Computer-Based Vocabulary Learning in the English Language: A Systematic Review

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Abstract—The goal of this article is to assess the efficiency of computer-based vocabulary instruction in English language classrooms and evaluate research on the usefulness of computer-based vocabulary acquisition, particularly in English language classes. The articles for the systematic review were selected from open-access databases. The present study adopts the systematic literature review (SLR) method to evaluate studies from 2010 to 2020. A total of one hundred and fifty sources were selected and analysed. Finally, forty articles were carefully chosen, focusing on the inclusion and exclusion criteria. Computer-based, multimedia and game-based vocabulary learning in English classrooms were the subjects of the study to address the research questions. The findings indicate that computer-based vocabulary learning is a frequent and effective approach to developing retention and learning new words. The study hopes that the suggestion is useful for researchers involved in English vocabulary learning and that, for further research, well-designed experimental studies can develop new options in learning vocabulary with the computer.

Index Terms—computer-based learning, technology, vocabulary learning, language learning, systematic review

I. INTRODUCTION

The advancement of computers and smart technologies has widely influenced English language teaching and learning in the last few decades. In the English language classrooms, instructors integrate computers, mobile phones and the internet to teach all the skills. Numerous software and applications of Computer Assisted Language Learning (CALL) are available online to enhance language learning. The increasing growth of CALL introduced approaches to English vocabulary learning. Al-Jarf (2007) explained a few methods for teaching vocabulary using semantic mapping, reading aloud, dramatizing, and teaching learners how to use online dictionaries and computers. CALL has been immensely utilized in a virtual environment and holds the greatest potential for use in the field of education. Computer applications are also widely used in the fields of psychology, medicine, science, games, and so on. In education, smart technologies and computers are creating an impact among teachers to become more familiar with terms like the internet, satellites, multimedia, educational games, electronic networks, virtual libraries, graphic information, science, and technology. This systematic literature review aims to analyze the articles that particularly focus on CALL in teaching and learning English vocabulary.

A. Literature Review

Computer-Based Learning (CBL) is used for educational purposes, and the computer hardware, software, peripherals, and input devices are crucial components of the educational environment when using computers for language learning. With the use of CBL, learners can learn informational representations to achieve their educational goals. Wilkins (1972) states that "without grammar, very little can be conveyed, without vocabulary, nothing can be conveyed" (p.111-112). Learning vocabulary is a crucial part of learning a language. Learning new words helps students become better speakers, writers, readers, and listeners. It also increases the learning comprehension and pronunciation of the learners. Without knowing the correct pronunciation of the words, the learners assume the wrong pronunciation or think words have incorrect meanings. The main issue in learning the target language is a lack of vocabulary because words in the language convey meaning (Krashen, 1989). Assuming the wrong meaning or pronunciation of words is the biggest mistake every language learner makes. To overcome this misconception, numerous studies on a variety of topics have been carried out in language courses. Learning strategies have been implemented by language instructors and researchers in the classrooms to develop the vocabulary of the students.

According to Davis (2006), technology has been incorporated into the language courses' curriculum. Since the end of the 20th century, language learning has changed as a result of computer-mediated communication (CMC). With the benefits of a computer, language classrooms are being used more for communication than for imparting information (Warschauer & Healey, 1998). In the 21st century, using a computer to learn a second or foreign language has several benefits. CALL supports autonomous language learning, where learners can learn independently. Technology, software,

and computer programmers empower students to work independently at any time or place with their learning materials (Salaberry, 1999; Rost, 2013).

B. Research Question

The following research questions serve as a basis for this review:

RQ1. What is the educational context of the learners mentioned in the articles?

RQ2. Which computer software is most frequently used in the selected articles?

C. Objective

The primary goal of this article is to review publications on computer-based vocabulary learning that were published from 2010–2020. It will also provide information about the specialists in computer-based vocabulary and activities used in teaching vocabulary.

II. Method

A. Guidelines for Conducting Systematic Review

The PRISMA guidelines were followed in the research to conduct the systematic review (Liberati et al., 2009). PRISMA helps the authors to conduct a proper review and to produce a systematic literature report of the study. Eligibility criteria are vital in assessing the validity and applicability of articles in the review. Selected articles have been processed under two criteria, criteria for inclusion and criteria for exclusion. Inclusion criteria have the characteristics of the paper that must be included in the study. Exclusion criteria have the characteristics of excluding the paper that must not be included in the study.

B. Inclusion Criteria

Inclusion Criteria (IC) 1: The paper has the following terms in the title:

Vocabulary Learning (or)

Computer (or)

Multimedia (or)

Online Game;

IC2: Conference proceedings (or)

Book chapters (or)

Journal articles;

IC3: The paper must be for language learners.

C. Exclusion Criteria

Exclusion Criteria (EC) 1: The paper is not open-source (not available online);

EC2: There is no emphasis in the paper on teaching English as a Second Language (ESL) or English as a Foreign Language (EFL).

EC3: The paper makes no mention of vocabulary learning.

EC4: Reviews, reports, and theses were not considered for systematic review.

D. Search Strategy

According to the search strategy, the data was collected from open-access databases and journals. The collection of articles started with three main aspects: "Vocabulary Learning" AND "Second Language Learning" AND "Foreign Language Learning." However, to make a high-quality study, a more comprehensive search has been made in searching the articles with the synonyms and words with the following search string.

"Vocabulary Learning" OR "Vocabulary Instruction" OR "Computer-Assisted" OR "Computer Instructed" OR "Multimedia" OR "Online Games" AND "English as Second Language Learning" OR "English as a Foreign Language." All the related research papers were collected using the year limits. The papers published from 2010–2020 were selected and used in the writing of this systematic literature review article.

E. Quality Assessment

In the review process, journal articles, book chapters, and conference papers were included. Review articles, theses, and reports were excluded from the process. To avoid duplication, the papers were checked keenly for duplications. Moreover, the abstract, instrument used in the study, and conclusion were screened down to check the available records. Even references and citations were checked.

F. Study Selection

In the eligibility criteria for every paper, the title, abstract, and keywords were recovered. In this phase, every paper is involved in the process of reading in a standardized manner. If the paper does not have content, it was involved in the phase of text analysis. The main variables of the study are summarised in the table.
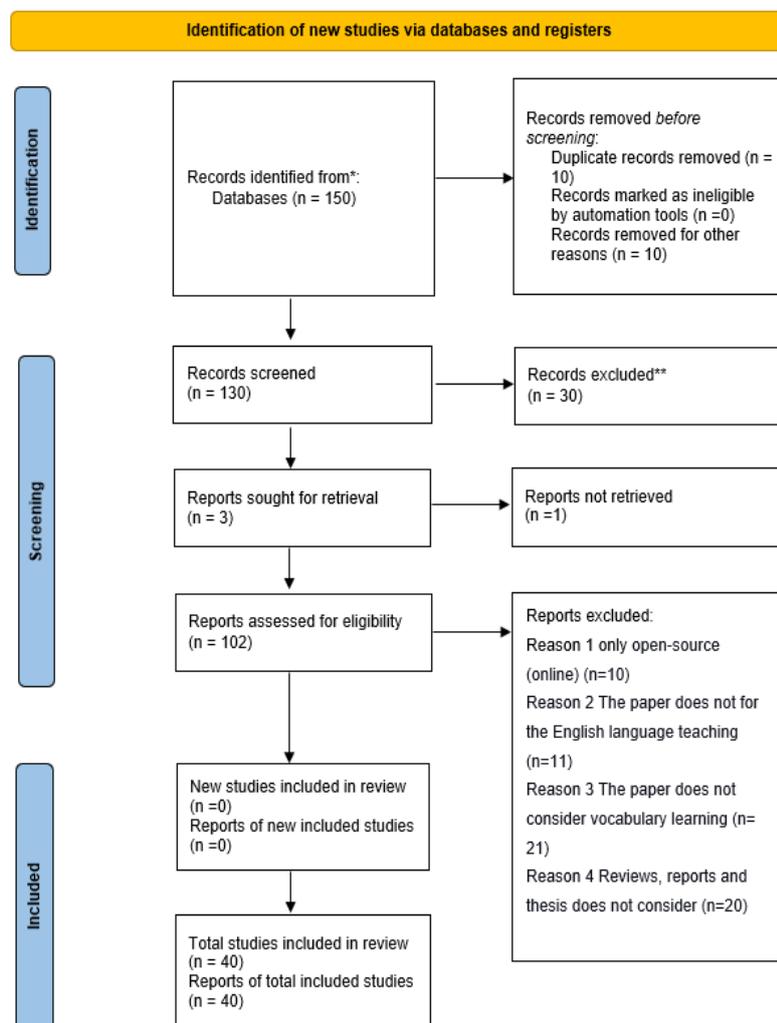
Figure 1 PRISMA Table for Data Collection

G. Data Synthesis

The papers were analysed to extract information about the activities and the year of publication. At first, a total of one hundred and fifty articles were identified in the open-access databases and no articles were identified from registered databases. After the identification process, the duplicate article was removed (n = 10) and none of the automation tools identified the articles as ineligible. Records deleted for further causes are (n = 5). In a second phase (n = 130), articles were screened but thirty articles were excluded based on title, source, and method used in the articles. Later, an (n = 1) article report was not retrieved, and one hundred and two articles were assessed for eligibility. A last manual search was conducted in several databases and journal sites to identify the articles. Finally, the search resulted in forty articles for conducting the systematic review.

H. Data Collection Process

Considering a systematic literature review, related papers were retrieved from the databases. The considered variables were the data, year of publication, and activities used in the article. The activities in the papers were analysed to check whether they were computer-related or non-computer-related. Articles for the study were registered if used in computer programs, computer software, or multimedia in the classrooms. In this review, important variables were collected under the platform that the studies were conducted on, which was online software, computer applications, or game applications. If the study does not involve computer-related things like mobile-assisted, robot-assisted, or other research articles related to technology, it is rejected from this study. The following information was collected from the articles: title of the article, year of publication, author's name, CALL software or activities used in the study, and conclusion of the study.

TABLE 1
STUDIES INCLUDED IN THE SYSTEMATIC REVIEW

Study	Population	CALL activities/ software used in the study	Outcome
Fatemeh Shoaei & Mohammad Alavi (2016)	N=62 Pre intermediate	Multimedia annotations: dictionary definitions and translations- story reading along with the audio.	CAL is an effective method of learning vocabulary.
Zuraina Ali et al. (2011)	N=123 UG	Fill- in- the-blanks and multiple-choice questions (vocabulary)	Dictionary strategy, contextual clues, and CALL increased long-term retention.
Elke Peters (2019)	N=142 Secondary	Watching the video with subtitles	On-screen imagery and on-screen text increased word recognition and recall.
Arzu Mutlu & Eroz- Tuga (2013)	N=48 intermediate	E-learning diary, yack pack (writing and discussion forum)	STG (Strategy Training Group) students learned words better than NSTG (Non-Strategy Training Group) students.
Dr. Levent Cetinkaya & Dr. Sutcu (2019)	N=112 Secondary	WhatsApp	Successful learning with multimedia annotations.
Marlin Steffi Marpaung (2020)	High school	Multimedia tools: Instagram posts and PowerPoint presentations	Learned vocabulary faster with retention.
Marc Ericson C. Santos et al. (2016)	N=31 UG	AR application and non- AR application	Using AR resulted in better retention among the students.
Daesang Kim & Dong-Joong Kim (2012)	N=135 Middle school	Small screen- iPod, medium screen- smartphone, and large screen- kindle	The large screen multimedia instruction helped the students to learn words.
Bahman Gorjian et al. (2011)	N=50 Intermediate and Pre-intermediate	CDs and dictionaries	Low achievers gained vocabulary in retention but could not keep the recall abilities.
Omer Esit (2011)	N=42 Intermediate	Computer laboratory with YVZ (Your Verbal Zone)	Reading activities with YVZ (Your Verbal Zone) have a positive effect on learners' vocabulary.
Raniah Kabooha & Tariq Elyas (2018)	N=100 intermediate	YouTube	YouTube improved students' vocabulary achievement
Elham Mahmoudi et al. (2012)	N=30 PG	Multiple-choice questions	High attitude towards learning vocabulary.
Somjai, Soontornwipast (2020)	N=45 10th grade	Vocabulary ability exercise	Effectiveness in the instruction of vocabulary learning.
Madhubala Bava Harji et al. (2010)	N=92 degree	Audio and video subtitles	Subtitles resulted in better vocabulary learning.
Huifen Lin (2015)	N=100 UG	"Trade Ruler" is a web-based simulation game	Decreased cognitive load and improved vocabulary recall.
Abdullah S. Aldera & Mohammed Ali Mohsen (2013)	N=50 UG	Watching the animation with annotation	Annotations did not significantly improve listening comprehension and recall over time.
Abbas Ali Zarei & Mahboubeh Gilanian (2013)	N=52 UG	Video with audio and captions	There are no significant differences among the multimedia combinations in L2 vocabulary.
Ninger Zhou & Aman Yadav (2017)	N=72 Preschool	Multimedia story reading, and paper story reading.	Media has a strong interaction with the target vocabulary.
Nasrin Ramezanali & Farahnaz Faez (2019)	N=132 intermediate	Glossed Words	It provided insights into vocabulary learning.
Takeshi Sato & Akio Suzuki (2010)	N=24	Dictionaries	3D images developed from learners' vocabulary.
Lu-Fang Lin (2010)	N=82 UG	Five English video lessons from the 2006 CNN news archive	Video increased incidental acquisition.
Merak Rahimi & Atefeh Allahyari (2019)	N=40	Photostory 3 by Microsoft	Impact on memory and cognitive strategies.
Chih -cheng Lin & Yi-fang Tseng (2012)	N=88 High school	Moodle site	Videos provide visual context for difficult target words.

Yavuz Samur (2012)	N=22 UG	ANT (animation + narration + text) and AN (animation + narration) without on-screen text	Developed redundancy in learning.
Burcu Varola & Gülcan Erçetin (2016)	N=90	Multiple-choice questions	Reading had positive effects on incidental vocabulary learning.
Michelle Mi-hee Choi (2011)	N=300 Preschool, middle, and high school	JCross, JQuiz, JMix, JCloze, JMatch, JM	Increased memory
Xue Shi (2017)	UG	Multimedia based learning materials	Better retention
Mohammed Ali Mohsen (2016)	N=43 UG	YouTube	Better retention
lham Mahmoudia et al. (2012)	N= 30 PG	Websites Go4English.com, Englishvocabularyexercises.com and Englishlearner.com	Promoted attitude in vocabulary learning.
Idé Edalati Shams (2013)	N=10	Weblog	Learners' autonomy knowledge increased.
Emine Turk & Gulcan Erçetin (2012)	N=82 High school	Website ''what is up with the weather?''	Reduced cognitive load and increased learning.
Yagmur Ersoy Ozer & Zeynep Koçoglu (2017)	N= 89 High school	Quizlet Flashcard Maker	Vocabulary learning and retention are effective.
Jing Shao (2012)	N=80 UG	I Love English Vocabulary (ILEV) Software	Attitudes toward multimedia software are favorable.
Parviz Maftoon et al. (2012)	N=40 Intermediate	VTS.S software	Learners learned better through e-feedback and computerized dictionaries.
Nilüfer Bekleyen & Adnan Yilmaz (2012)	N=9 UG	Jing (computer program)	Positivity towards vocabulary learning.
Tomonori Ono (2017)	N=26 UG	Memrise Spaced Repetition Software (SRS)	Word length had an impact on memory retention.
Fatemeh Enayati & Gilakjani (2020)	N=61 High school intermediate	Tell Me More (TMM) software,	Learners used words in different contexts
Ebrahim Nejati et al. (2018)	N=40 Intermediate and pre-intermediate	CAVI software, vocaboly	Developed retention
Jafar Eizadpanah & Mehdi Ghaedrahmat (2014)	N=61 Intermediate	CAVL software, word wazir	Developed learners' word knowledge
Franciosi (2017)	N=84 UG	Quizlet and the game energy city	Improved transferability of vocabulary

III. RESULTS

A. Distribution on a Year Base

The graph shows the number of studies conducted from 2010 to 2020. The total number of papers collected from open-access databases and journals is shown in the graph. The year 2012 is at the top of the list with nine research papers on computer-based vocabulary learning. The results show that the pedagogy of English language teaching has improved due to the development of computer technology. The year 2017 has six papers, and the years 2013, 2016, and 2017 have the same five publications each year. The years 2010, 2018, and 2020 have three publications per year. The less focused years for computer learning are 2014 and 2015, with two publications in each year. The year 2018 has the highest number of publications in 2014, whereas 2015 has the lowest number of publications.
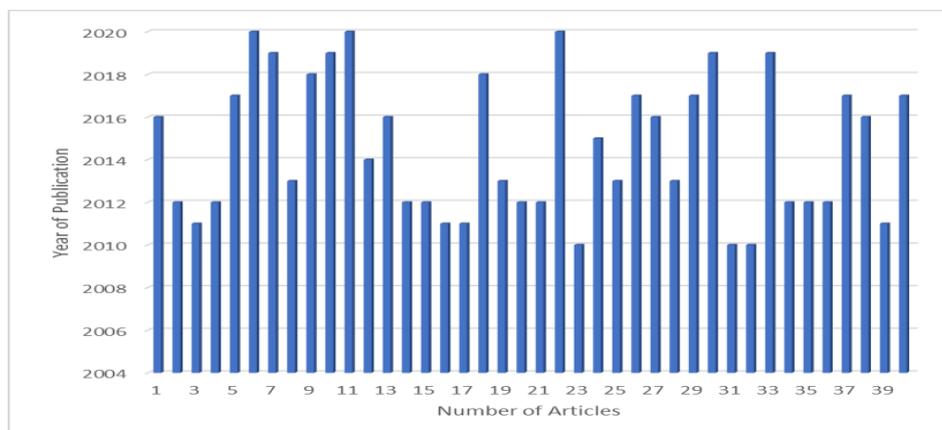

Figure 2. Distribution of Year of the Selected Papers

B. Educational Level of the Learners

The titles and abstracts of the articles were screened properly to determine the number of learners and the educational level of the learners used in the study. Figure 3, mentioned below, provides the educational segment mentioned in the

articles. The educational levels mentioned in the articles are undergraduates (35%), school (22%), intermediate level students (20%), postgraduate (5%), intermediate (5%), pre-intermediate (5%) and (8%) unclear educational levels mentioned in the articles. In a few articles, there is no specification of the educational level, qualifications, or the total number of students. The important point to be noted is that, in the American context, middle school or high school are mentioned as sub-levels. While outside the American context, secondary education covers the entire post-elementary level.
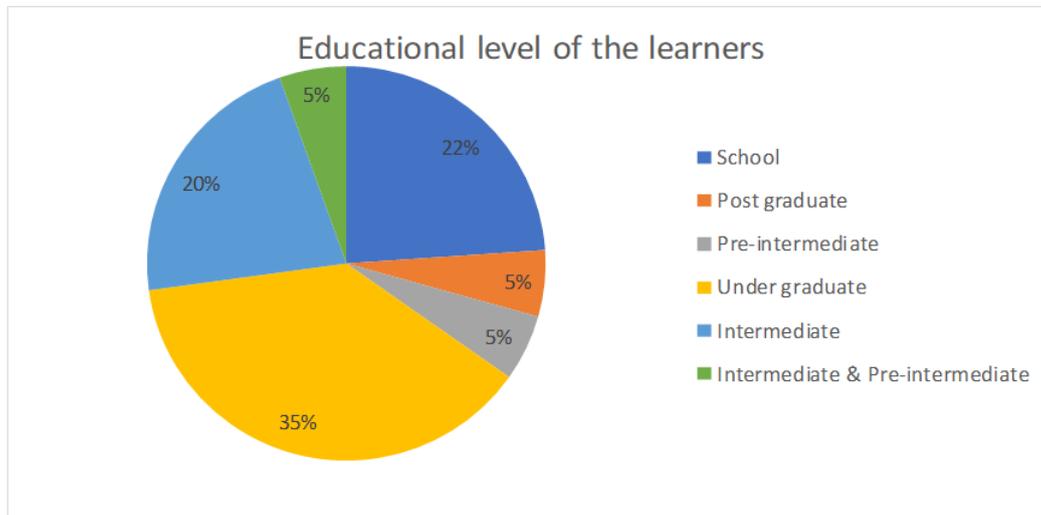

Figure 3. Educational Level of the Learners in the Selected Papers

C. Software Used in the Articles

The major trend found in assessing the articles on vocabulary learning and teaching is computer software, multimedia, and other instructions. The final sample included forty studies. The studies related to this subject published before 2010 or after 2020 were not included in this study. Of the total forty articles, the majority of nineteen were based on learning vocabulary with computer software. The participants of the studies were from middle school to postgraduate learners. Playschool students were not involved in learning with computer software. The words included in the software were mostly taken from the learners' syllabus or academic word lists. The learners were given prior information about the software before using it. This made the students learn new words using the computers. Numerous studies have been conducted in the areas of vocabulary acquisition and computers. Duolingo and rosette stone are computer-based software widely used in the process of teaching and learning. This systematic literature review gives insight into the computer software used in the articles to teach vocabulary. Among the nineteen articles (47%), two articles deal with the same computer software known as Quizlet. A digital flashcard, Quizlet, is used to teach second language vocabulary to lower-level students. According to Ashcroft et al. (2016), "The effect of using digital flashcards on L2 vocabulary learning compared to using paper flashcards at different levels of English proficiency" (p.14). Students with lower levels of proficiency outperformed intermediate students. This proves that digital flashcards are more beneficial than paper flashcards (Ozer & Zeynep Kocoglu, 2017). Quizlet is an online learning tool with game features. Using this game-based method in his experimental study, Franciosi (2017) proves that computers in foreign language classrooms benefit learners by learning vocabulary with transferability.

Multiple computer programs were used in the process of learning vocabulary. The researchers' interest in gaining knowledge through computer programs made them use a computer to learn new or unknown vocabulary. The software in the articles contained new words, synonyms, antonyms, definitions, and examples of the vocabulary. These articles were examined concerning the characteristics of the studies for meaningful processes and the practice of future research. In the criteria of multimedia in vocabulary learning, seventeen articles (43%) were selected. Learning with multimedia is learning words with text, animation, narration, and video. The multimedia study included reading stories, listening to the audio, writing on the computer or manual, and recording the audio spoken by the learners. Among the total number of articles, four (10%) were included in the website criteria. These articles were based on the vocabulary learned from the website and weblog. "What's up with the weather?" is an application of nine hundred and eighty words chosen from a website (Turk & Gulcan Ercetin, 2012), or a weblog to post comments and write reflective essays (Shams, 2013).
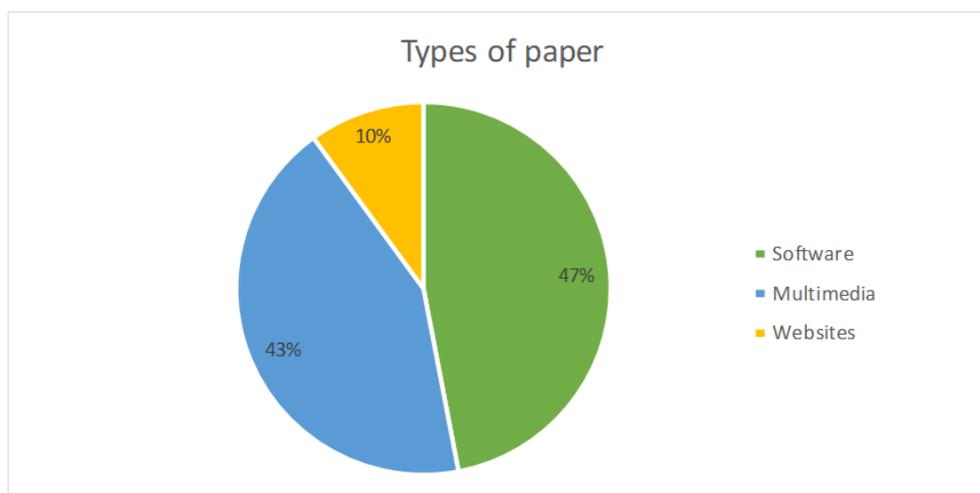
Figure 4: Types of Papers Used in the Study

IV. DATA ANALYSIS

The researcher analysed the data to show the mean differences between the numbers of selected articles. To provide details about the studies conducted in the field of computer-based English language teaching, data were presented in a tabular column. The experimental and control groups of the study were examined to find the mean difference. The value difference is listed in Table 2 to demonstrate the benefit of computers in English-speaking classrooms.

TABLE 2
DATA ANALYSIS

Study	Participants	Mean (CG)	Standard deviation (CG)	Mean (EG)	Standard deviation (EG)	Standard error differences
Enayati, F., & Gilakjani, (2020)	61	42.16	7.448	37.47	6.642	0.806
Kabooha & Elyas (2018)	100	31.3	9.2	46.5	8.6	0.6
Sato, T., & Suzuki, A. (2010)	24	0.504	0.067	0.519	0.057	0.01
Samur (2012)	22	4.00	1.000	6.91	1.514	-0.514
Jafar &Ghaedrahmat (2014)	61	11.3846	1.84015	16.2037	2.02987	-0.18972
Marpaung & Situmeang (2020)	30	73.80	17.697	70.83	16.968	0.729
Nejati, E., et al. (2018)	40	30.0667	3.69298	35.4667	3.13657	0.55641

V. DISCUSSION

A. Finding

This study has provided a systematic literature review of computer-based vocabulary learning at different educational levels. This research emphasizes vocabulary learning in a computer environment, knowing the depth of computer programs and their importance in academics. This can benefit the instructors who implement these strategies in schools, colleges, and for academic purposes. Overall, the results suggest that computer-based vocabulary instruction benefits students' growth in memory and greater performance at different educational levels. These findings provide evidence that learning with a computer could be an effective educational tool. This study concludes that most of the studies have post-tests and delayed post-tests to teach vocabulary among learners. Vocabulary learning is necessary for learning a second language and a foreign language (Coady & Huckin, 1997; Harley, 1996; Nation, 2001). Learning vocabulary is the biggest obstacle in learning the language. In language, words are used to convey meaning, and considering the importance of words, it is gaining attention in the field of research (Krashen, 1989). The results of this research also highlight that academic performance is high when CALL software and activities of vocabulary are implemented in language learning. By using the computer, learners become more engaged and participatory than in the traditional classroom.

B. Limitations

The research is limited to the selected articles from 2010-2020. The article's content analysis is limited to two research questions. Using multiple databases to collect the articles managed to gain sustainable results in finding the articles. The area covered in the articles does not cover all languages, all fields of computer use, or all journals. It is limited to the English language and computer-based vocabulary learning. Hence, the study has limitations in finding comprehensive article searching procedures and analysis in writing this systematic literature review.

VI. CONCLUSION

The study highlights the benefits of computers in English-language classrooms. The research has implications for future studies and analysis in English language learning. The study identifies the numerous computer tools and activities that are successful in a teaching environment. However, the use of computers is crucial for creating a successful learning atmosphere. The research explains the benefits of using computer-based activities and tools in English vocabulary learning. Based on the data analysis of the papers, this article suggests that vocabulary learning is more effective with the use of computers in English language classrooms.

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