquiring new users and providing increased capacity (Genc, 2012; Pachler et al., 2010). It is argued that “the future of language learning lies more with MALL and especially with pen assisted language learning (PALL) than with CALL” (Chaka, 2008, p. 539) owing to distinguishing features of MALL: “mobility, ubiquity, and connectivity; portability and handleability; convergence, multifunctionality, cross-platform blending, optionality, and convenience; access, accessibility, availability, and affordability; and context-awareness, personalization, and flexibility” (Chaka, 2008, p. 542). As a result, research on mobile-based emerging technologies in the domain of language teaching and learning is pivotal to gaining greater insight into the benefits of MALL environment for mastery of language skills. Especially, in this era where the appearance of different types of mobile apps claiming to help language learning is on the rise, language teachers and learners should be informed of their value by the scientific community.

Reading speed training apps designed with the aim of speeding up on-screen reading are among these aforementioned environments. While widespread use of mobile phones among language learners fuels the boom of app development, research on the effects of these apps on reading performance is lagging behind. A few studies in this field have revealed mixed findings about the benefits of using reading training apps in improving reading comprehension and strategy use and awareness. As a result, this study aims to scrutinize the effects of a reading speed training app on EFL learners' development of reading comprehension and strategy use/awareness considering a mediating role for reading rate.

## **2. Literature review**

### **2.1. Rapid Serial Visual Presentation (RSVP) Technology**

As a ground-breaking invention, Rapid Serial Visual Presentation (RSVP) has the exclusive trait of displaying words (or at times, groups of words) set at a fixed pace and point (Forster, 1970). In RSVP, words are serially displayed at a time in order to lessen the eye movements and intensify the concentration while reading (Rahimi & Babaei, 2020). To put it differently,

RSVP is the process of sequentially displaying images at the same spatial location at high presentation rates with multiple images per second, as an instance with a stimulus onset asynchrony no greater than 500ms but often lower than 100ms, i.e., >10 stimuli presented per second (Lees, Dayan, Ceotto, McCullagh, Mahuire, Lotter & Coyle, 2018, p. 1).

RSVP technology is widely employed in pedagogy since it allows psycholinguists to manage exposure period of the stimuli and examine its impact on comprehension, recognition, and retention (Öquist & Goldstein, 2003). Thus, RSVP is proved to be an apposite means for accelerating pedagogical outcomes, typically in mainstream education and, more particularly, in language acquisition. It is postulated that factors such as text size, visual structure, segmentation unit, and presentation units are crucial factors that significantly condition retention in RSVP (Lemarié, Eyrolle & Cellier, 2008).

RSVP was previously deemed to be one of the experimental models used in the examination of attentional mechanisms integrated it into both the written language and comprehension process (Forster, 1970). Compared to regular reading, in which readers are required to dedicate plenty of time reading the words and take other factors such as the frequency, function, length, and position of the words into account, RSVP forces the readers to read the entire words within a text, incorporating the words missed or evaded in regular reading (Just & Carpenter, 1980).

Numerous facts confirm the supposition that RSVP can affect reading comprehension (e.g., Cocklin et al., 1984; Proaps & Bliss, 2014; Potter et al., 1980; Forster, 1970; Bouma & de Voogd, 1974; Masson, 1983; Benedetto et al., 2015; Just, Carpenter & Woolley, 1982). Many studies conducted on RSVP suggest that retention could be at an acceptable level and even more significant than or equal to regular reading. However, several contributory factors can negatively impact reading comprehension in RSVP. For instance, it is documented that reading comprehension substantially decreases when students quickly glimpse through each word for a brief period (like 85 ms - Just, Carpenter & Woolley, 1982). Furthermore, if the students are not allowed to pause at the end of every sentence, they fail to appropriately attend to the reading comprehension tests as though a significant decline would be noticeable in their performance (Benedetto et al., 2015).

## **2.2. RSVP and reading**

From an educational perspective, teachers expect that their students become more capable readers. Based on verbal efficiency theory (Perfetti, 1985), the ability to read is attributed to reading speed and reading comprehension. Similarly, Grabe (1991) ascribes both apposite reading rate and retention ability to be the chief characteristics of fluent reading in language acquisition.

Several studies conclude that an ordinary L1 adept reader is capable of delivering virtually 250 to 300 words per minute (wpm), along with nearly 90 fixations per 100 words (Nation, 1997; Carver, 1982; Nation, 2009), while college students move the speed up a notch to roughly 300 wpm (Hunziker, 2006). Masson (1983) also estimated the maximal reading rate at about 800-900 wpm and reported that reading beyond these rates is impossible without skipping the words. However, it should be noted that the reading rate in either second or foreign language is considerably slower in comparison to the mother tongue (Droop & Verhoeven, 2003; Fraser, 2007).

It is also documented that fluency skills in reading “are directed at allowing the reader to see larger sentences and phrases as wholes, a process which assists in reading more quickly” (Hudson, 2007, p. 80). Fluency development is assumed as one of the chief four strands of a language course, and it is advised to dedicate roughly equal time to it in the curriculum (Nation, 2007). It is suggested that “speed-reading courses need to be incorporated as an essential part of all reading classes” (Chung & Nation, 2006, p. 198). Other than that, numerous researchers regard reading speed as a curriculum-based measurement, a valid and reliable procedure to

observe learners' advancement on a frequent basis and make instructional decisions (Tichá et al., 2009).

According to RSVP studies, it is perceived that determining the ultimate set of presentation parameters for RSVP is yet a reasonably challenging task (Proaps & Bliss, 2014). Myriads of studies reveal that readers can grasp the passage presented at a pace similar to the skim-reading technique, between 8 to 12 words every second (Potter, Kroll & Harris, 1980; Ward & McNamara, 1982; Masson, 1983). Similar to traditional text presentation formats, reading at a rate of 250 words per minute (wpm) (i.e., four words per second) may noticeably augment the performance (Proaps & Bliss, 2014).

RSVP technology allows learners to control their reading speed as though they can read the end of the text during the given time; this is moderately in marked contrast to traditional and time-based reading tasks in which some students may not be able to do during the given time (Rubin & Turano, 1992). Moreover, it is indicated that RSVP simulates visual experience of regular reading and eliminates the need for eye movement (Rayner, 1998). Moreover, the argument that the removal of eye movements would lessen the cognitive load, proposed by some researchers (e.g., Potter, 1984), is utterly rejected by many researchers (Castelhamo & Muter, 2001) as RSVP may boost the cognitive load and occasionally divert the reader's focus and attention from the passage (Bouma & de Voogd, 1974).

Besides, it is documented that RSVP removes regressions and prevents learners from following the previously read parts of the text again, which, in turn, would affect the comprehension since regressions and rereading occur when readers face a problem while processing the linguistic sections of the text (Reichle, Rayner & Pollatsek, 2003). Nevertheless, regressions are not the only distinctive features between traditional reading and RSVP in such a way that a whole host of research studies demonstrate that during reading, accessing readers' knowledge and information starts primarily with words in advance of having them fixated via the parafoveal processing; additionally, the acquired information is later used to advance the processing just when the words are directly fixated (Rayner, 2009; Schotter et al., 2012). Monitoring the duration and sequence of word processing together with the oculomotor system is consequential for a clear comprehension of the text as if removing regressions endangers comprehension solemnly (Schotter, Tran & Rayner, 2014).

From a pedagogical perspective, conducting further studies on the topic seems to be essential as reviewing the literature postulates that an overwhelming majority of the research conducted in this area merely shed light on native-speaker subjects, ethnic groups, and cultural context or the differences observed between males and females; so the impact of RSVP on

EFL/ESL learners is admittedly scarce (Masson, 1983) especially within the MALL environment. Furthermore, while some scholars have paid conspicuous heed to the differences in reading comprehension and reading rate as a result of implementing RSVP technology, to the best knowledge of the authors, no study has focused on the mediating role of reading rate on the relationship between reading strategy awareness/use and reading comprehension thus far. Moreover, the current research surpasses prior studies on the grounds that it also entails examining eye-movement impact through RSVP technology on learners' awareness of reading strategies within the MALL environment.

### 3. Methodology

#### 3.1. The aim of the study

It is evident in the literature that language learners' reading comprehension is under the influence of their reading strategy use and awareness. The role of reading rate in this equation has been found to be mixed, suggesting that in some educational contexts reading rate may hinder or counterbalance reading comprehension.

Research shows that this negative association can be influenced by incorporating suitable speed reading techniques into reading classes. Thus, it is possible to hypothesize that the relationship between reading strategy use and reading comprehension can be mediated by reading rate provided that the speed reading is integrated into a reading course where eye movement training is provided based on RSVP technology. In this way, the reading rate may function as a mediator that explains the underlying mechanism of the relationship between strategy use (IV) and reading comprehension (DV). The conceptual model of the study is

displayed in

Fig. 1.

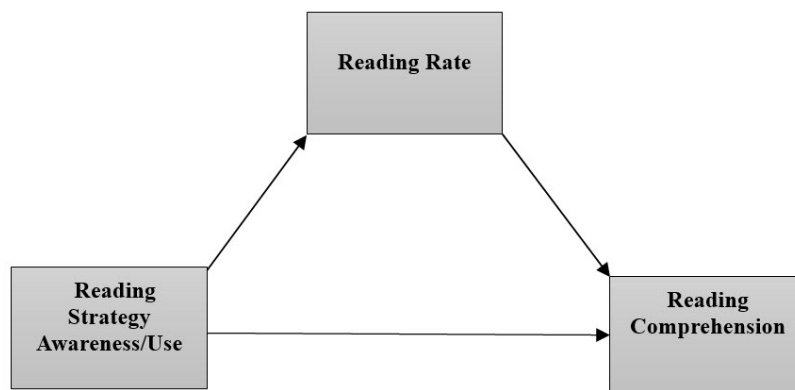


Figure 1. The conceptual model of the study

As a result, the current study seeks to answer the following research question:

1. Does reading rate function as a significant mediator between reading strategy awareness/use, and reading comprehension?

To answer this question, the study employed a one-group pre-test post-test experimental design to be able to examine the accuracy of the conceptual model of the study.

### **3.2. Participants and the context**

Seventy-two advanced EFL learners who enrolled in two English courses in Fall 2019 participated in the study. The sample comprised both males (n=46) and females (n=26) within a range of 18-22 years old.

### **3.3. Data collection tools and procedures**

The primary instruments employed in the study comprise the revised version of Metacognitive Awareness of Reading Strategies Inventory (MARSIR), reading section of the International English System Test (IELTS) Academic Test along with Reading Trainer Application installed on the participants' smartphones. The detailed account of the research instruments is elaborated upon as follows:

#### **3.3.1 MARSIR**

Metacognitive knowledge in reading is delineated as “the knowledge of the readers’ cognition in the way of reading and the self-control mechanisms they exercise when monitoring and regulating text comprehension” (Mokhtari & Reichard, 2002, p. 49).

The renewed version of the Metacognitive Awareness of Reading Strategies Inventory (MARSIR) (Mokhtari Dimitrov & Richards, 2018) was used to measure partakers’ metacognitive awareness of reading strategies before and after the study. MARSIR has been developed to replace the former Survey of Reading Strategies (SORS) questionnaire (Mokhtari & Sheorey, 2002). Considering the fact that “for students with advanced levels of English proficiency, either measure is fine to use” (Mokhtari et al., 2018, p. 239) and given the practicality issues, MARSIR was elected to be implemented in the current research since the subjects were entirely proficient EFL students.

The MARSIR is devised to scrutinize the students’ metacognitive awareness in light of the tactics utilized during the reading process, particularly assessing three comprehensive

strategy sections, viz. Global Reading Strategies (GRS), Problem-Solving Strategies (PSS), and Support Reading Strategies (SRS).

Each section encompasses five items developed on the basis of a five-point Likert scale, ranging from 1= “not aware of the strategy at all” to 5= “fully aware of the strategy, and implementing it during the reading process”. Average scores of 3.5 or higher signify a high level of awareness, while scores of 2.5 to 3.4 and 2.4 or lower imply a medium level of awareness and low level of awareness, respectively. The reliability of the scale was estimated using Cronbach’s Alpha and found to be 0.78 and 0.70 for the pretest and posttest, respectively.

### **3.3.2. Reading Trainer Application (RTA)**

RTA is a prize-winning application, scored 4.7/5 by over seventeen thousand individuals on both Play Store and App Store. Integrated with rapid serial visual presentation technology, it offers myriads of exercises and challenges to enable the readers to enhance their reading speed significantly and their retention and comprehension abilities concurrently. The built-in exercises concentrate upon warming up the eyes and training them in order that learners can boost their respective mental capacity to possess an improved extent of retention. At the outset, the application measures the users’ reading rate, in words per minute (WPM), and comprehension level. Afterward, according to the statistics provided individually from each user, it starts suggesting the most properly adjusted series of units, comprised of various exercises, focusing upon enabling learners’ mental capacities to cover the passages faster while maintaining the same or even better degree of comprehension by training the eyes to only see chunks of words while reading.

RTA’s tasks are primarily divided into two groups, namely eye-brain-based training, and the exercises, requiring instant reaction and feedback from the learners. The software also provides a particular section, designed and inspired based on RSVP, called *Power Reader*. It offers different display modes, including centered words, highlighted lines, and fixation per row as a supplementary section. Moreover, this section allows the readers to determine their reading speed, adjust the difficulty level of the passages and even simply import their favorite texts into the application.

Last but not least, the software continually serves the users with charts and figures, reporting their progress, vicissitudes, and performance for further evaluation (HeKu IT GmbH, Reading Trainer, Play Store).



### 3.3.3. IELTS reading section

Reading part of the IELTS academic test, comprised of three sections and forty questions, with texts totaling approximately 2000 to 2750 words, was given to the participants for both pre-test and post-test. Further details on the IELTS academic reading test are illustrated in Table 1.

Table 1. IELTS Academic Reading Test

(<https://takeielts.britishcouncil.org/take-ielts/prepare/test-format>)

<b>Format</b>	The test comprises three long texts, ranging from the descriptive and factual to the discursive and analytical taken from journals, magazines, books, and newspapers, selected picked for a non-specialist audience but also suitable for people entering college courses or pursuing professional registration.
<b>Timing</b>	60 minutes including the transfer time
<b>Number of Sections/ Questions</b>	3 Sections (each section contains one long passage) 40 questions.
<b>Task Types</b>	Fill gaps in a passage of written text or a table, match headings to written text to diagrams or charts, complete sentences, give short answers to open questions, answer multiple-choice questions
<b>Text Types</b>	Texts range from the descriptive and factual to the discursive and analytical. Texts may encompass non-verbal materials such as diagrams, graphs, or illustrations. If texts contain technical terms, then a simple glossary is provided.
<b>Marks</b>	Each correct answer receives one mark. Scores out of 40 are converted to the IELTS 9-band scale. Scores are reported in whole and half bands.

The reliability coefficients of the tests were estimated using KR-21 and found to be 0.75 and 0.81 for the pretest and posttest, respectively.

### 3.3.4. Procedure

Seventy-two advanced EFL students were chosen, and their entry awareness of reading strategies, reading proficiency, and reading speed were examined before the study. Subsequently, they were familiarized with RTA and its functionalities. They were trained for 12 weeks in order to practice with the RSVP-based challenges inside the application. They were also asked to do additional exercises at home. After thoroughly concluding the required training, reinvestigation of the participants' awareness of reading comprehension, reading strategies, and reading speed was carried out. The findings were eventually examined, and the results were interpreted.

#### 4. Findings and discussion

In order to assess the suggested model prior to the study when students had not taken any eye movement training with RSVP, simple mediation analysis was conducted using PROCESS v3.5 (Hayes, 2018). The statistical diagram of the model is shown in Fig 2.

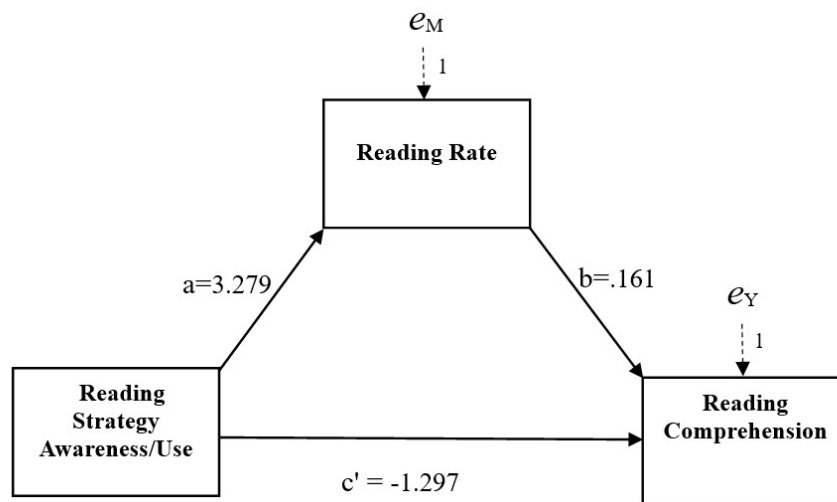


Figure 2. The statistical diagram of the mediation model prior to the intervention

The model coefficients for data obtained before the intervention are reported in Table 1.

Table 1. Model coefficients for the model of the study (prior to the intervention)

Antecedent	Consequent							
		M (Reading Rate)			Y (Reading Comprehension)			
		Coeff.	SE	p	Coeff.	SE	p	
X (Reading strategy)	a	3.279	4.538	.472	c'	-1.297	.940	.172
M (Reading Rate)		---	---	---	b	.161	.025	.000
Constant	i <sub>M</sub>	133.795	16.382	.000	i <sub>Y</sub>	3.912	4.813	.419
		R <sup>2</sup> =.0080			R <sup>2</sup> =.386			
		F(1, 65)= .522 , p=.472			F(2, 64)= 20.181, p=.000			

Also, the result of total, direct and indirect effects of the model before the intervention are summarized in Table 2.

Table 2. Effects of reading strategy awareness/use on reading comprehension (prior to the intervention)

Total effect of X on Y						
Effect	SE	t	p	LLCI	ULCI	
-0.768	1.183	-0.649	.518	-3.131	1.594	
Direct effect of X on Y						
Effect	SE	t	p	LLCI	ULCI	
-1.297	.940	-1.379	.172	-3.176	.581	

Indirect effect of X on Y			
Effect	BootSE	BootLLCI	BootULCI
.528	.759	-1.082	1.966

As shown by the result of model estimation (Tables 1 and 2), reading rate does not mediate the relationship between reading strategy awareness/use and reading comprehension, considering 95% bootstrap confidence interval, when the students had not taken any eye movement training at the outset of the study.

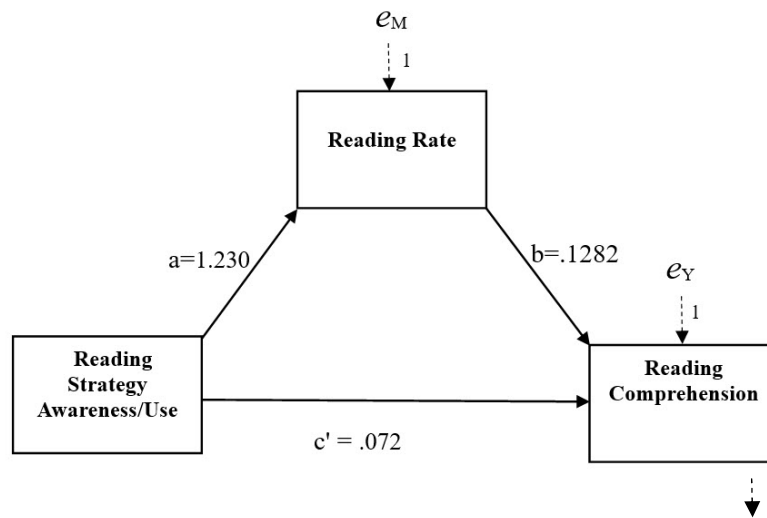


Figure 3. The statistical diagram of the mediation model after the intervention

After the intervention, the model was tested again. In order to assess the suggested model after the intervention (eye movement training to increase the reading rate) simple mediation analysis was conducted using PROCESS v3.5 (Hayes, 2018). The statistical diagram of the model is shown in Figure 3. The model coefficients for data obtained after the intervention are reported in Table 4.

Table 4. Model coefficients for the model of the study (after the intervention)

Antecedent	Consequent							
		M (Reading Rate)			Y (Reading Comprehension)			
		Coeff.	SE	p		Coeff.	SE	p
X (Reading strategy)	a	1.230	.582	.038	c'	.072	.082	.383
M (Reading Rate)		---	---	---	b	.128	.016	.000
Constant	i <sub>M</sub>	194.874	35.456	.000	iy	-9.928	5.826	.092
		R <sup>2</sup> =.0080				R <sup>2</sup> =.502		
		F(1, 69)= .060 , p=.038				F(2, 68)= 34.359, p=.000		

Also, the result of total, direct and indirect effects of the model after the intervention are summarized in Table 5.

Table 5. Effects of reading strategy awareness/use on reading comprehension (after the intervention)

<b>Total effect of X on Y</b>					
<b>Effect</b>	<b>SE</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
.230	.108	2.112	.0383	.0128	.447
<b>Direct effect of X on Y</b>					
<b>Effect</b>	<b>SE</b>	<b>t</b>	<b>p</b>	<b>LLCI</b>	<b>ULCI</b>
.072	.0824	.876	.383	-.0922	.236
<b>Indirect effect of X on Y</b>					
<b>Effect</b>	<b>BootSE</b>	<b>BootLLCI</b>	<b>BootULCI</b>		
.157	.076	.0281	.327		

As shown by the result of model estimation (Table 5), reading rate is a significant mediator of the relationship between reading strategy awareness/use and reading comprehension, considering 95% bootstrap confidence interval, after the students took eye movement training.

These findings suggest that reading rate plays a significant mediating role in the relationship between reading strategy use and reading comprehension when the readers are instructed by eye movement training. The positive value of reading rate suggests that EFL learners who read faster can process the text better and comprehend its message more accurately compared to those having a lower reading rate. It is worth noting that such a reading rate has been gained through the eye movement training received via RSVP technology implementation within the MALL environment.

At the outset, the findings of the study lend credence to the preliminary studies on the relationship between CALL and reading comprehension (Juola, Ward & McNamara, 1982) as innovative approaches to teaching reading would guarantee higher levels of strategy awareness/use and comprehension (Dreyer & Nel, 2003). The reason lies in the fact that technology-enhanced learning environments in general and MALL in particular promote motivation and sustained cognitive effort in doing difficult language tasks such as reading comprehension as “the most important obstacle to a sense of comprehension or satisfaction is an unwillingness to confront the input” (Bacon & Finnemann, 1990, p. 467).

It should also be noted that the interplay between motivation and cognitive effort would impact readers' attitudes towards and perceptions of language learning that would lead to management of cognitive load (Ozer & Kiliç, 2018). Type of instruction through MALL, technology-based instructional content, and the way the texts were read throughout eye movement training all led to less anxiety in comprehending the texts and as a result more time was spent on applying strategies. This is in stark contrast with mixed findings in the literature concerning cognitive load management in the RSVP learning environments (Bouma & de

Voogd, 1974); and supports the fact that the task load may decline as a result of the appropriate use of this technology (Castelhano & Muter, 2001) while attention is not deflected. Instead, *Reading Trainer Application* has helped bottom-up information processing and thus contributed to interactive reading where the gist of meaning is understood faster with more strategy use.

This finding is in agreement with what other researchers have suggested concerning the incorporation of apposite technological tools and applications into reading instruction that a higher degree of comprehension and employment of strategies would be guaranteed, as students' comprehension may be facilitated through graphic illustrations on the screen (Dreyer & Nel, 2003). Also, RSVP has tremendous potential for improving the reading skills of language learners with diverse characteristics, including age, language proficiency, and gender (Babaei & Rahimi, 2020).

Axiomatically, various facts corroborate the assumption that RSVP is capable of conditioning reading comprehension (e.g., Cocklin et al., 1984; Proaps & Bliss, 2014; Potter et al., 1980; Forster, 1970; Bouma & de Voogd, 1974; Masson, 1983; Benedetto et al., 2015; Just, Carpenter & Woolley, 1982). The findings accord closely with a number of other studies concerning the impact of RSVP on reading speed and reading comprehension. It is suggested that RSVP technology is capable of lowering the amount of time needed for planning or eye movement, which, in turn, induces a more effective reading comprehension process in a way that comprehension does not deteriorate at higher speeds (Boo & Conklin, 2015). This further supports the assumption that better reading skills may give rise to a diminution in the number of eye movements essential to process the written information (Hutzler & Wimmer, 2004). It has been postulated that natural eye movements are ineffective, the reason being that the readers tend to move their eyes in less insignificant forward saccades and more recurrent regressions than required in regular reading (Crowder, 1982). While employing RSVP, the reader's speed enhances since the reader will use the foveal region (the center of the visual field) to read the highlighted words at a given instant, which, in turn, augments concentration and eschews digressions that ultimately conduce to the more frequent deployment of support reading strategies (Beccue & Vila, 2004).

The findings of the study confirm what is reported by other researchers, revealing that efficient eye movement, as well as eye movement training, empower readers to foster their both reading skills (Dodick et al., 2017) and oral reading fluency (Allen, Beatty & Blanco, 2012). It also overshadows what was formerly found concerning RSVP's adverse effects in deploying reading strategies (Harmer, 1998).

In contrast, findings of the previous studies and findings of this research show no consistency regarding the claim that RSVP might arguably retard the reading rate as well as retention at particular paces (Benedetto et al., 2015; Chen & Chien, 2007; Potter, 1984). Also, it rejects the argument that reading rate in RSVP is not superior to traditional reading (Benedetto et al., 2015) or that comprehension is better in traditional reading compared to RSVP. What has been found here does not support previous research on RSVP claiming that improving reading speed via RSVP transpires at the expense of sacrificing comprehension (Potter et al., 1980; Just & Carpenter, 1980; Russell, James & Cohlma, 2002)

As for the pedagogical implications of the current study, the findings are particularly of utmost significance for the following groups:

1. Language teachers can appositely adapt themselves with the class and accordingly opt for the best reading strategy following the students' reading and comprehension levels. Moreover, they can monitor and control their students' anxiety levels in different speed settings via their mobile phones and help them overcome their various weaknesses pertinent to both pace and retention while coping with reading comprehension tasks.
2. As for EFL learners, the utilization of both mobiles and modern technologies could lead to their further growth of interest and enthusiasm, exceptionally getting them engaged in educational activities performed during the class in consequence. They would also be capable of autonomously pursuing their educational goals, boosting their reading comprehension skill, and monitoring their respective progress.
3. Last but not least, the findings of this study would enable syllabus designers to integrate both MALL and CALL into the teaching arena during their programs so that language learners could enjoy the invaluable features offered by the contemporary technologies within their educational curriculum.

## 5. Conclusion

The current study is one of the pioneers in the arena of integrating RSVP technology and eye movement training into EFL classrooms, which aimed at examining the relationship between reading strategy awareness and reading comprehension mediated by reading rate within the MALL environment. The findings revealed that using *Reading Trainer Application* in reading instruction augmented learners' reading rate significantly, which, in turn, played a significant mediating role by empowering the students to process and grasp the text appreciably better. The findings attest that the integration of eye movement training into mobile phones via RSVP, as a

prominent device amongst language learners, is a preferable way to promote reading rate by enhancing learners' metacognitive awareness of reading strategies.

While the findings of the conducted study may yield far-reaching consequences for a wide range of scholars, language academics, and learners within the EFL realm, further research is warranted to cast new light on various aspects of RSVP technology within the MALL environment especially in terms of its efficiency in a variety of education systems in both private language institutes and schools. Also, more studies are required to be performed on the same topic through triangulating quantitative and qualitative data. Qualitative data can be collected by observation, interviews and think-aloud protocols to understand the underlying reasons why RSVP technology assists EFL learners' reading speed and strategy use. One line of research may also focus on using neuroscience-based tools such as electroencephalogram (EEG) or eye-tracking technology to monitor the readers' performance during reading to investigate the way they read paper or on-screen texts and analyze their eye movements more rigorously through the output data.

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