A Microlearning ESP Program to Develop University Students' Vocabulary and Reduce their Cognitive Load

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Abstract

This research aimed at examining the effect of a proposed microlearning-based ESP program on developing vocabulary and reducing the cognitive load of university students. The quasi-experimental design was adopted using (60) students enrolled in level two (first year) at the Faculty of Fine Arts, Mansoura University. The participants were divided into two groups: an experimental group studied through the microlearning ESP program, which was designed according to the ADDIE model, and a control group received regular instruction. A needs analysis questionnaire was administered to the Fine Arts students, and it was revealed that vocabulary is a main requirement for them since it affects their speaking and writing performance. Other instruments designed and used were a standards checklist for microlearning design, a vocabulary test, and a cognitive load scale. The results indicated that experimental group students outperformed their counterparts of the control group in vocabulary learning. Besides, the cognitive load post-level of the experimental group was reduced compared to their pre-level and to the control group's post-cognitive load level as well. Accordingly, the microlearning ESP program proved its positive effect on developing vocabulary learning and reducing the cognitive load of students at the Faculty of Fine Arts.

Keywords: ESP, vocabulary, cognitive load, microlearning.

برنامج فى اللغة الإنجليزية للأغراض الخاصة قائم على التعلم المصغر لتنمية المفردات وخفض العبء المعرفى لدى طلاب الجامعة

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كلية التربية- جامعة المنصورة

المستخلص

هدف البحث إلى قياس أثر برنامج فى اللغة الإنجليزية للأغراض الخاصة قائم على التعلم المصغر فى تنمية المفردات وخفض العبء المعرفى لدى طلاب الجامعة، وتبنى البحث المنهج شبه التجيريبى باستخدام عينة (60) من طلاب المستوى الثانى بكلية الفنون الجميلة، جامعة المنصورة،وتم تقسيم الطلاب إلى مجموعتين: مجموعة ضابطة درست باستخدام التدريس المعتاد، ومجموعة تجريبية درست من خلال البرنامج المقترح القائم على التعلم المصغر، والذى تم تصميمه فى ضوء خطوات نموذج ADDIE، حيث تم تصميم وتطبيق استمارة لتحليل احتياجات الطلاب فى تعلم اللغة الإنجليزية، وقد تبين انهم فى حاجة ماسة لتنمية مفردات اللغة لما لها من أثر كبير فى اداؤهم الشفهى والكتابى، وتم استخدام وتطبيق عدد من الأدوات وهى قائمة بمعايير تصميم التعلم المصغر، واختبار مفردات، ومقياس العبء المعرفى، وقد أكدت النتائج تفوق طلاب المجموعة التجريبية على أقرانهم من طلاب المجموعة الضابطة فى تعلم المفردات، وأثبتت النتائج ايضا انخفاض المستوى البعدى لطلاب المجموعة التجريبية فى العبء المعرفى مقارنة بمستواهم القبلى وأيضا بمستوى المجموعة الضابطة البعدى، وبالتالى فقد تأكد الأثر الايجابى للبرنامج المقترح فى اللغة الإنجليزية للأغراض الخاصة القائم على التعلم المصغر فى تنمية تعلم المفردات وخفض العبء المعرفى لدى طلاب كلية الفنون الجميلة.

الكلمات المفتاحية: اللغة الإنجليزية للأغراض الخاصة، المفردات، العبء المعرفى، التعلم المصغر

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Introduction

English has become the international language of business and communication, which reflects the importance of improving all the language skills for those whose objective is to have a good mastery of English. Different aspirational educational reforms have been established to deeply incorporate English into curricula for providing students with the linguistic abilities required all over the world. Teaching English, particularly at the university level, has become an essential priority through creating English courses that cater to the diverse demands of students with varied specialties. This is known as English for specific purposes, or simply (ESP). The major goal of ESP is to design appropriate courses or programs for various learners whose target is to be able to use English in communicating with others in the professional field as well as in real-life situations.

In the last few decades, English for Specific Purposes (ESP) has become one of the most significant subfields of English for Speakers of Other Languages (ESOL). In Egypt, ESP courses are commonly offered in both public and private universities. Teaching vocabulary in the ESP context is considered a major part of English language teaching at the university level. Having rich vocabulary enables the students to communicate and express themselves easily. Vocabulary is not a target in itself; however, rich vocabulary makes the skills of writing, reading, listening, and speaking much easier to perform; thus, it is a solid foundation upon which to build the overall language proficiency. Donesch-Jezo (2014) supported this, indicating that students usually want to expand the amount of vocabulary in their memory since it is the best measure of their language competence. All ESP course syllabi should demonstrate how words join and function both grammatically and semantically, as well as identify which words should be used in various situations.

Designing ESP courses or programs is undergoing a rapid transformation into new learning and teaching environments that are highly flexible, configurable, and collaborative. There are various technologies that could support such an environment for helping ESP college students improve their academic and study skills. Tan (2017)

indicated that since the amount of time allotted for obligatory classes is restricted and the task must be completed in a short time; and since college students need repeated practice to grasp the English language skills well, microlearning is highly recommended for properly meeting that requirement of ESP teaching.

Microlearning is a short, small, fine, and powerful teaching approach. Short means that the teaching/learning activity lasts a short time from 5 to20 minutes; small implies that the capacity and the topic addressed is small; fine implies that the activities are outstanding, and the content is carefully chosen; and powerful means the teaching resources and materials are broadly applicable and there is excellent interaction between teachers and students. Shao (2015) also stated that microlearning has visual and auditory stimulation and is more interesting than traditional teaching. Microlearning can attract students' interests greatly and facilitate the improvement of memory efficiency. Listening, speaking, and watching is practiced easily, which leads to enhancing students' language. All of this can also help reduce college students' cognitive overload since their memory capacity and attention span is considered and the content is delivered in meaningful short chunks.

Accordingly, the current research sought investigating the effect of a proposed microlearning-based ESP program to develop vocabulary learning and reduce the cognitive load of university students.

Review of related literature

ESP

ELT can be categorized into ESP and EGP (Hutchinson &Waters, 1987). ESP is a broad term that describes the teaching of English to students who are learning the language for a specific work- or study-related reason. ESP has always focused on needs analysis, as well as teaching students how to communicate effectively in the task required by their academic context (Dudley-Evans & St. John, 1998). This definition of ESP is supported by Zaher et al. (2020) who distinguished between EGP and ESP indicating that EGP does not rely on a specific context of language and is taught for students in schools to enable them to use English in their daily life. ESP, on the other hand, focuses on the language needs that the learners will use in their academic or professional working environment.

Along the same lines, Zukhriddin & Kizi (2022) concluded that ESP can be considered as a specialized version of EGP that incorporates practical linguistic abilities to prepare students for the successful

performance of professional tasks. However, EGP offers core English language knowledge and skills at the school level in which students' occupational/professional interests are not clearly determined. Unlike EGP, the starting point for curriculum design in an ESP context is an analysis of learners' needs rather than a linguistic analysis. Needs analysis is a learner-centered approach that allows teachers to get insights into students' interests and objectives. Thus, the learning goals are more obvious than those of general ESL/EFL courses.

Needs analysis is regarded as the cornerstone of ESP. The concept of needs analysis has changed a lot over time. At the beginning of ESP (the 1960s and early 1970s), it focused on determining learners' communicative needs and the methods for reaching the target specific teaching goals. Nowadays, the task of needs analysis is more complicated; it also tries to collect data about the learners and define the target situation and the ESP learning environment (Otilia, 2015). Moreover, Axmedovna, et al. (2019) indicated that needs analysis is a crucial initial phase that assists in identifying learners' needs and interests. Additionally, it assesses their language background and preferences for a successful and effective course design.

Needs analysis is also deemed as the process of collecting the basic information and the specific requirements to meet the goals of ESP. It addresses the teaching approach, methodology and strategies, material design, topics, and language features. Having the results of needs analysis, the teachers are able to analyze and assess their ESP classes; thus, the institution and the teachers can determine what should be implemented and improved, and what should be not (Nimasari, 2018).

Several research was conducted on needs analysis and its significance as the initial phase in ESP design. For example, Kazar & Mede (2014) conducted a study to assess the target needs of the students engaged in an ESP program provided by the Faculty of Fine Arts in Turkey. Instruments of the study included the use of a pre-needs analysis questionnaire, and a semi-structured interview for measuring the perceptions of the participants' target needs. The results showed that the ESP program should emphasize the efficient application of language strategies in the assigned activities like enhancing presentation skills, acquiring key vocabulary, writing email messages, and reading academic materials.

In addition, Axmedovna, et al. (2019) analyzed university students' needs in the field of law to identify their wants, needs and lacks prior to preparing an ESP course. A needs analysis questionnaire was designed and administered to fulfill the purpose of the research. Analyzing the

acquired data indicated that almost all of the students are willing to take this course since they need English in their sphere and for their future job. Obviously, all of them have certain difficulties in their writing and speaking; particularly, in terms of using proper words, writing accurately, fluency and using a variety of words.

Furthermore, Sari (2019) examined the difficulties of learning English for students enrolled in an informatics study program. This research employed a descriptive analysis method with a qualitative approach using questionnaires for obtaining the required data. Findings revealed that the students' main difficulties are limited vocabulary and insufficient understanding of grammar.

Sukarni (2022) also aimed to find out the English teaching materials needed for Fine Arts students. Administering questionnaires for data collection led to revealing that all the language skills are needed for the target students, and the mostly needed language skill is speaking. Regarding the language components, vocabulary is mainly required by the students and internet-based teaching materials are also highly needed.

In Egypt, interest in ESP increased during the 1990's, since ESP centers have been established at various Egyptian institutions (e.g., Ain Shams, Alexandria, Mansoura, etc.), which supported the advancement of intensive research in the field. A study was conducted to assess the attitudes and motivations of ESP learners in different academic years at Mansoura University. Findings indicated that students' attitudes toward their ESP classes are generally positive. However, a number of issues, including irrelevant course material, difficult timetables, lack of technology use, inappropriate teaching techniques, and poor learning environment, have a negative impact on their attitudes (Ali, 2014).

Besides, Shaalan (2020) examined students' academic and professional needs, wants, and lacks in order to design a course that fulfills and meets their needs at the Dentistry College, Al-Azhar University. A quantitative methodology was used where a dental vocabulary pre-post-test and interviews were administered to collect data. The findings indicated the effectiveness of the ESP project-based course to improve learners' dental vocabulary. It was also recommended that using innovative approaches in the vocabulary courses would enhance learners' ability to be creative, independent, and problem solvers.

Based on what has been previously mentioned, it can be inferred that English, at the international level, is the language of communication in fields of science, technology, medicine, industry, arts, etc. ESP, accordingly, deals specifically with English used in these different

professional areas. Its importance has increased exponentially over the past decades worldwide, and particularly in Egypt. Previous research, based on analyzing the needs of ESP learners of different fields of study, proved that vocabulary is a highly significant element of ESP learning; and deficiency in vocabulary knowledge adversely affects the development of the other language skills. Therefore, developing vocabulary learning is deemed as the major goal of the current research.

Vocabulary

One of the most difficult and important aspects of language learning is vocabulary due to being essential for effective and useful communication (Al-Khresheh & Al-Ruwaili, 2020). Hinkel (2015) stated that vocabulary is vital in every aspect, from writing and reading to speaking and listening. Learners' vocabulary will dictate their success or failure in learning a particular language. With a larger vocabulary, a person will be able to understand more of what s/he reads or hears, which, in turn, helps him/her use vocabulary during spoken or written communication. On the contrary, the social interactions, engagement in academic learning routines, understanding as part of reading instruction, and comprehension as part of content area instruction are at least four areas in which learners' performance may be hampered by a low knowledge of English vocabulary.

Linguistically, vocabulary is words as well as their lexical meaning, context, pronunciation, spelling, and conjugation. The challenge of learning and remembering vocabulary has traditionally been argued to be the greatest among these elements. Consequently, vocabulary learning and teaching have been crucial for language acquisition in many disciplines of study for both teachers and students, especially ESP vocabulary, since vocabulary changed from a supporting function to a major one (Dennison, 2014; Chirobocea-Tudor, 2018).

ESP vocabulary plays a dominant role in ESP courses and their accompanying ESP materials, since learners need technical or specialized words to comprehend and explain the ESP subject matter (Duong, 2022). ESP vocabulary can be referred to in the literature as special purpose, specialized, technical, sub -technical, and semi -technical vocabulary. In essence, such terms usually refer to the vocabulary of a particular area of study or professional use (Coxhead, 2013).

Hence, it is important to distinguish between two categories: technical and semi-technical vocabulary because they are very essential to learners studying English for specific and academic purposes. Semi-technical vocabulary is used in general language but has a higher frequency of

occurrence in specific and technical descriptions and discussions; while technical or academic vocabulary has specialized and restricted meanings in certain disciplines and may differ in meaning across disciplines (Dudley-Evans & St. John, 1998). Both technical and semi-technical vocabulary should be given priority in ESP teaching because learners need to master various academic skills like reading research in a specific academic field, listening to teachers' lecture, writing academic papers and discussing or presenting their own ideas or research (Dudley-Evans & St. John, 1998 and Brooks, 2014).

For enhancing the skill of learning new ESP vocabulary, research has been conducted to identify how effective various strategies and approaches are in improving vocabulary learning. Nwokolo (2020), for example, attempted to determine the possible strategies for teaching ESP vocabulary in Nigeria. It was proven that in order to ensure a fruitful learning process, vocabulary instruction should take place in clearly defined, innovative contexts. The teaching materials used should also be carefully selected by the language instructor, whose responsibility is to facilitate learning by establishing suitable learning environments, introducing the target vocabulary and linguistic structures, and guiding the students as they practice using the target words.

Openness to technology and the use of smartphones may offer diversity to the ESP classroom and make it more relevant to the students' world. New technology can successfully enhance the achievement of one of the main objectives of ESP which is acquiring specialized vocabulary. (Chirobocea-Tudor, 2018). Consistently, Li, Ying, Chen & Guan (2022) examined the use of virtual reality (VR) as an innovative means for improving incidental vocabulary learning and promoting students' learning engagement and performance. The findings demonstrated that the experiential learning-based VR was effective and enjoyable, and led to enhancing geography students' incidental vocabulary acquisition and engagement.

To sum up, ESP vocabulary is of great importance for students if they are to improve their communication skills in general or in discipline -specific contexts. If inappropriate methodologies are adopted for teaching/learning ESP vocabulary, this will hinder students' vocabulary learning and, in turn, will add to their cognitive overload. Thus, selecting an appropriate approach, which is highly recommended to be technology-based, would successfully enhance the development of students' vocabulary, and reduce their cognitive overload.

Cognitive Load

Cognitive load refers to the amount of information the working memory can hold at any given time (Loveless, 2023). The cognitive load theory assumes that humans have a limited working memory capacity; whereas the long-term memory that contains chunks of information, called by schemas, is unlimited. Schemata are supposed to be abstracted in the working memory and may be automatized due to practice. These schemata are the source of human knowledge, yet the working memory is not capable of processing numerous elements at once. Accordingly, the core principle of the cognitive load theory is that processing instructional information leads to cognitive load which is placed in the working memory and influences the learning outputs (Sweller, 1988 & Peter, Katharina & Gabriele, 2009).

In the learning process, to enhance learners' academic performance and learning quality, the limited working memory should be fully used, and the irrelevant cognitive load should be reduced as much as possible since cognitive overload can affect the academic performance and will result in a series of negative impacts (Zhang, 2013). Cognitive load theory identifies three different types of cognitive load: intrinsic, extraneous, and germane load. The three types are generally assumed to be additive– (that is, intrinsic load + extraneous load + germane load = total cognitive load). Cognitive overload occurs when the total cognitive load exceeds the working memory capacity of the learner (Sweller, 2010).

Sweller (1994, 2010), Zhang (2013) and Center for Education Statistics and Evaluation (2018) clarified the distinction between these types illustrating that intrinsic cognitive load relates to the inherent difficulty of the subject matter being learnt; this type is affected by the difficulty of the material, and the learner's background knowledge. Extraneous cognitive load refers to how the subject matter is taught. The material and environment affect this type since poorly constructed materials and busy classroom environments can lead to the split-attention effect and add to extraneous cognitive load. In contrast to these two types, the germane cognitive load is considered the good type where the working memory links new ideas with information in the long-term memory. It relates to the load imposed on the working memory by the process of learning, or the process of transmitting information into the long-term memory through schema construction. It is the good type of cognitive load where the working memory connects new ideas with information in the long-term memory.

Cognitive overload occurs when students are given more information or tasks to complete than they can handle. It can also happen

during face-to-face classes but has a higher possibility of emerging in online learning due to the challenges associated with processing a foreign language while participating in an online course (Warrick, 2021). Cognitive overload is considered a concern in foreign language instruction. Language learners must make a conscious effort to listen to and speak in a foreign language, which requires them to employ more cognitive processes for understanding a sentence than they would if it were in their mother language (Sweller, 2017).

The Center for Education Statistics and Evaluation (2017 and 2018) illustrated that the cognitive load theory has provided valuable insights for the instructional techniques that are directly applicable to the classroom. They are described as follows:

- The worked example effect: learners who are given worked examples, for explaining every task clearly, perform better on subsequent tests than learners who are required to solve the equivalent tasks themselves.
- The expertise reversal effect: this supports the gradual integration of more independent problem-solving activities as learners gain experience.
- The redundancy effect: requiring learners to process redundant information hinders learning because it overloads working memory; thus, the cognitive load theory recommends filtering learning material from redundancy.
- The split attention effect: this can be eliminated by physically integrating separate sources of information so that they do not have to be mentally integrated by the students.
- The modality effect: this is connected to the split attention effect but offers a different way to lessen the cognitive load than physically integrating separate sources of information. Instead, combining multiple modes of communication—both visual and auditory—can reduce the unnecessary load on the working memory.

Cognitive overload and the tension it causes are considered significant hindrance to effective vocabulary learning and retention. Thus, well-designed mobile micro-courses are suggested in order to decrease the extraneous cognitive load and foster the germane load while ensuring that the total cognitive load does not exceed what learners can tolerate. Microlearning employs the principles of the cognitive load theory since it can reduce the total cognitive load by excluding irrelevant information or purposefully organizing information into schemas. Information can be

integrated (i.e., text and visual together) so the brain can view them as one chunk; or they can form schemas by attaching meaning to each chunk.

Microlearning

The rapid advancement of modern information technology has prompted the use of microlearning, where teachers must define learners' actual needs and use innovative techniques to provide the content in the form of micro-learning. This learning mode enables learners to independently identify their learning time, place, and contents based on their own real situation. At the same time, teachers and learners can stay in touch by communicating and discussing with each other if there are any problems and difficulties; this encourages learners to take initiative while also expanding their horizons and enhancing their skills without adding to their workload (Zhou, 2021).

The term "micro-learning" was originally used in 2005 by Research Studios Austria, where its essence was described as "learning in small steps". Microlearning refers to an educational approach that offers bite-sized, small learning units where larger chunks of information are broken into smaller, more manageable pieces. This "less is more" approach provides students with experiences that optimize learning by making materials more manageable, more desirable, and more engaging (Gutierrez, 2018). It is all about getting e-learning in small doses, as tiny bursts of training material and activities that can be comprehended in a short time (Kamilali and Sofianopoulou, 2015 & Jomah, et al., 2016). Microlearning is totally different from micro-teaching, which is a teacher training technique used in most pre-service teacher education programs for learning teaching skills. Micro-teaching employs real teaching situations for developing skills and helps to get deeper knowledge regarding the art of teaching (Remesh, 2013).

Microlearning is an approach to learning design that filters out materials that are irrelevant or redundant. This leads to reducing the cognitive overload and the overcrowding of the working-memory with unnecessary information. Focusing on narrowly defined "chunks" of essential information makes it easier for remembering and understanding, which increases the chance that knowledge is deeply understood and applied (Kapp and Defelice, 2019 & Leary et al., 2020). Microlearning is created mainly to adapt to the limits of the human brain regarding its attention span and to reduce the cognitive load, resulting in effective students' learning (Wang, Luo & Qu, 2017). In the same vein, Susilana et al. (2022) indicated that microlearning is useful for reducing students'

useless cognitive load while fostering productive cognitive load; thus, their learning outcomes are nearly exceptional.

Hug (2010) and Shah, et al. (2019) supported the incorporation of mobile devices to create microlearning environments for a variety of reasons, including: (1) content is typically a customizable audio-visual microcontent, (2) attention span and time periods are fairly short, (3) mobile devices enable the design of micro-steps in formal and informal learning contexts, (5) the microlearning environment is mobile, flexible and social, and (6) mobile devices are often associated with micro platforms.

In this concern, Jahnke, Lee, Pham, He & Austin (2020) illustrated that the microlearning activities should meet the following criteria: (a) they should be practical and interactive; (b) they should be "snackable," meaning that students should be able to finish them whenever it is convenient and in a short time; (c) they should include multimedia content; (d) they should provide immediate formative feedback; and (e) finally, they should be accessible on a variety of devices and operating systems.

Redondo, Rodr´ıguez, Escobar and Vilas (2020) & Ghafar, et al. (2023) indicated that microlearning emerges as a suitable solution as it is based on breaking down new concepts into small fragments or pills of content, which can be consumed in short periods of time. Micro-content focuses entirely on the transfer of relevant information, with the use of visual interactive elements, decreasing the likelihood that the learner would tune out or leave the training. Teachers also can easily update materials according to the target learning goals. The micro-lessons are flexible enough to support different learning styles and may be adapted to each learner's needs. Unfortunately, it was revealed that micro-learning is not an appropriate approach for teaching complex, abstract concepts that require the integration of interdisciplinary knowledge; however, micro-learning is an outstanding option for simple, rote learning, which can be either incorporated with more complicated training or for the acquisition of fundamental skills. It was also detected that university lectures provide a supportive environment for the adoption of this novel approach because of its potential to enhance learners' motivation and engagement as well as retention levels.

The microlearning approach depends on employing video games, podcasts, blog spots, wiki-pages; or short messages on networks such as Twitter or Facebook. The social features of such techniques have led to the quick spread of microlearning and the reinforcement of the learning

task (Bruck, Motiwalla & Foerster, 2012; Redondo, Rodríguez, Escobar & Vilas, 2020; and Ghafar, et al., 2023). Since microlearning overcomes the problems of short class periods and the existence of too many students in a class, Meng & Wang (2016) stated that microlearning is very effective when applied in college English courses, indicating that if learners have access to relatively few learning units, they may study whenever, wherever, and for a short time through this teaching approach. Microlearning can enhance the improvement of students' overall English skills as well as their ability for autonomous learning. Consistently, Fang (2018) emphasized that microlearning may be helpful in college English instruction due to the considerable quantity of English input students get.

Regarding the significance of microlearning application in college instruction, Kossen and Ooi (2021) reported on the efficacy of its design principles when experimented in an Australian and a Malaysian university to create accessible and attractive online courses with the aim of increasing student success. Microlearning design has been implemented in some courses by creating bite-sized materials. The courses included micro-lectures and short lecturer videos which aim at assisting learners to comprehend the content more effectively. Findings revealed that the first trial which included delivering shorter duration lessons was a useful way to make the learning materials more manageable and engaging and thus, supporting the potential of microlearning design in reducing cognitive overload and stress. Further, the second trial based on delivering learning as an audiovisual experience led to successfully making the content more interesting for students and stimulating their interest and engagement.

Besides, Wang & Gong (2023) aimed at speeding up the process of English vocabulary mobile microlearning design to enhance the efficacy of students' learning English. It was found that microlearning is crucial for learners to efficiently learn English, to have a rich vocabulary, and to master different grammatical structures. The English vocabulary mobile microlearning system should be gradually applied to colleges and universities. Gorham, Majumdar & Ogata (2023) also evaluated how an asynchronous microlearning app might develop students' skills for providing peer feedback on EFL spoken content. This study adopted a quasi-experimental single-group pre-post- research design. Findings indicated that the proposed app offered scaffolded support that led to the development of students' peer feedback skills on spoken content.

Microlearning can be delivered and made accessible through various mobile applications. WeChat mobile application is one of the tools that is appropriate for delivering microlearning due to its features

and functions that make it applicable to college English teaching. Yan (2019) indicated that it allows the students to study English in small chunks, gives them flexibility to communicate and converse with other students and teachers, boosts their enthusiasm for writing, enriches the learning resources, and cultivates their capacity for self-reflection and autonomous study. WeChat also supports students' sense of teamwork, initiative, creative writing, and critical thinking by encouraging student-student and student-teacher collaboration and interaction.

Namaziandost, et al. (2021) assessed the impact of WeChat application on developing Iranian EFL learners' vocabulary knowledge. Findings revealed that WeChat could foster autonomous learning since it assisted learners to review class content and share thoughts effectively. The Moments threads and posts enriched WeChat with varied language materials which could provide students with a variety of linguistic input to meet their different interests and needs. The effectiveness of using WeChat on developing Iranian EFL learners' vocabulary knowledge was indicated as WeChat facilitated the creation of a friendly and comfortable communication context for the learners as well as a platform for language practice and application.

In light of the previously mentioned review of literature, it can be concluded that the mastery of English language vocabulary is important for ESP learners; and it is very important for them to build a consistent body of vocabulary that is specific and frequently used in their field of study. Yet, teaching vocabulary, especially in ESP courses, is turning into a challenge for English language teachers. Vocabulary is an integral part of any English teaching course, and it should be taught on a regular basis following proper design. In addition, careful selection of what vocabulary will be picked for teaching, and what approach or activities will be employed to teach it should be a major priority. Adopting improper approaches to teaching ESP vocabulary might lead to increasing learners' cognitive overload. Microlearning has been recommended for implementation to develop ESP vocabulary learning in the most efficient and effective way possible through short pieces of content. Therefore, the current research assessed the effect of designing and using a proposed microlearning ESP program on developing university students' vocabulary learning and reducing their cognitive load.

Context of the problem

Most Egyptian undergraduate students are required to register in ESP classes. Vocabulary knowledge is deemed as an essential element in ESP courses not only for enhancing oral communication skills, but also

for improving the four language skills: listening, speaking, reading, and writing. The previous literature review indicated that ESP students often struggle with vocabulary acquisition, and they encounter different problems due to their lack of vocabulary knowledge in workplace settings. It was also indicated by previous research (e.g., Kazar & Mede, 2014 and Sukarni, 2022) that vocabulary is highly required, especially for Fine Arts students, since they need to master specialized words to be used in speaking and writing about their works of art.

Furthermore, such a conclusion regarding the significance of developing vocabulary was also supported by the researcher's teaching experience with students at the Faculty of Fine Arts, which led to deducing that those students encounter problems related to learning vocabulary and that the methods used in teaching them add to their learning overload.

Statement of the problem

According to what was previously indicated, the research problem was stated as:

"Students at the Faculty of Fine Arts need to develop their vocabulary learning in addition to their need to learn in a mode that reduces their cognitive load". Thus, the current research attempted to investigate the effect of a proposed microlearning ESP program on developing those students' vocabulary and reducing their cognitive load.

Questions

The current research attempted to answer the following questions:

1. What are the standards of designing a proposed microlearning ESP program?
2. What are the features of the proposed microlearning ESP program for developing university students' vocabulary and reducing their cognitive load?
3. What is the effect of the proposed microlearning ESP program on developing university students' vocabulary?
4. What is the effect of the proposed microlearning ESP program on reducing university students' cognitive load?

Purpose

The main purpose of the research was examining the effect of a proposed microlearning ESP program on developing vocabulary learning and reducing the cognitive load of the second level students at the Faculty of Fine arts.

Delimitations

The research delimitations were as follows:

1. A group of university students (N = 60) enrolled in level two (first year) at the Faculty of Fine Arts, Mansoura University, in the first semester of the academic year 2022-2023.
2. Vocabulary (technical and semi-technical) required for positively affecting students' communication as well as their overall language skills.

Operational definition of terms

ESP (English for Specific Purposes)

ESP is an active sub-field of Applied Linguistics in general, and of Teaching English as a Foreign Language (TEFL) in particular. It refers to teaching English to university students or individuals already in employment; with reference to the vocabulary and skills they need. An ESP course or program focuses on one occupation or profession, such as technical English, scientific English, medical English, English for tourism, English for fine or applied arts and so on. This research focuses on the vocabulary required in the field of Fine Arts.

Vocabulary

Linguistically, vocabulary is words as well as their lexical meaning, context, pronunciation, spelling, and conjugation. ESP vocabulary in the current research refers to the technical and semi-technical words necessary for communication and comprehension in the field of Fine Arts. Technical or academic vocabulary has specialized Arts-based meanings, while semi-technical vocabulary is used in general communication but has a higher frequency of occurrence in Fine Arts.

Cognitive Load

Cognitive load refers to the amount of information the working memory can process at any given time. The cognitive load theory offers recommendations for avoiding overloading learners with more than they can efficiently process into schemas for long-term memory storage and future recall.

Microlearning

Microlearning, known as bite-sized learning, is an instructional approach designed to deliver the learning content in small, focused, and easily digestible micromodules which are introduced on a regular short-term basis (15-20 minutes) and drilled through ESP vocabulary-based activities. Microlearning employs various interactive materials, such as video clips, quizzes, gamified activities, and mini assessments to improve

engagement and facilitate learning. Microlearning is delivered through WeChat application which is a mobile messaging app and a social media platform. Group video calls, Moments timeline, voice messaging, WeChat channels are examples of the features utilized for delivering the microcontent.

Hypotheses:

The present study tested the following hypotheses:

1. There is a statistically significant difference at 0.05 level between the mean score of the control and the experimental groups in the post administration of the vocabulary test in favor of the experimental group.
2. There is a statistically significant difference at 0.05 level between the mean score of the experimental group pre-post administrations of the vocabulary test in favor of the post administration.
3. There is a statistically significant difference at 0.05 level between the mean score of the control and the experimental groups in the post administration of the cognitive load scale in favor of the experimental group.
4. There is a statistically significant difference at 0.05 level between the mean score of the experimental group pre-post administrations of the cognitive load scale in favor of the post administration.
5. There is a negative correlation between students' vocabulary learning and reducing their cognitive load.

Method of the research

Participants

The target participants were (60) university students (N=60) enrolled in level two (first year) at the Faculty of Fine Arts, Mansoura University. They were divided equally into two groups: an experimental group studied through the proposed microlearning ESP program, and a control group studied through the regular instruction. Both groups received the pre- and post-administrations of the vocabulary test and the cognitive load scale.

Design

The research adopted the quasi-experimental approach using a pre-post administration to two independent groups design to examine the effect of a proposed microlearning ESP program on developing vocabulary learning and reducing the cognitive load of the second level students at the Faculty of Fine arts.

Instruments

The following instruments were designed and used to achieve the purpose of the current research:

A. A standards checklist for designing the microlearning ESP program
B. A vocabulary learning test
C. A cognitive load scale

A detailed illustration of each one of these instruments is presented in the following section.

A. The standards checklist for microlearning design

For designing the proposed microlearning ESP program, some standards and indicators were adapted and developed based on reviewing literature that addressed designing microlearning. The checklist was presented to some specialists in methodology & curriculum design and educational technology to evaluate its appropriateness and validity. The final form of the checklist (appendix A) included forty indicators categorized in the following eight main standards:

1. The learners are the central basis of the microlearning design process.
2. A single objective is addressed in each micromodule.
3. The content of the microlearning modules is simple and concise.
4. Microlearning uses a variety of formats.
5. The microlearning modules are interactive.
6. Microlearning is accessible, flexible, and responsive.
7. Microlearning modules follow an easy navigation structure.
8. Micro-assessment is employed in microlearning.

B. The vocabulary learning test

The vocabulary test was designed for: identifying the homogeneity level of the control and experimental groups and determining the participants' pre-and post-vocabulary levels; thus, assessing the effect of the proposed microlearning ESP program on developing university students' vocabulary. The vocabulary test consisted of 35 items or questions which were carefully specified and stated to ensure that various and different words (technical and semi-technical) are addressed and measured. It was also important to ensure that the lexis or vocabulary used adapts to the target participants' language level; and that the instructions of the test are explicit and clear.

To establish the validity of the test, it was given to some specialists in TEFL to assess the questions according to covering different vocabulary, suitability to the participants and clarity of the language used. Most of the jury comments indicated that the test items are varied, and they properly measure students' level of vocabulary learning.

The internal consistency and reliability of the vocabulary test were estimated through the test pilot administration conducted to (30) students (level 2), at Mansoura Faculty of Fine Arts, other than the main participants of the study.

Firstly, the discriminant validity of the vocabulary test was estimated through comparing the students with high scores and those with low scores using Mann–Whitney (U) test. Results are illustrated in table (1).

Table 1

Comparing the mean scores of the upper and lower quartiles of the vocabulary test

Variable	Groups	N	Mean ranks	Total ranks	U	Z	Sig. level
Vocabulary	Upper quartile	8	12.5	100	0	3.401	0.01
	Lower quartile	8	4.5	36			

Table (1) shows that there is a statistically significant difference between the upper and lower quartiles or between students with high scores and those with low scores, which supports the validity of the test in discriminating between students.

Secondly, the reliability of the test was also estimated by getting the value of Cronbach Alpha (α) which was 0.753. Thus, the reliability of the test was established, and it can be administered as one of the research tools. Appendix (B) presents the final version of the test.

The test time was also estimated by calculating the total time taken by all the pilot participants to complete the test and dividing it by their number (30). The mean time was, then, obtained as 900/30= 30 minutes (+5 minutes for test instructions). Thus, it was found that (35) minutes would be considered an appropriate time for the students to answer the test.

C. The cognitive load scale

The cognitive load scale was designed for assessing the Fine Arts students' level of cognitive load before and after implementing the microlearning-based treatment. The scale included thirty items addressing the three main types of cognitive load as follows:

- Intrinsic cognitive load: statements from 1 to 10

- Extrinsic cognitive load: statements from 11 to 22
- Germane cognitive load: statements from 23 to 30

For supporting objectivity, the scale included the use of positive and negative statements in each cognitive load type. A 5-point Likert scale (① strongly disagree, ② disagree, ③ neutral, ④ agree, and ⑤ strongly agree) was used to reflect students' points of view. To evaluate the validity of the scale, it was submitted to a number of TEFL and psychology specialists to assess the statements of the scale in the light of clarity and appropriateness. The jury members expressed their opinions, which showed that the scale is understandable and suitable for evaluating students' cognitive load when learning ESP vocabulary.

The scale's internal consistency and reliability were further evaluated by administering it to a pilot sample of thirty students enrolled in the second level at the Faculty of Fine Arts.

Firstly, the discriminant validity of the cognitive load was estimated through using Mann–Whitney U test as shown in table (2).

Table 2

Comparing the mean scores of the upper and lower quartiles of the cognitive load scale

Variable	Groups	N	Mean ranks	Total ranks	U	Z	Sig. level
Cognitive load	Upper quartile	8	12.5	100	0	3.391	0.01
	Lower quartile	8	4.5	36			

Table (2) illustrates that there is a statistically significant difference between the upper and lower quartiles or between students with high scores and those with low scores, which reflects the validity of the scale to discriminate between students.

Secondly, the internal consistency was estimated by calculating the correlation coefficient between the score of each statement and the total score of the cognitive load type to which it belongs; the results are illustrated in table (3).

Table 3

The correlation between the score of each statement and total score of the related type of cognitive load

Dimensions	NO	Correlation Coefficient	Dimensions	NO	Correlation Coefficient	Dimensions	NO	Correlation Coefficient
Intrinsic CL	1	0.852**	Extrinsic CL	11	0.858**	Extrinsic CL	21	0.659**
	2	0.861**		12	0.831**		22	0.768**
	3	0.873**		13	0.826**	Germane CL	23	0.8**
	4	0.861**		14	0.808**		24	0.689**
	5	0.764**		15	0.87**		25	0.782**
	6	0.773**		16	0.729**		26	0.842**
	7	0.848**		17	0.783**		27	0.916**
	8	0.799**		18	0.739**		28	0.863**
	9	0.84**		19	0.747**		29	0.889**
	10	0.769**		20	0.827**		30	0.805**

****Correlation is significant at the 0.01 level.**

Table (3) shows that the correlation coefficients between the score of each statement and the total score of the type to which it belongs are positive at 0.01 level which supports the strong correlation between the scores of the statements and the total score of each type to which they belong.

Moreover, the correlation coefficient between the score of each cognitive load type and the total score of the scale was estimated, and results are illustrated in table (4).

Table 4

Correlation coefficients between the cognitive load types and the total score of the scale

Dimensions	Correlation Coefficient	Sig
Intrinsic CL	0.976	0.01
Extrinsic CL	0.93	0.01
Germane CL	0.968	0.01

Table (4) shows that the correlation coefficients are positive at 0.01 level which supports the valid internal consistency of the cognitive load scale.

Thirdly, the reliability of the scale was also estimated by getting the value of Cronbach Alpha (α) as shown in table (5).

Table 5

Values of Cronbach's Alpha for the cognitive load scale

Types	N of Items	Cronbach's Alpha
Intrinsic CL	10	0.947
Extrinsic CL	12	0.944
Germane CL	8	0.932
Total	30	0.98

The values of Cronbach's Alpha for the types of cognitive load as well as for the total scale, as shown in table (5), indicate that the cognitive load scale is reliable and can be administered as one of the research instruments. The scale's final form is presented in appendix (C).

Furthermore, the time for responding to the scale was estimated by getting the total time taken by all the pilot students and dividing it by their number (30). Thus, (15) minutes, plus 5 minutes (for instructions), would provide an appropriate time (20 minutes) for the students to respond to the scale.

The Treatment

Designing the proposed ESP microlearning program

For designing the proposed ESP microlearning program, the ADDIE model phases (analysis, design, development, implementation/teaching, and evaluation) were adopted. These phases are described as follows:

1. ***Needs analysis***

The qualitative method was employed for analyzing and determining the needs of the Fine Arts students (level 2) in learning English. A needs analysis questionnaire (see appendix D) was designed and administered to a number of (30) students. It included questions about students' purpose, difficulties, language priorities, and preferred teaching mode and materials. Students' responses were analyzed and presented in percentage form.

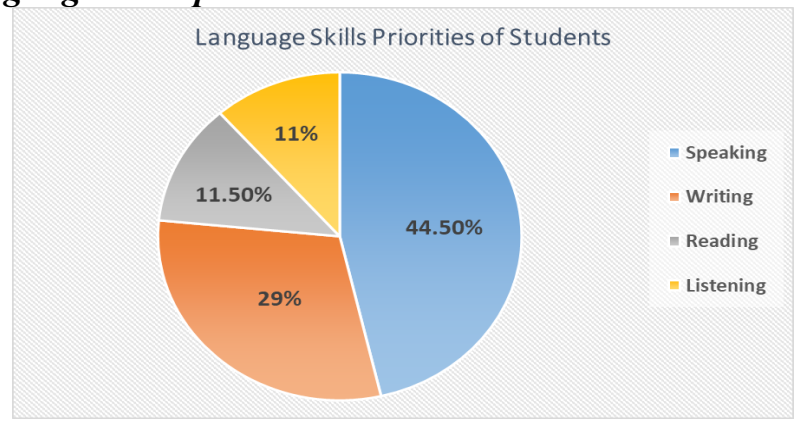
Analyzing students' responses revealed that most of the students (97%) were interested in taking an ESP course and they considered it very important. Concerning students' purpose of learning English, 45% of the students chose learning English for better communication, 25% chose the purpose of increasing academic score, followed by 23% who chose

the purposes of work and travel, and finally 7% selected other purposes. Regarding students' difficulties of learning English, it was found that students' biggest difficulties were related to speaking, writing, vocabulary, reading comprehension, listening, and grammar.

In addition, analyzing students' responses regarding their language priorities revealed that speaking is the most needed language skill as 44.5% of the students selected speaking, 29% chose writing, 11.5% chose reading, and 11% chose listening, as illustrated in figure (1):

Figure 1

Students' language skills priorities

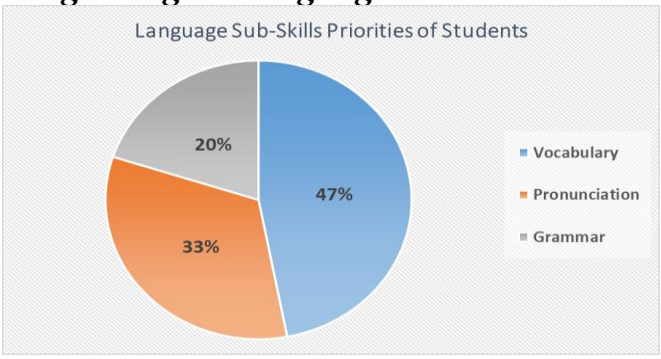


This result is considered largely logical since students need the speaking ability when they are asked to present their works of art either in the English lecture or when participating in international exhibitions.

Moreover, based on students' responses on the language subskills part, it was found that 47% of the students chose vocabulary as a subskill priority, then pronunciation (33%) and grammar (20%). Accordingly, learning English vocabulary was considered to be highly needed by Fine Arts students since vocabulary mastery can enhance students' speaking and writing performance, which is consistent with the previous results about language skills priorities.

Figure 2

Students' priorities regarding the language sub-skills



Concerning students' preferred teaching mode, it was found that 55% of the students preferred the online mode, 25% preferred blended learning, and 20% chose face-to-face mode. Concerning the preferred learning material aspect, 60% of students chose materials related to Fine Art, 25% chose general materials, while 15% chose topics related to daily activities.

Based on the needs analysis results, developing ESP vocabulary was settled on to be the main target of the present research.

2. ***Design***

This phase addressed the design of the proposed ESP microlearning program starting with defining the objectives, content, materials, and strategies and techniques, as illustrated below.

2-1. Target objectives of the ESP program were specified as:

- Developing the Fine Arts students' vocabulary learning, as they were expected to be able to:
  - Deduce meaning of the target vocabulary.
  - Pronounce the target vocabulary properly.
  - Use the words in spoken and written communication.
  - Spell the target vocabulary correctly.
- Reducing students' cognitive load in learning ESP vocabulary.

2-2. Content: the ESP program content was provided in (15) micromodules in addition to the orientation module. A corpus-based approach was used to identify words (technical and semi-technical) targeted for improvement. Criteria of word selection included (1) importance to the Fine Arts ESP context, (2) difficulty for students, (3) occurrence across a range of different text types, and (3) appropriateness to teaching through microlearning. The selected vocabulary was divided throughout the micromodules to be sequentially presented in smaller chunks to minimize the cognitive overload and adapt to the limits of the human brain's attention span. The content was mainly activity-based; the activities were designed to be repeated and reinforced over time, helping students retain the vocabulary they have learned. For designing the micro-content, it was necessary to consider the following principles suggested by Leene (2006):

- Format: Modules were designed to be brief, short, and easily perceived.
- Focus: Objectives and topics are defined clearly in brief and concise sentences.
- Autonomy: Each part of the micro-content is independent, so learners do not need to search for extra information.
- Structure: The content is simple, but essential information (such as title, topic, authors, labels, etc.) is condensed through varied activities.
- Simple access: The content is easily accessible anytime, anywhere.

2-3. Time: microlearning activities are relatively short. It does not take learners more than 15 to 20 minutes to finish all content segments in a microlearning module.

2-4. Materials & media: the materials used to present the ESP vocabulary were chosen to be related to Fine Arts, so they suit the students' field of study. Various interactive materials were incorporated such as videoclips, quizzes and gamified activities. WeChat mobile application was also selected to be the medium for presenting the microlearning ESP program due to its multiple features including for example, multimedia messaging, group chat and calls, free voice and video calls, sticker gallery, Moments timeline, Channels and Mini Programs.

2-5. Strategies & techniques: some strategies based on the cognitive load theory were used to enhance students' vocabulary learning and optimize the load on their working memories. Examples to these strategies include:

- Tailoring the micro-content based on students' current knowledge and skill (element interactivity effect).
- Using worked examples for teaching new vocabulary (worked example effect).
- Gradually increasing independent problem-solving as students become more proficient (expertise reversal effect).
- Cutting out irrelevant and inessential information (redundancy effect).
- Presenting the essential information related to a specific concept together (split-attention effect).

- Simplifying complex vocabulary by delivering it both orally and visually (modality effect).
- Encouraging students to visualize the vocabulary that they have learnt (imagination effect).

In addition, different microlearning techniques were employed throughout the micromodules where each module followed the sequence: introduction, activity, and conclusion. The microlearning techniques employed in the program were as follows:

- Video Microlearning: vocabulary was presented through short, engaging video clips. These clips were used to explain the target words or provide a visual overview of the target topic.
- Interactive gamified microlearning: quizzes, simulations, and interactive games were employed to help students practice what they have learned.
- Micro-assessments: short and focused assessments were used throughout the modules to test students' mastery of new words. These assessments were used to provide feedback on students' learning progress and identify areas where they need additional support.

3. ***Development:*** this phase included finalizing the preparation and design of the ESP micro-modules (see appendix E), according to what was mentioned in the "design phase".
4. ***Implementation*:** this step included implementing the proposed microlearning ESP program. The experiment started with **pre-administering** the research instruments (the EFL vocabulary test and the cognitive load scale) to students of the control and experimental groups at the beginning of the first semester of the academic year 2022/2023, to assess their actual levels regarding the target variables, in addition to establishing the homogeneity between the two groups. *t*-test for independent samples was used to show whether there was any difference between the control and experimental groups concerning the vocabulary learning level, as illustrated in table 1.

Table 6

Establishing homogeneity between the control and experimental groups in the pre-administration of the vocabulary test

Total	Groups	N	Mean	SD	*t*	DF	Sig
	Experimental	30	13.03	3.378	0.427	58	Not Sig at 0.05
	Control	30	12.63	3.864			

Table (6) illustrates that *t*-value is not significant which indicates that there was no significant difference between the mean score of the control and experimental groups on the vocabulary test. Thus, both groups were homogeneous in their vocabulary learning level before implementing the experimental treatment.

In addition, the cognitive load scale was administered to both groups before the treatment to measure students' cognitive load level and establish the homogeneity between the two groups. Results of the pre-administration of the cognitive load scale are presented in table (7).

Table 7

Establishing homogeneity between the control and experimental groups in the pre-administration of the cognitive load scale

Types of CL	Groups	N	Mean	Std. Deviation	T Value	DF	Sig
Intrinsic CL	Experimental	30	38.27	3.841	0.352	58	Not Sig at 0.05
	Control	30	38.63	4.214			
Extrinsic CL	Experimental	30	45.17	3.405	0.523	58	Not Sig at 0.05
	Control	30	44.7	3.505			
Germane CL	Experimental	30	12.7	1.149	0.435	58	Not Sig at 0.05
	Control	30	12.53	1.756			
Total	Experimental	30	96.13	4.79	0.198	58	Not Sig at 0.05
	Control	30	95.87	5.588			

Table (7) shows that *t*-value is not significant for each of the cognitive load types as well as for the total scale, which means that there was no significant difference between the two groups. This supports the homogeneity between the experimental and control groups in their level of cognitive load.

The proposed microlearning ESP program was then ***implemented*** throughout the first semester of 2022/2023 academic year, through the following procedures:

- An orientation module was implemented to help participants of the experimental group become familiar with the microlearning ESP program, its objectives, content, media, the mobile application used, and the phases of each micromodule. Students were also trained on how to use the WeChat application for studying and reviewing the microcontent, and sharing messages, responses, and thoughts more efficiently.
- The students studied the main fifteen micro-modules following the same phases in all modules (objectives and introduction, activity, and conclusion/assessment), with the instructor's assistance, support, and guidance of each phase. Delivering the micro-content through WeChat application facilitated the use of various materials including videoclips, Fine Arts- related articles, gamified activities, mini-programs for various English resources, quizzes, and micro-assessment tasks. Besides, throughout the micromodules of the program, strategies based on the cognitive load theory, as mentioned earlier in the design phase, were employed to maximize students' vocabulary learning and reduce their cognitive load.

5. ***Evaluation*:** this final stage assessed the effect of the proposed microlearning ESP program. It included:
   - Formative evaluation, where students' interactions and responses to the micro-assessments, quizzes and games are evaluated on an ongoing basis and where students are provided with tailored and guided feedback.
   - Reflection: at the end of each micromodule, students were required to reflect on each module's content and activity. A link, to a reflective log designed through Microsoft Forms, was sent to all the students through WeChat group messaging

where they could mention their comments and recommendations for the upcoming modules.

- Summative evaluation, which focused on the overall effectiveness of the proposed program through **post-administering the research instruments.** The following section presents the related results of the pre- and post-administrations.

Results

Testing the first hypothesis

t-test for independent samples was used to verify the first hypothesis which stated that" There is a statistically significant difference at 0.05 level between the mean score of the control group and the experimental group in the post administration of the vocabulary test in favor of the experimental group". Results are presented in table (8).

Table 8

Comparison between the control and experimental groups in the post-administration of the vocabulary test

Total	Groups	N	Mean	SD	*t*	DF	Sig
	Experimental	30	31.13	2.345	12.89	58	0.01
	Control	30	21.8	3.199			

Table (8) shows that the mean score of the experimental group students (31.13) in the vocabulary test is higher than that of the control group (21.8). In addition, *t*-value is significant at 0.01 level, which reflects that there is a statistically significant difference between the experimental and control groups in the post-administration of the vocabulary test in favor of the experimental group. In other words, the experimental group students outperformed their counterparts of the control group in their vocabulary learning level; thus, the first hypothesis is verified and accepted.

Testing the second hypothesis

t-test for dependent samples was used to verify the second hypothesis, which addressed the difference between the experimental group's pre- and post-administrations of the vocabulary test. Results are illustrated in table (9).

Table (9)

Comparing the experimental group's pre-post administrations of the vocabulary test

Vocabulary test	Measurement	N	Mean	SD	*t*	DF	Sig	)η2(
Total	Pre	30	13.03	3.378	19.67	29	0.01	0.93
	Post		31.13	2.345				

As presented in table (9), *t*-value is significant at 0.01 level, which reflects the statistically significant difference between the mean score of the experimental group's pre-post-administrations of the vocabulary learning test in favor of the post-administration because of using the microlearning ESP program. Moreover, the table illustrates that the effect size level of the proposed microlearning program on the experimental group students' vocabulary learning is large. Thus, since both the *t*-value and the effect size enhance the positive effect of the ESP program on students' vocabulary, the second hypothesis of the research is accepted.

Testing the third hypothesis

Results of testing and verifying the third hypothesis, which stated that, "there is a statistically significant difference at 0.05 level between the mean score of the control and experimental groups in the post-administration of the cognitive load scale in favor of the experimental group", are illustrated in table (10).

Table 10

Comparison between the control and experimental groups in the post-administration of cognitive load scale

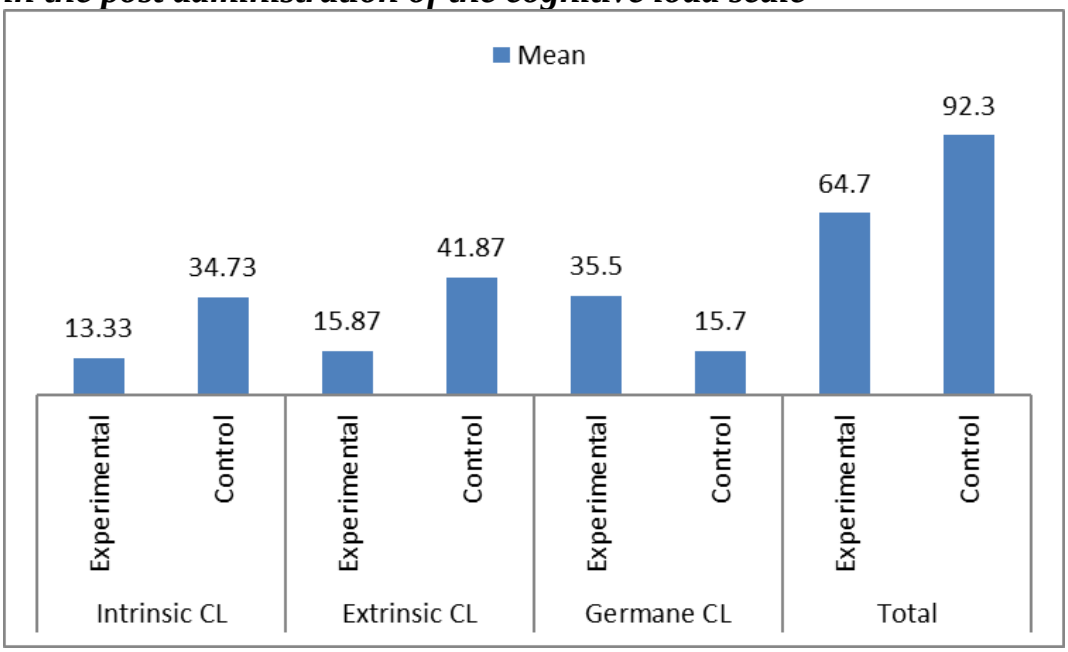
Types of CL	Groups	N	Mean	SD	*t*	DF	Sig
Intrinsic CL	Experimental	30	13.33	1.155	22.37	58	0.01
	Control	30	34.73	5.112			
Extrinsic CL	Experimental	30	15.87	0.937	35.19	58	.01
	Control	30	41.87	3.937			
Germane CL	Experimental	30	35.5	1.280	23.05	58	0.01
	Control	30	15.7	4.527			

Total	Experimental	30	64.7	2.07	17.64	58	0.01
	Control	30	92.3	8.318			

Table (10) indicates that the *t*-values are significant at 0.01 level, which proves that there are statistically significant differences between the control and experimental groups in the three types of cognitive load as well as in the total score of the scale. This difference is in favor of the least mean (64.7) of the experimental group. Besides, the table illustrates that the experimental group students' means in the intrinsic, extrinsic, and total load are lower than those of the control group; however, the experimental group's mean score in the germane cognitive load (which is considered the good type of cognitive load) is higher than that of the control group. This supports the positive effect of the microlearning program on reducing the intrinsic and extraneous load and fostering the germane load (which is directly relevant to learning). This illustration is also clarified through figure (3).

Figure 3

Comparison between the means of the experimental and control groups in the post administration of the cognitive load scale



Since the theorists of cognitive load generally consider intrinsic, extraneous and germane load to be additive, and as table (10) shows that the total cognitive load of the experimental group is significantly lower than that of the control group; then, the third hypothesis of the study is proved and accepted.

Testing the fourth hypothesis

Concerning the fourth hypothesis which claimed that " there is a statistically significant difference at 0.05 level between the mean scores of the experimental group's pre-post administrations of the cognitive load scale in favor of the post administration", table (11) presents its related results.

Table 11

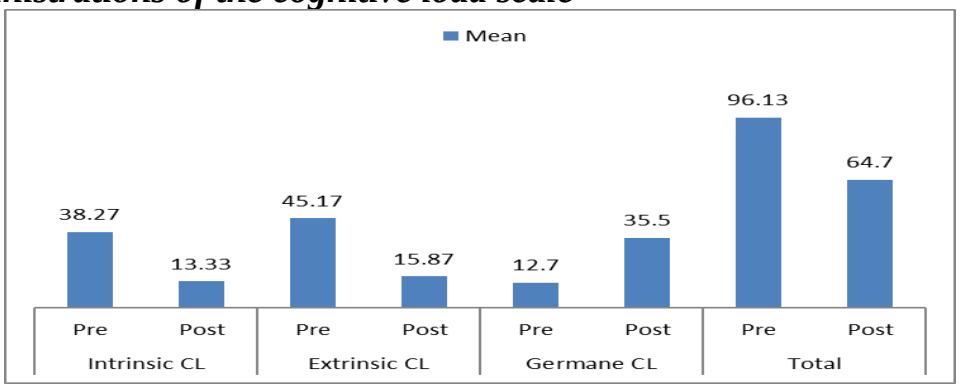
Comparing the experimental group's pre-post administrations of the cognitive load scale

Types of CL	Measurement	N	Mean	SD	*t*	DF	Sig	)η2(
Intrinsic CL	Pre	30	38.27	3.841	34.37	29	0.01	0.976
	Post		13.33	1.155				
Extrinsic CL	Pre	30	45.17	3.405	46.71	29	0.01	0.987
	Post		15.87	0.937				
Germane CL	Pre	30	12.7	1.149	68.35	29	0.01	0.994
	Post		35.5	1.28				
Total	Pre	30	96.13	4.79	34.71	29	0.01	0.976
	Post		64.7	2.07				

Table (11) illustrates that the estimated *t*-values are significant at .01 level, which reflects the statistically significant difference between the experimental group students' mean scores in the pre- and post-administrations of the cognitive load scale in favor of the post-administration with least mean (64.7) for the total scale. Additionally, the table supports the large effect size of the proposed program on reducing students' total level of cognitive load compared to their level before implementing the microlearning program. Moreover, Figure (4) shows that the students had lower levels in the first two types and the total cognitive load compared to their pre-levels, but their post-level of the germane cognitive load was higher than their pre-level, which is a positive indicator on enhancing students' positive load.

Figure 4

Comparison between the means of the experimental group's pre- post administrations of the cognitive load scale



Accordingly, based on the results presented in table (11) and figure (4), it can be said that the fourth hypothesis is verified and accepted.

Testing the fifth hypothesis

With regard to the fifth hypothesis which claimed that "there is a negative correlation between students' vocabulary learning and reducing their cognitive load". Spearman correlation coefficient was used to verify this hypothesis. Table (12) illustrates the value of the correlation coefficient and its significance.

Table 12

Establishing the correlation between vocabulary learning and cognitive load

Correlation coefficient	Vocabulary learning	Sig. level	Direction
Cognitive load	-0.752	0.01	Negative

Table (12) shows that the value of "r" (= -0.752) is significant at 0.01 level, which indicates that there is a negative correlation between students' vocabulary learning and their level of cognitive load. Therefore, the fifth and last hypothesis is verified and accepted.

Discussion

The current research was conducted to assess the effect of designing and implementing a proposed microlearning ESP program on developing university students' vocabulary learning and reducing their cognitive load. Students enrolled in level two (first year) at the Faculty of Fine Arts were the target participants, where their needs were assessed as a first step for designing the proposed program. It was revealed that vocabulary in general, and ESP lexis in particular, occupies a great importance and is

a main requirement for them since it affects their speaking and writing performance when they are required to present or report their works of art when participating in international exhibitions. This result is consistent with the results reached by Kazar & Mede (2014) and Sukarni (2022) who supported that mastery of vocabulary is highly needed for the students of Fine Arts.

To achieve the purpose of the current study, the experimental and control groups administered a vocabulary test and a cognitive load scale before and after implementing the experimental treatment. The previously mentioned statistical results indicated that the experimental group students' mean score was significantly higher than that of the control group in the vocabulary learning test. Besides, the ESP vocabulary level of the experimental group students was significantly higher than their pre-level, which revealed that the proposed microlearning ESP program has a positive effect on developing students' vocabulary learning.

These results are in agreement with the earlier studies carried out on assessing the effect of microlearning on enhancing students' language skills and vocabulary, in particular. For example, Meng & Wang (2016), Wang & Gong (2023), and Gorham, Majumdar & Ogata (2023) indicated that microlearning is important for learners to truly improve their English, to have a rich vocabulary, and to master varied grammatical structures. It was recommended that the English vocabulary mobile microlearning programs should be gradually applied to colleges and universities.

As for the cognitive load, the results section revealed that there was a statistically significant difference between the mean scores of the experimental and control groups in the post administration of the cognitive load scale in favor of the lower mean of the experimental group. Besides, the experimental group students' level of cognitive load was significantly lower than their pre-level. This supports the result that the proposed microlearning program had considerable potential for decreasing the cognitive load of the students in learning ESP vocabulary. Such results are consistent with Wang, Luo & Qu (2017), Kapp and Defelice (2019), Leary et al. (2020), Redondo, Rodr´ıguez, Escobar & Vilas (2020), and Susilana et al.(2022); all revealed that microlearning is adapted mainly to suit the limits of the human brain, and to minimize the useless cognitive load while enhancing the productive cognitive load, since content is presented in small chunks and redundant information is filtered out.

Moreover, the results indicated that there was a negative correlation between students' vocabulary learning and reducing their cognitive load.

This means that these two variables tend to move in opposite directions from one another; as students' vocabulary improves, their cognitive load in learning vocabulary decreases.

Regarding the WeChat application used for delivering the ESP micromodules, it was indicated that this application helped the students review the content and share thoughts more efficiently. This can be interpreted as WeChat is rich in the language materials (e.g., images, videos, games, learning tips, etc.) posted through the Moments timeline, which could offer students varied linguistic input to meet their different interests and needs. In addition, WeChat enabled the instructor to communicate with the students either individually or in groups through WeChat messaging to provide tailored guidance and immediate feedback. These significant points were also supported by Yan (2019) and Namaziandost, et al. (2021) who emphasized that WeChat facilitated a student-centered teaching mode and enhanced students' collaboration and friendly communication with peers on the assigned activities. WeChat messaging also helped stimulate students' enthusiasm and interest and fostered their self-initiative learning ability, thus spreading micro-content and attracting learners.

However, results of this study are in conflict with what Varshney (2018) emphasized concerning research conducted by Ohio University, Illinois State University and Nebraska University. It was indicated that participants who used mobile networking software scored lower than those who learned through the regular instruction. Students simply cannot multitask with the various distractions on their mobile devices, and they are mentally preoccupied with irrelevant information, which results in a drop of attention and hinders cognitive performance in tasks. Kim, et al. (2019) also supported this conclusion, indicating that phone distractions occur every 3– 4 minutes for over a minute in duration. It was emphasized that in-class phone usage is negatively correlated with student grades.

Such contrasting results can be interpreted as the current study considered the limited attention span of the students through adopting the microlearning approach, in which unnecessary redundant information is avoided and the content is delivered in shorter duration supporting the "less is more" principle. Thus, the learning materials are more manageable and engaging, and the students are less likely to drop out during learning. This, in turn, led to reducing students' cognitive load.

The implementation of microlearning included the use of videoclips, quizzes, mini-assessments, and gamified activities, which fostered students' engagement and motivation; therefore, learning is fun

and memorable. Consistently, students' responses and comments mentioned in their reflective logs supported the current results, as students indicated that the microlearning program enhanced their vocabulary learning and reduced their learning overload due to the bite-sized modules and snackable activities. Some of the students' comments included that the videos were interesting and short with easy-to-understand examples and explanations, learning was much less boring, and the mini-program apps enabled them to pronounce words properly and practice them more. They also indicated that they liked the Micro-lectures, which were focused and to the point, and which were helpful and assisted them with interpreting information for a better understanding of the learning materials. All of this indicated that the proposed microlearning ESP program was effective in developing students' vocabulary learning and reducing their cognitive overload.

Conclusion

The current research investigated the effect of a proposed microlearning ESP program on developing university students' vocabulary learning and reducing their cognitive load. The above-mentioned statistical results and discussion indicated that the proposed microlearning-based program had significant potential for enhancing the Fine Arts students' vocabulary learning and decreasing their cognitive overload. Students in the experimental group who studied through this novel approach outperformed those in the control group who learned using conventional English instruction. The mobile microlearning ESP program which employed the principles of the cognitive load theory offered the Fine Arts students an environment rich with experiences that optimize their learning by using snackable content and manageable, attractive, and engaging materials and activities.

Recommendations

Based on the research results and discussion, the following recommendations are provided:

- Microlearning should be employed in the development of various courses and programs for enhancing learners' English linguistic abilities.
- ESP courses and programs presented for undergraduate and post graduate students should be designed according to the microlearning approach where the unnecessary information is avoided and content is delivered in small chunks and limited time.

- Designers of the pre-university stages should include the use of mobile microlearning-based activities in the English textbooks for enhancing students' vocabulary as well as the other language skill.
- The principles and strategies of the cognitive load theory should be considered in designing instruction for students of different stages either at university or pre-university levels.
- Teachers and instructors must consider their students' memory capacity and attention span when teaching and delivering the new content to enhance their learning and reduce their cognitive load.

Suggestions for further research

In the light of the research results and recommendations, the following research suggestions are provided:

- The impact of microlearning courses on enhancing ESP university students' linguistic subskills such as grammar, pronunciation, reading comprehension, etc.
- The effectiveness of a program based on the cognitive load theory in improving university students' writing skills.
- Assessing and analyzing the needs of university students regarding their English language priorities, challenges, and preferred learning modes.
- The effect of microlearning activities on developing the EFL oral communication skills among secondary stage students.

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