

Iranian Architecture Students' Learning Styles and Vocabulary Learning: A Content-Based Instruction Approach

Kobra Tavassoli^{*1}, Tahereh Mohammad Aghaei¹, Maryam Rahmatollahi¹

¹ Department of Teaching English and Translation, Ka.C., Islamic Azad University, Karaj, Iran

Corresponding Author's Email: kobra.tavassoli@kiaiu.ac.ir

KEYWORDS

Content-based Instruction,
EAP, Learning Style,
Technical Vocabulary,
Vocabulary Acquisition

ABSTRACT

Vocabulary serves as the cornerstone of every effective communication as it enables individuals to express their thoughts and emotions. When acquiring a language and their new words, individuals often employ various learning styles to comprehend concepts and achieve their goals. Considering the possibility that learning styles of the learners may contribute to their vocabulary learning, this mainly quasi experimental research endeavored to investigate if Iranian architecture students' learning styles impact their acquisition of technical English vocabulary through content-based instruction. Utilizing three main data collection instruments, including Nelson English proficiency test, Felder-Soloman questionnaire, and the researcher-made test of vocabulary, which was administered as the pretest and posttest, the researchers collected the data required from a total of 60 male and female undergraduate architectural engineering students at the university level. Over a period of one and a half months, during six two-hour sessions, the participants, who were previously categorized into an experimental group and a control group, engaged in technical topics through content-based instruction. To explore the potential cause-and-effect relationships, a repeated measures MANOVA was used. The findings revealed that the architecture students predominantly displayed reflective, intuitive, visual, and sequential learning styles, as opposed to active, sensing, verbal, and global learning styles. Moreover, an increase in the posttest scores of both groups indicated no significant difference in the performance of the two groups in terms of their vocabulary knowledge. Accordingly, it is concluded that Iranian architecture students' learning style preferences had no significant effect on their acquisition of technical English vocabulary through content-based instruction.

ARTICLE INFO

Article type: Research Article

Article history:

Received: 10 February 2025

Revised: 31 July 2025

Accepted: 07 August 2025

Published online: 07 August 2025

Introduction

Globalization necessitates international interactions and effective communication across countries with different languages and cultures. By the same token, removing linguistic and cultural barriers to exchange information and to cooperate with diverse organizations has gained prominence. With the emergence of various scientific and professional societies in today's world, where individuals' communication is no longer limited by time, place, and other contextual factors, the acquisition of English language skills for specific academic and professional purposes is the backbone of any scientific and academic exchange. As Valisherjon o'g'li and Xalilillo (2023) asserted, "English language acts as a repository of wisdom and wit. English language is a propeller for advancement of career and a machine to mint money. And it is a telescope to view the vision of future" (p. 199). Acquiring vocabulary, mastering grammar, learning pronunciation, and understanding language usage all necessitate addressing learners'

How to Cite: Tavassoli, K., Mohammad Aghaei, T., Rahmatollahi, M. (2025). Iranian Architecture Students' Learning Styles and Vocabulary Learning: A Content-Based Instruction Approach. *International Journal of Practical and Pedagogical Issues in English Education*, 3(3), 38-54. DOI: 10.22034/ijpie.2025.505865.1087



© The Author(s).

different needs and learning styles through a wide range of approaches, methodologies, and schools of thought (Kashef & Barzegari, 2023). Programs designed to teach and learn English for Specific Purposes (ESP) seem to be an essential and undeniable component of educational systems as they address students' professional needs and requirements after their graduation. "Professionally oriented education is a priority in the system of renewing education" (Orasta, 2023, p. 134).

Considering the important role of ESP in academic fields, all students are obliged to acquire technical vocabulary as it is the foundation of the ESP curriculum. An individual's knowledge of foreign language and their ability to communicate are vital components of professional activity (Orasta, 2023). By emphasizing technical vocabulary, students learn to integrate language within the subject matter to become professional architects who possess a strong command of the English language. To achieve this, they must perform proficiently in all four macro skills of English, which requires a comprehensive mastery of vocabulary that aligns with their academic and professional goals. Although having proficiency in grammatical aspects of a language is necessary (Farhady et al., 2018), it does not guarantee that individuals will be able to communicate effectively (Rashid et al., 2022). Communication may fail due to not knowing appropriate words. Similarly, Brooks et al. (2021) highlighted that the absence of vocabulary knowledge prevents students' academic success. As a vital element of language education, it is a foundation of both language learning and use (Dobakhti et al., 2020). Therefore, learning vocabulary is essential to achieving language mastery.

According to Le and Miller (2023), for years, acquiring vocabulary has been considered as the main component of learning a language. In the context of English for Specific Purposes (ESP), technical vocabulary is of paramount importance because it is the key of specialized material. Fostering students' vocabulary within ESP classrooms has, in fact, formed the basis for many recent studies. Up to now, various research projects have been conducted on the importance of vocabulary in ESP (e.g., Tavassoli & Beyranvand, 2023; Tavassoli et al., 2023). Employing a cognitive approach focused on memory, repetition, and mnemonic devices, Valentyna (2023), for example, proposed a three-stage taxonomy for improving technical vocabulary competence which encourages students to select the correct learning strategy. Somatization, improving lexical skills, employing cognitive operations to choose appropriate words, forming a cohesive whole, and concentrating on the automatization of cognitive lexical operations have all proven to be helpful for enhancing students' vocabulary acquisition. Hardiyanti and Herda (2023) asserted that the 21st-century learning necessitates ESP students to collaborate, communicate, stay creative, and think critically to attain competence in language. The researchers observed that the students benefited from using flash cards as they showed more enthusiasm toward learning vocabulary. Employing a dialog Chabot, Qasem et al. (2023) observed that this interactive tool helps ESP students learn vocabulary. Orasta (2023) took the strategies used by the students into account and maintained that students' proficiency at all levels should be taken into consideration. Yet, in another study, Dobakhti et al. (2020) observed that the use of vocabulary learning strategies, particularly mnemonic and rote-based strategies, enabled elementary EFL learners to have better retention, with the mnemonic strategy group outperforming both the rote-based and control groups. These are just a few studies highlighting the importance of vocabulary learning.

To have successful learning in which students can achieve their academic goals, various dimensions and elements, such as students' needs and preferences, ought to be considered. Students may require different tools to overcome the difficulties they encounter while engaging

in educational endeavors (Benitez-Correa et al., 2022). As mentioned above, attaining effective vocabulary knowledge plays a pivotal role in enhancing language proficiency and, consequently, in communicating effectively. Different learners, however, manifest different needs and adopt different learning styles based on their characteristics and abilities. Learning style refers to “cognitive, affective, and physiological traits that are relatively stable indicators of how learners perceive, interact with, and respond to the learning environment” (Keefe, 1979, p. 4). Each student makes use of their own unique learning style to improve their knowledge, skills, and expertise in English learning (Naim & Mokodenseho, 2022). They engage in learning tasks that correspond with their preferred learning style, such as having dialogues, engaging in group discussions and collaborative conversations, or watching movies. In such learning contexts, being aware of distinct types of students’ learning style can assist teachers in optimizing classroom activities and creating a learning environment that is made to incorporate appropriate techniques, strategies, and tasks to accommodate students’ diverse learning styles (Saswandi et al., 2023). Choosing a suitable learning style is of paramount importance, as unlike students’ abilities and talents, learning styles do not reflect students’ natural aptitude that divides them into gifted and non-gifted learners. Instead, they involve individual preferences or habitual ways of approaching the learning process. Individuals’ preferences indicate a continuum ranging from one extreme to another. By employing various effective approaches, individuals can be successful in any of these preferences (Dörnyei, 2014).

In addition to what has been stated so far, differences in learners' language proficiency may be attributed to their individual characteristics, the method and quality of instruction, and the resources available (Shewangizaw, 2024). Brinton and Holten (2001) maintained that teaching language should not be separated from teaching content because authentic content provides the most natural and rich context for learning language. According to Snow and Brinton (2023), considering various educational settings, objectives, and target populations, CBI is a dominant approach to language teaching that endeavors to integrate language and content instruction to facilitate second or foreign language learning. More simply put, Zakirova (2023) asserted that “content-based instruction (CBI) is a context where language and content are taught simultaneously. It is closely linked with the cognitive approach to teaching foreign languages as the language is taught through meaning or in a meaningful context” (p. 112). Scholars and academics have consistently reported the effectiveness of CBI in improving students' reading comprehension skills (Hurtado Vargas, 2023; Shams, 2023), motivation and vocabulary acquisition (Hurtado Vargas, 2023), intrinsic motivation for listening (Miyasako, 2018), oral proficiency in the target language, including speaking and listening (Pratama & Fitriani, 2020), metaphorical competence (Ahrari, 2023), language proficiency, self-confidence, and the development of cognitive and learning habits (Al-Wadi, 2023). Moreover, Miyasako (2023) observed that prospective elementary school teachers had positive perceptions of CBI at the beginning of the study, with their perceptions slightly improving after the course. Yamagishi (2023) also argued that developing literacy and academic ability seems to be the primary focus of CBI.

As learning styles and preferences vary from one individual to another, architecture students, in this case, are no exception. Understanding and determining what learning styles students adopt is essential for modifying the teaching and learning process to align with their academic success, which is significant for the overall quality of the educational systems. Within the field of architecture, it is necessary to consider the diverse range of students’ learning style preferences and to equip them with appropriate tools and methods that are in line with their

distinct characteristics. Despite the numerous studies conducted across various academic disciplines focusing on English for specific purposes (ESP), learning style preferences, and content-based instruction (CBI), there remains a noticeable gap in investigating whether learning style preferences impact technical vocabulary learning of architectural engineering students following content-based instruction. In other words, considering Kazemainy et al.'s (2023) assertion that learning styles are theoretically positively associated with individuals' language outcomes, the researchers of the current study sought to explore the effect of Iranian architecture students' learning styles on their acquisition of technical English vocabulary through content-based instruction. As a result, the following research question was posed:

Does Iranian architecture students' learning style significantly affect their learning of technical English vocabulary through content-based instruction?

In line with the research question mentioned above, the following null hypothesis was formulated:

Iranian architecture students' learning style does not significantly affect their learning of technical English vocabulary through content-based instruction.

Method

Design

In this study, the researchers pursued three primary objectives: first, they aimed to identify the learning style preferences of architectural engineering students based on Felder-Silverman Learning Style Model (FSLSM). Second, they introduced the fundamental educational principles of content-based instruction (CBI) and teaching specialized architectural terminology. Third, they examined the cause-effect relationship between these two main variables. Therefore, to achieve these objectives, the researchers adopted a mixed-method design including a main experiment followed by an interview. According to Creswell and Creswell (2022), this type of research design relies mainly on the quantitative data (Quan) and follows a qualitative (qual) survey to validate the quantitative findings. Experimental research, as defined by Williamson and Johanson (2017), is a scientific approach used to investigate cause-and-effect relationships between variables; of which, experimental designs are of two types including true experiments and quasi-experiments, with the latter being the primary approach used in this research. In contrast to true experimental research, quasi-experimental designs involve the non-random selection of participants (Thomas, 2021).

Participants

Focusing on senior undergraduate architecture university students, the researchers conducted the study in 2021 and selected the participants through a convenience sampling method, which, as Patel et al. (2023) maintained, refers to "the process of gathering a sample in a way that is most easily accessible to the person doing the research" (p. 125). Before beginning the present study, Nelson English test was conducted on a total of 70 undergraduate students majoring in architectural engineering. This initial assessment was done with the aim of evaluating their proficiency in the English language. After excluding 10 students to ensure the homogeneity within the participant group, the final sample comprised 60 senior undergraduate students (i.e., 36 females and 24 males). The participants were all native Farsi speakers within the age range of 22 to 25. All the participants agreed to take part in this study.

Table 1

Demographic Information of the Participants

Group	N	Gender	Age Range	Educational Background	L1
Experimental group	30	Male and female students	22-25	undergraduate architectural engineering students	Farsi
Control group	30	Male and female students	22-25	undergraduate architectural engineering students	Faris

Assessments and Measures

In order to collect the data necessary to achieve the objectives of the current research project, several instruments were employed, including the Nelson English proficiency language test, the online version of the Felder-Soloman Index of Learning Styles (ILS), the researcher-developed vocabulary test serving as both pretest and posttest, and a semi-structured interview.

Nelson English Proficiency Language Test

To establish the homogeneity of the participants in terms of their English language proficiency, the Nelson English proficiency language test, Section 200 A, was administered. Developed by Coe and Fowler (1976), this standardized test consisted of 50 items divided into two sections: 14 cloze items and 36 grammar items presented in the form of multiple-choice questions. The test was designed to assess the participants’ grammatical competence and vocabulary knowledge. Each participant was given 45 minutes to complete the test and received one point for each correct response.

Felder-Soloman Index of Learning Styles

Next, to obtain insights into the participants’ learning style preferences, the online version of the Felder-Soloman Index of Learning Styles (ILS) (1997) was utilized. This self-assessment questionnaire consists of 44-item and measures individuals’ preferences across the four dimensions presented in Felder-Silverman Learning Styles Model (FSLSM). Each dimension indicates two opposing preferences. The dimensions include the (a) active/reflective, (b) sensing/intuitive, (c) visual/verbal, and (d) sequential/global scales. The ILS questionnaire includes 11 items per dimension, with two response options per item: ‘a’ for active, sensing, visual, and sequential learners, and ‘b’ for reflective, intuitive, verbal, and global learners (Güneş, 2004).

Test of Vocabulary

Ultimately, to evaluate the participants’ vocabulary knowledge in the field of architectural engineering, an ESP vocabulary test was developed by the researchers. The test functioned both the pretest and the posttest. It consisted of 25 multiple-choice items, and each participant had 20 minutes to complete it. The selection of 25 lexical items seemed logically practical to administer, as it was believed that the test would neither result in the participants’ fatigue, nor would it lead to their disengagement, ensuring the reliability of their responses. The test items were derived from two primary course books entitled *English for the Students of Architecture* by Farhady and Tavakoli (2005) and *Visual Dictionary of Architecture* by Ching

(1995). This was done to ensure the relevance and appropriate difficulty of the test for senior architecture students. Moreover, the test was reviewed and piloted, and its problematic items were revised. To prevent the participants from memorizing the questions and answers, the order of items in the posttest was rearranged.

Semi-Structured Interview

In addition, to obtain deeper insights into the participants' experiences of content-based instruction, a semi-structured interview was conducted after the treatment sessions. The interview consisted of several open-ended questions which focused on the participants' attitudes toward their classroom procedures, the extent to which they believed these procedures facilitated their comprehension and vocabulary retention, and the ways in which they enhanced their engagement. The researchers also asked for the participants' suggestions about improving learning vocabulary in ESP contexts. Each interview lasted approximately 20 minutes and was audio-recorded. The recordings were then transcribed and analyzed using thematic content analysis to determine the primary themes and objectives.

Procedure

This research project was conducted in 2021 over a span of six sessions, each held once a week. It included 60 Iranian male and female undergraduate architecture students selected from the initial pool of 70 students at the university level. To initiate the study and ensure the homogeneity of the participants in terms of their language proficiency, the students took the Nelson English Test, Section 200 A, within a 45-minute time limit. Based on the outcomes of this assessment, 60 participants, whose scores fell within the range of 43 to 50, were selected. Scores within the range of 43 to 50 indicated a proficiency level of upper-intermediate to advanced, and thus met the homogeneity criteria.

Subsequently, the participants were given 40 minutes to complete a web-based inventory of 44 multiple-choice items, known as the Felder-Silverman Index of Learning Styles (ILS). This instrument allowed the researchers to identify the participants' learning styles based on psychological and behavioral attributes. The ILS questionnaire assisted researchers in both understanding the students' learning needs and guiding them in applying appropriate instruction. It helps bridge potential gaps between students' learning styles and teaching methods and facilitates smoother learning experiences (Felder & Spurlin, 2005). Each question encouraged the respondents to select the answer that best reflected their learning preferences.

Following the identification of dominant learning styles among the participants, they were divided into two distinct groups including the experimental group and the control group. The experimental group received the specific intervention under investigation, while the control group received a placebo involving traditional methods of vocabulary teaching employed (Thomas, 2020). Traditional vocabulary teaching methods mainly involved direct instruction of words through word lists, dictionary definitions, and out of context. In the experimental group, Content-based Instruction (CBI) was implemented with a focus on the integration of content and language, an emphasis on meaning before form, the use of authentic materials, and the application of scaffolding in a learner-centered environment. Accordingly, the researchers aimed to present lessons on architectural topics to provide participants with meaningful contexts in which they could use vocabulary more effectively. Comprehension and use of content through reading and discussion were prioritized over a focus on linguistic forms. Moreover, visual aids

and excerpts from architecture books and websites were purposefully selected and practiced in class. They were presented in the form of simple tasks to more complex, production-oriented activities. To complete these tasks, participants were required to work collaboratively, either in pairs or in groups, and they were required to engage in various discussions and receive feedback from their peers (Brinton et al., 2003; Richards & Rodgers, 2014; Stoller, 2004). In contrast, the control group received traditional vocabulary instruction that emphasized memorization and relied on long lists of decontextualized words. Prior to beginning the experiment, both groups underwent a pretest, consisting of 25 multiple-choice items, to determine whether any statistically significant differences existed in the participants' vocabulary knowledge.

Organizing the members of the experimental group based on their learning styles allowed the researchers to implement curriculum topics in a way that aligned with their learning preferences. That is to say, the researchers initially categorized the participants based on their learning styles (i.e., reflective, intuitive, visual, and sequential) and then they endeavored to match classroom activities and materials based on their preferences. For visual learners, for example, diagrams, drawings, videos, and other visual aids were used. It is noteworthy to mention that all of the participants received the same content, but only the mode of delivery and classroom tasks were modified on the basis of their learning styles. Meanwhile, the control group received instruction on the same topics, irrespective of the participants' learning styles. Emphasizing on the acquisition of technical vocabulary through content-based instruction, the treatment phase extended over six two-hour sessions over a period of one and a half months. The curriculum was meticulously designed to introduce specialized topics, while the focus was on commonly used vocabulary in the field of architectural engineering during each session.

One week after the treatment phase ended, the students completed a 25-item multiple-choice posttest, parallel to the pretest but with the item order reshuffled, to evaluate the impact of the participants' learning styles on their technical vocabulary acquisition and determine the learners' progress after completing the course. To achieve the research objective in this respect, a repeated measures MANOVA was employed so that the researchers would simultaneously be able to examine the effect of the participants' learning styles and time (i.e., pretest and posttest) on multiple dependent measures, that is, their vocabulary scores, while also considering how these factors may interact with each other. As stated by Tabachnick and Fidell (2019), MANOVA is an appropriate procedure to be used in studies that involve several dependent variables measured over time. This is especially true when certain assumptions, such as homogeneity and normality, are met, just like what was observed in this study.

Finally, at the end of the study, the researchers conducted semi-structured interviews with the participants to gain insight into their attitudes toward content-based instruction and whether it facilitated their learning of technical vocabulary. The interviews were first audio-recorded, then transcribed and analyzed using thematic content analysis. After careful reading of the transcriptions several times, the initial codes were determined and subsequently grouped into themes. Moreover, to enhance the trustworthiness of the findings, another colleague was asked to cross-check the coding and confirm the extracted themes. The qualitative phase of the study enabled the researchers to obtain rich insights regarding participants' experiences.

Results

Preliminary Investigation

This research endeavor was initially done with 70 senior undergraduate students specializing in architectural engineering. An assessment of their general English language proficiency led to the exclusion of 10 students to ensure a homogeneous sample. Data obtained from the remaining 60 students with test scores exceeding 43 indicated average and advanced proficiency levels and were utilized for the subsequent analyses. To ensure a reliable understanding of the underlying data and to draw meaningful conclusions from statistical tests, it is essential to examine the assumption of normal distribution. According to Mohammadi Zenouzagh (2017), if the significance level of the Kolmogorov-Smirnov test is greater than the research confidence interval (.05), the data is assumed to follow a normal distribution. In this study, the significance value for the English proficiency test was .06 which exceeded the critical p-value (.05) and thus confirmed the normality assumption. Concerning the pretest, the significance values of .13 and .16 for the experimental and control groups, respectively, were higher than the threshold of .05. This affirmed the normal distribution of the pretest dataset. Furthermore, the significance values of the Kolmogorov-Smirnov test for both experimental and control groups were .09 and .05, correspondingly, which assumed the normality of posttest scores in both groups.

The evaluation of the homogeneity of the data is a fundamental prerequisite in any research initiative. Levene's test is an inferential statistic used to determine the homogeneity of variances within the same distribution. A significance level greater than the research confidence threshold (.05) in Levene's test indicates that the assumption of homogeneity of variances is met (Mohammadi Zenouzagh, 2017). The significance value for assessing the homogeneity of the English proficiency test was .31 which surpassed .05 threshold and confirmed that the target population exhibited homogeneity in distribution. Regarding the pretest and posttest of the experimental and control groups, Levene's test yielded significance values of .9 and .92, respectively, both of which exceeded the threshold of .05 and supported the assertion that the assumption of equal variances was satisfied. Therefore, the homogeneity of the data in both groups was confirmed.

For assessing the reliability of the researcher-made vocabulary test, Cronbach's alpha was employed to determine the reliability of both the pretest and posttest. According to Daud et al. (2018), the Cronbach's alpha value less than .6 is considered low, while a value between .6 and .8 is moderate and acceptable. In this respect, Cronbach's alpha values for the experimental and control groups in the pretest were .6 and .61, respectively, which exceeded the .6 threshold. These values indicated sufficient internal consistency and reliability for the pretest. Similarly, the Cronbach's alpha values for the posttest in both the experimental and control groups were .6 and .62, respectively. Since these values are above the .6 threshold, an acceptable level of reliability was observed for the posttest as well.

Investigation of the Research Question

Following a thorough examination of the preliminary assumptions of the tests employed in this study, including normality, homogeneity, and reliability, the subsequent analyses were undertaken to determine the acceptance or rejection of the null hypothesis of the study. To identify the dominant learning style of Iranian architecture students, descriptive statistics indicated a clear preference for the reflective style (70%, n=42) over the active style (30%, n=18) for the processing dimension. In contrast, for the remaining three dimensions, no significant

variation was observed. For the perception dimension, 53.3% (n = 32) exhibited an intuitive preference, while 46.7% (n = 28) preferred a sensing style. Additionally, 56.7% (n=34) favored the visual style in the reception dimension, whereas 43.3% (n=26) indicated a preference for the verbal style. In the understanding dimension, over half of the students (55%, n=33) preferred a sequential learning style, while 45% (n=27) demonstrated a preference for the global style.

Next, to investigate the null hypothesis, which stated that “the learning style preferences of Iranian architecture students do not have any significant effect on learning technical English vocabulary through content-based instruction”, a repeated measures MANOVA was employed, which analyzed scores across variables based on repeated observations. Initially, the researchers assessed the students’ performance on the pretest and posttest, with an emphasis on vocabulary knowledge by comparing mean scores of the two groups (Table 1).

Table 1

Descriptive Statistics of the Vocabulary Pretest and Posttest of the Experimental and Control Groups

	Group	Mean	SD	N
Pretest	Experimental	21.83	1.62	30
	Control	22.40	1.54	30
Posttest	Experimental	22.63	1.35	30
	Control	22.80	1.34	30

As observed in Table 1, the mean score of the experimental group increased from 21.83 in the pretest to 22.63 in the posttest which indicates a noticeable enhancement in the participants’ performance. Similarly, the vocabulary test scores for the control group improved from 22.40 in the pretest to 22.80 in the posttest, which implies an increase in their vocabulary knowledge at the end of the experiment. Given the rise in mean scores for both groups from the pretest to the posttest, a more intricate analysis was required to scrutinize the influence of the independent variable (i.e., learning styles) and time (as the within-subject factor) on the dependent variable (i.e., vocabulary scores). The initial analysis involved conducting the Box’s M test to verify the homogeneity of covariance matrices. The significance value for the test of equality of covariance matrices was .97 which indicated that the result was not statistically significance. Consequently, the assumption of equal covariance matrices was satisfied. Since the homogeneity of the covariance matrices was confirmed, the Pillai’s Trace from the Multivariate Tests table (i.e., Table 2) was the appropriate statistical measure to proceed with.

Table 2

Tests of the Main Effect and the Interaction Effect of the Experimental and Control groups on the Vocabulary Pretest and Posttest

Effect		Value	F	Sig.	Partial Eta Squared
Time	Pillai's Trace	.15	5.17	.00	.15
Group	Pillai's Trace	.04	1.24	.29	.04
Time * Group	Pillai's Trace	.02	.74	.48	.02

In Table 2, the term “time” in the first row serves as the within-subject factor and indicates the variation in students’ scores from the pretest to the posttest. The significance value reported in this row is .00 which falls below the conventional threshold of .05. This signifies that time had a statistically significant impact on students’ performance in learning technical English vocabulary and indicated a change in the dependent variable (scores) over time. Additionally, the Partial Eta Squared is examined employing the subsequent thresholds: .01 indicates a small effect, .06 a medium effect, and .14 a large effect. In this case, the Partial Eta Squared of .15 indicates a large effect size for time (Sigmundsson et al., 2022). The second row “group” indicates the contrast between the experimental and control groups’ performance on the vocabulary pretest and posttest. The reported significance value of .29 exceeds the standard significance level of .05. Correspondingly, the Partial Eta Squared value of .04 indicates a small effect size. The third row assessed whether the interaction between time and group influences the vocabulary test scores. The significance value for this interaction effect is .48, which is above the significance level of .05. It is concluded that the interaction effect is not statistically significant. Furthermore, the reported Partial Eta Squared of .02 also reflects a small effect size for the interaction of time and group.

Table 3

Tests of the Within-Subject and Between-Subject Effect of the Experimental and Control groups on the Pretest and Posttest

Source	Type III Sum of Square	df	Mean Square	F	Sig.	Partial Eta Squared
Time (Greenhouse-Geisser)	12.97	1.401	9.22	4.01	.02	.06
Group (Greenhouse Geisser)	8.45	1.40	8.45	3.50	.06	.05
Time * Group (Greenhouse-Geisser)	1.60		1.13	.49	.48	.00

According to the findings presented in Table 3, the significance value of “time” is .02, which is below the conventional threshold of .05. This confirms the primary impact of time on the improvement of students’ scores from pretest to posttest. Nevertheless, the Partial Eta Squared, with the value of .06, indicates a moderate effect size. Moving to the second row, entitled “group”, the researchers examined whether a noteworthy difference exists in the performance of students in experimental and control groups. The reported significance value of .06 exceeds the .05 threshold, and this suggests that the observed difference is not statistically significant. Furthermore, the third row concentrates on the interaction effect of time*group, with a significance value of .48. This value surpasses the predetermined significance level of .05 which indicates that the simultaneous effect of time and group is not an influential factor affecting the students’ learning of technical vocabulary. These results indicated that the null hypothesis of this study could not be rejected. In other words, the Iranian architecture students’ learning style does not significantly affect their learning of technical English vocabulary through content-based instruction.

Upon completion of the experiment, the participants underwent interviews to discuss their experiences and provide insights into their engagement in a content-oriented classroom. Given that one of the salient features of content-based instruction (CBI) is the utilization of content-related materials, the primary objective of these interviews was to collect the students' perspectives on the efficacy of CBI in facilitating technical vocabulary learning with fewer difficulties. An analysis of the interviews revealed that a majority of respondents exhibited a positive attitude toward learning technical vocabulary through content-based instruction. Specifically, 76.6% of the participants, that is, 46 out of 60, emphasized that contextualizing content and introducing unfamiliar elements through practical, real-life examples in CBI significantly enhanced their comprehension and retention of vocabulary.

Moreover, the most prominent feature arising from the interviews was the simultaneous emphasis on language and content development, which students found to enhance the effectiveness of the learning process. Approximately 91.7% of students perceived studying meaningful topics related to their areas of interest as a positive factor that not only enhanced language acquisition but also encouraged a more positive attitude toward their language learning journey. Additionally, 51 out of 60 interviewees confirmed that participating in this content-oriented class, which structured around a learner-centered approach, heightened their engagement with the content. They expressed satisfaction with activities designed to promote interactions and active involvement in the learning process and believed that such activities fostered collaborative learning and developed their communication skills. However, a minority of students felt that CBI would not significantly impact their vocabulary learning and viewed it a time-consuming approach.

Discussion

Since every individual employs a unique learning style and approach for the acquisition of knowledge and skills in a different way, successful learning occurs when information is presented to learners based on their individual learning styles. In this study, the researchers assessed the dominant learning styles of architectural engineering students and investigated the relationship between these learning styles and their achievement scores in technical English vocabulary. To identify the dominant learning styles among the participants, the researchers utilized the ILS questionnaire, which focused on four main dimensions (i.e., processing, perception, reception, and understanding). Statistical analysis of data obtained from the students' responses to 44 items led to the identification of the dominant learning styles in each dimension, namely: (1) reflective, (2) intuitive, (3) visual, and (4) sequential. Regarding the impact of learning styles on students' acquisition of technical English vocabulary in CBI classes, the performance of the two groups was measured by comparing their pretest and posttest scores. The study revealed that although students in both groups showed progress in learning technical words, the experimental group showed slightly higher gains than the control group as their mean scores from pretest to posttest increased. However, this difference was not significant and accordingly should be interpreted with caution.

Other researchers in the field provided support for similar findings. For example, Tadayonifar et al. (2021) found significant differences on students' vocabulary learning posttest scores in relation to their learning styles. In another study, Panah Dehghani (2021) observed that among 44 undergraduate students, multimodal and visual learners performed the best on vocabulary tests. Using PowerPoint-designed vocabulary organizers, Sarani and Ghollasi Moud (2022) found that all students with visual, auditory, read/write, and kinesthetic learning styles

improved their scores; however, the improvements made by the visual and kinesthetic ones were more significant than those of auditory and read/write ones. In addition, considering the effects of content-based instruction, others observed its effectiveness on vocabulary development. Sariani et al. (2022) indicated that CBI improved students' writing skills through the mastery they obtained in vocabulary. Hurtado Vargas (2023) likewise observed the positive effect of CBI on learners' vocabulary acquisition. All these positive outcomes, as Zhang et al. (2022) maintained, can be attributed to the fact that in CBI classes, the teacher integrates topics with students' prior knowledge, sets grammar aside, encourages students to appropriately use technical vocabulary to reflect the subject content, and stimulates their thinking.

Furthermore, after the completion of the experiment, the participants were asked to share their experiences of participating in a content-oriented classroom. The majority expressed satisfaction with the experiment, and this highlighted the fact that the topics taught based on content made language learning more interesting and motivating. They also noted that the new topics were easier to recall and learn. As asserted by Kışlal and Gezer (2021), integrating content and language instruction creates an environment in which authentic learning opportunities are provided that benefit both the teacher and students. By holding positive attitudes toward such classes, language teachers can enhance their teaching quality for young language learners. Using semi-structured interviews, Pratama and Fitriani (2020) indicated that teachers hold positive views toward CBI. However, concerning students, it should be noted that although they enjoyed the subject content and language integration, they were not satisfied with the scope of vocabulary, expressions, and grammar they had in conveying meaning. Overall, the findings of the present study suggested that adapting instruction to individual learning styles and implementing content-based approaches positively impacted students' experiences and outcomes in learning technical English vocabulary.

Conclusion

The present study aimed to investigate whether learning styles contribute to the acquisition of technical English vocabulary and the proficiency levels achieved among architectural engineering students. Since every individual possesses a unique learning style and approaches knowledge acquisition and skill development differently, successful learning can be facilitated by presenting information that is based on learners' individual styles. As observed, in this study, the majority of the participants exhibited reflective, intuitive, visual, and sequential learning styles. Furthermore, learning styles may influence how individuals grasp concepts and acquire information. Understanding one's specific learning preferences can enhance their learning experience. Therefore, teachers need to familiarize themselves with these differences so that they can implement their best teaching strategies for the benefit of diverse learners and find a balanced teaching approach that covers most students' learning styles. Adapting teaching styles to learning styles can positively influence students' academic achievements. Moreover, relying solely on one teaching method may not be effective for all students in a classroom.

Teaching through a content-based approach and selecting appropriate instructional materials, including carefully designed content, can serve as an effective strategy. Such tasks can attract learners with various styles and preferences. By emphasizing a learner-centered approach, the content-based instruction classroom encouraged active student engagement, stimulated group interactions, and promoted effective communication. The specific learning preferences of students may be less critical than providing them with engaging teaching materials. When

students become interested in the teaching process, an efficient learning process and notable academic achievement can be obtained.

Furthermore, one of the major steps in designing educational materials is considering the stakeholders' needs. In this regard, materials developers in the architectural engineering field must maintain a balance between students' needs, the course objectives, and preferred learning styles. They should select topics and organize content based on the identification of the program and develop instructional strategies accordingly. In addition, they must evaluate students' progress, enabling them to understand whether the material is effective in achieving learners' goals and learning objectives.

The results of this study did not support the rejection of the null hypothesis. However, given the widespread use of learning style measures in educational settings, further research in this area is necessary. In future studies, a larger sample would be recommended to enhance the generalizability of the reported findings. Additionally, future research could consider various demographic factors, including educational qualifications and gender. Furthermore, since the adoption of appropriate learning styles and the enhancement of learners' understanding are essential considerations, future studies could explore these aspects using different models of learning styles. The effective application of diverse learning styles in the academic setting goes beyond vocabulary acquisition. ESP, in particular, is not solely concerned with mastering a specific language skill. Therefore, future research should investigate whether learning preferences influence other language skills among architecture students. Moreover, given the diversity of strategies available for learning new words, researchers could assess the simultaneous effect of using different vocabulary-learning techniques and students' learning styles on their academic achievement in ESP contexts.

This study, like many others, is not without limitations. First, using convenience sampling to collect the required participants may limit the generalizability of the results obtained. Second, the relatively short duration of the treatment (i.e., six two-hour sessions over one and a half months) might not have been sufficient to observe long-term effects of the treatment. Lastly, focusing solely on vocabulary acquisition, without examining its transfer to productive skills, is another limitation the researchers had. When interpreting the findings of this study and planning future investigations, researchers and scholars need to bear these points in mind. Setting these limitations aside, the present study endeavored to provide valuable insights into the interplay between learning styles and vocabulary acquisition in ESP contexts. It is hoped that it will lay the foundation for future investigations in this field.

References

- Ahrari, R. (2023). The effect of content-based instruction and collaborative learning instruction on the development of the metaphorical competence of Iranian upper-intermediate EFL students. *International Conference on Language, Literature, History and Civilization*. SID. <https://sid.ir/paper/1082948/en>.
- Al-Wadi, H. M. (2023). The potential of using content-learning tasks in promoting literacy skills for EFL/ESL Bahraini learners. *Journal of Language Teaching and Research*, 14(2), 425-435.
- Benitez-Correa, C., Vargas-saritama, A., Gonzalez-Torres, P., Quinonez-Beltran, A., & Ochoa-Cueva, C. (2022). Students' preferences and learning styles in relation to reading and

- writing strategies at distance higher Education. *International Journal of Learning, Teaching and Educational Research*, 21(4), 316-336.
- Brinton, D. M., & Holten, C. (2001). Does the emperor have no clothes? A re-examination of grammar in content-based instruction. In J. Flowerdew & M. Peacock (Eds.), *Research perspectives on English for academic purposes* (pp. 239-251). Cambridge University Press.
- Brinton, D. M., Snow, M. A., & Wesche, M. B. (2003). *Content-Based second language instruction*. University of Michigan Press.
- Brooks, G., Clenton, J., & Fraser, S. (2021). Exploring the Importance of vocabulary for English as an additional language learners' reading comprehension. *Studies in Second Language Learning and Teaching*, 11(3), 351-376.
- Ching, F. D. K. (1995). *Visual dictionary of architecture*. Wiley.
- Coe, N., & Fowler, W.S. (1976). *Nelson English language tests*. Thomas Nelson and Sons Ltd.
- Creswell, J. & Creswell, J. D. (2023). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches Sixth Edition*. Sage Publications.
- Daud, K. A. M., Khidzir, N. Z., Ismail, A. R., & Abdullah, F. A. (2018). Validity and reliability of instrument to measure social media skills among small and medium entrepreneurs at Pengkalan Datu River. *International Journal of Development and sustainability*, 7(3), 1026-1037.
- Dörnyei, Z. (2014). *The psychology of the language learner: Individual differences in second language acquisition*. Routledge.
- Dobakhti, L., Zohrabi, M., & Tadayyon, P. (2020). An investigation into the usability of rote and mnemonic strategies for vocabulary education among elementary EFL learners. *Teaching English Language*, 14(2), 301-321. <https://doi.org/10.22132/TEL.2020.119162>
- Farhady, H., & Tavakoli, P. (2005). *English for the students of architecture*. SAMT Publications.
- Farhady, H., Tavassoli, K., & Irani, F. H. (2018). Selecting corpus-based grammatical structures for ESP/EAP materials. In Y. Kırkgöz & K. Dikilitaş (Eds.), *Key issues in English for specific purposes in higher education. English Language Education, Vol 11*. Springer. https://doi.org/10.1007/978-3-319-70214-8_5.
- Felder, R. M., & Soloman, B. A. (1997). *Index of learning styles questionnaire*. [On-line]. Available: <http://www.engr.ncsu.edu/learningstyles/ilsweb.html>.
- Felder, R.M., & Spurlin, J. (2005). Reliability and validity of the index of learning styles: A meta-analysis. *International Journal of Engineering Education*. 21(1), 103-112.
- Güneş, C. (2004). *Learning style preferences of preparatory school students at Gazi University* [Master's thesis, Middle East technical university]. Middle East Technical University. Available: <https://etd.lib.metu.edu.tr/upload/12605465/index.pdf>.
- Hardiyanti, R. L. P., & Herda, R. K. (2023). Teaching vocabulary using flash cards in Indonesian ESP Classroom: A one-shot case study. *JELITA: Journal of Education, Language Innovation, and Applied Linguistics*, 2(1), 1-11.

- Hurtado Vargas, L. Y. (2023). *Developing reading skills through a content-based instruction approach* [Doctoral dissertation, Facultad de Artes y Humanidades]. Universidad De Caldas
- Kashef, S. H., & Barzegari, F. (2023). EFL teachers' attitudes towards self-directed language learning in diverse academic settings. *International Journal of Practical and Pedagogical Issues in English Education*, 1(3), 1-11. <https://doi.org/10.22034/ijpie.2023.179557>.
- Kazemainy, F., Barjesteh, H., Golaghaei, N., & Nasrollahi Mouzirji, A. (2023). Learning styles, technology savviness, and Iranian EFL learners' vocabulary knowledge: The mediating role of learners' preferences and needs during agile app development. *Teaching English as a Second Language Quarterly*, 42(2), 51-80.
- Keefe, J. W. (1979). Developing a defensible learning style paradigm. *Educational Leadership* 48(2), 57- 61.
- Kişlal, İ., & Gezer, M. Ü. (2021). Turkish primary-level EFL teachers' views on the scope and effectiveness of content-based instruction. *e-Kafkas Journal of Educational Research*, 8(3), 612-626
- Lai, Y., & Aksornjarung, P. (2017). The effects of content-based instruction on listening and speaking abilities of Thai EFL University students, *Journal of Creative Practices in Language Learning and Teaching*, 5(2), 1-20.
- Le, C. N. N., & Miller, J. (2023). A core meaning-based analysis of English semi-technical vocabulary in the medical field. *English for Specific Purposes*, 70, 252-266.
- Miyasako, M. (2023). What are would-be elementary school teachers' perceptions of content-based instruction on teaching English to young learners? *Bulletin of University of Teacher Education Fukuoka*, 72, 71-84.
- Miyasako, N. (2018). Does theme-based CBI in active learning affect university students' intrinsic-extrinsic motivation and listening comprehension? *International Journal of Curriculum Development and Practice*, 20(1), 49-62.
- Mohammadi Zenouzagh, Z. (2017). *Application of SPSS in research on applied linguistics*. Islamic Azad University Publication.
- Naim, S., & Mokodenseho, S. (2022). Implementation of the virtual learning models during the covid19 pandemic: Students' perspectives and its lessons. *Jurnal Kependidikan: Jurnal Hasil Penelitian Dan Kajian Kepustakaan Di Bidang Pendidikan, Pengajaran Dan Pembelajaran*, 8(3), 617-628.
- Orasta, K. (2023). Vocabulary teaching strategies using in ESP classes. *Gospodarka iInnowacje.*, 33, 134-137.
- Panah Dehghani, A. (2021). Learning styles and vocabulary learning by Iranian undergraduate EFL learners. *Contemporary Educational Research Journal*, 11(4), 176-185.
- Patel, Sh., Jena, S.R., Gupta, A., & Lathar, P. (2023). *Research methodology theory and techniques*. Xoffencer International Publication
- Pratama, M. G. & Fitriani, S. (2020). The perceptions of teachers and students on the use of content-based instruction in teaching speaking at P4M Mataran. *The Asian ESP Journal*, 16(4), 22-32.

- Qasem, F., Ghaleb, M., Mahdi, H. S., Al Khateeb, A., & Al Fadda, H. (2023). Dialog chatbot as an interactive online tool in enhancing ESP vocabulary learning. *Saudi Journal of Language Studies*, 3(2), 76-86.
- Rashid, M. H., Lan, Y., & Hui, W. (2022). The importance of vocabulary in teaching and learning in applied linguistics. *Linguistics and Culture Review*, 6, 541-550.
- Richards, J. C., & Rodgers, T. S. (2014). *Approaches and methods in language teaching* (3rd ed.). Cambridge University Press.
- Sarani, A., & Ghollasi Moud, S. (2022). The effect of teaching vocabulary through PowerPoint designed vocabulary organizers on different learning styles of pre-intermediate Iranian EFL learners. *Teaching English Language*, 16(1), 311-329
- Sariani, S., Rozi, F., & Yaningsih, Y. (2022, March). Content-based instruction (CBI) in writing e-brochure: Integrating vocabulary learning and technology-enhanced language teaching. In *International Conference on Applied Science and Technology on Social Science 2021* (iCAST-SS 2021) (pp. 499-506). Atlantis Press.
- Saswandi, T., Oktavia, A., Wijayati, W., & Jaya, R. (2023). The correlation among students' learning styles and students' motivation in learning English with their vocabulary Mastery. *Journal on Education*, 6(1), 927-941.
- Shams, S. (2023). *Comparing The effectiveness of content-based language instruction and communicative language teaching in improving the reading comprehension skills of Iranian intermediate English learners* [Master's thesis, University of Stavanger]. University of Stavanger
- Shewangizaw, G. (2024). Comparative analysis of English proficiency of technical and vocational trainees: Insights across three modalities. *International Journal of Practical and Pedagogical Issues in English Education*, 2(3), 67-85. <https://doi.org/10.22034/ijpie.2024.473485.1035>.
- Sigmundsson, H., Haga, M., Elnes, M., Dybendal, B. H., & Hermundsdottir, F. (2022). Motivational factors are varying across age groups and gender. *International Journal of Environmental Research and Public Health*, 19(9), 5207.
- Snow, A., & Brinton, D. (2023). *Content-Based instruction: What every ESL teacher needs to know*. University of Michigan Press.
- Stoller, F. L. (2004). Content-Based instruction: Perspectives on curriculum planning. *Annual Review of Applied Linguistics*, 24, 261-283. <https://doi.org/10.1017/S0267190504000111>
- Tabachnick, B. G., & Fidell, L. S. (2019). *Using multivariate statistics* (7th ed.). Pearson.
- Tadayonifar, M., Entezari, M., & Valizadeh, M. (2021). The effects of computer-assisted L1 and L2 textual and audio glosses on vocabulary learning and reading comprehension across different learning styles. *Journal of Language and Education*, 7(2), 202-221.
- Tavassoli, K., & Beyranvand, S. (2023). How Instagram as a MALL tool impacts EAP learners' technical vocabulary learning and perceptions in an electronic context. *SN Social Sciences*, 3(70), 1-22. <https://doi.org/10.1007/s43545-023-00657-z>.

- Tavassoli, K., Khedri, N., & Rahmatollahi, M. (2023). The effect of content and language integrated project (CLIP) instruction through co-teaching on electrical engineering students' vocabulary knowledge for professional purposes. *Iranian Journal of Applied Linguistics*, 26(1), 7-7. <http://ijal.khu.ac.ir/article-1-3226-en.html>.
- Thomas, L. (2020, September 24). *Control groups in scientific research*. Scribbr. <https://www.scribbr.com/methodology/control-group/>.
- Thomas, L. (2021, October 18). *An introduction to quasi-experimental designs*. Scribbr. <https://www.scribbr.com/methodology/quasi-experimental-design/>.
- Valentyna, B. (2023). Teaching technical vocabulary to university beginners, using new technologies: Ukrainian case. In E. Pluzhnik, P. Liudmyla, I. Mushenyk, L. Prudka, D. Marchenko, R. Harchenko, S. Belei, P. Lidiya, M. Levon, & H.M. Hubal (Eds.), *Modern Education Using the Latest Technologies* (pp. 232-233). International Science Group.
- Valisherjon o'g'li, A. H., & Xalilillo, Q. (2023). Globalization and the spread of English. *Golden Brain*, 1(10), 199-205.
- Williamson, K. & Johanson, G. (2017). *Research methods: Information, systems, and contexts*. Chandos Publishing.
- Yamagishi, K. (2023). Theory and practice of content-based instruction (CBI) and content & language integrated learning (CLIL) in a Japanese EFL setting. *神田外語大学紀要*, 35, 439-457.
- Zakirova, Z. Z. (2023). The effectiveness of content-based instruction in EFL contexts. *Educational Research in Universal Sciences*, 2(5), 112-114.
- Zhang, L., Li, Q., & Liu, W. (2022). A study on the effectiveness of college English teaching based on content-based instruction teaching philosophy. *Frontiers in Psychology*, 13, 921654.

Kobra Tavassoli is an associate professor of TEFL at Islamic Azad University, Karaj, Iran. She is teaching language assessment, research methodology, and language teaching methodology courses at BA, MA, and PhD levels. Her areas of interest are language assessment and teacher education. She has published in different journals and presented in national and international conferences on these topics.

Tahereh Mohammad Aghaei holds an M.A. in TEFL from Karaj Islamic Azad University. She is currently teaching English courses at language institutes. Her research areas are ESP/EAP and content-based instruction.

Maryam Rahmatollahi, a lecturer and researcher, is a PhD candidate of TEFL at Karaj Islamic Azad University, Iran. Her area of interest is the role of technology in language teaching and she has published some articles in this area recently.