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Research Article

The Impact of Technology-Enhanced Vocabulary Learning Strategy Training on Reading Performance

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Abstract

Recently, there has been a growing enthusiasm for the impact of vocabulary learning strategies (VLSs) on students' learning outcomes. This interest stems from the fact that most learners exhibit considerable difficulties in the comprehension and retention of language vocabulary, which really impedes their language proficiency in a variety of language aspects such as reading comprehension. By the same token, technology-enhanced learning has significantly caused a paradigmatic shift in the educational landscape as it offered learners unparalleled opportunities that could positively contribute to their educational success. Therefore, the current study aimed to examine the transformative effect of technology-enhanced vocabulary learning strategy training on reading performance of Moroccan high school students. Aiming toward this purpose, a quasi-experiment with a pretest-posttest non-randomized control-group design has been orchestrated to evaluate outcomes. The sample of the study encompassed two pre-formed intact classes. One of the classes was assigned as an experimental group (n = 30) and the other one as a control group (n = 30). To determine whether there was any significant difference between the two groups, the independent samples t-test was employed. The results revealed that participants in the experimental group outperformed their counterparts in the control group with respect to overall reading performance. The results also showed that participants in the experimental group achieved higher mean score in manifesting the ability to comprehend and identify meaning of the unknown vocabulary presented in the reading passage. However, the results disclosed that the two groups displayed equal performance in terms of showing ability in understanding facts and ideas stated in the reading text. Based on the findings, some pedagogical implications are discussed.

Keywords

Vocabulary learning strategies, reading performance, technology-enhanced VLS training, facts and ideas comprehension, unfamiliar vocabulary

1. Introduction

1.1 Background

Vocabulary is one of the most indispensible requisites for human languages. Vocabulary knowledge is also a critical

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component in obtaining proficiency in the four language skills (Bernhardt, 2005). The performance of a learner on a specific text, for example, depends on various factors including lexical knowledge. Limited vocabulary knowledge can seriously hinder the process of reading comprehension. So this lexical restriction can unfavourably affect achieving language proficiency not only in language comprehension but also in language production. In this sense, Killingly et al. (2024) explain that reading and vocabulary skills are highly dependent on one another. Moreover, Nation (2013) clarifies that vocabulary is fundamentally essential in productive language skills such as speaking and writing since it contributes in clear and coherent expression of ones' thoughts and ideas. So the criticality of vocabulary knowledge has recently created a growing interest in the effective ways that could assist learners grasp, retain, and recall the meanings of lexical items in a foreign language (e.g. Patra et al., 2022; Seffar, 2014).

In the same vein, information and communication technology (ICT) is receiving more and more attention in language classrooms due to the increasingly rapid evolution of this sector. This evolution has been witnessed in different domains and sectors; the matter which has created a broad spectrum of technological devices, software applications, and online platforms. This widespread of technology has significantly attracted the attention of educators and researchers alike. Technology has also caused a remarkable change and considerable transformation in the way of teaching and learning enabling both teachers and learners to use technology to their full advantage. Therefore, investigating the impact of ICT on education has become more crucial and relevant than ever.

The effectiveness of utilizing ICT tools in learning and teaching has been backed up by different studies from the relevant literature. The implementation of these tools could provide both teachers and learners with a wide range of opportunities and affordances. Al-Awfi (2024), for example, reports in a study that technological tools such as interactive whiteboards, online quizzes, and learning applications could promote students' motivation and engagement when these tools are used effectively. Moreover, Al-Mukhaini & Al-Khanjari (2021) highlight that resorting to active learning strategies like interactive quizzes, simulations, and collaborative online activities could immensely help learners recall and retain information unlike traditional learning methods and strategies

In the Moroccan educational context, there has been an uptick in interest regarding the integration of language learning strategies and technology-assisted learning in Moroccan EFL classrooms over the past few years. The English Language Guidelines (M.E.N., 2007) that provides Moroccan teachers with different practical steps to teach English to EFL learners has placed great focus on the significant role of integrating learning strategies in classroom practices. Seemingly, the definition stated in the guidelines is broad and general since it does not specify the strategies required for each language area such as vocabulary. Moreover, these strategies seem to be scarcely implemented in the Moroccan classrooms since focus is more often laid on learning a certain language area rather than learning how to learn that area and deal with it effectively. Therefore, learners are not usually equipped with sufficient learning strategies to be able to deal with different language skills and components. By the same token, Morocco has witnessed considerable changes in terms of incorporating technology in the field of education which has dramatically impacted the learning and teaching landscape. The Higher Council of Education, Training and Scientific Research (CSEFRS) in Morocco has addressed a wide range of issues pertaining to educational reforms in Morocco including the integration of different ministerial programmes such as GENIE (generalization of information and communication technologies in education) in 2005, and JawazTice (a digital platform enabling teachers to enhance and promote their digital skills) in 2025.

1.2 Aim and significance of the study

The aim of the study at hand is to contribute to the influence of technology-assisted vocabulary learning strategy training on learners' reading performance. The focus here is placed on questioning learners' achievement in reading comprehension as a unique language skill; as well as questioning their capability of manifesting competence in understanding the texts' content that includes facts and ideas, in addition to the texts' vocabulary. Concomitant with this aim, a quasi-experiment with a pretest-posttest non-randomized control-group design was conducted. So as to give an orientation to the study at hand, the following research questions constitute the pivotal axis of the study:

1. How does training on technology-enhanced vocabulary learning strategies affect learners' overall performance in reading comprehension?
2. How does training on technology-enhanced vocabulary learning strategies impact learners' ability to understand facts and ideas stated in a reading text?
3. How does training on technology-enhanced vocabulary learning strategies affect learners' ability to identify the meaning of unfamiliar vocabulary presented in a reading text?

The abovementioned research questions could be reformulated as the following testable hypotheses:

1. Compared to their counterparts in the control group, the overall reading performance level of the experimental group would be higher after being acquainted with the necessary vocabulary learning strategies.
2. Learners' performance in showing ability to

understand facts and ideas stated in a reading text would be the same for both experimental and control group after the posttest.

3. Training on technology-enhanced vocabulary learning strategies would help learners in the experimental group achieve higher results in showing ability to identify the meaning of unfamiliar vocabulary presented in a reading text.

The significance of the current study lies in its usefulness for educators, course designers, textbook writers, policymakers, and all those who are involved in the scope of language teaching and learning. The study has got an intention to offer rich insights into research-based evidence pertaining to the efficacy of vocabulary learning strategies that would assist in elevating students' competency and autonomy. So the findings and implications derived from the study could provide a clear picture related to the necessity of incorporating technology-assisted VLSs as an integral part of the pedagogical practices as well as equipping both learners and teachers with these strategies for the sake of attaining the utmost results in language learning arena

2. Literature Review

2.1 VLSs and Reading Comprehension

Research on VLSs demonstrates the impactful role of vocabulary acquisition in learning a foreign language. The conclusion that we could draw from such studies reveals the fact that vocabulary learning strategies can have a profound impact on helping language learners acquire new lexicon either in a formal or informal setting. Ayana et al. (2024), for example, reports on a study that vocabulary learning strategies helped learners attain better vocabulary knowledge achievement. Similarly, Wu (2019) explains that vocabulary learning strategies correlate in a positive way with learners' vocabulary size. Additionally, Dessalew & Mohammed (2024) found that training on vocabulary learning strategy assisted learners achieve better performance in both vocabulary knowledge breath and vocabulary knowledge depth.

Although the correlation between vocabulary acquisition and reading comprehension has been widely discussed in the literature, very little importance, to our best knowledge, has been given to the effect of VLSs on reading performance. However, some researchers (e.g. Beck et al., 2002; Davis, 1968) considered the integration of an organized and systematic strategy to vocabulary learning and teaching as a significant aspect of reading comprehension. One of the empirical studies conducted in this regard was a quasi-experiment by Affendi & Benedict (2021) which examined the impact of VLS use on the breadth and depth of vocabulary and reading comprehension performance among L2 pre- university students. The results showed the significant outperformance of the experimental group in vocabulary size tests and reading comprehension tests. Another study by Heidari et al. (2012) examined the effect of vocabulary learning strategy instruction on ESP vocabulary achievement and reading comprehension. The results of the posttest revealed the positive impact of VLS instruction on ESP learners' vocabulary achievement and reading comprehension.

The topic of VLSs needs to be addressed in the Moroccan EFL context. Although vocabulary instruction fulfils a pivotal role in vocabulary enhancement, it has been observed that little studies have been conducted on the impact of VLSs on Moroccan classroom practices. However, the scarce studies on VLSs in Morocco demonstrate that EFL learners utilize a very limited number of vocabulary learning strategies when dealing with vocabulary learning. The results of a study conducted by Aqachmar and Khadira (2019), for example, uncovered that the guessing of a word's meaning from context and the use of bilingual dictionaries are among the most frequently used strategies by the learners of a class in a Moroccan public high school. Another study by Seffar (2014) reports that compensation strategies (including skills such as the use of guessing and gestures) and social strategies (including skills such as asking for clarification and cooperating with others) are used most frequently by Moroccan university students.

2.2 VLSs and ICT

Although the abovementioned studies paved the way for investigating the correlation between vocabulary learning strategies and reading performance, negligible consideration has been afforded to this effect within the realm of information and communication technology (ICT). However, it is found in literature that general technology-assisted learning could lead to better vocabulary enhancement and improved reading skills. As it pertains to vocabulary enhancement, Sağlık and Sural (2024), for instance, studied the influence of technology-enhanced and context-based vocabulary activities on vocabulary knowledge and learning motivation. The findings reveal that participants displayed higher vocabulary knowledge when being taught using context-based vocabulary activities implemented with technology-enhanced materials. The results also indicated that technology-enhanced activities assisted in the betterment of the students' learning outcomes compared to activities conducted utilizing printed materials. Correspondingly, in tertiary level, Van & Thanh (2022) reported in a mixed method research study that mobile assisted language learning had a positive impact on university students' vocabulary acquisition. In the Arabic context, Albaqami (2024) examined the influence of technology-based and non-technology-based

vocabulary learning activities on vocabulary output of Saudi EFL learners. The results drawn from the study revealed that participants who were exposed to technology-enhanced output (email-pushed output) attained greater learning performance.

It has also been established in the literature that technology-mediated learning not only leads to better vocabulary expansion but also to heightened reading competency. A study carried out by Hawamdeh et al. (2025), for instance, explored the impact of Classpoint technology on reading comprehension among non-native Arabic students. The results revealed that learners who were taught via Classpoint technology illustrated notable progress in reading performance. This corroborates findings from Shafiee's (2025) study who found that learning through artificial intelligence interventions not only helped learners achieve substantial improvement in reading comprehension, but also assisted in reinforcing their self-regulated behaviours.

As it pertains to the Moroccan context, interest has been on the rise regarding the incorporation of technology-assisted learning for the sake of vocabulary enhancement and reading proficiency. A study by Outamgharte et al. (2025), for example, investigated the impact of Electronic L1 and L2 glosses on vocabulary acquisition among Moroccan university students. The results highlighted that learners presented with electronic gloss conditions reported better vocabulary gains and highlighted greater reading competency. Moreover, Larhmaid (2018) investigated the impact of electronic-based reading materials and printed reading materials on the Moroccan university students. The findings disclosed that undergraduate students tend to spend more time on digital reading materials than the printed ones.

In examining the existing literature on the correlation between vocabulary learning and reading performance, it becomes obvious that noticeable gaps persist both on a global scale and within the Moroccan context. Globally, various research efforts target the relationship between vocabulary instruction and reading competency, and limited scrutiny was witnessed in regards to the impactful role of vocabulary learning strategies. Additionally, the limited relevant studies tend to overlook the influence of technology-mediated vocabulary strategies and place more emphasis on the traditional way of presenting these strategies to language learners. In addition, most research is limited to exploring the effect of VLSs on students' general learning outcomes, neglecting the effect of these strategies on each particular language skill or component. Furthermore, the studies attempting to address one particular language skill often treat that skill as a single entity overlooking the subs-kills that might also be of paramount importance. For example, studies often highlight the effect of learning strategies on reading comprehension as a single skill, while the components shaping this comprehension (such as distinguishing between ideas and facts comprehension and vocabulary comprehension) are not always taken into account.

Although the body of literature on VLSs has proliferated globally, there remains a conspicuous gap in the research related to the Moroccan context. While a couple of studies aimed to illuminate the efficacy of VLSs in learning outcomes in general, the influence of these strategies on reading achievement is underrepresented. Moreover, limited empirical evidence is noticed in relation to the influence of VLSs within ICT framework. This sparseness in research hampers our comprehension of the potential advantages of the digital tools on learning outcomes, as well as hindering educational stakeholders from appropriate decisions grounded in context-specific evidence. The study at hand has an implication of filling these gaps found in the literature so as to provide valuable insight and tailored solutions that resonate with socio-cultural influences. Thus our research contributes to the discourse surrounding VLSs, through uncovering the impact of technology-enhanced VLS training on reading performance.

3. Methodology

3.1 Research design

To address the research questions of the study, a pretest-posttest non-randomized control-group design has been employed. In this design, participants are assigned to two different conditions: an experimental condition and a control condition. Then participants in both conditions get pretested on the dependent variable. After being pretested, the participants in the experimental group are presented with an experimental treatment as the main intervention. After the intervention, a posttest is administered to both groups to figure out the impact of the experimental treatment (Phakiti, 2014). The simplest version of the pretest-posttest non-randomized control-group design is to have one experimental group and one control group; which is the version that has been adopted in the current study.

3.2 Participants

The study at hand involves 60 participants constituting two intact classes of a Moroccan public high school. One class has been assigned as an experimental group (n = 30) and another one as a control group (n = 30). The English language proficiency level of the two groups is relatively the same. The learners' language proficiency was elicited through checking the grades they achieved in the first semester with average mark of (14.36) for the control group, and (14.06) for the experimental group. The participants are also second-year baccalaureate students – physics stream - who have been

studying English at least for four years.

The data related to demographic traits of the participants was basically obtained from the pretests and posttests. That is, participants were required to fill in a form at the top of each test-paper including information on their age and gender. The data obtained from the respondents based on their gender reveals a slight predominance of males in both groups, with 20 males and 10 females in the experimental group, and 17 males and 13 females in the control group. As for the participants' age, the participants in both groups predominantly share the age of 17.

3.3 Procedures

Before carrying out the experiment, extensive preparation was undertaken. The process of implementing the study was almost the same for both intervention and control group, except that the control group did not receive any treatment. The preparation included selecting effective vocabulary learning strategies and designing the tests. It also included securing permissions through the obtainment of authorization from school administration. Moreover, the participants were assured that data and results will be tackled with complete confidentiality. The researcher implemented the study in regular class time at the same school he is teaching. Because the researcher is the one who designed the material and the tests, a pilot study was conducted to test the reliability of the pretest and posttest, the relevance and validity of the test items, and the suitability of the test conditions. As for the reading comprehension test, the researcher adopted a passage which was once before presented to baccalaureate students during a previous national exam. The purpose behind selecting such as a text is due to the fact that learners are familiar with such reading passages as they suit their level. The necessary modifications of the test items were subsequently made by the researcher to agree with the research objectives.

Data in the present study was collected over eight consecutive weeks. In the first week, a reading pretest was administered to both experimental and control group. From the second to the seventh week, the intervention took place. In the eighth week, participants received a posttest to identify any likely change in the reading performance. Both pretests and posttests were carried out in the same examination room by the same invigilator (the researcher). The teacher did not inform the participants whether they belong to the control group or the experimental group for the sake of minimizing any artificial behaviour.

3.4 The pretest and posttest

The test items in the reading pretest and posttest followed a special organization. These questions were fundamentally split into two broad sections. The test items in the first section were presented to participants following Barrett's Taxonomy (1968) of comprehension skills. That is, the items demonstrated different levels of complexity, ranging from simple questions that require explicit information from the text, to more challenging questions that push learners to think critically. Details on the organization of the comprehension test items are demonstrated in the table 1 below.

Table 1 *The organization of the comprehension test items following Barrett's Taxonomy (1968)*

The comprehension skill level	**The questions presented**
Literal comprehension	*How did ... happen? Why .... happened?*
Reorganization	*Put the events in the correct order according to the text.*
Inferential comprehension	*Match each idea with the correct paragraph.*
Evaluation	*What is the author's attitude towards ...?*
Appreciation	*What do you think of ...?*

The selection of Barrett's Taxonomy was due to two fundamental reasons. The first reason lies in the fact that this taxonomy offers a simple and systematic organization of the main reading skills as it minimizes the potential overlap in the classification of these skills. The second reason is the fact that learners in Moroccan high schools are always presented with comprehension test items following the order of Barrett's Taxonomy (although educators or students may not be aware of this organization). Therefore participants would find it easier to deal with the questions stated in the pretest and posttest since they are already exposed to such pattern. However, as for questions that target advanced critical thinking (those that fall under the appreciation class in Barrett's Taxonomy) learners are not usually exposed to such questions in Moroccan formal and standard tests. Nevertheless, learners can sometimes come across such questions in some reading activities included in the official textbooks.

The second broad section targets test items related to the understanding of unfamiliar vocabulary. In the Moroccan context, the items of this type are usually presented to students at the end of reading tests after being presented with the questions that test their comprehension of the text' facts, events, ideas, etc. These vocabulary-targeted test items are usually meant to evaluate learners' lexical knowledge as well as their ability to apply certain skills such as understanding meaning using a textual context. The test items presented to

participants both in the pretest and posttest included the following:

- Find in the text words that mean almost the same as. (looking for a synonym)
- Find in the text words that mean almost the opposite of. (looking for an antonym)
- Circle the right word's explanation according to the text.
- Pick out from the text a sentence or a phrase which shows that:
- Fill in the blank with a word or expression from the text.

Devoting a whole section for vocabulary-targeted test items is actually inevitable because of the nature of the study's research questions. In the first question, we seek to examine the effect of technology-enhanced VLS training on overall reading performance. Overall reading performance in the present study refers to students' ability to comprehend facts and ideas that a reading text presents, as well as showing ability to understand the unfamiliar vocabulary existing in this text. In the second question, we address the impact of technology-enhanced VLS training on understanding the facts and ideas presented in the reading text. This question has been addressed through providing participants with a couple of comprehension test items basing on Barrett's Taxonomy. Although this taxonomy offers a structured and systematic framework for reading comprehension skills, it does not actually give much importance to language-based items such as those targeting lexical knowledge. Accordingly, another set of test items has been required. Hence, the third research question is an attempt to find out the impact of technology-assisted VLSs on identifying meaning of the unfamiliar vocabulary presented in a reading text. This question therefore brings much needed attention to vocabulary-centred test items. These items will serve as a useful instrument that would assist in measuring the potential effect of technology-assisted vocabulary learning strategies on learners' vocabulary understanding.

It is worth mentioning that the total mark of both pretest and posttest is 20 points. This mark is split into two parts: 10 points are given to test items targeting understanding facts and ideas in the text (section 1), and 10 points to test items targeting identifying texts' vocabulary (section 2). The items in both sections receive the same scoring percentage. However, for a productive item that requires participants to produce language, a higher scoring percentage is offered to such an item. It is noteworthy that minor grammatical and spelling mistakes are tolerated in all students' responses since the focus of the targeted items is chiefly on comprehension skills rather than morphosyntactic aspects.

3.5 The training and training material

The training on vocabulary learning strategies offered to participants was based on Schmitt's (1997) model. Schmitt's taxonomy categorizes VLSs into two fundamental classes: discovery strategies (including determination strategies and social strategies) and consolidation strategies (including social strategies, memory strategies, cognitive strategies, and metacognitive strategies). Choosing this model was due to the fact that it reflects a clear and unambiguous categorization of vocabulary strategies; hence adopting this model would help the researcher tackle these strategies in a clear and uncomplicated way. The training workshop was offered six weeks before administering the pretest. Each training workshop lasted for one hour and a half. The treatment and all other parts of the experiment were handled by the present researcher. The reason for this was to minimize any potential instructor-related extraneous variables. The trainer prepared a couple of worksheets, along with a PowerPoint presentation entitled "Technology-enhanced Vocabulary Learning Strategies".

During the entire workshop, learners in the experimental group were exposed to target vocabulary learning strategies through technology-mediated instruments. Learners received the input through PowerPoint presentations as a primary teaching medium. PowerPoint is a software program developed by Microsoft company. This program enables EFL educators to adopt professional-looking presentations into their pedagogical practices so as to make lessons well-organized and help them present their teaching material in a structured manner (Segundo & Salazar, 2011). Incorporating PowerPoint slides into the workshop sessions was due to its crucial role in providing a visual and interactive format that assists in attracting attention, enhancing engagement, and boosting understanding. Additionally, leveraging the dynamic PowerPoint features such as animations, contextually relevant images and videos, as well as related hyperlinks could serve as a facilitator to cater for students' learning styles in order to assure that the target strategies have been absorbed in the effective way.

In addition to PowerPoint presentations, the workshop was characterized by the incorporation of Mobile Assisted Language Learning (MALL). MALL has been defined as the learners' utilization of mobile technology devices such as smartphones and tablets that facilitate the enhancement of language learning through the provision of variant accessible digital applications and resources (Vega et al., 2020). Using this approach as an essential part of VLSs training that makes the workshop attendees leverage different advantages of their mobile phones in a personalized and flexible manner. Hence learners are encouraged to get access to online dictionaries, translation applications, search engines, or any available learning platform that could enable them to be actively engaged in the learning process. This approach equally encouraged learners to be engaged in peer learning as well as

receiving immediate feedback from each other which empowered their sense of community and boosted a motivating learning environment.

3.6 Selected Vocabulary

In the training workshop, various types of vocabulary were incorporated for the sake of enriching students' learning experience. Participants were initially offered a worksheet including a list of English-French cognates (words which have similar spelling and meaning in both English and French, such as cable), and English-Arabic cognates (words which have similar meaning in both English and Arabic, and are relatively pronounced the same, such as alcohol). Participants were also provided with a list of words which the researcher believes that students are not familiar with. The participants' job was to guess the meaning of each word through analysing its morphemes; that is, checking the prefix, suffix, or the root that belongs to that word. Furthermore, the workshop was supplemented with a range of thematic vocabulary related to different topics such as technology, shopping, animals, and environment. The target vocabulary was embedded within meaningful contexts and real-life situations. Learners were required to exploit the context in order to explore the meaning of the words under question. Four types of contextual clues were targeted: guessing meaning through checking words' definitions, guessing meaning through checking examples, guessing meaning through checking synonyms or comparisons, and guessing meaning through checking antonyms or contrasts. The utilization of mind-maps and repetitions were also encouraged to enhance the retention of the newly learnt vocabulary.

4. Findings

4.1 The impact of the training on overall reading performance

In order to determine any differences between the two groups in terms of general reading performance before the treatment, the pretest scores of the two groups were analysed using the independent sample t-test in SPSS. Table 2 details the results obtained from the analysis. The table reveals no statistically meaningful difference between the control and treatment group. The data disclose that the mean scores and standard deviations of control and experimental group are M = 9.63, SD = 4.55 and M = 9.70, SD = 5.02, respectively. Comparing the two means together, we notice that the participants in both groups exhibit the same ability in regards to general reading performance.

Table 2 *Descriptive statistics of students' overall reading performance before the treatment*

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Control Group	30	9.6333	4.55982	.83251
	Experimental Group	30	9.7000	5.02511	.91746

To answer the first research question that aims to examine whether training on vocabulary learning strategies assisted by technological means has an impact on overall reading performance, learners' gain scores were analysed in the posttests. Table 3 elaborates the scores the control group achieved from posttest and compares them to those of the experimental group. On average, the control group achieved M = 9.10 (SD = 4.22), whereas the experimental group scored M = 12.83 (SD = 4.23). The results clearly show that the mean scores of the experimental group are different from those of the control group. Put differently, the participants in the experimental group outperformed their counterparts in the control group.

Table 3 *Descriptive statistics of students' overall reading performance after the treatment*

	Group	N	Mean	Std. Deviation	Std. Error Mean
Posttest	Control Group	30	9.1000	4.22921	.77214
	Experimental Group	30	12.8333	4.23518	.77324

To explore whether the treatment had a significant impact on the intervention group, a test for equal variances was carried out. Data in table 4 elaborate independent samples t-test results obtained from student gain scores. The data attained, $t(58) = -3.41$, $p = 0.001 < 0.05$ reveal that the two groups demonstrated a sort of dissimilarity which indicates that the results are considered to be statistically significant. Taking a closer look at the obtained data, we may reach the conclusion that the treatment provided fulfilled a critical role in helping participants in the experimental group to achieve higher scores in overall reading performance.

Table 4 *An Independent Samples t-test comparing the mean scores of the pretests (overall reading performance)*

	Leven's Test for Equality of Variances	*t-test for Equality of Means*

		F	Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	
Posttest	Equal variances assumed	.001	.975	-3.416	58	.001	-3.73333	.92275	
	Equal variances not assumed			-3.416	58.000	.001	-3.73333	.92275	

	Group	N	Mean	Std. Deviation	Std. Error Mean
Posttest	Control Group	30	6.133	2.31537	.42273
	Experimental Group	30	5.967	2.69717	.49243

4.2 The impact of the training on facts and ideas comprehension

Prior to the treatment, the mean scores of the control and experimental group have been compared in the pretests to explore any differences in terms of showing ability in comprehending facts and ideas in a reading text. As specified in table 5, the mean score for the control group is (M = 5.96), and the corresponding standard deviation is (SD = 2.17). The mean score for the experimental group is (M = 5.76), and the corresponding standard deviation is (SD = 2.29). As could be elicited from the data, the means for the both groups are relatively the same.

Table 5 *Pretest descriptive statistics related to students' ability to understand facts and ideas*

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Control Group	30	5.967	2.1732	.3968
	Experimental Group	30	5.767	2.2997	.4199

To answer the second question that states whether training on VLSs influences learners' ability in understanding texts' facts and ideas, the results of the posttests were exposed to analysis using independent samples t-test. As could be shown in table 6 below, the mean score for the control group is (M = 6.13), and the corresponding standard deviation (SD = 2.31). The mean score for the experimental group is (M = 5.96), and the corresponding standard deviation (SD = 2.69). These findings reveal that the mean scores of the two groups are relatively similar.

Table 6 *Posttest descriptive statistics related to students' ability to understand facts and ideas*

Moreover, the independent samples t-test which was applied to compare the attained scores highlighted that both control and experimental group manifested equal performance in regards to the ability to understand facts and ideas stated in the reading passage. That is, data in table 7, t(56.69) = 0.25, p = 0.79 > 0.05, suggest that the training on vocabulary learning strategies did not have any significant impact on learners' ability in understanding facts and ideas that a reading text presents. So the experimental group and the control group were able to perform equally in spite of the fact that the former group underwent the treatment.

Table 7 *An Independent Samples t-test comparing the mean scores of the posttests (facts and ideas comprehension)*

		Leven's Test for Equality of Variances		*t-test for Equality of Means*				
		F	Sig	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
Posttest	Equal variances assumed	1.505	.225	.257	58	.798	.16667	.64899
	Equal variances not assumed			.257	56.699	.798	.16667	.64899

4.3 The impact of the training on identifying meaning of unfamiliar vocabulary

In order to address the third research question which states whether training on technology-enhanced VLSs has an effect on learners' ability to identify the meaning of unfamiliar vocabulary in a reading text, the scores of participants in both groups have been compared in the pretests and posttests. The results shown in table 8 highlight the descriptive statistics

pertaining to vocabulary test items before the intervention. The table reveals the data obtained from the pretest of both control and experimental group to measure their ability in identifying meaning of the vocabulary stated in the reading passage. The data discloses that the mean scores and standard deviations of control group and intervention group are M = 3.40, SD = 2.84 and M = 3.66, SD = 3.19, respectively.

Table 8 *Descriptive statistics of vocabulary comprehension before the treatment*

	Group	N	Mean	Std. Deviation	Std. Error Mean
Pretest	Control Group	30	3.400	2.84787	.51995
	Experimental Group	30	3.667	3.19842	.58395

Since the third research question aimed to examine the outperformance or underperformance of either of the groups regarding showing ability to identify the meaning of vocabulary presented in a reading passage, a comparison of the mean scores of both groups after the treatment has been conducted. Table 9 highlights the descriptive statistics of the data obtained from vocabulary test items in the posttests. According to the table, the posttest mean of the control group is 2.96 (standard deviation = 2.266), and the mean of the experimental group is 5.76 (standard deviation = 2.848). These statistics indicate that the experimental group has achieved higher mean score and therefore it outperformed the control group.

Table 9 *Descriptive statistics of the vocabulary comprehension after the treatment*

	Group	N	Mean	Std. Deviation	Std. Error Mean
Posttest	Control Group	30	2.967	2.26645	.41379
	Experimental Group	30	5.767	2.84888	.52013

To check whether the difference between the two groups is significant, further statistics have been required. Table 10 demonstrates the results of the Independent Samples t-test comparing the mean scores of the posttests. According to the analysis exhibited in the table, we can clearly observe the significant difference in the mean scores between the control group and the intervention group. The significance level t (58) = - 4.21, p= 0.000 was actually smaller than set p-value (i.e. 0.05). The achieved results suggest that participants in the experimental group were able to achieve more success in displaying competency in identifying meaning of unfamiliar vocabulary exposed in the reading passage.

Table 10 *An Independent Samples t-test comparing the mean scores of the posttests (understanding unfamiliar vocabulary)*

		Leven's Test for Equality of Variances		***t-test for Equality of Means***				
		F	**Sig**	**t**	**df**	**Sig. (2-tailed)**	**Mean Difference**	**Std. Error Difference**
Posttest	**Equal variances assumed**	2.497	.120	-4.213	58	.000	-2.80000	.66465
	Equal variances not assumed			-4.213	55.210	.000	-2.80000	.66465

5. Discussion

To address the first research question in which we attempt to explore any significant differences between the control and treatment group in terms of overall reading performance, findings from the pretest and posttest were analysed. Data from the pretest suggest no significant difference between the two groups. The results reveal that the learners' reading abilities across the two groups were relatively the same before the intervention took place. As for the posttest, it was notably evident that the participants in the experimental group outperformed their counterparts in the control group.

In light of the data obtained from the posttest, it appears that the treatment group yielded intriguing insights regarding the impact of technology-mediated VLSs on general reading proficiency. The findings unequivocally manifest that the exposure to technology-mediated VLS training substantially impacted general reading proficiency. This indicates that participants in the experimental group not only obtained higher scores, but also profited from the dynamic learning environment facilitated by technology-integrated vocabulary learning strategies. The comparative analysis also reveals that the higher mean score achieved by the treatment group is not

merely a coincidence but it rather reflects the usefulness of VLSs in attaining better reading outcomes.

As a result, the training on technology-enhanced VLSs offered to students had a positive impact on their learning outcomes as it contributed in helping them deal with the reading passage and comprehension test items in an effective way. For this reason, we can state that the null hypothesis "There is no significant difference in learners' ability in regards to overall reading performance" has been rejected, whereas the alternative hypothesis "There is a significant difference in learners' ability in regards to overall reading performance" has been accepted. This conclusion indicates the fact that the second hypothesis stated earlier in this study (i.e. compared to their counterparts in the control group, the overall reading performance level of the experimental group would be higher after being acquainted with the necessary vocabulary learning strategies) has been proven to be acceptable.

These results are in accordance with the findings of other researchers such as Affendi (2021), who examined the impact of VLSs use on the breadth and depth of vocabulary and reading comprehension performance among L2 pre-university students. The results are also in alignment with the findings of Heidari et al. (2012) who investigated the effect of vocabulary learning strategy instruction on ESP vocabulary achievement and reading comprehension. Both studies reported the positive influence of vocabulary learning strategies on reading performance.

In consideration of the potential effect engendered by technology intervention, the findings sound to be harmoniously congruent with other existing studies such as Hawamdeh et al. (2025) and Shafiee (2025). A common thread among these studies is the premise that digital tools, technological methods such Classpoint technology and artificial intelligence aided learners to achieve remarkable progress in reading competency. Regarding the framework of the Moroccan setting, the findings sound to be in consonance with findings reported by Outamgharte et al. (2025) and Larhmaid (2018) which placed more emphasis on the effectiveness of online learning platforms and variant e-learning tools in empowering learners to attain utmost results in reading comprehension.

Although the abovementioned studies elucidated the effectiveness of VLSs and contributed to our knowledge in realizing the critical role of technology-enhanced learning in promoting general reading performance, the types of the reading skills that students tackled remained unaddressed. Alternatively expressed, such studies give priority to test items targeting comprehending textual facts and ideas while vocabulary-centred items received no significance. That is why the current study attempts to fill in this gap in the literature as it sought to explore the impact of VLSs on comprehending facts and ideas stated in a reading passage, as well as the effect of these strategies on demonstrating ability to understand unfamiliar vocabulary in the passage.

With this objective at the forefront, and to ascertain a response to the second research question pertaining to the impact of technology-enhanced VLS training on facts and ideas comprehension, a thorough examination of the pretest and posttest findings was undertaken. Based on these findings, it was observed that both groups showed equal understanding skills during the two tests. In other words, in spite of being subject to the training condition, the experimental group exhibited a performance similar to that of the control group after administring the posttest. This parity in scores could be possibly due to one underlying factor which is attributed to the nature of the vocabulary learning strategies. That is to say, vocabulary learning strategies predominantly prioritize dealing with vocabulary learning or acquisition over comprehending facts and ideas presented in the text. These strategies regularly compel learners to be engaged with unfamiliar vocabulary and new lexicon in preference to navigating the factual information and conceptual ideas mentioned in the reading passage.

According to these findings, we may come to the conclusion that the hypothesis previously articulated in this study (Learners' performance in the ability to understand facts and ideas stated in a reading text would be the same for both experimental and control group after the posttest) has been proven to be validated. The acceptance of this hypothesis stimulates further investigation and calls for further analysis into the influence of VLSs on the comprehension and interpretation of textual facts and ideas. Thus the upcoming studies addressing the impact of VLSs on reading proficiency are invited to make a definitive distinction between comprehension of facts and ideas and comprehension of vocabulary and lexicon. While both dimensions contribute to overall comprehension, each aspect encompasses specific skills and cognitive process which are pivotal for effective engagement with a reading text.

So as to address the third research question related to the effect of technology-assisted VLSs on identifying unknown vocabulary, data derived from both pretests and posttest was meticulously analysed. The pretest data indicate that the treatment and control group exhibited relatively the same performance before the intervention. The posttest data, however, revealed substantial difference in the scores of the two groups. These finding provide compelling evidence pertaining to the potency and functionality of technology-enhanced VLSs in augmenting the ability to tackle the unfamiliar words and expressions mentioned in the reading text. This suggests that the training on VLSs had a profound impact on learners' lexical knowledge and vocabulary skills during the treatment sessions. Moreover, the PowerPoint presentations and Mobile Assisted Language Learning approach, along with the various visuals aids and

software applications provided by these digital facilities, assisted in catering to variant learning styles which led to meaningful engagement with unfamiliar vocabulary and created better vocabulary retention.

Accordingly, we may come to the conclusion that the null hypothesis "There is no significant difference in learners' ability to identify the meaning of the vocabulary presented in a reading text" has been rejected, whereas the alternative hypothesis "There is a significant difference in learners' ability to identify the meaning of the vocabulary presented in a reading text" has been approved. Put differently, the hypothesis outlined earlier (Training on technology-assisted vocabulary learning strategy would help learners in the experimental group achieve higher results in showing ability to identify the meaning of the unfamiliar vocabulary of a reading text) stands to be confirmed. This confirmation is rooted in the premise that the training undertaken and the usefulness of the structured instructional technological methods served as a booster to help language learners address the specific lexical challenges and gain deeper understanding of unfamiliar vocabulary.

The findings are in agreement with prior research that emphasises the capitalized role of VLSs in fostering vocabulary knowledge. This aligns for instance with the study carried out by Dessalew & Mohammed (2024) which points to the transformative effect of VSL training on attaining outstanding performance in vocabulary knowledge breath and vocabulary knowledge depth. This also resonates with findings by Wu (2019) which suggest that learners' vocabulary size is positively associated with vocabulary learning strategy instruction. As it pertains to the key involvement of technology-mediated instruction, the results also parallel findings obtained from Sağlık and Sural (2024) which revealed the critical function of technology-enhanced learning material in cultivating vocabulary skills. This similarly corresponds with Albaqami's (2024) key finding which uncovered the instrumental role of technology-enhanced input in promoting vocabulary acquisition. All in all, evidence gathered from the study adds to the proliferation body of research pertaining to the efficacy of technology-driven learning in the realm of vocabulary acquisition.

6. Pedagogical Implications and conclusion

The present article was a contribution to address the impact of technology-assisted vocabulary learning strategies on reading performance in the Moroccan context. Although there were fewer studies that provided a useful starting point for exploring the correlation between VLSs and academic improvement within the Moroccan classrooms, the current research hoped to go beyond the broad ideas of the general effect of VLSs on language learning, as it has limited this effect to one specific language component; i.e. reading comprehension. The notion of VLSs is really a promising area of investigation with paramount importance because of the crucial role of these strategies in achieving learners' autonomy and academic success. Hence the objective of the study was to sketch out this role. Because this scope of VLSs is a wide area of investigation, the researcher has attempted to narrow it down by focusing on the influence of these strategies on learners' reading performance. In order to obtain utmost and reliable results in this regard, the study addressed this issue through adopting a quasi-experimental design.

The present study could be useful and beneficial for stakeholders in education. The study's results suggested the supreme importance of integrating vocabulary learning strategies into EFL/ ESL classrooms and language courses. The findings also reveal the necessity of policy-makers and material designers to reconsider language curricula and syllabi through taking into account evidence-based practices and incorporating efficient learning strategies in order to elevate students' academic outcomes. The focus in this respect should be on encouraging learners to take as much responsibility for their learning as possible in a sense of equipping them with the necessary learning strategies so as to make their learning an autonomous process. Thus learners should be taught how to learn independently through introducing them to the effective tools that would contribute to their language proficiency.

The study also highlights the criticality of the wise integration of technology-mediated learning within the instructional methods and teaching practices. Educators as well as educational stakeholders can harness the implementation of digital tools and technology-driven methods through creating more motivating learning environments that enjoy a number of interactive platforms, useful software applications, and collaborative learning experiences that would cater for diverse learning styles and assist in accelerating vocabulary acquisition and promoting reading comprehension. The study also brings to attention the necessity of digital literacy for educators and the needs for ongoing professional development pertaining to raising educators' awareness of the wise implementation of ICT in their classroom instructional activities.

To wrap it up, the present study has endeavoured to explore the impact of technology-driven vocabulary learning strategies on reading performance. A quasi-experiment was conducted to figure out the impact of VLSs on reading comprehension and vocabulary identification. The results demonstrated a positive impact of the VLSs on reading achievement, especially in regards to identifying unfamiliar vocabulary. However, the scope of the study was limited to the effect of VLSs on reading performance while the other

language areas such as listening, writing, and speaking were unconsidered. Consequently, further research has been required to examine the potential influence of vocabulary learning strategies training, as facilitated by technology instruction, on other language aspects.

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