

Concept Maps as a Cognitive Tool in Language Education

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Abstract

One of the most important goals of today's educational programs is the effective transfer of knowledge to students. In addition to teaching materials, the methods used are also effective in transferring knowledge and developing students' cognitive abilities. The use of contemporary learning methods is crucial in conveying targeted knowledge to students. In this context, language education has become a key objective of curricula, from preschool to higher education. While language learning is haphazard and unplanned in preschool, it is now systematically and systematically delivered to students starting in primary school. Achieving language learning at the targeted level undoubtedly depends on the effectiveness of the teaching methods used. Recently, concept maps, a modern learning method that presents the relationships between concepts through graphics and other visuals, have become an effective method for developing language skills such as listening, reading, speaking, and writing in students of all levels. Their implementation in educational practices has been recommended in prepared curriculums. Concept maps are concrete graphics that illustrate the relationship between a single concept and other concepts within the same category. Furthermore, concept maps are an effective method used to enhance students' conceptual understanding, particularly in developing conceptual understanding. In other words, a concept map is a two-dimensional diagram that shows the interrelationships of concepts under a broader heading. In language education, instructional materials and techniques are an important element of the learning-teaching process. The primary goal in the learning-teaching process is to make learning easier and increase learning efficiency by addressing the subject

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more concretely, more closely, and more familiarly. Teaching materials most often serve this purpose in the learning-teaching process. Concept maps are a frequently used teaching material in education. In this context, this study aims to emphasize the role and importance of concept maps in language education, which allow students to identify relationships between concepts and to present this information in various forms, such as graphics. This study, conducted using the field literature method, reviewed the relevant literature and presented theoretical information about concept maps used in language education.

1. INTRODUCTION

Concepts are mental structures that help understand and organize events, objects, or phenomena. The primary goal of the educational process is to enable students to grasp the relationships between information and concepts. Acquiring knowledge by establishing meaningful connections between these structures supports lasting learning rather than superficial memorization. In this context, Novak and Gowin (1984) emphasized the importance of teaching methods that allow students to actively explore knowledge. Concept maps, in particular, have been described as an effective teaching-learning tool that visually represents how students learn and make sense of information. This method, which develops students' conceptual thinking and perception levels, also offers an effective strategy for increasing achievement. Concepts are mental structures that help understand and organize events, objects, or phenomena. Comparing the concept maps students prepare before and after a lesson provides a benchmark for understanding how they relate their existing knowledge and their progress throughout the lesson. This assessment allows students to see how they structure concepts and the connections they make. This approach encourages students to understand their knowledge more deeply and to establish relationships between concepts more accurately. The teaching-learning process is a dynamic one consisting of planning, implementation, and evaluation phases (Esiobu & Soyibo, 1995; Okebukola, 1990). In recent years, discussions on how subjects should be assessed have demonstrated that traditional assessment methods (open-ended questions, multiple-choice tests, etc.) cannot fully measure students' conceptual understanding (Kaya & Ebenezer, 2003). As a result of these discussions, the concept of "authentic assessment," which proposes a more in-depth and continuous assessment of students, has emerged. Concept maps are offered as an alternative method for such assessments (Ebenezer & Haggerty, 1999).

With the increasing popularity of e-learning, providing customized courses tailored to students' individual abilities and learning outcomes has become a more common goal in education. In this context, adaptive learning systems enhance students' learning processes by providing personalized guidance. Indeed, the 2024 Turkey Century Education Model addresses this issue, emphasizing the need for differentiated instruction and individualized approaches to education, and adopting a teaching strategy designed to meet students' diverse learning needs. It is emphasized that this approach aims to tailor educational processes to each student's learning profile, readiness level, interests, and abilities. It is stated that the Turkey Century Education Model, focusing on elements such as flexible grouping, continuous assessment, and adaptation, aims to create an environment where every student can have the maximum learning opportunity (MEB, 2024). Concept maps play a critical role in achieving these goals. Concept maps can be prepared manually, or they can be automatically generated using the two-stage concept map generation (TP-CMC) approach, based on students' past test records (Tseng, et al., 2007). Concepts can be defined as mental structures that represent common characteristics of objects, events, thoughts, and phenomena in the world. These structures enable people to make sense of, organize, and communicate information about the world. Some key characteristics of concepts can be summarized below:

Unique and General Properties: Concepts are formed by identifying and grouping different and similar characteristics of entities using scientific and technological methods. Each concept has its own unique descriptive or functional aspect.

- **Abstraction and Generalization:** Concepts are general and abstract representations of specific objects and events. According to Aksan's (1995) definition, concepts are linguistic abstractions based on the common characteristics of objects, shapes, and situations in the world.
- **Individual Differences:** Concepts can have different meanings from person to person. In other words, the meaning of a concept can change depending on individual experiences and knowledge.
- **Relationship with Mental Development:** Concept development is directly proportional to an individual's mental development. Children, in particular, learn and develop concepts in parallel with their mental development. While young children learn concrete concepts, older students learn abstract concepts by establishing relationships between these concepts.

- **Organization and Grouping:** Concepts exist in vertical and horizontal organization. In other words, they can be grouped by establishing hierarchical or horizontal relationships between concepts.
- **Symbolic Representation:** Some concepts can be remembered through shapes or symbols, and these symbols contribute to the mental representation of the concept.

The concept map method is an effective teaching strategy that supports meaning-making in the language learning process. This method allows students to structure knowledge, visualize relationships between concepts, and make the learning process more systematic (Novak & Cañas, 2008). Concept maps have been shown to have positive effects, particularly in terms of vocabulary development, understanding grammar rules, reading comprehension skills, and writing (Ausubel, 1968). This method, consistent with the constructivist learning approach, helps students make new learning more meaningful by activating their prior knowledge (Jonassen, Beissner, & Yacci, 1993). Research has shown that language education supported by concept maps strengthens students' long-term memories and increases their active participation in the learning process (Heimlich & Pittelman, 1986). Therefore, the more widespread use of concept maps in language education is considered an important pedagogical tool that supports students' learning processes. Students' existing concepts play a crucial role in their conceptual learning process. New concepts are learned and reinforced by connecting them to previously learned concepts. Therefore, teachers' understanding of students' existing concepts plays a crucial role in understanding how well they grasp new information. The primary goal in Turkish lessons is to enable students to grasp general and specific meanings through the analysis of reading passages. This process involves a series of analysis steps to analyze the meaning and structure of the text:

- **Word Analysis:** It's important to begin analyzing reading passages with words. The feelings and ideas expressed in texts are best expressed through words. A correct understanding of words, idioms, terms, and concepts is critical for a holistic understanding of the text. Words whose meanings are unclear make it difficult to fully grasp the main idea and connotations of the text.
- **Sentence and Paragraph Analysis:** After correctly understanding the words, sentences are analyzed to determine the main idea of the paragraph. The main idea of the paragraph, in turn, is tied to the overall message of the text. Main ideas play a central role in understanding the purpose of the text.

- **Attention to Functional Words:** Functional words play a crucial role in understanding the organizational structure of a text. These types of words facilitate understanding how ideas in the text are interconnected and make the reading process more efficient.
- **Visualization Techniques:** Akyol (2006) states that visualizing words and concepts allows students to better understand concepts. Techniques such as concept maps and mind maps can help students establish connections between main and supporting ideas in a text.
- **Different Reading Techniques:** Abstract words and concepts can be introduced to students through different reading techniques. Event-based texts, which stimulate students' imaginations, are particularly effective tools for learning new words and concepts. Words and concepts in such texts are easier to learn and understand when considered in context.
- **Informational Texts:** In informational texts, recognizing main ideas, concepts, and vocabulary plays a key role in text comprehension. Accurately identifying and analyzing supporting words and concepts in such texts also contributes to text comprehension (Akyol, 2006).

In short, the text analysis process begins with a clear understanding of words and concepts and continues with analyzing the overall structure and main ideas of the text. Different techniques used in this process can be effective in introducing students to new concepts and vocabulary. Breaking down reading passages into small, meaningful pieces, such as concepts, allows students to better understand the text and facilitates transitions between concepts. At this point, concept maps stand out as an important tool. Concept maps are an effective technique not only for understanding abstract or unfamiliar words, but also for grasping the general structure and main ideas of reading passages.

A concept map is a technique that graphically presents the characteristics of concepts or their relationships with other concepts. This method facilitates understanding information by visually organizing concepts. According to Karapür (2002), "Concept maps are structures that visually organize information." These structures allow:

- **Relationships Between Concepts:** Students see the relationships between concepts more clearly. This allows them to progress more quickly and effectively in the learning process.
- **Visualization:** Visualizing information facilitates learning and helps information become more retentive. Establishing connections

between concepts reinforces the learning of concepts, especially abstract or difficult-to-understand concepts.

- **Key Principles and Propositions:** Concept maps organize the relationships between concepts based on specific principles and propositions. This facilitates understanding how concepts form a whole.

Concept maps allow students to divide texts into smaller parts and grasp the meanings and relationships between these parts. This method also helps identify the main and supporting ideas in the text, enabling students to develop a deeper understanding, especially in information-dense texts. Concept maps are an effective technique for analyzing texts and understanding the concepts they contain (Novak & Gowin, 1984). This tool helps students better understand texts and organize information by visualizing the relationships between concepts. By visualizing concepts graphically, students can see connections between information more clearly and, therefore, recall information more easily (Kinchin, Hay, & Adams, 2000).

The Impact of Concept Maps on Learning

Concept maps are an effective teaching technique, particularly when learning complex topics, that allows students to organize information, concretize abstract concepts, and thus see the connections between topics more clearly. Developed by Novak and Gowin (1984), this technique goes beyond traditional memorization methods and promotes meaningful learning. The concept map method achieves the following benefits:

Visualization of Information: Concept maps graphically concretize the main points of a topic and enable students to organize it in their minds. During this process, students visually analyze the relationships between concepts, which contributes to knowledge retention. Because information and concepts are supported by visuals, retention becomes easier.

Intellectual and Mental Skills: When creating a concept map, students use intellectual processes to find appropriate connections between concepts. This process is not limited to simply placing concepts; students also analyze the content of the topic and make the information meaningful. As Barut (2006) stated, this process forces students to establish meaningful relationships between concepts.

Meaningful Learning: Concept maps allow for a comprehensive overview of topics by defining the cause-effect relationships between concepts.

This encourages a deep understanding of information, rather than merely superficial learning. Understanding the interrelationships of concepts allows students to learn topics in a more meaningful and organized way.

Active Participation and Retention: When students create concept maps on their own, they make the topics more retentive. In this process, students analyze, structure, and transform information into visual form, actively participating in learning. The maps they create through effort and practice support long-term retention of knowledge. Concept maps are tools that visualize the relationships between information and concepts and can be used for a variety of purposes. These maps present the main concept and its related sub-concepts in a clear structure, revealing the connections between concepts. Concept maps are divided into the following categories based on their content and drawing style (Altın, 2002):

- Complete and linked concept maps: Clear relationships between main and sub-concepts are clearly displayed.
- Complete but unrelated concept maps: While concepts are distinct, their relationships are not clearly shown.
- Incomplete and unrelated concept maps: Both concepts and their relationships are incomplete.

Concept maps are also divided into three types based on their shape:

- Spider maps: The main concept is at the center, and subconcepts are displayed in a surrounding pattern.
- Chain maps: Concepts are organized in a sequential chain.
- Hierarchical maps: The main concept is at the top, and subconcepts are arranged in a descending order.

In addition to these, mixed concept maps can also be found, and these maps are usually created by combining different types. The basic principles and steps to be taken into account when creating concept maps ensure their effectiveness and clarity. The stages of this process (Şenay, A. 2007):

- Topic and level compatibility: A topic appropriate to the student's level should be selected. The topic should be linked to the student's prior knowledge.
- Reading the text: The text to be mapped should be read carefully. The main theme or most general concept of the text should be determined and selected as the main concept.

- Selecting key concepts: Important key concepts related to the main concept should be identified and listed.
- Avoiding repetition: Each concept should appear only once on the map and should appear in at least one proposition.
- Concepts should not become explanations: The list should not include explanations or principles related to the concepts; it should only include the concepts.
- Organization of concepts: Main concepts and sub-concepts should be placed orderly, and concepts at the same level should be at the same hierarchical level.
- Using visual dividers: Concepts should be displayed in shapes or boxes for easy identification.
- Identifying relationships: After listing concepts, the relationships between them should be identified and shown with lines. The direction of the relationship should be indicated with arrows.
- Explaining relationships: Short statements explaining the relationship in a few words should be written on the lines.
- Cross-connections: There should be cross-connections between different sections of the map, and these connections should demonstrate the synthesis between the concepts.
- Choosing a title: A strong title should be chosen for the map, and this title should activate students' prior knowledge.
- Simplicity: To be useful for students, the map should not be overly complex; it should be kept simple.
- Summarizing: After the mapping process is completed, the map should be summarized in a paragraph.

These steps guide the process of creating a concept map, helping to better organize and comprehend information. Concept maps can be used as an effective tool in both individual and group work throughout the educational process. These maps, which can be beneficial at every stage of educational activities, facilitate students' more systematic approach to information and their understanding of the relationships between concepts. Concept maps are an important tool used in education, particularly to enhance the learning process and enable students to make sense of and organize information. Numerous studies on this topic demonstrate that concept maps increase

students' learning levels, help them retain information in long-term memory, and enhance conceptual understanding skills.

Stages of Using Concept Maps in the Education Process

- **Preparation Phase:** Before beginning a new topic, students can visualize what they already know about the topic using a concept map. This activates prior knowledge and helps identify areas of the topic where they are lacking.
- **Research and Explanation Phase:** By using concept maps during the course of the topic, students can connect newly learned information to existing knowledge and develop a deeper understanding of the topic.
- **Assessment Phase:** After the topic is completed, students' understanding can be measured using a concept map. This assessment also helps the teacher identify areas of the topic where gaps exist.

Advantages of Concept Maps:

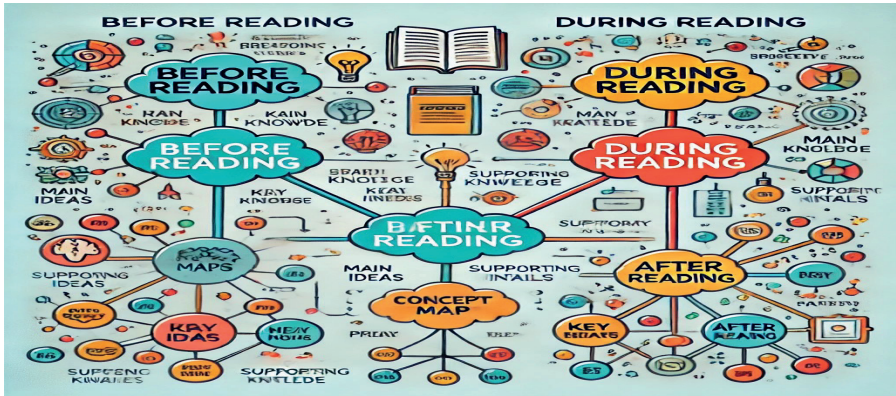
- **Ability to make connections:** Concept maps allow students to see connections between topics and ease difficulties transitioning between units.
- **Hierarchical Learning:** Organizing topics in a hierarchical manner contributes to more permanent and comprehensive learning.
- **Use as Homework:** A concept map drawn in class can be assigned as homework. This allows students to identify areas where they are lacking and incorporate new concepts at home.

The Use of Concept Maps in Language Education

Language education is a complex process that develops an individual's ability to think, understand, interpret, and express. Effective language learning requires students to make sense of information and activate the learning process. In this context, teaching strategies based on the constructivist learning approach, in particular, enable students to better organize concepts and make learning more permanent (Novak & Cañas, 2008). One of these strategies, the concept map method, helps students visualize information and identify semantic relationships during the language learning process (Ausubel, 1968). The relationship between concept maps and language education and their effects on language skills can be described as follows:

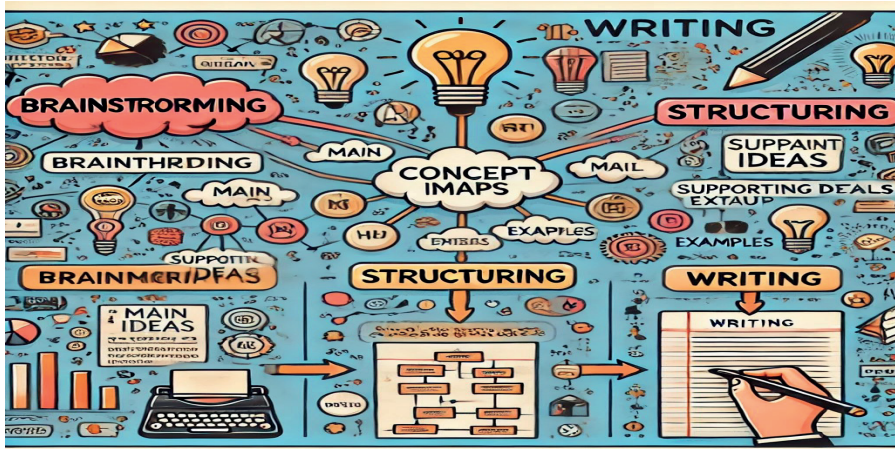
Vocabulary Teaching: These are effective tools that enable students to learn new words in context and increase their memorability (Nation, 2001).

Reading and Comprehension Skills: The reading process occurs in three stages: pre-reading, during reading, and post-reading. Concept maps are used in different ways at each of these stages to support understanding the main idea of the text and retention of information (McNamara, 1996). Before reading, students must activate their prior knowledge and anticipate the main points of a text to make sense of it. Concept maps help students organize their knowledge of the text. During reading, concept maps enable students to identify key information in the text and see conceptual relationships. The post-reading process involves students consolidating the information they have gained from the text and evaluating its meaning. In this stage, concept maps support the summarization of information learned from the text and the clarification of the main idea.



(OpenAI DALL·E, 2025).

Writing Skills: Written expression is a complex process that requires students to organize their thoughts, present them in a logical flow, and express them effectively. Concept maps support this process as an important tool in the planning, structuring, and development stages (Hyland, 2003). Concept maps are a powerful visual tool that enhances written expression skills. They help students plan their essay writing process, achieve cohesion in their writing, and organize their thoughts effectively. Educators' active use of concept maps in writing instruction will be greatly beneficial in developing students' written expression skills.



(OpenAI DALL-E, "Concept Maps in Teaching Writing", 2025).

Speaking Skills: Speaking is a complex process that requires an individual to verbally express their thoughts and communicate meaningfully and fluently. In this process, concept maps allow for the organization of ideas before speaking, the maintenance of fluency during speaking, and post-speaking evaluation. The planning, implementation, and evaluation stages are critical in developing this skill. Concept maps facilitate the process by providing the speaker with a visual guide in these three stages. Before giving a speech, a concept map is created by identifying the main ideas and subtopics. This stage allows the speaker to organize what they are going to say and create a logical flow (Novak & Gowin, 1984). A concept map helps the speaker follow the flow of the topic, remember important points, and establish connections between topics. This is particularly advantageous in structured speeches, such as academic presentations or discussions (Alvermann, 1981). By returning to the concept map after the speech, the strengths and weaknesses of the speech can be analyzed, allowing the individual to deliver more structured and effective expressions in future speeches. Concept maps contribute to effective speaking by providing a structured and meaningful learning process for developing speaking skills. Research shows that this method increases fluency, expands vocabulary, and boosts self-confidence. Educators' effective use of concept maps in teaching speaking skills will significantly contribute to students' development of speaking proficiency and communication skills.



(OpenAI DALL-E, “Concept Maps in Teaching Speaking”, 2025)

METHOD

This study was conducted using document analysis, a qualitative research method. Document analysis is a method that aims to systematically examine existing written sources on a specific topic and analyze the information contained in these sources (Yıldırım & Şimşek, 2018).

Areas of Use

- Literature review: Used to formulate research questions, examine previous studies, and provide in-depth information on the topic.
- Policies and practices: This method can be used to evaluate the impact of specific policies or practices and to understand their consequences.
- Cultural and historical analyses: Used to better understand past events, ideas, and social values.
- Organizational studies: Frequently used to analyze the structure, processes, and cultural structures of institutions (Bowen, 2009).

Advantages:

- In-depth analysis: Allows for a comprehensive review of existing literature and written materials.
- Different perspectives: It reveals diverse perspectives by comparing researchers' different interpretations of the same topic.

- **Data collection:** It is an important data collection tool, especially in retrospective or historical research.
- **Qualitative data analysis:** It enables the systematic analysis of qualitative data from written documents (Yıldırım & Şimşek, 2018).
- **Accessibility:** It provides easy access to most written sources and does not require physical infrastructure.
- **Cost-effectiveness:** It does not require expensive equipment for conducting research.
- **Time-saving:** It saves time by accelerating the data collection process from existing sources.
- **Comprehensiveness:** It enables the acquisition of extensive data covering broad time periods or different geographic regions (Bowen, 2009).

Disadvantages

- **Risk of bias:** Because document authors may reflect their own opinions, these biases can influence the research.
- **Reliability issues:** The accuracy and reliability of the documents used may not always be guaranteed.
- **Representativeness:** Accessing all relevant documents may not always be possible.
- **Subjective interpretations:** Different researchers may draw different conclusions from the same document, which can create variability in the interpretation process (Yıldırım and Şimşek, 2018).

FINDINGS

Research examining the role and effects of concept maps in language teaching demonstrates that this method positively impacts the learning process and increases student achievement. The effects of this method have been examined under the following headings:

Impact on Language Education: Concept maps are an important teaching tool that helps students structure knowledge, construct meaning, and use language more effectively in the language learning process. Research has shown that concept maps have positive effects on vocabulary learning, grammatical comprehension, reading comprehension, and written expression skills (Novak & Cañas, 2008; Jonassen, Beissner, & Yacci, 1993). With

this method, students can better organize information and connect new information to their prior knowledge, resulting in lasting learning (Ausubel, 1968). Furthermore, concept maps are emphasized as an important tool for teachers to assess learning processes and analyze students' cognitive structures (Johnson, Pittelman & Heimlich, 1986). Therefore, the dissemination of concept maps in language education is considered as a method that supports learning processes and increases students' academic success.

Impact on Academic Achievement: Various studies have shown that concept maps increase student achievement. For example, Novak and Cañas (2008) stated that concept maps help students structure knowledge, making the learning process more meaningful. As a result, students were found to achieve higher scores on exams and tests. A study by Chiou (2008) found that students who used concept maps had significantly higher academic achievement compared to a control group.

Understanding and Knowledge Organization: Research demonstrates that concept maps improve students' conceptual understanding. Kinchin (2000) emphasized that students who work with concept maps can better organize pieces of information and understand complex concepts more clearly. This method helps students establish relationships between concepts, enabling them to better grasp the subject matter.

Impact on Learning Motivation: Many studies have also reported that students engage more actively in lessons and increase their learning motivation by using concept maps. Markow and Lonning (1998) stated that this method increases students' interest in lessons and enables them to participate more actively in the learning process.

Impact in Different Disciplines: Research on the use of concept maps in various disciplines, such as science, social sciences, and mathematics, demonstrates the effectiveness of this teaching method across disciplines. In science courses, in particular, concept maps facilitate students' understanding of basic concepts and accelerate their knowledge construction processes (Novak & Gowin, 1984).

Student Views: The positive contributions of concept maps to the learning process for students have been frequently cited. A meta-analysis conducted by Nesbit and Adesope (2006) showed that students comprehend course materials more easily using concept maps and that this method develops creative thinking skills.

These findings clearly demonstrate that concept maps are an effective teaching tool for improving student achievement.

CONCLUSION AND DISCUSSION

Concept maps are an effective teaching strategy that helps students organize information, understand conceptual relationships, and develop language skills during language learning. The literature emphasizes that concept maps support cognitive processes and promote meaningful learning (Novak, 2010; Moon, Hoffman, & Novak, 2011). Specifically, concept maps are reported to strengthen learners' knowledge structure, enable them to grasp information from a holistic perspective, and increase learning motivation (Horton et al., 1993). Furthermore, within the context of Mayer's (2003) multimedia learning theory, concept maps are argued to support students' learning processes by integrating visual and verbal information. Experimental studies demonstrate the effects of concept maps on language learning. For example, Novak and Cañas (2008) report that concept maps increase students' academic achievement and develop critical thinking skills. However, a meta-analysis by Nesbit and Adesope (2006) revealed that concept maps are particularly effective in understanding complex concepts and in forming long-term memory. Similarly, research by Alibali (2006) indicates that students actively participate in learning processes and can manage their cognitive processes more effectively with concept maps. However, the effectiveness of concept maps can vary depending on how they are used in teaching and students' individual learning styles. It has been noted that students with low spatial skills, in particular, may have difficulty creating concept maps (Fiorella & Mayer, 2015). In this context, it is crucial that teachers receive training in the pedagogical use of concept maps and inform students about this technique. It is important that future studies focus on how to use concept maps more effectively across different age groups and language proficiency levels. Concept maps are considered an effective teaching method in language education, supporting cognitive processes, helping to organize knowledge, and enhancing learning retention. However, for this method to be implemented most effectively, factors such as teacher guidance, students' cognitive capacities, and learning styles must be taken into account. Further academic research on the effective use of concept maps will contribute to making language learning more efficient. Concept maps are learning and assessment tools with a free and flexible approach. They can be created with different structures and central concepts and can be assessed in various ways. However, requiring students to add specific concept names to the given concept map framework can limit their conceptual thinking processes. This is a negative aspect of using concept maps as an assessment tool. It is more appropriate for students to create concept maps through group work, discussion with peers, and collaboration. The most appropriate approach is for students to prepare concept maps individually, using their

own knowledge and without any resources or limitations. Students who learn how to create concept maps can express their conceptual understanding more easily after an average of 4-5 hours of training. Furthermore, the evaluation criteria for concept maps are flexible and can be adapted by teachers or researchers to suit their educational objectives. For example, the points awarded for propositions (1 or 2 points) and cross-references (5 or 10 points) can be modified. Concept maps offer teachers a flexible assessment environment that includes student participation before and after the learning process. Their most significant difference from other graphical approaches is that they can be used both as a strategy to enhance meaningful learning and as an effective technique for assessing conceptual understanding. This study has demonstrated that the use of concept maps in language teaching has a positive impact on learning processes and student achievement. By facilitating the structuring and meaningfulization of knowledge, concept maps help students better understand complex topics and retain what they have learned. They also develop students' skills in organizing, analyzing, and thinking creatively about information. Academic studies have demonstrated that concept maps allow students to establish connections between topics, concretize abstract concepts, and participate more actively in their own learning processes. Concept maps are effective across different age groups and educational levels, both at primary and university levels.

The results of the study support findings in the literature on the use of concept maps in education and language teaching. Concept maps, with their potential to enhance knowledge retention and deep learning, appear to be a suitable strategy for constructivist learning approaches. Students can actively organize information using concept maps, thereby developing deeper understanding. Furthermore, the use of concept maps is not only student-centered but also allows teachers to better direct their learning processes. However, it should be noted that concept maps may not be effective in all situations, that students unfamiliar with this method may experience initial difficulties, and that teachers require thorough preparation to use this technique effectively. Guidance on how to use concept maps plays a critical role in the success of this technique. The findings of this study demonstrate that concept maps have positive effects not only on cognitive processes but also on learning motivation and self-confidence. This method, which encourages students' active participation, is considered a powerful tool for creating more interactive and meaningful learning environments in the classroom. In this context, the more widespread integration of concept maps into the education system may have the potential to improve teaching quality. Future research could examine the long-term effects of concept maps, explore the sustainability of student success with this method

more comprehensively, and consider its integration with different teaching approaches. Concept maps are considered an important tool in student-centered education that makes learning processes more meaningful. Teachers' effective use of this method and its support with technological tools can increase educational success. Furthermore, providing regular feedback to students and expanding its use across disciplines will further enhance the effectiveness of this method. Concept maps are among the powerful tools that make student learning processes more effective and meaningful.

The results of some important studies examining the impact of concept maps in education can be summarized as follows: Novak and Alberto Cañas (2008) investigated the effects of concept maps on the organization of knowledge and conceptual understanding, and stated that these maps help students better understand and organize complex concepts. A meta-analysis by Nesbit and Adesope (2006) showed that concept maps significantly contribute to both learning success and knowledge retention. It was emphasized that visualizing the relationships between concepts, in particular, enables students to be more successful in the long-term learning process. Şimşek (2010) investigated the contribution of concept maps to students' critical thinking and problem-solving skills. Consequently, they found that concept maps help students structure their thought processes, thereby developing more effective problem-solving skills. Wang, Lee, and Li (2021) examined the effects of concept maps on student motivation and found that these maps make the learning process more engaging, especially for students who are visual learners. Visual representation of concepts and relationships increases students' interest in learning. Similarly, Hsu and Huang (2020) emphasized that concept maps, when used in group work, improve students' collaboration skills and positively influence classroom interaction. Research based on Ausubel's Cognitive Learning Theory demonstrates that concept maps help students integrate new information into their existing knowledge structures. Concept maps stand out as an important tool, particularly in making abstract and complex concepts more understandable. A study by Duit and Treagust (2013) indicates that concept maps help students better understand scientific concepts and develop scientific thinking skills. Research on the effects of concept maps in various disciplines, such as science, mathematics, and social studies, demonstrates the adaptability and impact of these maps across different subjects. The use of concept maps in education significantly helps students establish meaningful connections between concepts, organize information, and develop a deeper understanding. Studies have shown that these maps have a positive impact on both academic achievement and long-term retention of knowledge.

The following suggestions can be offered for the effective use of this method in education:

1. Integrating Concept Maps into Lesson Plans: For the effective use of concept maps, systematic inclusion in lesson plans is recommended. Using concept maps at the beginning and end of a lesson, especially when teaching abstract and complex topics, can help students understand their prior knowledge and organize the information they have learned (Novak & Cañas, 2008). This allows students to connect new concepts to their prior knowledge, leading to more sustained learning.

2. Supporting Student-Centered Learning Approaches: Concept maps make a significant contribution to student-centered learning processes. Applications that allow students to create their own maps encourage active learning. Therefore, it is recommended that teachers guide students in creating concept maps and help them use this process as a learning support tool (Nesbit & Adesope, 2006).

3. Expanding Their Use Across Different Disciplines: Concept maps should be widely used in science, social sciences, and language education. In language learning, visualizing the relationships between vocabulary and language structures can help students better understand concepts (Chiou, 2008). Similarly, in social sciences, the relationships between historical events and sociological concepts can be taught more effectively with concept maps.

4. Concept Maps Supported by Technological Tools: With technological advancements, the use of digital concept map tools should be encouraged. Students can more easily and quickly organize relationships between concepts and develop different perspectives with digital concept map programs. Therefore, it is recommended that the use of such software be encouraged in schools (Novak & Cañas, 2008).

5. Regular Feedback and Assessment: For the more effective use of concept maps in the teaching process, it is important for teachers to provide regular feedback to students. Maps can also be used to assess student knowledge. This assessment process can help students identify learning gaps and better establish connections between concepts (Kinchin, 2000).

6. Incorporating Concept Maps into Teacher Training: To use concept maps effectively, teachers must have sufficient knowledge of this method. Therefore, it is recommended that training in the use of concept maps be included in teacher training programs. This allows teachers to develop more effective and creative teaching strategies for their students (Nesbit & Adesope, 2006).

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