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Designing Image Processing Software to Probe into EFL Learners' Mental Presence and Examining its Application in their Reading Achievement

Arezou Shahmoradi[1], Behzad Ghonsooly*[2], Omid Mazandarani[1], Ghasem Barani[1]

[1]Department of English Language Teaching, Aliabad Katoul Branch, Islamic Azad University, Aliabad Katoul, Iran.

[2]Department of English, Faculty of Letters and Humanities, Ferdowsi University of Mashhad (FUM), Iran.

[2]Department of English Language Teaching, Aliabad Katoul Branch, Islamic Azad University, Aliabad Katoul, Iran.

Email: Shahmoradi.arezou@gmail.com

Email: omazandarani@gmail.com

Email: baranighasem56@gmail.com

*Corresponding Author's Email: ghonsooly@um.ac.ir

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ABSTRACT

It is a general belief that learning management systems (LMSs), especially smart ones, can better learning outcomes. Accordingly, information-age educational centers have to be designed and prepared to adopt these technological developments, sooner or later. The purpose of this study was to assess the effect of a smart reading instruction management system (RIMS) on the reading ability of Iranian EFL learners. A mixed-methods design was adopted. Accordingly, forty learners selected via convenient sampling took part in the quantitative stage of the study in which a quasi-experimental design was adopted. The results of statistical analyses also showed that RIMS had a significant effect on reading comprehension so the participants (n = 20) made improvements after the course and outdid their counterparts in the control group. Additionally, the qualitative analysis of mediation episodes that occurred in the experimental group showed that RIMS is perceived to be flexible in terms of meeting learners' needs and interests. It is motivating and provides chances for storing teacher-learner interaction for future formative assessment, incompetency diagnosis, and feedback provision. Moreover, it is perceived to be a suitable timesaving breakthrough for promoting individualized learning methods.

KEYWORDS: Learning Management System; Mediation; Reading Ability; Reading Instruction

INTRODUCTION

Information and communication technology (ICT) have created dramatic changes in all aspects of individual and collective life so in education, it has led to the birth and growth of e-learning, virtual and smart schools (Kalita, 2015). This implies that both teachers and learners must be prepared for coming inevitable technological changes in their educational environment. A smart learning environment is a practical and purposeful proposal for the implementation of the most advanced modern educational methods and a scientific view of the current state of the

country's educational system. The establishment of a smart learning environment is one of the adopted solutions in responding to today's new educational needs, one which could be the unexpected crises faced during the COVID-19 pandemic since 2020.

The fact is that the introduction of educational technology and one of its most recent developments, virtual learning, and learning management systems (LMS) which are based on information technology in the field of L2 teaching has not only changed the nature of the teaching-learning process (Zarghami, 2009) but also expanded its boundaries beyond physical classes and learning environments. Accordingly, instructional environments have created new learning opportunities and have undergone fundamental changes and modifications over the past few decades (Carliner & Shank, 2008).

Anohina (2005) considers the manifestations of ICT-based education to include: computer-assisted education, distance learning, Internet-based education, resource-based education, web-based education, technology-based education, and online education. Online education as a new manifestation is a special type of education that uses the Internet and other technologies based on the Web to provide learning experiences (Stewart, 2004). Although the popularity of this mode of education has been on the rise in the past decades, the breakout of the Corona pandemic in 2020 catalyzed the shift to online education.

During the past year, students and teachers witnessed a totally unimagined situation in which they had to interact totally virtually on commonplace platforms and unfamiliar virtual learning environments developed for managing their students' learning processes and teachers' instructional methods, as well. This situation was a fertile field of unexpected teaching-learning problems. In this regard, one of the problems encountered in L2 classrooms is to teach reading comprehension on a distant learning platform. This challenge was the motive for the researchers to design an app that could intelligently manage the learners while they were doing reading comprehension activities, either online or offline, far from their teachers.

In fact, developing a smart application and an intelligent learning management system for L2 reading comprehension is an unprecedented mission in the field of L2 instruction in Iran and most other contexts, to the best knowledge of the present researcher. Accordingly, the lack of sufficient background knowledge on the possible consequences of the introduction of such an application into an L2 instructional program, the present researcher decided to explore the operational aspects of putting such an educational technology into practice prior to its final design and implementation. That is, the rationale for conducting this study was to explore the non-engineering and educational aspects of using such an LMS for L2 instruction.

There have been some attempts to introduce ethical challenges of computer-assisted language learning (CALL); however, they either considered the challenge from a general perspective, such as Heffernan and Wang's (2008) study on English teachers' perceptions of copyright issues or focused on specific e-learning cases (Wang & Hefferman, 2010). Akbulut et al. (2008) claimed that learners' gender, course content, and users' previous ICT experience impact their ethical computer behavior in terms of hardware and software use, and do not cover e-learning ethics. Additionally, most of the studies in the past two decades concentrated on learners' privacy, such as Tu (2002) and Jerman-Blazic and Klobucar (2004), and the results were based on an outsider's observation, take Schultz (2006) and Kano (2008) for examples. Although there has been a dearth of data regarding ethics, and opportunities to study English teachers' and students' conduct in traditional or virtual classrooms using CALL, there has been very little research including both English learners' and teachers' perspectives on the issue. This may be due to the fact that "different countries usually have different standards of e-learning ethics. Further, for the sake of expedience, many CALL teachers simply do not want to tackle these issues, as doing so would inhibit them from developing and using e-learning materials" (Wang &Heffernan, 2010, p. 798). Based on the aforementioned

rationales, the researcher put a newly developed learning management system, RIMS, into trial and examined its effect on the learners' reading ability.

RESEARCH QUESTIONS OF THE STUDY

The present study was guided by the following research questions:

RQ 1: Does mediation through RIMS have any significant effect on Iranian EFL students' reading achievement?

RQ 2: What mediation strategies were used to increase the mental presentation of the learners receiving the intervention of the study?

REVIEW OF THE RELATED LITERATURE

A smart learning environment, due to its flexible curricula, the possibility of teaching with new methods, having a wide range of educational programs and methods, and focusing on the role of learners, taking into account individual differences and paying more attention to learners' needs, interests and talents, can be effective in bridging the existing educational gaps (Afzalkhani & Ghods, 2012). In this regard, Jimoyiannis (2010) believes that proper learning in the 21st century requires learners to use ICT. Not only do they need this technology to increase their learning of facts, but they also need it to solve their problems in real-world situations. The most important goals of smart learning environments are the all-round growth of students, upgrading individual abilities and capabilities, training thoughtful manpower, improving learning, improving information transfer to lifelong learning, facilitating students' access to multiple information resources, creating learning opportunities, participatory and exploratory learning, creating the right environment to increase students' creativity, establishing an atmosphere of freedom of thought and achieving the best possible results (Perkins, 2011; Siewming, 2010). The success and effectiveness of the use of technology in teaching and curriculum and the use of smart learning environments depends, to a large extent, on teachers' acceptance and attitude towards technology (Al-Zaidiyeen et al. 2010), and the extent to which teachers use technology.

Since technology is now one of the most important elements of educational systems and its use and integration in a curriculum show the level of progress and the changing needs of society, technology acceptance should be considered an important element in modern educational environments (Falun et al. 2011). In most definitions of curriculum, four elements of purpose, content, classroom strategy, and evaluation, are included and technologies such as learning management systems (LMS) can have a great impact on all four elements.

Technology can be used as a means to motivate learners by engaging them in a learning process. With the use of ITS in educational environments, students' motivation will be increased. A considerable problem that many teachers and educators are facing, is that many learners lack motivation and this problem cannot be solved unless through the marriage of instruction and technology. According to Yang et al. (2016) using technological tools in the classroom increases learners' motivation and engagement. Similarly, Carver (2016) proposed that "the major reason teachers chose to use technology was that they felt it resulted in increased student engagement" (p. 115). As Cakir et al. (2019) proposed using web-based Office Master ITS systems in the classroom for learners resulted in learners with higher motivation than those who lack this system in their class. There are other studies related to motivation with similar results (Aleven, Roll, McLaren, & Koedinger, 2016; Duffy & Azevedo, 2015).

Among the four skills in language learning, reading is one of the important ones. According to Sofiana and Mubarok (2020), reading is important because learners' capabilities to read and comprehend written materials impressively are significant in order to obviate the need for daily communication and to be successful in academics. Reading is a process in which recognition and comprehension of the text take place. Reading is a combination of complex and cognitive processes along with skills, strategic knowledge, and context to comprehend and extract

meaning (Pearson & Cerveti, 2013). Nejabati (2015) proposed that understanding the main idea and comprehending the text are the main points in learning reading. Although learners may face some problems in reading like a lack of comprehension of the main idea of the text and their low motivation in reading, the use of technologies such as applications and media can be a good tool to solve these problems (Sofiana & Mubarok, 2020). They can increase learners' reading achievements and their motivation. Motivation is a significant factor that is needed by learners when they read. It can increase readers' engagement in the process of reading and gives readers a more positive attitude toward reading. It also makes the reading process more meaningful (Pecjak & Peklaj, 2006).

METHODOLOGY

PARTICIPANTS

The quantitative phase of the study which included a quasi-experimental design with a pretest and posttest was a small-scale study that was conducted on 40 male (n = 16) and female (n = 24) learners of English in two language institutes who were taking an intermediate English as a foreign language course and studying Top Notch 3B. They were selected based on convenient sampling, according to the researcher's accessibility to the classes. Moreover, the researcher could access these classes based on the teachers' and institute administrators' agreement about supporting this project. The learners, who were 15 to 17 years old, were selected based on their scores on the Oxford Placement Test. Then they were divided into two groups, an experimental group (n = 20), including 6 male and 14 female learners, covering the reading tasks on RIMS, and a control group (n = 20), including 10 male and 10 female learners, doing reading tasks in a conventional manner.

INSTRUMENTS

OXFORD PLACEMENT TEST

This standardized test includes 40 multiple-choice items (retrieved from www.oup.com) to measure the proficiency level of EFL learners and also to exclude those learners whose English proficiency level is significantly beyond others. It assessed learners' knowledge of grammar, and vocabulary, as well as reading text comprehension and a writing task to measure learners' ability to produce English language. To determine the reliability of the placement test results, Cronbach Alpha for the total number of test items was calculated ($\alpha = .79$).

READING COMPREHENSION PRETEST AND POSTTEST

A reading test which was constructed by the present researcher using Examview 5.0 based on a bank of test items for Top Notch 3B developed by the authors and publisher of the textbook, was administered to all participants in both the experimental and the control groups twice, once as a reading comprehension pre-test before embarking on the study and another as a post-test at the end of the study. The test included texts with 30 multiple-choice items to determine the reading ability of the learners and their progress after the course of the research. The reliability of the test was calculated to be .76 using KR-21.

READING INSTRUCTION MANAGEMENT SYSTEM (RIMS)

In order to monitor the mental presence of the EFL learners in a face-to-face class as well as an online (virtual) class, a learning management system was developed to monitor the mental presence of the learners in the class, in general, and specifically when doing reading comprehension tasks. This software, as described in the software development section, is based on smart detection of facial clues and eye-tracking which form the basic symptoms of mental presence and attending a learning task. The software was designed to be run on an average PC or laptop and is dependent on the photos or motion pictures recorded via a webcam in online classes or a supplementary camera joined with a teacher's laptop in a face-to-face class. This also helps the teacher to record the class, as was done in this research. the recorded videos were used to further analyze the mediation strategies used in the experimental group. The results of the analysis are presented in the next section.

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RIMS can detect multiple faces in the frame and provide statistics of mental presence based on face tracking and eye tracking for each learner separately. That is, the teacher can detect the mental presence of a single learner, a group of learners, or a class, in total, real time. The statistics can be recorded based on a set time lapse, say, every 10 seconds, for each learner so that separate profiles of mental presence are available whenever the teacher retrieves the mental presence of the learners. A sample of a report for a single learner is shown below.

01 - Done! Created a dataframe from your processes

	Face	Number	Time	Eyes Status	Final Status
0	Face	#1,	6:46:3,	High	Engaged
1	Face	#1,	6:46:4,	Eye	closed
2	Face	#1,	6:46:5,	Eye	closed
3	Face	#1,	6:46:6,	Medium	Engaged
4	Face	#1,	6:46:7,	Medium	Engaged
5	Face	#1,	6:46:8,	Medium	Engaged
6	Face	#1,	6:46:9,	Medium	Engaged
7	Face	#1,	6:46:10,	Medium	Engaged
8	Face	#1,	6:46:11,	Medium	Engaged
9	Face	#1,	6:46:12,	Medium	Engaged

Figure 1
A sample of a report for a single learner from RIMS

As shown in Figure 1 RIMS could detect the engagement and mental presence of a learner second by second and report the extent to which the learner was attending the task with mental presence. Through eye-tracking and face-tracking, it was shown that the learner was engaged in the task, not completely but moderately. The same procedure can be conducted for a learner who is accomplishing a reading comprehension task. That is, the extent of mental presence for a learner over a reading comprehension task can be provided by RIMS, as shown in Figure 2.

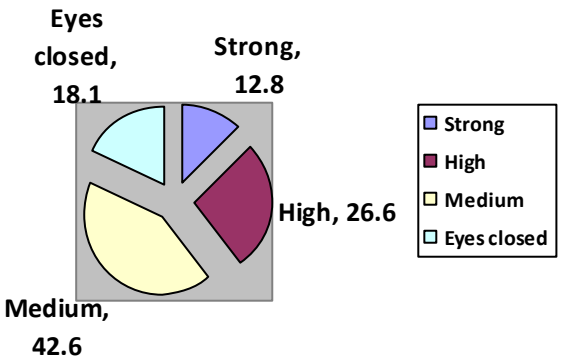

Figure 2

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A sample of a report for a single learner from RIMS after completing a reading task

As shown in Figure 2, according to the output from RIMS, the teacher could conclude that the learner had a medium level of mental presence while doing the task. That is, almost one-fifth of the period, she was not concentrating on the task when her eyes were closed. Moreover, she had a medium level of mental presence during two-fifths of the task duration. Only one-third of the task duration she had high or very high (strong) mental presence.

PROCEDURE

SOFTWARE DEVELOPMENT

The program was designed and developed in small incremental phases according to the Minimum Viable Product obtained from the employer and the changes in each stage were made after feedback from the participants and the employer in the software source. Due to the short time of the project and taking into account the expertise of the participants, the Agile Design Pattern (Figure 3) was used as a Software Development Life Cycle so that programmers could get the necessary bug fixes with rapid development and at each stage after reporting and feedback from users and apply according to the desired ci/cd.

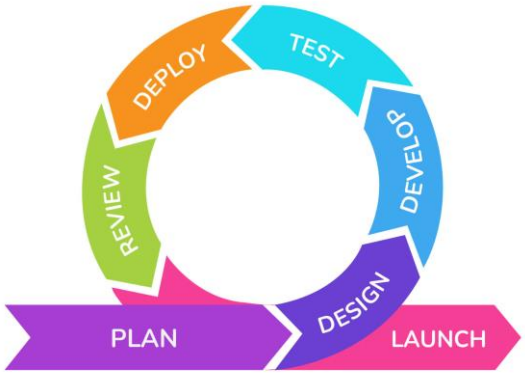

Figure 3
Steps of the Agile Model as Implemented in this Research

Accordingly, the following steps were taken for the software development:

1. Plan
2. Determining the amount of software production budget by the employer
3. Select members of the programming and management team
4. Determine the position of people
5. Understand the task description and schedule of project implementation and delivery
6. Arranging a contract and determining the number of members' salaries

After the development team was employed, the agile model was followed to develop software based on the expectations and features determined by the researcher.

EXPERIMENTAL PHASE

The experimental phase of the study began with the selection of participants which was conducted after making arrangements with the institutes. The learners were in intact classes in two language institutes. A female and a male class taught by the same teacher were selected as the control group. Similarly, the ones in the other institute were selected as the experimental group. Not all learners in these classes were selected as the participants of the study. Only those whose OPT scores fell within ±1 standard deviation above and below the mean were included in this

study. However, the other students were present in the same class doing the activities assigned to the participants of the study but their scores were not included in this study.

Having administered OPT, and selected homogeneous learners, the researcher approached the learners in both the control group and experimental group and described the purpose of the study. They were asked to take the pretests, the scores of which were used to see if the learners were significantly similar in terms of their reading ability, reading self-efficacy, and motivational currents.

The learners in the control group underwent the conventional instruction in their Top Notch 3B class, while their counterparts in the experimental covered the reading tasks in the student book as well as the workbook through RIMS. The method of presentation in both groups was similar and followed pre-task, task, and post-task phases and the only difference between the groups was the platform used for the instruction.

Pre-task

The learners started with pre-reading activities, which were called enabling activities. They were provided with the necessary background knowledge to organize activities and comprehend the text. The teacher helped them activate their own background knowledge to prepare for reading. This was done before reading in the class.

Task

The while-reading phase was also done in the class so that learners could be engaged mainly in questioning. These questions were mostly posed by the teacher and were prepared by the teacher before the class. More specifically, the teacher asked questions after students finished their reading a text. These questions, which were posed after reading aimed at:

1- Comprehension of vocabulary
2- Deciphering main ideas
3- Understanding text structure

In order to have a better picture of the treatment, the following stages were taken for reading every session:

1- Previewing: Making learners focus on the first sentences of the paragraphs in the text.
2- Using context for vocabulary: learners are guided to use structural or lexical clues available in the text to guess the meaning of a given unknown word or expression.
3- Reading for main ideas: the teacher asks questions such as "What would be a good title?", "What is the subject?" and so on to make learners find the main idea of the text.
4- Scanning for details which is done by looking for the keywords or their synonyms. The learners are expected to first recognize the keywords in the question posed by the teacher and follow them in the text.
5- Making inferences: the learners are expected to describe the relation between the ideas found in the text by providing evidence from the passage.

Post-task

Then, learners were expected to present a summary, which was defined in this study as a shortened version of an original text, stating the main ideas or what the learners grasped from the passage. In this study, the summary was defined as the integration of important pieces of information that appeared in the text so that the product summaries became like the learners' mental representations of the original texts.

The learners were encouraged to give a summary based on the following guidelines:

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Identify and organize the main idea and important information

1. What was the main idea?
2. What important things did the writer say about this?
3. Check to make sure you understood what the main idea was and the important things the writer said about this.

Then, the learners took the post-tests including, the re-administration of the reading comprehension test, reading self-efficacy, and motivational currents questionnaire. The data were collected and then inserted in statistical packages for further analysis.

RESULTS

In this section, the results of the statistical analysis conducted for assuring the homogeneity of the control group and experimental group are presented. Accordingly, a null hypothesis was formulated to be tested, stating that the two groups were not significantly different in terms of their general English proficiency level as measured by the OQPT test.

Table 1
Group Statistics for OQPT Scores

	Group	N	Mean	Std. Deviation	Std. Error Mean
OPT	Experimental	20	31.35	1.84	.41
	Control	20	31.20	1.76	.39

Table 1 shows that the OQPT scores of the two groups were similar, as reflected in the reported mean scores for the control group (M = 31.20), and the experimental group (M = 31.35). To further analyze the homogeneity of the two groups, the normality of the distribution was also checked.

Table 2
Tests of Normality for OQPT Scores

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
OQPT	Experimental	.13	20	.20*	.96	20	.65
	Control	.15	20	.20*	.94	20	.27

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

Based on the results shown in Table 2, the distributions of the scores in both groups were normal since the observed p levels obtained from the Kolmogorov-Smirnov test and Shapiro-Wilk test were all above .05. This is also shown in the following figure.

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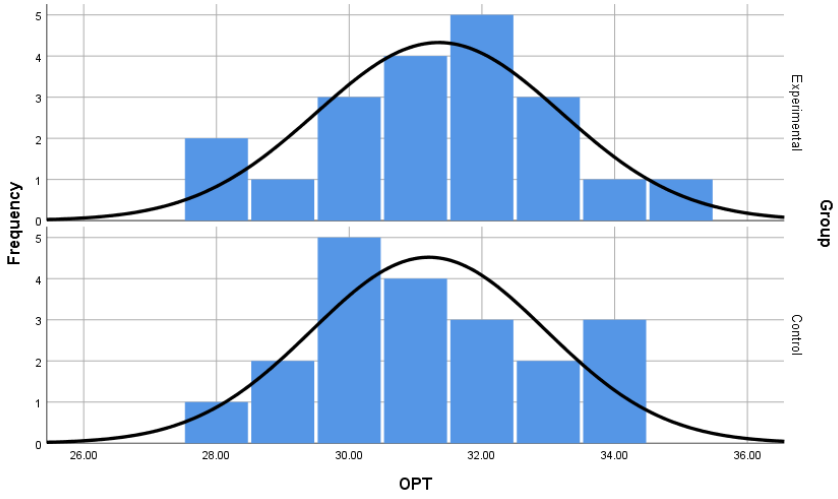

Figure 4
Normality of Distribution of OQPT Scores

With reference to the fact that the distribution of OQPT scores was normal, a parametric test, an independent samples t-test was used to test the homogeneity of the scores. The results are shown below.

Table 3
Independent Samples Test for OQPT scores

	F (Levene's Test)	Sig.	t	df	Sig. (2-tailed)
OQPT	.00	.97	.26	38	.79

Based on the statistics reported in Table 3, it was concluded that the difference between the variances of the two groups was negligible (F = .00, p = .97 > .05), and the difference between the means of OQPT scores of the two groups was insignificant (t = .26, p = .79 > .05). Accordingly, it was argued that the two groups were similar in terms of their proficiency levels.

ANSWERING THE FIRST RESEARCH QUESTION

The first research question of the study was:

> RQ 1: Does mediation through RIMS have any significant effect on Iranian EFL students' reading achievement?

To answer this research question, the following null hypothesis was formulated:

> H01: Mediation through RIMS does not have any significant effect on Iranian EFL students' reading achievement.

Table 4
Group Statistics for Reading Comprehension Test Scores

	Group	N	Mean	Std. Deviation	Std. Error Mean
Reading (Pretest)	Experimental	20	18.70	1.83	.41
	Control	20	18.40	1.75	.39
Reading (Posttest)	Experimental	20	22.60	1.84	.41
	Control	20	20.75	1.25	.27

As shown in Table 4, the observed means for the pretest scores collected from the experimental group (M = 18.70) and the control group (M = 18.40) were very close. However, the posttest mean score of the experimental

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group (M = 22.60) was considerably more than that of the control group (M = 20.75). To test the null hypothesis, the researcher conducted a parametric test due to the fact that the distribution of the scores was normal, as shown below in Table 5.

Table 5
Tests of Normality for Reading Comprehension Test Scores

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Reading (Pretest)	Experimental	.140	20	.200*	.937	20	.214
	Control	.187	20	.065	.911	20	.068
Reading (Posttest)	Experimental	.127	20	.200*	.967	20	.680
	Control	.179	20	.092	.942	20	.258

*. This is a lower bound of the true significance.
a. Lilliefors Significance Correction

As shown in Table 5, the distributions of the scores in both groups were normal since the observed p levels obtained from the Kolmogorov-Smirnov test and Shapiro-Wilk test were all above .05 which confirmed the assumption that an independent samples t-test could be run to test the hypotheses. It was also confirmed by the following charts in Figures 2 and 3.

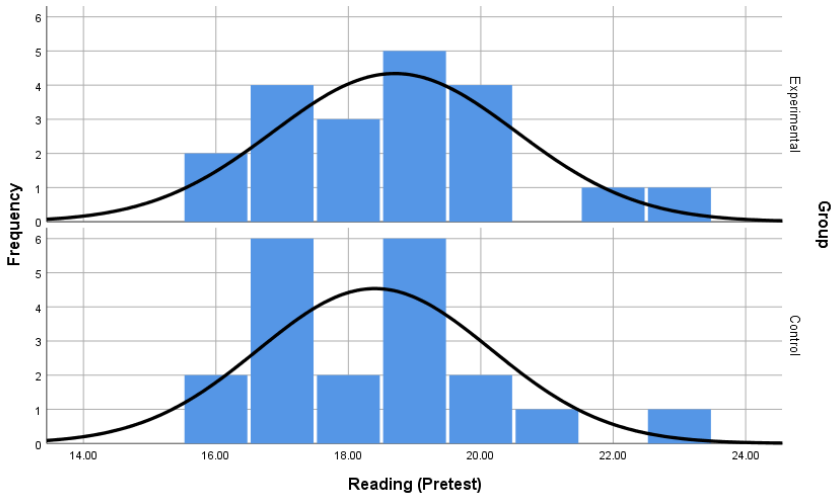

Figure 2
Distribution of Reading Comprehension Pretest Scores

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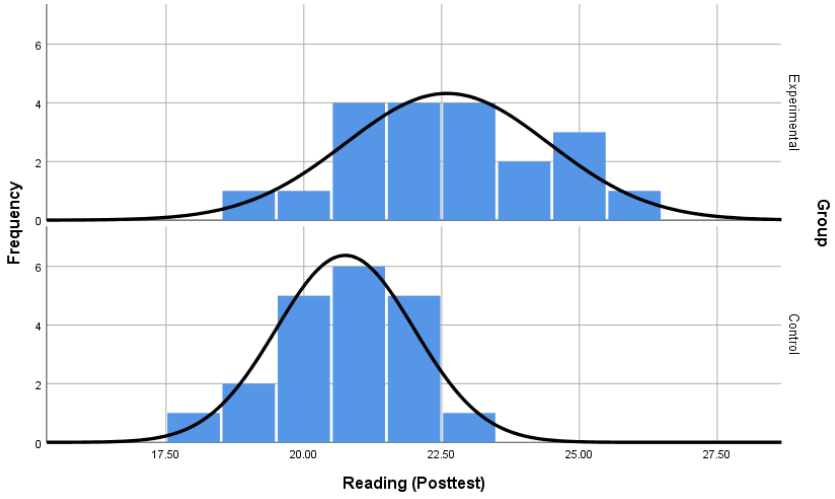

Figure 3
Distribution of Reading Comprehension Posttest Scores

Considering the fact that the normality of the distribution of reading comprehension test scores was confirmed, an independent samples t-test was used to test the null hypothesis. The results are shown below.

Table 6
Independent Samples Test for Reading Comprehension Test Scores

	F (Levene's Test)	Sig.	t	df	Sig. (2-tailed)
Reading (Pretest)	.00	.92	.52	38	.60
Reading (Posttest)	3.21	.08	3.70	38	.00

According to the statistics reported in Table 4.6, it was concluded that the difference between the variances of the two groups in pretest was negligible (F = .00, p = .92 > .05), and the difference between the means of reading pretest scores of the two groups was insignificant (t = .52, p = .60 > .05). Accordingly, it was argued that the two groups were similar in terms of their reading ability before the course. The difference between the variances of the two groups in the post-test was negligible (F = 3.21, p = .08 > .05), and the difference between the means of reading post-test scores of the two groups was significant (t = 3.70, p = .00 < .05). Accordingly, it was argued that the null hypothesis was rejected and the experimental group using RIMS outperformed the control group in terms of their reading ability.

ANSWERING THE SECOND RESEARCH QUESTION

As mentioned earlier, the implementation of RIMS could significantly affect the reading comprehension ability of the participants. It is believed that the improvements observed in the participants were owing to the mediation offered during one-to-one interaction between the teacher and the students whose mental presence was monitored. The first and last sessions of the one-to-one interaction of the teacher and the learners using RIMS were compared. The analysis which was based on the pattern adopted by Shabani (2018) was based on a typology of mediational strategies offered by the teacher during her dialogue with the students.

The following lines demonstrate the Typology of Mediational Strategies used by Shabani (2018) that are arranged from the most implicit to the most explicit. This outline was used to quantify the dialogic interactions that occurred between the teacher and learners. The frequency of the mediation was drawn and provided insights into the learners' developmental changes in their level of dependency on their teachers. The mediational strategies were:

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1-MS 1: Identifying the source of error
2-MS 2: Narrowing down the location of the error
3-MS 3: Raising students' awareness
4-MS 4: Nominating potential sources of error
5-MS 5: Proposing probable correct response
6-MS 6: Offering correct response and explanation

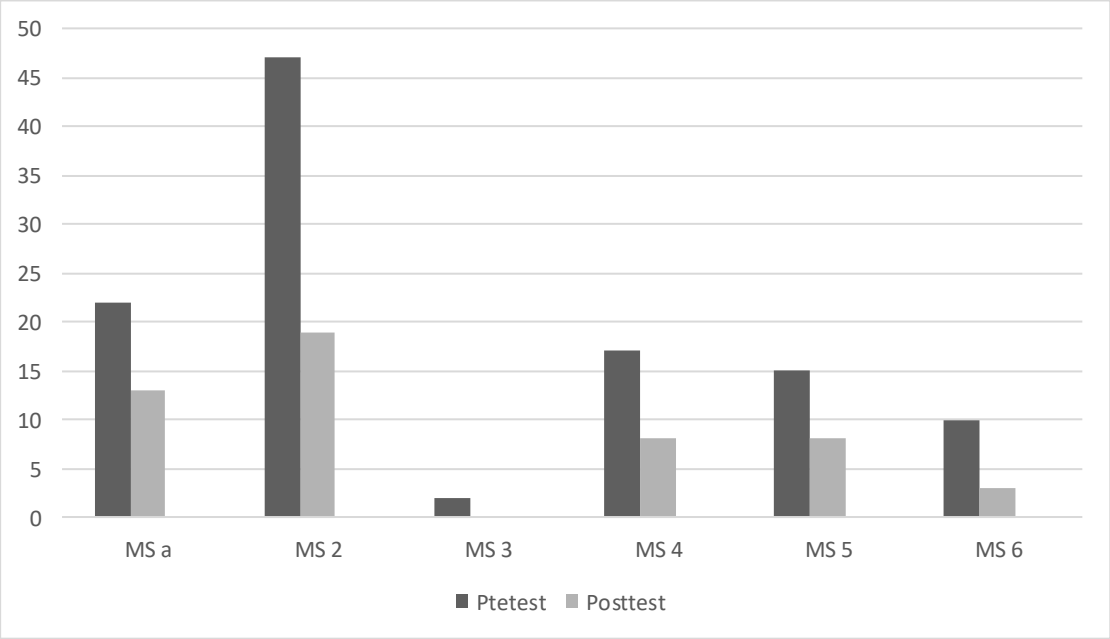

Figure 4
Mediational strategies on pretest and posttest for the RIMS group

The learners' relative development can be seen in the last session and can be justified by the effects of raised dialogic and mediated instruction during the course thanks to RIMS which could assist the teacher with the identification of distracted and mentally-absent students in the class. The figure above shows the rare occurrence of mediational moves in the last session. The frequency of explicit strategies (MS 6 and MS 5) decreased along with other types of mediation strategies. Identifying the source of error and narrowing down the location of error were still the most frequent types of strategies. This phenomenon shows the expansion of learners' ZPD to higher levels and learners' reduced demands for external interference and support which shows that they became more autonomous and self-regulated in terms of writing abilities.

As mentioned earlier, it is believed that the promoted mediation in the class where RIMS was used was the source of the improvements made in the learners' reading comprehension ability as well as other measured variables, including motivational currents and self-regulation. The distribution of the types of mediational strategies is shown in the following figure.

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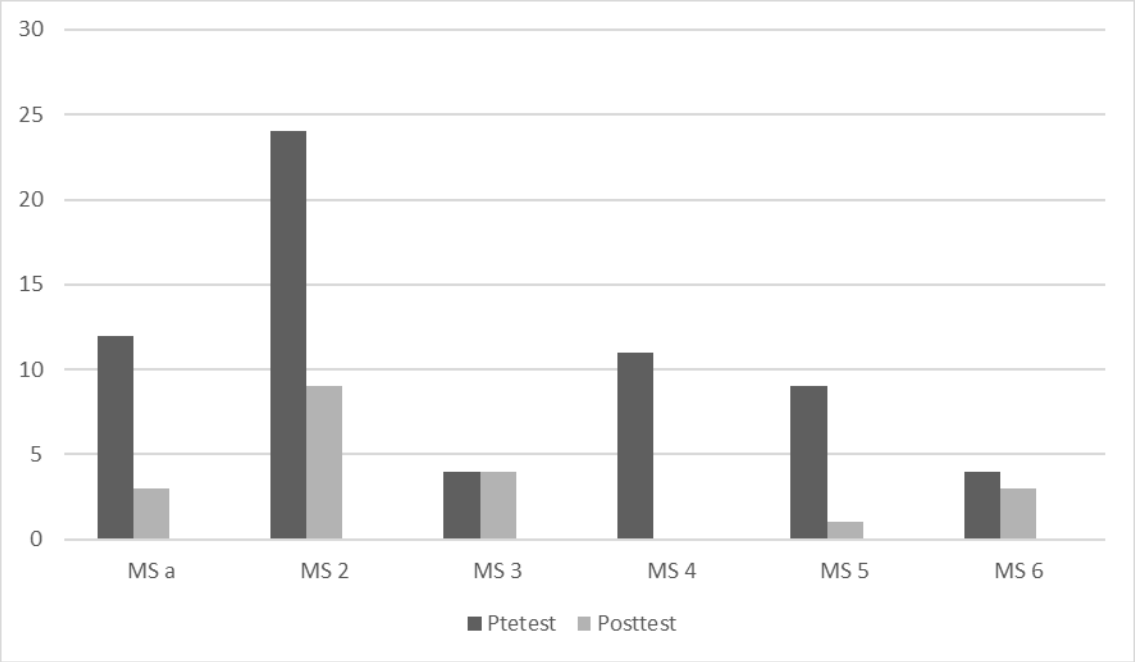

Figure 5
Mediational strategies on pretest and posttest for the RIMS group

The learners' relative development is evident in the last session and can be explained by the effects of dialogic and mediated instruction in groups during the course. The figure above shows the decline of the frequencies of MS in the posttest. The frequencies of explicit strategies (MS 4 and MS 5) decreased to a great extent. This phenomenon similar to what is shown for the RIMS group reflects the expansion of learners' ZPD to higher levels. Learners' reduced demands for external interference confirm that they became more autonomous and self-regulated in terms of writing abilities.

DISCUSSION

The results of this study showed that one possible solution to improve the reading comprehension of foreign language learners is to use a learning management system (LMS) to support reading in a foreign language. An LMS, in this study RIMS, is a software application that allows teachers and learners to create, manage, and access online courses and materials. RIMS in this study could offer several advantages for foreign language reading comprehension, such as:

- Providing a variety of texts and activities that suit different levels, interests, and goals of learners. For example, teachers can choose from articles, stories, reviews, emails, notices, and signs that match their proficiency level and learning objectives.
- Offering interactive features that enhance learners' engagement and motivation. For example, learners can use quizzes, audio, and images to check their understanding, practice their skills, and enrich their learning experience.
- Enabling learners to use reading strategies that help them process and retain the information they read. For example, learners can use dictionaries, questions, and feedback to clarify meanings, infer meanings, monitor comprehension, and evaluate comprehension.
- Allowing learners to access the RIMS anytime and anywhere, as long as they have an internet connection. This means that learners can read at their own pace and convenience, and review the materials as often as they need.

Using RIMS for foreign language reading comprehension can be beneficial for both teachers and learners. Teachers can use RIMS to design and deliver effective reading instruction that meets the needs and preferences of their students. Learners can use RIMS to practice and improve their reading skills in a flexible, interactive, and supportive environment.

The results obtained in this study are in agreement with a number of research findings about the effect of learning management systems (LMS) on foreign language learners' reading comprehension.

In line with the results of the previous studies on the effect of LMSs on foreign language learners' reading comprehension, it can be argued that RIMS also can have positive effects on foreign language learners' reading comprehension by providing them with:

- A variety of authentic texts and genres that suit their level and interest (Oetomo et al., 2022).
- Opportunities to practice their reading skills and strategies in different contexts and tasks (Yudhana, 2021).
- Immediate and individualized feedback on their performance and progress.
- Motivation and engagement through gamification, personalization, and social interaction (Ismail et al., 2020).
- Autonomy and self-regulation over their learning pace, goals, and choices (Pahamzah et al., 2021).

However, the effects of LMS on foreign language learners' reading comprehension are not uniform or guaranteed. They depend on various factors related to the learner, the LMS, the teacher, and the learning environment. Some of these factors are:

- The learner's prior knowledge, proficiency level, learning style, motivation, attitude, and beliefs (Pahamzah et al., 2021).
- The LMS's design, usability, functionality, content quality, and alignment with the curriculum and learning objectives (Oetomo et al., 2022).
- The teacher's role, guidance, support, and feedback (Prasetya, 2021).
- The learning environment's accessibility, reliability, security, and compatibility (Prasetya, 2021).

Therefore, it is essential to consider these factors when designing, implementing, and evaluating RIMS, or any other LMSs, for foreign language learners' reading comprehension. Moreover, it is important to conduct more empirical studies on the effects of RIMS on foreign language learners' reading comprehension in different settings and contexts.

CONCLUSION

The findings of this research are impregnated with a number of pedagogical implications for teacher training courses. First and foremost, such courses need to equip the prospective teachers with the knowledge, skill, and experience of using LMS in general and smart LMSs such as RIMS, in particular. Teachers need to become aware that for better performance and implementing more modern and effective teaching and assessment methods, RIMS or other smart LMSs may give them a wider range of energy-saving and timesaving opportunities to help their learners, fulfill higher-level learning objectives and motivate them, as well. RIMS, similar to many other smart LMSs, provides an enjoyable interface and tools that facilitate giving feedback, tracing learners' improvement, diagnosis of their incompetency, and formative assessment. Accordingly, there is a need to make pre-service teachers familiar with these developments and encourage in-service teachers to adopt them.

In this way, teachers can create maximum learning opportunities for learners in and out of the classroom by considering the time element. With RIMS or other smart LMSs, learners' outcomes may be maximized teaching methods are easily adapted to different learning styles.

Due to the different capabilities of RIMS and other smart LMSs, material developers and pioneering syllabus designers are recommended to innovatively incorporate visual, auditory, and sensory styles or eight

intelligences within the content of their course. In addition, they are recommended to reconsider learning needs, interest, and motivation through enriching the content bank of such smart LMSs to care for individual learners.

During the course of the research, there were some limitations, the most important of which were as follows.

- There was little research on the use of smart LMSs in the field of language teaching and a lack of a strong background in their use for foreign language teaching; it is suggested that more empirical research be done for the possible use of smart LMSs for the purpose of language skills.
- More research is needed to be done on the process of smartening language classes. In addition, more research is needed on the process of preparing teachers to use such smart LMSs.
- Research on the process of teacher-learner interaction in smart LMSs such as RIMS is scarce. More conversation or interaction analysis research is needed within this area.
- Considering the potential capabilities of LMSs such as RIMS for handling individual differences, future research can focus on providing empirical evidence on the use of individualized learner-centered instruction, such as those relying on multiple intelligences, within these environments.
- With reference to the applicability of TAM for such studies, more research may be done to inform the lesson planners, syllabus designers, educational administrators, and policymakers about the possible barriers to teachers' adoption of smart LMSs such as RIMS.

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