MIND MAPPING IN TECHNICAL VOCABULARY LEARNING: PERCEPTIONS OF TEACHERS AND SECOND-YEAR NON-ENGLISH MAJORS AT HANOI UNIVERSITY OF INDUSTRY

SƠ ĐỒ TƯ DUY TRONG VIỆC HỌC TỪ VỰNG CHUYÊN NGÀNH: NHẬN THỨC CỦA GIẢNG VIÊN VÀ SINH VIÊN KHÔNG CHUYÊN NĂM HAI TẠI TRƯỜNG ĐẠI HỌC CÔNG NGHIỆP HÀ NỘI

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ABSTRACT

Mind mapping is considered a useful technique for enhancing vocabulary learning through visual organization and active engagement. At Hanoi University of Industry, second-year non-English majors often struggle with acquiring and retaining technical vocabulary in their English for Occupational Purposes (EOP) courses. Therefore, this article investigates teachers' and students' perceptions of using mind mapping in technical vocabulary acquisition. A mixed-methods design was employed, combining surveys and interviews as data collection tools. The results suggest that participants perceived mind mapping as beneficial for vocabulary retention and understanding, as well as fostering motivation and interest. Triangulation of the data provided more comprehensive insights into these perceptions.

Keywords: *Mind mapping, technical vocabulary learning, perceptions, non-English majors.*

TÓM TẮT

Sơ đồ tư duy được xem là một kỹ thuật hữu ích giúp nâng cao hiệu quả học từ vựng thông qua việc tổ chức thông tin trực quan và thúc đẩy sự tham gia tích cực của người học. Tại Trường Đại học Công nghiệp Hà Nội, sinh viên không chuyên tiếng Anh năm hai thường gặp khó khăn trong việc tiếp thu và ghi nhớ từ vựng chuyên ngành trong các học phần Tiếng Anh định hướng nghề nghiệp (EOP). Vì vậy, bài báo này tìm hiểu nhận thức của giảng viên và sinh viên về việc sử dụng sơ đồ tư duy trong quá trình tiếp thu từ vựng chuyên ngành. Nghiên cứu áp dụng phương pháp hỗn hợp, kết hợp bảng hỏi và phỏng vấn làm công cụ thu thập dữ liệu. Kết quả nghiên cứu cho thấy người tham gia nhận định rằng sơ đồ tư duy có lợi cho việc ghi nhớ và hiểu từ vựng, đồng thời góp phần thúc đẩy động lực và sự hứng thú trong học tập. Việc đối chiếu dữ liệu đã mang lại những hiểu biết toàn diện hơn về các nhận thức này.

Từ khóa: *Sơ đồ tư duy, học từ vựng chuyên ngành, nhận thức, sinh viên không chuyên tiếng Anh.*

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1. INTRODUCTION

In the digital age, language learning plays a vital role in education and professional development. To master a language, learners need to develop four key skills: listening, speaking, reading, and writing. Vocabulary serves as the foundation for these skills, enabling effective communication and comprehension. Richards and Renandya confirmed that vocabulary is a fundamental element of language proficiency, forming the foundation for learners' ability to speak, listen, and write effectively. They noted that without a sufficient vocabulary base and effective strategies for learning new

words, learners are unlikely to reach their full potential and may become discouraged from taking advantage of the opportunities available to them [1]. For students in technical fields, learning vocabulary can be particularly challenging due to the complexity and specificity of technical terms, which are often difficult to remember and apply in practice. Feng et al. [2] highlighted mind mapping as an effective strategy for enhancing vocabulary instruction and promoting long-term retention, a view echoed by Fiktorius [3], who regarded it as a highly effective teaching tool.

At Hanoi University of Industry, non-English majors, in their English for Occupational Purposes (EOP) courses, often encounter difficulties in learning and retaining vocabulary, particularly in their second year when they are required to acquire technical terms that are challenging to remember and apply effectively. These challenges are further compounded by the limitations of traditional memorization methods. The use of mind-mapping techniques represents an innovative approach to fostering learners' skills [2]. Mind mapping, a visual learning technique, has been shown to support vocabulary learning by promoting organization, association, and active engagement. While previous research has demonstrated its benefits in general language learning, little is known about its application to technical vocabulary acquisition in EOP contexts in Vietnam. This study addresses this gap by exploring the perceptions of both teachers and students regarding the use of mind mapping in learning and the retention of technical vocabulary in EOP courses among second-year non-English majors at Hanoi University of Industry.

2. LITERATURE REVIEW

2.1. Technical vocabulary

2.1.1. Definition of technical vocabulary

Nation distinguished technical vocabulary as a specific type of specialized lexis used in particular fields, setting it apart from academic vocabulary, which represents another specialized lexical group [4]. Liu and Lei defined technical vocabulary as words or phrases with specialized meanings in a particular subject area, recognized mainly by a specific community of users [5].

2.1.2. Challenges in learning technical vocabulary

Challenges in deriving meaning from context

For learners with limited proficiency, understanding the meanings of technical terms from context is often hindered by their restricted vocabulary knowledge. This lexical deficiency prevents them from fully comprehending the surrounding discourse and weakens their ability to effectively infer meanings [6]. Consequently, learners may encounter difficulties in meaningfully engaging with technical texts.

Polysemy or technical meanings distinct from everyday usage

When learning technical vocabulary, learners frequently face challenges with words that already have well-established everyday meanings. Since these familiar senses are deeply rooted in their mental lexicon, grasping the specialized meanings and functions of such terms within a specific domain becomes more challenging [6]. This issue highlights the cognitive burden that polysemy imposes on the process of L2 technical vocabulary acquisition.

Lack of specialized background knowledge

Another difficulty arises from the fact that technical vocabulary often demands background knowledge of the field in which it is used [4]. Students, and in some cases even language instructors, may lack sufficient subject-matter expertise to fully comprehend or accurately interpret such terminology [7]. In the absence of this disciplinary foundation, vocabulary learning can remain superficial and disconnected from authentic application.

Challenges in acquiring technical vocabulary in L2 Learning

In addition to the specific obstacles associated with technical vocabulary, learners face the broader challenges of acquiring vocabulary in a second language. As Stella Kourieos observed, merely recognizing the meaning of a word while reading does not guarantee that it will be securely stored in memory or integrated into active vocabulary use [8]. The gap between receptive recognition and productive mastery remains a persistent issue in L2 learning.

2.2. Mind mapping as a tool for learning technical vocabulary

Definition of Mind Mapping

According to Hofland [9], mind mapping helps L2 learners by providing more meaningful repetitions of new vocabulary, which supports better retention. This technique allows learners to engage with words more deeply rather than just memorizing them. By using pictures and graphic designs, mind mapping creates a

more engaging learning environment, boosting both memory and learner motivation [10].

Al Shdaifat et al. explained that a mind map presents information visually by placing a central concept at the center, from which main topics extend and connect to more detailed subtopics. This flexible graphic tool can help with exploring ideas, organizing notes, and fostering creative thinking [11].

The benefits of Mind Mapping

Mind mapping is a useful method that offers numerous advantages in education, enabling learners grasp new concepts more easily while supporting teachers to deliver lessons more clearly and effectively. Green [12] emphasized the importance of using mind maps, noting the following benefits:

(1) Mind mapping stimulates both hemispheres of the brain, encouraging creativity, analysis, and faster idea generation by organizing information visually. This method aligns with the brain's natural functioning, making it more effective than passive approaches.

(2) Memory retention improves when words are combined with images, as in mind maps, rather than relying on text alone. The brain more easily recalls visual imprints, and using keywords makes ideas easier to remember, understand, and explain.

(3) Linking and grouping ideas through mind maps helps organize thoughts clearly, encourages the generation of new ideas, and increases the likelihood of remembering connected concepts compared to isolated notes.

(4) Mind maps give an overview of the entire topic and its subtopics while allowing quick access to detailed information. They simplify complex ideas by presenting both general and specific points clearly, helping users focus on key aspects and achieve a deeper understanding of the subject.

(5) Mind mapping saves time by allowing quick access to essential details, avoiding the slow, detail-by-detail memorization of traditional study methods. With its clear structure and minimal words, it enables faster information processing and recall.

(6) Mind maps can help overcome idea blocks by providing a systematic framework that sparks creativity, starting with key questions such as why, where, what, when, and how.

In addition, a recent systematic review synthesizing studies from the past five years (2020-2024) confirmed the effectiveness of mind mapping in supporting vocabulary retention, while also enhancing learners' motivation and autonomy. In the review, Syukur et al. [13] indicated that mind mapping enhances both short-term and long-term vocabulary retention, contributing to more efficient memory of lexical items.

Furthermore, a meta-analysis of randomized controlled trials (RCTs) with medical students indicated that mind maps and concept maps significantly improved academic performance, with effect sizes ranging from moderate to large. This systematic review stated that mind maps are effective tools for enhancing the performance of undergraduate preclinical medical students, particularly by improving knowledge retention and comprehension [14]. While the benefits of mind mapping for vocabulary learning in general are well established, its application in learning technical vocabulary within English for Occupational Purposes (EOP) contexts deserves particular attention. Unlike general vocabulary, technical vocabulary often requires learners to deal with highly specialized meanings, polysemy, and background knowledge that may not be readily accessible. Mind mapping can help overcome these challenges by visually linking specialized terms with related concepts, functions, and contexts of use, thus making abstract or field-specific knowledge more concrete. In EOP settings, this visual organization not only supports memory retention but also facilitates deeper understanding of how technical terms operate within professional discourse, which is often more demanding than everyday language use.

The drawbacks of Mind Mapping

Aside from its undeniable advantages, Green [12] also identified certain disadvantages of mind mapping:

(1) Changing habits and thinking patterns is challenging and often resisted, requiring at least 21 days to form a new habit. For those unfamiliar with mind mapping, adapting may take time and at least 12 sessions to follow its rules. Mind mapping can challenge existing thinking styles, benefiting intuitive thinkers more, while logical thinkers may prefer linear note-taking but could adapt with enough practice.

(2) Unlike note-taking, mind maps may be hard to understand for those who do not present during their creation. Images, symbols, and keywords can be difficult to interpret without context. Thus, mind mapping mainly benefits participants involved in the session.

(3) Creating a mind map can be challenging for beginners despite its apparent simplicity. It requires skills, effort, and understanding of key steps, which teachers can help provide. The ultimate goal is to enhance learning, understanding, and information retention.

3. METHODOLOGY

In this study, a mixed-methods approach was employed to investigate teachers' and students' perceptions of using mind mapping as a tool to support students in learning vocabulary. Data were collected through a student survey and teacher interview, with the questionnaire and interview protocols carefully adapted from Ababsa Wahiba's dissertation [15], ensuring both contextual relevance and research validity. The adaptation process involved language modification and contextual adjustment, followed by expert review to ensure content validity. A pilot test with 20 students was conducted to check clarity and appropriateness. For the interview guide, minor wording adjustments were made after piloting with two teachers to ensure clarity and contextual relevance.

The questionnaire is divided into four parts to gather students' perspectives on using mind mapping for learning technical vocabulary. Part 1 collects students' personal information. Part 2 examines their views on the perceived importance of learning technical vocabulary and the reasons behind these opinions. Part 3 investigates their experiences and opinions regarding the use of mind mapping in technical vocabulary learning. Part 4 invites students to provide suggestions for enhancing the application of mind mapping in learning technical vocabulary. This instrument thus provided a broad, quantifiable overview of learners' attitudes and practices.

To complement this, the teacher data were collected through a semi-structured interview protocol comprising seven guiding questions. The interview questions explored teachers' views on the importance of technical vocabulary (Q1), their training and experience in using mind mapping (Q2, Q3), the benefits of applying this technique (Q4), potential challenges faced by students (Q5), overall effectiveness for learning and retention (Q6), and suggestions for improvement (Q7). This protocol aimed to gain a deeper understanding of the pedagogical reasons, classroom contexts, and professional perspectives shaping teachers' use of mind mapping.

By combining a student survey (breadth) with teacher interviews (depth), the two instruments complemented each other, enabling both measurable trends and rich explanations to be captured, thus ensuring a comprehensive understanding of the issue under study.

3.1. Research questions

In line with the aim of exploring how both teachers and students perceive the use of mind mapping in learning technical vocabulary, this study was guided by the following research question: *"What are teachers' and students' perceptions of using mind mapping for technical vocabulary learning?"*.

3.2. Participants and context

The participants of this study consisted of second-year non-English major students enrolled in technical programs at Hanoi University of Industry (HaUI). A total of 160 students, representing eight different disciplines - Mechanical Engineering, Information Technology, Automotive Technology, Electrical and Electronic Engineering, Garment and Fashion Design, Business and Trade, Tourism and Hospitality, and Chemistry and Environmental Technology - with 20 students from each discipline, took part in the survey. These students were studying English for Occupational Purposes (EOP) under a blended learning model, in which vocabulary, grammar, listening, reading, and writing were provided through the online platform, while speaking activities were primarily practiced in face-to-face classroom sessions. Importantly, the student participants were purposively selected as they had been taught by teachers who integrated mind mapping into vocabulary instruction. This ensured that the students had direct exposure to mind mapping techniques during their vocabulary learning.

In addition, 10 teachers of English from the same institution were purposively chosen for semi-structured interviews. The selection of teacher participants was based on their actual use of mind mapping in EOP instruction. We specifically selected teachers with at least five years of teaching experience to ensure sufficient expertise in English language instruction. Having incorporated mind mapping into their classroom practice, particularly in vocabulary lessons, these teachers could provide concrete and authentic insights into its effectiveness and practicality.

The research context is significant, as non-English major students at HaUI often encounter challenges in acquiring and retaining technical vocabulary essential for their studies and future careers. The blended learning environment further creates both opportunities and constraints for applying strategies such as mind mapping, making this context highly relevant for the present investigation.

3.3. Ethical considerations

This study was conducted in accordance with institutional research ethics guidelines. Prior to data collection, participants were informed about the purpose of the study, their right to withdraw at any time without penalty, and the voluntary nature of their participation. Informed consent was obtained from all participants. To ensure confidentiality and anonymity, no identifying information was collected, and responses were used solely for research purposes. Data were stored securely and accessible only to the researcher.

3.4. Data collection

In this study, 160 questionnaires were distributed to students after they had completed their English course for the 2024-2025 academic year in May 2025. All 160 questionnaires were collected and met the validity criteria and were therefore included in the analysis. The questionnaires were administered in class under supervision and checked for duplication to ensure data validity. For the teachers, data were collected through both face-to-face and online interviews.

3.5. Research design and data integration

This study used a convergent mixed-methods approach, with quantitative and qualitative data collected concurrently and given equal importance. The quantitative data from student surveys and the qualitative insights from teacher interviews were analyzed independently before being merged at the interpretation step. This integration enabled triangulation, ensuring that findings from both sources might complement, confirm, and contrast with each other. In cases where there were differences between survey findings and interview data, both perspectives were reported to provide a more nuanced understanding rather than favoring one data source over the other. This approach improved the study's overall validity and offered a comprehensive picture of teachers' and students' perceptions of utilizing mind mapping for technical vocabulary learning.

4. RESULTS AND DISCUSSION

4.1. Results

4.1.1. Analysis of Students' questionnaire

4.1.1.1. Students' perspectives on the importance of learning technical vocabulary

Question 1: In your opinion, how important is learning technical vocabulary?

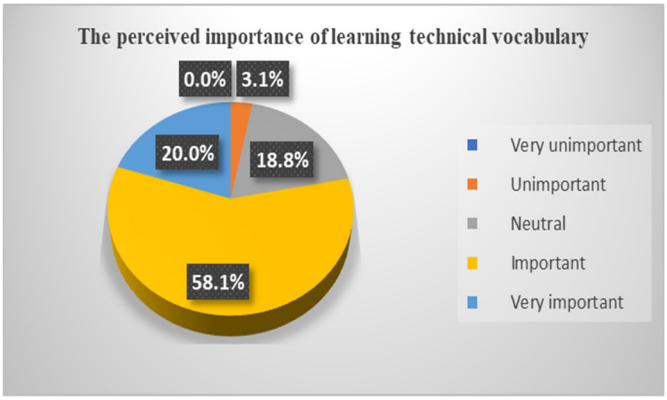

Figure 1. The perceived importance of learning technical vocabulary

As can be seen from the pie chart, the majority of students perceive technical vocabulary as important. Among the 160 participants, 93/160 (58.1%) rated it as *Important* and 32/160 (20%) as *Very important*, indicating that 78% of students recognize the significance of technical vocabulary in their learning and academic activities. A smaller portion of students, 30/160 (18.8%), were *Neutral*, suggesting some uncertainty about its importance, while only 5/160 (3.1%) considered it *Unimportant* and none rated it as *Very unimportant*. These findings imply that most students are aware of the value of mastering technical vocabulary, which provides a solid foundation for applying effective learning strategies. For the students who are neutral, additional guidance or explanation about the role of technical vocabulary in their field of study may help enhance their awareness and motivation.

Question 2: Why do you think technical vocabulary is important for your field of study?

Table 1. Reasons for the importance of learning technical vocabulary

Reasons	Number of students	Percentage
For success in exams and assignments	131	81.9%
For effective communication in the field	125	78.1%
For better career opportunities	101	63.1%

For reading technical materials	98	61.3%
For reading academic journals, research papers, and articles	67	41.9%
For writing reports and thesis	54	33.8%
Others	8	5.0%

(Multiple responses permitted; percentages calculated over N=160)

The findings reveal that students recognized multiple reasons for the importance of learning technical vocabulary, with exam- and study-related purposes receiving the highest agreement. Specifically, 81.9% of respondents indicated that technical vocabulary was essential for success in exams and assignments, followed closely by 78.1% who considered it important for effective communication in their field. Career-related purposes were also strongly emphasized, as 63.1% of students selected "for better career opportunities."

Practical needs were reflected in the responses as well, with 61.3% highlighting the role of technical vocabulary in reading technical materials. More academically advanced activities, such as engaging with academic journals, research papers, and articles, were recognized by 41.9%, while 33.8% linked technical vocabulary with the ability to write reports and theses. Only 5% of respondents suggested other reasons. These included purposes such as travelling and cultural exchange**,** pursuing further studies abroad**,** understanding technical standards and specifications**,** working with machinery and equipment manuals, and participating in engineering conferences and workshops. These reasons, though less common, highlight the diverse needs of students across various technical disciplines such as mechanical engineering, electronics, chemical engineering, information technology, and automation, etc.

Overall, these results suggest that students value technical vocabulary both for immediate academic success and for long-term professional development, with communication and exam performance emerging as the most prominent motivations.

4.1.1.2. Students' perspectives on Mind Mapping and Technical Vocabulary Learning

Question 3: How often do you use mind mapping?

Figure 2 shows that students reported varying frequencies in their use of mind mapping for technical vocabulary learning. A majority of respondents, 84/160 (52.5%), stated that they sometimes used mind mapping, while 51/160 (31.9%) indicated they used it often. In contrast, only 9/160 (5.6%) reported using it always, and 16/160 (10%) admitted they rarely applied this technique.

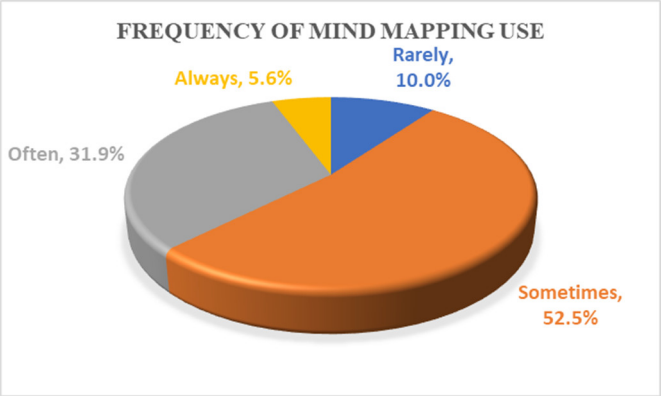

Figure 2. Frequency of mind mapping use

These results suggest that while mind mapping is recognized and employed by many students, it is not yet consistently integrated into all learning practices. The relatively low percentage of students who always use mind mapping may reflect that the technique is still viewed as a supplementary tool rather than a habitual learning strategy.

Question 4: To what extent do you find mind mapping effective in helping you learn and retain technical vocabulary?

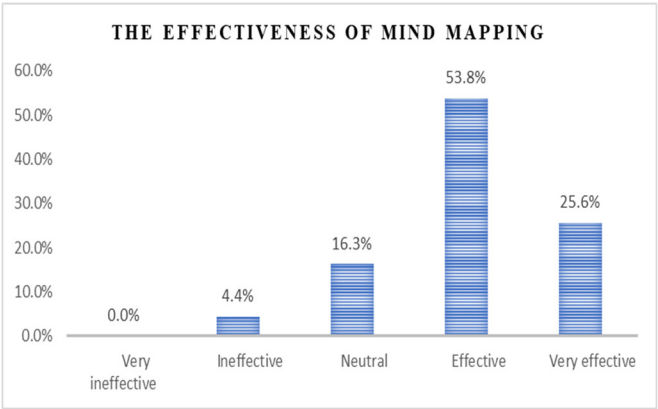

Figure 3. The effectiveness of mind mapping in learning technical vocabulary

Figure 3 shows a generally positive perception. A large majority of respondents rated mind mapping as either effective (86/160; 53.8%) or very effective (41/160; 25.6%), together accounting for nearly 80% in total. Meanwhile, 16.3% (26/160) of students remained neutral, suggesting that they neither found it particularly helpful nor unhelpful. Only a small proportion expressed negative views, with 4.4% (7/160) rating it ineffective and none rating it very ineffective.

These findings indicate that most students perceive mind mapping as a useful tool for learning and retaining technical vocabulary, although a minority still show uncertainty or limited appreciation of its effectiveness.

When explaining their choices, many students who rated mind mapping as effective or very effective highlighted that it helped them visualize and organize new words, making them easier to remember. They also mentioned that the use of colors and branches kept them engaged and allowed them to see connections between technical terms and related concepts, which enhanced long-term retention. In contrast, students who selected a neutral response stated that while mind mapping could be useful, they sometimes preferred other strategies such as flashcards or sentence-making and felt that its usefulness depended on the type of vocabulary being learned. A small number of students who considered it ineffective explained that they found it time-consuming or felt that linear notes were more practical for exam preparation.

Question 5: What specific benefits do you think mind mapping provides in technical vocabulary learning?

Table 2. Benefits of using mind mapping in technical vocabulary learning

Benefits	Number of students	Percentage
Improving memory through words and images	115	71.9%
Organizing and connecting ideas in a clear way	99	61.9%
Giving an overview of the whole topic with details and key points	95	59.4%
Stimulating the brain and supporting creativity	88	55.0%
Saving time and making learning faster	75	46.9%
Overcoming idea blocks and encouraging new ideas	57	35.6%
Others (please specify):	6	3.8%

(Multiple responses permitted; percentages calculated over N=160)

The results show that students recognized multiple advantages, with improving memory through words and images standing out as the most frequently acknowledged benefit (71.9%). This was closely followed by organizing and connecting ideas in a clear way (61.9%) and giving an overview of the whole topic with details and key points (59.4%), indicating that many students valued mind mapping for its role in structuring and summarizing information (Table 2).

In addition, stimulating the brain and supporting creativity was chosen by 55%, while saving time and making learning faster was noted by nearly half of the respondents (46.9%). A smaller group of students (35.6%) felt that mind mapping was useful for overcoming idea blocks and encouraging new ideas. Only 3.8% mentioned other reasons not listed in the questionnaire. These included its role in facilitating group work and collaboration, as students could easily share and develop ideas together; enhancing presentation skills by making information more visual and accessible; and making learning more enjoyable, which helped reduce stress when dealing with complex technical vocabulary. Some students also highlighted that mind mapping could be adapted to different learning styles and proved useful for exam preparation and quick revision. Although less frequently reported, these responses show that mind mapping offers additional, context-specific advantages that contribute to a more engaging and supportive learning process.

Overall, the data suggest that students primarily appreciate mind mapping for its cognitive benefits in memory, organization, and overview, while aspects related to creativity and efficiency are recognized but considered secondary.

Question 6: What challenges have you experienced when using mind mapping to learn technical vocabulary?

Table 3. Challenges of using mind mapping in technical vocabulary learning

Challenges	Number of students	Percentage
Changing habits and getting used to mind mapping	96	60.0%
Understanding mind maps without joining the session	81	50.6%
Creating mind maps and learning basic skills as beginners	61	38.1%
Others (please specify):	9	5.6%

(Multiple responses permitted; percentages calculated over N=160)

Table 3 indicates several key difficulties. The most common issue, reported by 60% of students, was changing habits and getting used to mind mapping, showing that many learners found it difficult to shift from traditional notetaking to a new visual method. More than

half (50.6%) also experienced problems in understanding mind maps without joining the session, suggesting that mind maps were sometimes unclear when used without explanation. Meanwhile, 38.1% struggled with creating mind maps and learning the basic skills as beginners, highlighting the need for initial training and practice. In addition, a small proportion (5.6%) pointed to other challenges such as time constraints or limited access to digital tools. Overall, these findings suggest that while mind mapping offers potential benefits, its use in technical vocabulary learning is still hindered by adjustment difficulties, interpretation problems, and lack of experience.

4.1.1.3. Students' suggestions and attitudes toward mind mapping

When asked whether it would be beneficial to replace traditional teaching techniques with mind mapping in teaching technical vocabulary (Question 7), a majority of students **(**112/160; 70%**)** answered *Yes*, explaining that mind mapping enhanced engagement and memory retention. Meanwhile, 48 students (30%) preferred traditional methods, arguing that mind mapping did not suit all learning styles.

Regarding the question of whether mind mapping should be used more often in technical vocabulary learning (Question 8), most respondents (118/160; 74%) agreed, noting that regular practice would improve their skills and familiarity with the technique. However, 42 students (26%) felt that frequent use might be time-consuming and less effective for quick revisions.

With Question 9 (suggestions for improving the use of mind mapping in technical vocabulary learning), students proposed a variety of ways to enhance its effectiveness. About 60% (96/160) highlighted the importance of training sessions on how to design effective mind maps, especially for beginners. Around 45% (72/160) recommended incorporating digital tools and software to make mind maps more efficient and visually appealing. Meanwhile, 38.1% (61/160) emphasized combining mind mapping with traditional learning techniques such as note-taking, quizzes, or group discussions, so that the method supports rather than replaces existing practices.

4.1.2. Analysis of Teachers' interview

The interview data was analyzed using thematic coding. All transcripts were read repeatedly to become acquainted with the content before being split into meaningful units. These units were then inductively classified and aggregated into bigger themes corresponding to teachers' perceptions, practices, benefits, and challenges related to mind mapping in technical vocabulary learning. To increase the validity of the analysis, a second researcher independently coded 30% of the transcripts. The intercoder agreement reached 85%, and any differences were worked out through discussion until consensus was obtained.

The following presents the findings, organized by interview questions, with both thematic patterns and frequency counts to illustrate the prevalence of each response.

Question 1: How important do you consider learning technical vocabulary for students?

All 10 teachers (100%) agreed that learning technical vocabulary was essential for students in English for Occupational Purposes (EOP) courses. Seven teachers (70%) perceived it as a foundation for reading comprehension and professional communication, while three teachers (30%) considered it important for enabling students to engage with specialized academic materials.

Question 2: Have you received any training on using the mind mapping technique in teaching technical vocabulary?

Only 3 out of 10 teachers (30%) reported having received formal training in mind mapping techniques. The remaining 7 teachers (70%) stated that they had learned informally, either through self-study or peer sharing, which was perceived as indicating a lack of systematic professional development in this area.

Question 3: How often do you use mind mapping in your teaching?

Three teachers (30%) reported using mind mapping frequently in their teaching, particularly for vocabulary lessons. Five teachers (50%) stated that they used it occasionally, while the remaining two teachers (20%) admitted that they rarely incorporated it, mainly due to time constraints or students' unfamiliarity with the technique.

Question 4: In your opinion, what benefits does mind mapping offer students for learning technical vocabulary?

The majority of teachers (80%) perceived mind mapping as a useful tool that helps students visualize word relationships and supports memory retention. Four teachers (40%) believed that it could enhance creativity and engagement during lessons, while two teachers

(20%) considered it beneficial in supporting group collaboration.

Question 5: What challenges or difficulties might students face when using mind mapping in their learning technical vocabulary?

Teachers identified several difficulties students might encounter. Six teachers (60%) stated that students often lacked the skills to design effective mind maps. Four teachers (40%) pointed out that students may over-focus on design rather than content. Additionally, three teachers (30%) reported that some students found digital tools for mind mapping difficult to use without proper guidance.

Question 6: Overall, do you believe mind mapping could improve students' learning and retention of technical vocabulary?

Eight teachers (80%) believed that mind mapping could be effective in supporting vocabulary learning and retention if integrated effectively. Two teachers (20%), however, remained cautious, perceiving it as more suitable as a complementary tool rather than a replacement for traditional methods such as note-taking or rote memorization.

Question 7: Do you have any suggestions for improving the use of mind mapping in technical vocabulary learning?

Teachers also provided valuable recommendations, with some aligning closely with students' perspectives. Half of the teachers (5/10; 50%) strongly recommended organizing training workshops, not only for students but also for teachers, to ensure effective classroom implementation. Four teachers (40%) suggested integrating digital mind mapping tools to increase engagement, reflecting student preferences. In addition, three teachers (30%) stressed the importance of providing sample mind maps and step-by-step classroom guidance to scaffold students' learning. Finally, two teachers (20%) underlined the need for collaborative mapping tasks, enabling students to exchange ideas and learn from one another in authentic contexts.

4.2. Discussion

The findings of this study reveal both alignment with and divergence from previous research on mind mapping in vocabulary learning. In this context, both students and teachers perceived mind mapping as a potentially useful tool for enhancing the organization and retention of technical vocabulary. A majority of participants highlighted specific benefits, such as improved visualization of word relationships and better long-term memory, which supports the established view that mind mapping fosters meaningful associations among lexical items. These perceptions are broadly consistent with earlier studies. For instance, Al-Jarf reported that mind maps enabled learners to expand their vocabulary range and recall words more effectively [16]. Similarly, Buzan noted that mind-mapping activities helped learners create more robust connections, transfer new vocabulary to long-term memory, and retrieve words more efficiently [17]. In the same vein, Sbaa et al. [18] found that students viewed mind mapping as supportive in structuring their thoughts and improving their comprehension of concepts.

When discussing the challenges of using mind mapping in learning technical vocabulary, both students and teachers provided valuable insights. Both students and teachers expressed that the effective use of mind mapping in technical vocabulary learning is hindered by learners' limited skills, showing a shared concern about the need for proper training and practice. However, their perspectives diverge in emphasis: students focused more on the difficulties of changing study habits and interpreting mind maps on their own, whereas teachers highlighted issues related to the quality of the maps, such as an overemphasis on visual design, as well as challenges in using digital tools without adequate guidance. These challenges underline that applying mind mapping in learning technical vocabulary is not straightforward, as it requires both the gradual adaptation of learners and sustained pedagogical support. Taken together, the similarities were evident in both datasets: in the survey (Q9), a majority of students requested training, while teachers, in interviews, also recommended workshops and professional preparation. This triangulation highlights a consistent perception across groups that skill development is essential for success. These findings partly echo those of Ababsa Wahiba, who also identified students' resistance and lack of familiarity as primary obstacles in applying mind mapping. Nevertheless, unlike the present study, Ababsa's research revealed that the majority of learners reported no significant difficulties, with only a minority mentioning issues such as information organization, limited detail, or time constraints [15]. This contrast may reflect differences in learning contexts, instructional support, and the extent to which learners were trained in using the technique.

In terms of pedagogical implications, both groups in the present study stressed the need for training sessions and the integration of digital tools. Students, in the

survey, highlighted the need for guidance and expressed a preference for combining mind mapping with quizzes and note-taking, while teachers, in interviews, recommended scaffolding through sample maps, clear instructions, and collaborative tasks. These perceptions are consistent with the attitudes of Tee et al., who suggested that teachers need to know how to teach mind mapping and integrate it effectively into their lessons [19]. Notably, the emphasis on combining mind mapping with traditional techniques such as note-taking or group discussion adds an innovative dimension to the discourse, suggesting that mind mapping is most effective when used complementarily rather than as a replacement strategy. Both students and teachers highlighted training as the primary need, though teachers also extended this to themselves, stressing professional preparation. Likewise, both groups agreed on the value of digital tools, while students preferred blending with quizzes and note-taking, and teachers emphasized scaffolding through sample maps, clear guidance, and collaborative tasks. Overall, these findings suggest that mind mapping works best through a blended approach that combines systematic training, technology integration, and complementary use alongside traditional practices.

Overall, by situating the findings within the broader body of literature, this study highlights both the perceived advantages of mind mapping for technical vocabulary learning and the contextual barriers to its consistent implementation. The results indicate that participants valued the need for structured training programs and greater pedagogical support to bridge the gap between theoretical potential and classroom practice.

5. CONCLUSION

This study sets out to examine students' and teachers' perceptions of using mind mapping for learning technical vocabulary. The results indicate that both groups recognize its benefits in organizing, visualizing, and retaining vocabulary, yet they also point to several challenges, including students' limited skills, difficulty in adjusting study habits, and teachers' concerns about the quality of mind maps and lack of clear guidance. Despite these issues, both groups strongly emphasized the need for systematic training and the integration of digital tools, which reflects current directions in technology-enhanced learning. Importantly, the study suggests that mind mapping should not be treated as a stand-alone method but rather as a complementary technique alongside established practices. Taken together, the findings underline the promise of mind mapping while highlighting the necessity of stronger pedagogical support, teacher preparation, and structured student training for more effective application.

Although this study provides useful insights, several limitations should be acknowledged. First, the research was conducted within a single institution and with a limited sample size, which may restrict the generalizability of the findings. Second, the sample consisted solely of students who had been taught with integrated mind mapping. While this purposive selection ensured that participants had sufficient experience to provide informed reflections, it may also have introduced favorable exposure bias, as no control group of students without such experience was included. Third, the study relied mainly on self-reported perceptions from students and teachers, without classroom observations or longitudinal data to capture how mind mapping influences learning outcomes over time.

Future research could address these limitations by involving a larger and more diverse sample across multiple institutions, incorporating classroom-based experiments, and using mixed methods to triangulate data. Additionally, studies could investigate the effectiveness of digital mind mapping tools compared with traditional paper-based maps, or explore how mind mapping interacts with different teaching strategies across various specialized disciplines.

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