Using Electronic Mind Maps Strategy in Teaching English to Develop Vocabulary Learning among Primary Stage Pupils

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مستخلص البحث

هدف البحث الحالي إلى معرفة أثر استخدام استراتيجية الخرائط الذهنية الإلكترونية في تدريس اللغة الإنجليزية على تنمية تعلم المفردات اللغوية لدى تلاميذ المرحلة الابتدائية. اعتمد البحث التصميم شبه التجريبي ذو المجموعتين؛ مجموعة ضابطة درست مفردات اللغة الإنجليزية باستخدام طرق التدريس المعتادة والمجموعة التجريبية درست مفردات اللغة الإنجليزية باستخدام استراتيجية الخرائط الذهنية الإلكترونية. وتم اختيار عينة عشوائية مكونة من ثمانين تلميذاً من تلاميذ الصف الخامس من مدرسة أسامة بن زيد الابتدائية بمدينة أسيوط – بمحافظة أسيوط للمشاركة في هذا البحث، وتم تقسيمهم بالتساوي إلى مجموعتين؛ مجموعة تجريبية ومجموعة ضابطة. وقامت الباحثة بإعداد واستخدام قائمة مفردات اللغة الإنجليزية للصف الخامس واختبار تعلم المفردات القبلي والبعدي. وأظهرت نتائج البحث وجود فرق ذو دلالة إحصائية عند مستوى دلالة (٠.٠١) بين متوسط درجات تلاميذ المجموعتين الضابطة والتجريبية في التطبيق البعدي لاختبار تعلم المفردات، لصالح المجموعة التجريبية. كما أكدت نتائج البحث على فاعلية استخدام الخرائط الذهنية الإلكترونية في تدريس اللغة الإنجليزية لتنمية تعلم المفردات اللغوية لدى تلاميذ المرحلة الابتدائية. وقادت هذه النتائج إلى بعض التوصيات والمقترحات لإجراء المزيد من الأبحاث المستقبلية لدمج الخرائط الذهنية الإلكترونية في تدريس اللغة الإنجليزية.

الكلمات المفتاحية: استراتيجية الخرائط الذهنية الإلكترونية – تعلم المفردات.

Abstract

The present research aimed at investigating the effect of using electronic mind maps strategy in teaching English on developing vocabulary learning among primary stage pupils. The research adopted the quasi-experimental design with two-groups; a control group that studied English vocabulary using usual teaching methods and an experimental group that studied English vocabulary using an electronic mind maps program. A stratified random sample of eighty fifth-grade pupils were selected from Osama ebn Zaid primary school, Assiut city, Assiut Governorate, to participate in this research and they were divided equally into two groups; an experimental group and a control group. The researcher prepared and used a fifth grade English vocabulary list and pre-post vocabulary learning test. The results revealed a statistically significant difference at (0.01) level between the mean scores of the control and the experimental groups in the post-administration of the vocabulary learning test, favoring the experimental group. The results indicated a positive effect of using electronic mind maps in teaching English to develop vocabulary learning among primary stage pupils. These findings lead to some recommendations and suggestions for further researches to integrate electronic mind maps in teaching English.

Keywords: Electronic mind maps strategy – Vocabulary learning.

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Using Electronic Mind Maps Strategy

Introduction

English is a universal language and learning English language is essential for anyone looking to succeed today. The English language is the most widely used language around the world and it plays a major role in many fields like education, technology, scientific and academic researches. Therefore learning English language makes it easier for people to share knowledge, communicate with others from different countries and cultures, find the information they need online and stay informed about world events.

Since the eighties of the twentieth century, the focus on English language education has changed from concentrating on memorization, grammar and learning from rote, to giving more attention to the use of language as a means to communicate with others around the world. Pupils today want to learn a language not only to communicate, but also as a way to find contacts, meet people and establish partnerships (Soontiens, 2004). Geographical limitations have been overcome by technology as pupils learn to reach out to the world around them, using their language and cultural skills to facilitate the connections they want to make (Eaton, 2010). The key to really building learners' confidence in learning a language is to prepare them effectively to learn. This means learning the vocabulary they need to understand and enjoy the language.

Vocabulary is the heart of any language. It represents one of the most important skills necessary for learning English as a foreign language. Schmitt (2010) noted, *"Learners carry around dictionaries and not grammar books"* (p.4), vocabulary is the basis for the development of all other skills: listening, speaking, reading, and writing. Indeed, vocabulary is the basic element for pupils in their attempt to use English language effectively.

Talking about the importance of vocabulary, the linguist David Wilkins (1972) wrote that *"... while without grammar very little can be conveyed, without vocabulary nothing can be conveyed."* (pp. 111–112). Since no one can deny the power of words, perhaps the greatest gift given to learners is a rich amount of vocabulary, which can not only help them in their academic life, but also in their future life.

Today's language classroom is vastly different from before; there are some new techniques concentrating on utilizing modern technologies in teaching and learning the language and the electronic mind maps is one of these technologies. Group (2021) believed that technology has changed the way of learning, from zero to hero. In his article about the impacts of technology on education, he assumed that the use of **technology in education is beneficial in many ways like:**

1. Increasing teacher's productivity and efficiency.

2. Reducing the cost of schooling.

3. Playing a significant role in teaching and learning process.

5. Encouraging collaboration in classrooms.

6. Encouraging more communication between teachers and parents.

It is well-known that *"A picture is worth a thousand words"* and many studies have shown that in most cases pupils have to see, read and interact with words 5–7 times before they are admitted to long-term memory. There is a strong relation between the ways a learner is educated and the way his senses operate, and a high amount of all sensory experience is visual (Buzan ,2000). Electronic mind maps strategy is an easy way to brainstorm thoughts without worrying about order or structure. It allows learners to visually construct their ideas and help them with analysis and recall.

Mind mapping was first introduced by Tony Buzan (1984) based on his researches in the way the brain works. Paulino (2020) described mind mapping as a flexible learning strategy because it does not require a structured outline or a specific way to be created. It is simply created by creativity and the flow of cognitive information translated into a visual diagram. Mind mapping strategy stimulates brainstorming, encourages critical thinking, helps organizing notes and makes the learning process more active.

The use of electronic mind mapping in the learning process provides variety of techniques used in the lessons which encourages students to be more cooperative and active. Vocabulary diagraming using electronic mind maps is a visual way to show how the words in a sentence are related. This warms up pupils and engages their interest more in visualizing the words they need to learn and keep in long-term memory. As well, electronic mind map is an effective strategy in language learning and teaching, especially in vocabulary learning. Moreover, this computer technology is very useful in reinforcing pupils' motivation to learn and practice.

Statement of the problem

Many fifth-grade pupils have difficulties in learning some necessary English vocabulary at this stage. Hence, the current research is an attempt to investigate the effect of using electronic mind maps strategy in teaching English on developing vocabulary learning among primary stage pupils.

Objectives

The current research aimed at developing fifth-grade pupils' vocabulary learning, through using electronic mind maps strategy.

Question

What is the effect of using electronic mind maps on developing fifth-grade pupils' vocabulary learning?

Hypotheses

1. There would be a statistically significant difference between the mean scores of the control group and the experimental group in the post-administration of the vocabulary learning test, favoring the experimental group.

2. There would be a statistically significant difference between the mean scores of the experimental group in the pre-post administration of the vocabulary learning test, favoring the post-administration.

Literature Review and Related Studies

The importance of vocabulary is demonstrated daily in and out of the school. In classroom, the acquisition of an adequate vocabulary is essential for success because without an extensive vocabulary, learners cannot understand each other or express their own ideas. Nation (2011) assumed that there is a complementary relationship between vocabulary knowledge and use English as a foreign language (EFL). He confirms that learning vocabulary items plays a vital role in all language skills.

Some studies investigate the effect of using electronic mind maps on learning and teaching process and the importance of learning vocabulary, for example: a study by Othman (2018) aimed at investigating the effectiveness of using mind mapping on the 3rd graders' vocabulary learning and improving their visual thinking. To achieve the objectives of the study, the researcher adopted the quasi-

experimental design with two-groups. The group of the study consisted of (80) male students and divided equally into two groups, the experimental group was taught using the mind mapping strategy while the control group received traditional teaching. The results of the study revealed that there was a statistically significant difference at (0.01) in the mean scores of the experimental and control groups in the vocabulary posttest favoring the experimental group due to the use of mind mapping. There was also a statistically significant difference at (0.01) in the mean scores of the experimental and control groups in the visual thinking posttest due to the use of mind mapping in favor of the experimental group.

Another study by Kord (2022) investigated the effect of E-mind mapping strategy on improving EFL basic stage students' English vocabulary. The researcher adopted the quasi-experimental design with two-groups. A group of (50) students were randomly chosen and divided into two groups: the experimental group students were taught English vocabulary using the e-mind mapping strategy, while the control group students were taught the same content through the traditional methods. To achieve the objectives of the study, the researcher used a vocabulary test. The results of the study reported a statistically significant large difference in the mean scores of the experimental and control groups favoring the experimental group in the vocabulary posttest due using E-mind mapping strategy in teaching EFL basic stage students' English vocabulary.

As such, Masoud and Ibrahim (2017) conducted a study to investigate the effectiveness of using an E-Mind Mapping Software based program on developing vocabulary acquisition of second year English majors at the Faculty of Education. A pre-post experimental

group research design was used to achieve the research objectives. Sixty students were randomly chosen and divided into two groups: the experimental group students were trained in the e-mind mapping based program and the control group students were taught the same content through the conventional method. Analysis of data obtained by students (using t-test) revealed that the experimental group significantly achieved higher level than the control group on the post administration of the vocabulary acquisition test.

In addition, Mezied and Qishta (2019) investigate the effectiveness of metacognitive strategy on vocabulary learning and its retention among eighth graders. To achieve the aim of the study, the researchers chose the experimental approach with two groups. The experimental group (41) learners, studied vocabulary learning through the metacognitive strategy while the control group (40) received usual teaching practice for vocabulary. An achievement vocabulary learning test was applied and the data was analysed and demonstrated a positive effect of the metacognitive strategy instructions on vocabulary learning of the experimental group.

Design

This research adopted the quasi-experimental design with two-groups; a control group that studied English vocabulary using usual teaching methods and an experimental group that studied English vocabulary using electronic mind maps strategy. In order to identify the effect of using electronic mind maps strategy on developing vocabulary learning among primary stage pupils.

Participants

A stratified random sample of eighty fifth-grade pupils were selected from Osama ebn Zaid primary school, Assiut city, Assiut Governorate, participated in this research and they were divided equally into two groups; an experimental group and a control group.

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A group of thirty fifth-grade pupils were randomly selected from Osama ebn Zaid primary school, Assiut city, Assiut Governorate, to whom the preliminary research materials and instruments were administered to assure their validity, reliability, stability and the time suitability for the current research.

Materials and instruments

The following materials and instruments were designed and used for researching purposes:

1. A list of fifth-grade English vocabulary.

2. A pre-post vocabulary learning test.

3. Teacher's guide.

4. Pupil's handouts.

Procedures

To answer the question of this research and achieve its objective, the researcher:

1. reviewed literature and previous studies related to electronic mind maps and vocabulary learning.

2. prepared a list of English vocabulary suitable for fifth-grade pupils.

3. presented the vocabulary list to jury members and modified it according to their instructions.

4. designed the electronic mind maps program (teacher's guide, pupil's handouts).

5. presented the electronic mind maps program to jury members and modified it according to their instructions.

6. designed the instruments of the research (vocabulary learning and vocabulary use tests).

7. presented the instruments of the research to the jury members to make suggested modifications and ensure their validity, reliability and stability; and made necessary modifications according to their instructions.

8. administered the materials and instruments of the research on a pilot group to measure the validity, reliability, stability, facility, difficulty, discrimination and time suitability.

9. made the relevant changes on the instruments of the research due to the pilot study results.

10. selected the research group randomly from fifth–grade pupils and dividing them equally into a control group and an experimental group.

11. pre–administered the vocabulary learning test on both groups of the research.

12. taught the experimental group using electronic mind maps and the control group using the usual method.

13. post–administered the vocabulary learning test on both groups of the research.

14. collected the results and analyzing them statistically to determine statistically differences between the scores of the experimental and the control group using SPSS.

15. interpreted and discussing the results to indicate the effect of using electronic mind maps on developing vocabulary learning among primary stage pupils.

16. proposed recommendations and suggestions for further researches based on the results of the research.

Electronic mind maps program

This part describes the electronic mind maps and the procedures followed to design and implement them, as follows:

1. Objectives of the electronic mind maps program.
2. Framework of the electronic mind maps program.
3. Design of the electronic mind maps program.
4. Validity of the electronic mind maps program.
5. Piloting the electronic mind maps program.

1. Objectives of the electronic mind maps program

The electronic mind maps were designed to develop the learners' ability to learn some English vocabulary through using the electronic mind maps strategy.

2. Framework of the electronic mind maps program

The framework of the electronic mind maps strategy includes a detailed description of the content, units, lessons, activities, teaching aids, teaching methods and evaluation techniques. That framework provides a plan of using electronic mind maps strategy step by step, which helps the teacher achieve the intended objectives of each lesson. Consequently, achieving the general objective of the electronic mind maps program will lead to achieving the objective of the research.

3. Design of the electronic mind maps program

The electronic mind maps program was designed according to the ADDIE model steps. The ADDIE model (General Model) is an instructional model provides a systematic, iterative process for determining training needs, designing instructional programs and materials, implementing these programs and evaluating their effectiveness. The electronic mind maps program was designed according to the ADDIE model following these steps:

1. Analysis.
2. Design.
3. Development.
4. Implementation.
5. Evaluation.

Step 1: Analysis

To analyze the electronic mind maps' program, the researcher analyzed the content to reach to the vocabulary learning objectives for fifth-graders and selected the vocabulary suitable for their level. Then, determined the learning environment, the participants of the research and assessed the learning outcomes by various types of questions. Finally, the researcher identified the schedule of administrating the electronic mind maps' program.

Step 2: Design

To design the electronic mind maps' program, the behavioral objectives were determined according to the general objective of each lesson and the information was gathered from fifth grade curriculum, previous literatures and books that are related to the research. In addition, questions and activities were used as assessment tools to ensure that pupils understand the content. The pupils' handouts also prepared for each pupil of the experimental group; it contained some vocabulary activities related to the program's objective.

Step 3: Development

To develop the electronic mind maps' program, a computer was used to design the electronic mind maps; Wondershare Mind-Master and Wondershare Edraw-Max programs were used to design the electronic mind maps. Microsoft Power-Point program was used to design, produce and present the electronic mind maps' lessons.

Step 4: Implementation

To implement the electronic mind maps' program, the researcher administered the vocabulary learning pre-test to both control and experimental groups before the administration of the electronic mind maps' program. Then, taught the electronic mind maps' program to the experimental group.

Step 5: Evaluation

To evaluate the electronic mind maps' program, the researcher used two types of evaluation:

1. Formative evaluation

An assessment tool (pupil's handouts) designed using different types of questions and applied at the end of each lesson to measure how far pupils were understood the lesson content.

2. Summative evaluation

A quantitative evaluation tool (the vocabulary learning test) designed and applied at the end of the program to measure how far using electronic mind maps strategy on teaching English developed pupils' ability to learn vocabulary.

4. Validity of the electronic mind maps program

To establish the validity of the electronic mind maps, it was presented to a group of jury members and made necessary modifications according to their instructions.

5. Piloting the electronic mind maps program

A sample lesson taught to a pilot group of 30 pupils who indicated that the given time was sufficient, the content was suitable and the instructions were clear.

English vocabulary list

The vocabulary list was prepared based on the aims of the fifth-grade curriculum, the teacher's guide and the related previous curricula. The vocabulary list aimed at determining whether these vocabularies were suitable for the fifth-grade pupils and their level, to be used in designing the program and the pre and post-tests.

Validity of English vocabulary list

To establish the validity of the vocabulary list, it was presented to a group of specialists including supervisors and teachers of English. Based on their instructions, the list was developed to reach its final form.

Vocabulary learning test

In the present research, two forms of vocabulary learning test were used to measure how far learning vocabulary was developed among fifth-grade pupils.

Vocabulary learning test question types

The two forms of the test consisted of 5 questions; each question had 6 items measured specified objectives and had detailed instructions and time duration.

Vocabulary learning test piloting

The two forms of the vocabulary learning test were administered to a group of 30 pupils to measure the validity, reliability, suitability, facility, difficulty, discrimination and time duration.

Vocabulary learning test validity

To establish the validity of the two forms of the vocabulary learning test, the following statistical methods were used:

1. Jury validity

The two forms of the vocabulary learning test have been presented to jury members who were asked to judge the validity of the tests. Based on their suggestions, some modifications were made. Then, the tests were presented once more to a number of jury members who approved their validity to pupils' level and to the objectives of the electronic mind maps.

2. Internal consistency

To verify the internal consistency of the two forms of the vocabulary learning test, Pearson correlation coefficients were determined between the scores of each test items and the total score of the test. The Pearson coefficient values for all the items were more than 0.3, which are statistically significant at $(0.05, 0.01)$ level. That confirms the internal consistency between the scores of each test item and the total score of the test, which indicated the validity of the two forms of the test.

3. Discriminant validity

The total score of the two forms of the vocabulary learning test were calculated separately to judge the validity of the tests. In addition, 25% of the highest scores were taken to represent high-achieving pupils and 25% of the lowest scores were taken to represent low-achieving pupils. Mann Whitney U test was used in comparing between the mean ranks, the results were as follows:

Table (1)
Discriminant validity for English vocabulary learning test

English vocabulary learning test	Group of Pupils	N	Mean Rank	Sum of Ranks	Z value	Sig.
Form A	high-achieving	8	12.44	99.50	3.33	0.01
	low-achieving	8	4.56	36.50		
Form B	high-achieving	8	12.50	100.0	3.37	0.01
	low-achieving	8	4.50	36.00		

It is clear from the previous table that there were statistically significant differences at (0.01) level between the mean ranks of high-achieving pupils and low-achieving pupils in the total score of the vocabulary learning tests, which indicates the discriminant validity of the two forms of the test.

Vocabulary learning test reliability

To assure the reliability of the two forms of the vocabulary learning test, Cronbach's alpha coefficient and Spearman-Brown split-half formula were used. The results were as follows:

Table (2)

Reliability coefficients for English vocabulary learning test

vocabulary learning test	Reliability coefficient	
	Cronbach's alpha	Spearman-Brown
Form A	0.805	0.821
Form B	0.773	0.790

It is clear from the previous table that all the values were more than 0.7 which is statistically significant at (0.01) level, thus indicates that the two forms of the vocabulary learning test are reliable.

Vocabulary learning test stability

The test-retest method was used to calculate the stability of the two forms of the vocabulary learning test. After administered them on a survey sample of 30 pupils, within a month time interval between the first and the second administered of the tests, the correlation coefficient was calculated between the pupils' scores in the first and the second administered of the tests. The values were more than 0.7 $(0.816$ for form A and 0.842 for form B$)$, which is statistically significant at (0.01) level, thus indicates the stability of the two forms of the tests.

Vocabulary learning test facility and difficulty indices

Facility and difficulty indices were determined using the data resulted from the pilot study. Using basic statistical equations, the facility and difficulty indices of the two forms of the vocabulary learning test items showed that the items were successfully showing differences among skilled and unskilled examinees.

Vocabulary learning test discrimination

Discrimination indices were determined using the data resulted from the pilot study. Using basic statistical equations, the discrimination indices of the two forms of the vocabulary learning test items showed that the items were successfully showing differences among skilled and unskilled examines.

Vocabulary learning test timing

To calculate the suitable timing for the vocabulary learning tests, the following equation was used:

Test time (form A) = $\dfrac{\text{Time taken by each pupil}}{\text{Total number of pupils}}$ $\dfrac{808}{30}$ =26.9 minutes

Test time (form B) = $\dfrac{\text{Time taken by each pupil}}{\text{Total number of pupils}}$ $\dfrac{790}{30}$ =26.3 minutes

The pervious equations suggested that the suitable time for the vocabulary learning test was approximately 27 minutes. Taking into consideration, about 3 minutes were needed to clarify test instructions; the suitable time for the vocabulary learning test should be 30 minutes.

Vocabulary learning test scoring

A scoring criterion was presented to help in scoring the test. Since the vocabulary learning test had a variety of items, there should be criteria whereby the teacher can assess pupils' vocabulary learning skills.

Findings

Differences between the control group and the experimental group in the pre-administration of the vocabulary learning test

Independent Sample T-test was used to calculate the differences between the mean scores of the control group and the experimental group in the pre-administration of the vocabulary learning test as follows:

Table (3)

Differences between the control and experimental groups' scores in the pre-administration of the vocabulary learning test

	Group	N	Mean	Std. Deviation	DF[*]	T value	Sig.
vocabulary learning test	Control	40	9.17	1.99	78	0.59	N.S[**]
	Experimental	40	9.45	2.28			

*DF = Degree of Freedom   **N.S = Non Significant

The previous table indicates that there were no statistically significant differences between the mean scores of the control and the experimental groups in the pre-administration of the vocabulary learning test. This reflects the homogeneity in the academic level between the control group and the experimental group in the pre-administration of the vocabulary learning test.

Testing Hypotheses

Hypothesis I

The first hypothesis stated that "There would be a statistically significant difference between the mean scores of the control group and the experimental group in the post-administration of the vocabulary learning test, favoring the experimental group".

To test the first hypothesis, an independent sample T-test was used to calculate the differences between the mean scores of the control group and the experimental group in the post-administration of the vocabulary learning test, as follows:

Table (4)

Difference between mean scores of the control and the experimental groups in the post-administration of the vocabulary learning test

vocabulary learning test	Group	N	Mean	Std. Deviation	DF	T value	Sig.
	Control	40	16.84	2.27	78	12.52	0.01
	Experimental	40	24.51	3.14			

The values presented in the previous indicate a statistically significant difference at (0.01) level between the mean scores of the control and the experimental groups in the post-administration of the vocabulary learning test, favoring the experimental group. Thus, the first hypothesis was proved and confirmed.

To find out the effect size of using electronic mind maps strategy in teaching English to develop vocabulary learning, Eta squared effect size equation and Cohen's d effect size equation were used as follows:

Table (5)

The effect size of using electronic mind maps in teaching English to develop vocabulary learning

English vocabulary learning test		Descriptive Statistics			Effect Size	
		N	Mean	Std. Deviation	Eta squared	Cohen's d
Group	Control	40	16.84	0.668	0.668	2.800
	Experimental	40	24.51	3.14		

It is clear from the previous table that the effect size values were large which implies a large effect of using electronic mind maps strategy in teaching English to develop vocabulary learning.

Figure (1)

Difference between mean scores of the control and the experimental groups in the post-administration of the vocabulary learning test
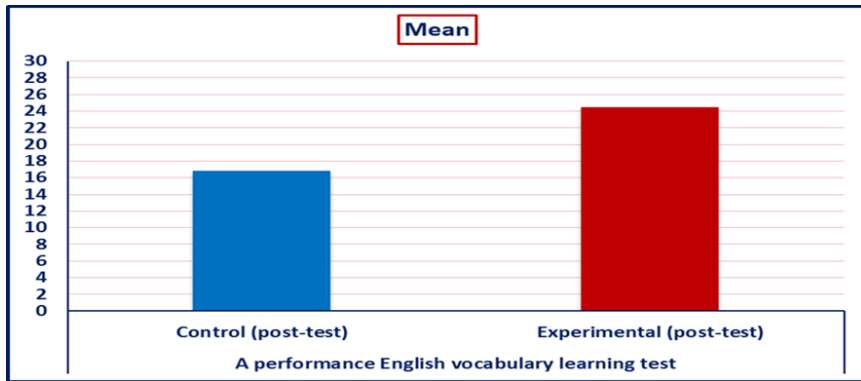

Figure (1) shows statistically significant difference between the mean scores of the control group and the experimental group, favoring the experimental group who studied using electronic mind maps. That confirms the effect of using electronic mind maps strategy in teaching English to develop vocabulary learning.

Hypothesis II

The second hypothesis stated that "There would be a statistically significant difference between the mean scores of the experimental group in the pre-post administration of the vocabulary learning test, favoring the post-administration".

To test the second hypothesis, a paired sample T-test was used to calculate the differences between the mean scores of the experimental group in the pre-post administration of the vocabulary learning test, as follows:

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Table (6)

Difference between the mean scores of the experimental group in the pre-post administration of the vocabulary learning test

	Experimental Group	N	Mean	Std. Deviation	DF	T value	Sig.
vocabulary learning test	Pre	40	9.45	2.18	39	27.09	0.01
	Post	40	24.51	3.14			

The values presented in the previous indicate a statistically significant difference at (0.01) level between the mean scores of the experimental groups in the pre-post administration of the vocabulary learning test, favoring the post-administration. Thus, the second hypothesis was proved and confirmed.

To find out the effect size of using electronic mind maps strategy in teaching English to develop vocabulary learning, Eta squared effect size equation and Cohen's d effect size equation were used as follows:

Table (7)

The effect size of using electronic mind maps in teaching English to develop vocabulary learning

English vocabulary learning test		Descriptive Statistics			Effect Size	
		N	Mean	Std. Deviation	Eta squared	Cohen's d
Experimental Group	Pre	40	9.45	2.18	0.950	5.572
	Post	40	24.51	3.14		

It is clear from the above table that the effect size values were large, which implies a large effect of using electronic mind maps strategy in teaching English to develop vocabulary learning.

Figure (2)

Difference between the mean scores of the experimental group in the pre-post administration of the vocabulary learning test
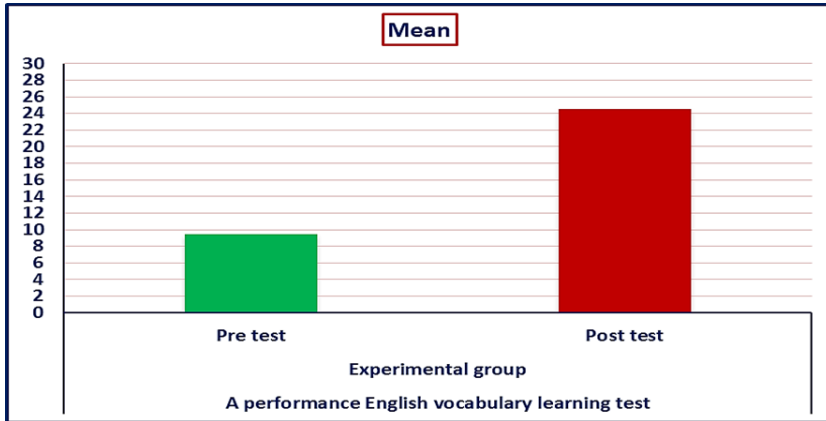

Figure (2) shows statistically significant difference between the mean scores of the experimental groups in the pre-post administration of the vocabulary learning test, favoring the post-administration after using electronic mind maps. That confirms the effect of using electronic mind maps strategy in teaching English to develop vocabulary learning.

Results and Discussion

This research was conducted to investigate the effect of using electronic mind maps strategy in teaching English to develop vocabulary learning among primary stage pupils. Results of the study confirmed that there has been much development on the pupils' level in learning vocabulary. Participants of the experimental group achieved a high progress in learning English vocabulary; which was confirmed by the statistically significant difference between the mean scores of the control and the experimental groups, favoring the experimental group.

The research revealed that the use of electronic mind maps strategy in developing vocabulary learning provides an active role for students and a tremendous positive effect on the participants while the instructor becomes a facilitator and a coordinator. The most significant results of this research were that electronic mind maps strategy is useful for improving students' ability to learn new vocabulary, brainstorming the ideas and improving vocabulary retrieving skills.

This result coincided with some previous studies such as the study of Al-Jarf (2015) study which emphasized that mind-mapping software can be used to help EFL students learning vocabulary effectively. Comparisons of the vocabulary pre and posttest scores of students who used vocabulary mind-maps and those who did not, showed significant differences in vocabulary acquisition as revealed by the posttest. Students who used vocabulary mind-maps made higher gains in vocabulary acquisition and more accuracy in vocabulary knowledge.

Also, results of the present research go with the results of a study by Samhudi (2015) which is aimed to investigate the role mind mapping technique on teaching vocabulary and know the improvement of students' vocabulary mastery after teaching learning vocabulary through mind mapping technique. The result of the study showed that mind mapping technique improved students' vocabulary mastery. In addition, the result of a questionnaire showed that most of the students agreed that mind mapping was able to advance them, improve their vocabulary, expand their ideas and increase their self confidence in learning.

In addition, the results of this research combined with the studies of Mohaidat (2018), Samonlux and Yimwilai (2020), which aimed at investigating the impact of using electronic mind mapping strategy on developing reading among the (EFL) students. The statistical analysis showed a significant difference between the mean scores of the control group who taught using the traditional methods, and the experimental group who taught the chosen texts using the electronic mind mapping strategy, favoring the experimental group. Besides, the results revealed the high effect of using electronic mind mapping strategy on enhancing students' reading abilities and their motivation.

Conclusion

Vocabulary is a fundamental element of a language as the main four skills: reading, writing, listening and speaking derived from vocabulary learning. This research found that pupils prefer to apply visual learning strategies to learn vocabulary in a foreign language. This is because EFL learners usually have prior knowledge on the concept or meaning of a word in their first language. Pupils have a clear goal and vision of what they want to learn, how they can learn it and then how to apply what they have learned. They also learn from their mistakes and find ways to correct them. This implies that teachers should boost pupils' motivation by helping them to set goals as well as use various teaching methods and learning strategies.

Electronic mind mapping is believed to be one of the learning strategies which can be used in teaching vocabulary to involve the essential idea and encourages memorizing vocabulary easily. Abd El-Hamid (2021) confirmed that electronic mind mapping was suitable for all ages and students as it reduces students' boredom and stimulates creativity and helps students to understand ideas at higher levels of thinking than teaching through rote memorization alone.

Furthermore, many previous studies such as: Al Dahhasi (2013), Abdul Aziz and Yamat (2016), Baghagho (2019), Al-Swalha (2021), Abdelhamid (2022), emphasized on how electronic mind mapping can be used to help students in learning vocabulary effectively. These studies present a model for enhancing EFL vocabulary learning using electronic mind mapping. The results of the previous studies describe that the implementation of electronic mind mapping techniques in the learning process help students to solve problems, brainstorm creative ideas, remember new vocabulary, take notes, enhance their reading skills, organize the tasks and prepare presentations.

In conclusion, the benefits of electronic mind mapping in education are endless; especially in EFL teaching and learning. Incorporating electronic mind mapping in education allows teachers to improve their presentations through visual learning strategy. Applying electronic mind mapping strategy in the English language classroom helps pupils to think better and organize the thinking flows to separate complex problems into simpler topics. Overall, electronic mind mapping is a significant learning strategy used to enhance teaching methods. It is used to improve the way teachers present material, assess student knowledge and make learning EFL more engaging in the classroom. Visualizing ideas through electronic mind mapping helps pupils to understand better and retain knowledge in a way that suits their specific needs.

Significance

The significance of this research stemmed from the following:

1. Encouraging pupils to learn vocabulary through technology (electronic mind maps).

2. Helping pupils to overcome their learning difficulties through visualizing their thoughts and ideas.

3. Saving class time through using modern technological teaching strategies to represent the content.

4. Promoting teachers to use electronic mind maps in teaching vocabulary to develop pupils' ability to learn vocabulary effectively.

5. Instructing curriculum designers to design learning courses using technology instead of traditional books.

6. Directing researchers to conduct more researches and studies on using technology to enhance the language teaching process.

Recommendations

Based on the results obtained through this research, the following recommendations were proposed:

Curriculum designers and decision makers might:

● Hold more training courses to English teachers on how to use electronic mind maps effectively in teaching inside the classroom.

● Engage teachers on workshops and training sessions to learn how to use technological aids.

● Provide schools with new technological devices and aids to help teachers and learners.

● Design learning courses using technology beside the traditional books.

The teachers might:

● Not only depend on traditional methods of teaching or activities.

● Encourage learners to use electronic mind maps to brainstorm ideas and find creative solutions for their problems.

● Use electronic mind maps as a new strategy to increase learners' motivation to learn English.

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● Give learners enough time to practice during the class and estimate them to decrease their anxiety.

The learners might:

● Learn how to use electronic mind maps by themselves in taking notes and summarizing lessons.

● Use electronic mind maps to enhance their ability to retain, retrieve and use vocabulary they learned.

● Overcome their difficulties in learning through visualizing their thoughts and ideas using electronic mind maps.

● Use electronic mind maps in studying and analyzing the information and concepts in English language.

5.10 Suggestions for further researches

Based on this research, the following studies are suggested for further researches:

● Using electronic mind maps in teaching English to improve EFL students' reading comprehension skills.

● Using visual thinking strategy to develop critical thinking for secondary stage students.

● A suggested program based on visual thinking strategy to develop creative writing skills for preparatory stage students.

● Using electronic mind maps to improve EFL grammar achievement among secondary stage pupils.

● A training program based on using mind mapping software to design interactive lessons for elementary stage teachers.

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