Education and Information Technologies
https://doi.org/10.1007/s10639-024-12688-x

Next-generation learning experience: The effect of technology-assisted and printed context-based vocabulary activities on vocabulary knowledge and learning motivation

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Received: 15 November 2023 / Accepted: 9 April 2024

Abstract
This study aims to compare and analyse the effects of context-based vocabulary activities with technology-assisted tools and printed materials on fourth-grade primary school students' vocabulary knowledge and learning motivation. One of the quasi-experimental designs, the "pretest-posttest control group design", was used in the study. There were two experimental groups and one control group. Technology-assisted context-based vocabulary activities were used in one of the experimental groups, and printed materials with context-based vocabulary activities were used in the other experimental group. The implementation was carried out in the control group according to the current Turkish curriculum. It was planned to teach vocabulary by utilising sentence and text context in context-based vocabulary activities. The research was conducted with students studying in three different fourth grade classes of a primary school, which were equivalent to each other according to the pre-tests. A total of 91 students from three groups (experimental-1: 30, experimental-2: 30, control: 31) participated in the study. The Vocabulary Knowledge Achievement Test (VKAT) developed by Yaşar-Sağlık (2022) and the Vocabulary Learning Motivation Scale (VLMS) developed by Genç-Ersoy and Belet-Boyacı (2018) were used in the study. After the pre-tests were applied, 14 lesson hours of interventions were carried out over 7 weeks. After the implementation, the process was finalised by applying post-tests. The data were analysed using one-way analysis of variance (ANOVA) on the difference in scores (post-test – pre-test). Also, the Tukey post hoc test was used to determine the source of the difference. In addition, partial eta squared (η2) values were calculated to determine effect sizes. As a result, it was found that context-based vocabulary activities conducted with technology-assisted tools and printed materials were significantly more effective in improving students' vocabulary knowledge than the current Turkish curriculum. In addition, it was also revealed that technology-assisted activities were more effective in improv-

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Published online: 24 April 2024

ing students' vocabulary knowledge than the activities carried out using printed materials. In terms of vocabulary learning motivation, the results are slightly different. It was found that context-based vocabulary activities conducted with technology-assisted tools were significantly more effective in improving students' vocabulary learning motivation than the current Turkish curriculum and the context-based vocabulary activities conducted with printed materials. In line with these results, it is recommended that technology-assisted context-based vocabulary activities be used to increase students' vocabulary knowledge and learning motivation.

Keywords Technology-assisted vocabulary instruction · Printed materials · Context-based vocabulary instruction · Vocabulary knowledge · Vocabulary learning motivation

1 Introduction

Evaluating and improving learning methods in an ever-changing world has become imperative. Accordingly, technology has become an essential variable in education and is recognised as a tool that transforms learning experiences (Prensky, 2001; Bates, 2015). With the increasing use of technology in education, students' learning styles, motivations, and knowledge acquisition processes have also started to change (Aysu, 2020). Especially with the COVID-19 pandemic that started in 2019, these tools and equipment have started to be used more in education systems as a requirement and necessity (Çalışkan, 2023).

The 21st century is recognised as a period in which mass media have spread rapidly, and digital technologies and transformations are occupying an increasingly important place in daily life due to scientific and technological developments. In parallel with this situation, the use of modern technologies in teaching environments has been increasing in recent years. Technological tools and materials provide students and teachers with fast and easy access to information by overcoming the limitations of traditional printed materials (O'Down, 2003; Toyoda & Harrison, 2002; Warner, 2004). The widespread use of computer-assisted digital learning tools with the opportunities provided by developing technology causes changes in learning-teaching processes (Huang et al., 2012). Transformations are observed from teaching activities using traditional classroom materials to digital educational activities in e-learning environments. In this process, digital technologies are now considered not only information tools but also tools that increase the cognitive power of the human mind (Berg et al., 2004).

One of the areas where technology-assisted education has become widespread and increasingly effective is vocabulary instruction. Vocabulary, which forms the building blocks of meaning, is the basis of mastering a language. It is also the key to communication, enabling speaking, listening, reading, and writing skills to become more fluent (Webb & Nation, 2017). For this reason, children's vocabulary should be developed starting from preschool (Karatay, 2007). There are different approaches to vocabulary instruction, including definitional, conceptual, and contextual approaches. However, the language that young children experience the most is

contextualised language. Therefore, we grounded our research on the context-based vocabulary teaching approach. According to Ediger (2002), context is the whole that determines the place of a word in a sentence, paragraph, or text and the meaning and value of the words and sentences that come before or after it. In the context-based vocabulary instruction approach, words are understood based on the context within the text. Finding the dictionary meanings of words from the dictionary or knowing the meaning of the word is not enough for vocabulary teaching; it is necessary to know in which situations the words are used in context or daily life and to transfer the words from short-term memory to long-term memory and to include them in the active vocabulary (Özdemir, 2017). The person who examines the relationships between sentences based on words with known meanings discovers the new word's meaning by inferring it from the context using their own knowledge and mental processes. This method is more effective than a dictionary and provides a spontaneous understanding of the meaning in its entirety (Özkan & Nurlu, 2020). Honeyfield (1977) stated that fill-in-the-blank exercises can be used in context-based vocabulary instruction. Similarly, our study was structured on fill-in-the-blank activities in text and sentence contexts. Although context-based vocabulary activities produce high-quality results, it is known that the learning environment in which these activities are carried out is also effective on students' vocabulary knowledge and motivation towards vocabulary learning. For this reason, in our research, we tried to determine in which learning environment the outcomes of context-based vocabulary activities are maximised with technology-assisted tools and traditional printed materials.

Vocabulary learning is not only comprised of vocabulary knowledge (Stahl & Nagy, 2006). Vocabulary learning motivation is also necessary for effective, meaningful, and permanent vocabulary learning (Çiftpınar, 2011). In order to increase motivation for vocabulary learning, strategies, methods, techniques, and materials that respond to students' interests and needs and are appropriate for their age and developmental level should be used (Dilidüzgün, 2014; Göçer, 2009; Gündoğdu, 2012; Karatay, 2007). At this point, technology-assisted applications, which have been included in the theoretical approaches related to vocabulary instruction in recent years, come to the fore. Newton (2019) stated that there should be some priorities to ensure and increase efficiency in the vocabulary teaching process in the classroom and listed adopting vocabulary teaching through technology among these priorities. According to the National Reading Panel (2000) findings, repetition and multiple exposure to vocabulary items and teaching vocabulary in rich contexts are essential in vocabulary instruction, and computer technology can be used to assist in vocabulary instruction. Technology-assisted vocabulary instruction involves several important factors. The fact that students select words directly from the keyboard instead of writing them down, the ability to see their mistakes immediately, and the richness of visual stimuli can make the learning process more effective. In addition, receiving a reinforcer (such as points) at the end of the practice can encourage students' participation. Yalçın (2022) stated that technological tools that support the multiple learning model, offer unlimited repetition, and do not have space and time constraints transform the vocabulary learning experience from simply memorising the meaning of the word to an experience in which the student can see the use of the word in context with different activities, test himself interactively, see his progress rate, determine which words

he has learning deficiencies in, gamify the vocabulary learning process and increase the permanence of vocabulary learning. Today, technology-assisted language learning applications, online communication tools, computerised dictionaries, and games are used to improve students' vocabulary (Yu & Trainin, 2022), to make the learning process independent and individualised, and to increase interest and motivation towards vocabulary learning (Arias et al., 2010; Baltrus, 2003; Wang et al., 2009).

Web 2.0 tools are the leading technology-assisted applications used in vocabulary instruction. These tools enable human interaction over internet networks (Akdoğan, 2020). With their dynamic, student-centred, easy-to-use, social, interactive, and collaborative structure, they facilitate classroom teaching and learning, place students in a more active position in the learning process (Borich, 2016), and improve their emotional and cognitive skills for vocabulary learning (Yaşar-Sağlık & Yıldız, 2021; Yaşar-Sağlık, 2022). Kenton (2022) stated that Web 2.0 explains the current state of the internet, which has more user-generated content and usability for users than its previous version, Web 1.0. With Web 2.0, the internet has further changed media, communication, and education. In this process, the role of individuals has changed from that of users of technological devices to producers of knowledge (Pisani & Piotet, 2009). Since 2004, the term Web 2.0, coined by Tim O'Reilly, has been used to describe a range of web-based technologies and services that facilitate user participation and collaboration (Lenao, 2023). Regarding the subject, Perumal and Vinothkumar (2022) stated that blogs and wikis do not immediately come to mind when Web 2.0 is mentioned; some essential Web 2.0 tools such as Glogster, Kidblog, Linoit, LiveBinders, Skype, Storybird, VoiceThread, and Wordle have many educational benefits. He also indicated that teachers should integrate these tools into their classrooms to improve and enrich their educational activities. Similarly, Goh and Kale (2016) argued that Web 2.0 applications allow students to share information and develop products through communication, idea sharing, and collaboration. Web 2.0 has fundamentally changed communication and information flow, opening the internet to the participation of ordinary people and sharing various types of content, and involving everyone in the knowledge production and sharing process (Boza & Conde, 2015). Perumal and Vinothkumar (2022) pointed out that thanks to Web 2.0 tools, students have become part of a global network of people and can benefit from the collective knowledge, intelligence, and skills of others worldwide in previously unimaginable ways.

Several experimental studies (e.g., Anjaniputra & Salsabila, 2018; Başoğlu & Akdemir, 2010; Davie & Hilber, 2015; Dodigovic, 2013; Hayati et al., 2013; Lu, 2008; Okkan & Aydın, 2020; Sanosi, 2018) have been conducted to investigate the effect of various technology-assisted vocabulary development applications, including digital games, mobile applications, instant messaging applications, and computer software, on vocabulary knowledge and vocabulary learning motivation. In the results of these studies, although the effect of technology-assisted applications on vocabulary knowledge is generally found to be positive, the results regarding vocabulary learning motivation are controversial. This makes it difficult to reach a general conclusion on the subject. In addition, there are relatively few studies conducted on primary school students, the sample group of this study, and in the process of mother tongue instruction. Most of the studies on the subject have been conducted on uni-

versity students and in the process of foreign language teaching. In this respect, there is a gap in the literature. Building upon existing research, we believe there is value in making subsequent inquiries into exploring practices that may positively influence vocabulary knowledge and learning motivation.

While such developments are taking place in technology-assisted instruction, on the other hand, teaching methods using traditional printed materials have been an essential part of education systems for many years and still have the potential to be effective for students (Mayer, 2003). Especially in classrooms without access to technology, teaching with traditional printed materials is still continued. Correspondingly, as in the aforementioned literature, it could be interpreted that vocabulary knowledge and learning motivation may be affected by teaching techniques, tools, and materials. In other words, it can be argued that technology-assisted materials, printed materials, and the vocabulary teaching practices in the current curriculum may produce different results in improving the quality of vocabulary teaching and learning. Analysing all these teaching techniques in a single study should result in contributions toward the determination of the most effective way to use vocabulary teaching. Therefore, our study aimed to examine the effects of context-based activities conducted with both technology-assisted tools and printed materials and the vocabulary teaching practices in the current curriculum on students' vocabulary knowledge and learning motivation. Comparing technology-assisted learning methods with traditional methods is essential in examining in depth the contribution of technology integration in education to students' learning experiences and determining effective vocabulary instruction strategies. The results obtained from the study can contribute to educators' understanding of how to use technology-assisted learning methods to guide students' vocabulary learning processes more effectively and increase their vocabulary learning motivation. The results can also contribute to the literature on using learning technologies in vocabulary instruction and serve as a guide for shaping future educational practices. In this context, the study's results will be valuable for anyone interested in developing quality and innovative teaching strategies, specifically vocabulary instruction.

Based on this information, the purpose of this study is to compare and analyse the effects of context-based vocabulary activities with technology-assisted tools and printed materials on the vocabulary knowledge and learning motivation of fourth-grade primary school students. In line with the research purpose, the students participating in the study were divided into three groups. Technology-assisted context-based vocabulary activities were applied to the experimental-1 group, context-based vocabulary activities were applied using printed materials to the experimental-2 group, and the control group was taught according to the current Turkish course curriculum. Therefore, the sub-problems are structured as follows:

1. Is there a statistically significant difference between the students' post-test and pre-test mean difference scores for "vocabulary knowledge" in different groups?
2. Is there a statistically significant difference between the students' post-test and pre-test mean difference scores for "vocabulary learning motivation" in different groups?

2 Conceptual framework

The conceptual framework of this study focuses on vocabulary, context-based vocabulary instruction, vocabulary learning motivation, and technology-assisted vocabulary instruction.

2.1 Vocabulary

Vocabulary is the indisputable foundation for mastering a language as it forms the building blocks of meaning. Extensive vocabulary knowledge can make speaking, listening, reading, and writing more fluent and situationally precise. It is the key to communicating successfully (Webb & Nation, 2017). In order to be able to make one's point and understand what is being said, it is necessary to know the meaning of enough words. These words, word groups, and word sets are called vocabulary (Bilge, 2019). In the conducted studies, it has been revealed that vocabulary knowledge includes the ability to define words, know more than one meaning of words, use words appropriate to the situation (Cronbach, 1942), and know the written and spoken forms, meanings, and uses of words (Nation, 2001). It has also been revealed that vocabulary knowledge has three dimensions: breadth, depth, and weight, and that words are categorised into two categories regarding the direction of use: receptive and expressive (Templin, 1995).

Learning vocabulary and competence in its use should be carried out systematically and planned starting from the preschool period. Acquiring basic language skills and using these skills at an advanced level of proficiency are related to a rich vocabulary (Karatay, 2007). Wide and deep vocabulary is directly related to reading skills. Only with a wide vocabulary is it possible to activate prior knowledge about the subject during reading and to integrate it with the new information obtained from the text and thus to access richer semantic resources. This increases reading comprehension (Ford-Connors & Paratore, 2015). Clarke et al. (2014) state that reading comprehension is based on efficiently accessing word meanings and integrating them into the text context. Similarly, Oakhill et al. (2014) stated that for reading comprehension, it is necessary to know the meaning of the words in a text as well as read them correctly. Indeed, according to Nagy and Scott (2013), if a person knows a word, they can recognise it, use it in new contexts, and use it to construct the meaning of a text. Otherwise, it becomes impossible to understand a text as a whole. Due to this importance, different methods and techniques have been used to improve vocabulary knowledge from past to present, and the effectiveness of these methods and techniques has been the subject of research. Research results have shown that technology-mediated vocabulary intervention, including effective vocabulary teaching principles, helps students increase their vocabulary (Anjaniputra & Salsabila, 2018; Davie & Hilber, 2015; Dodigovic, 2013; Hayati et al., 2013; Lu, 2008; Sanosi, 2018). Therefore, the present study is based on the hypothesis that technological tools frequently used in teaching today will have positive effects on students' vocabulary knowledge if they are used with appropriate strategies for vocabulary teaching.

2.2 Context-based vocabulary instruction

Although there are many different approaches to vocabulary instruction, Herman and Dole (1988) categorised these approaches into three categories: definitional, conceptual, and contextual. In the contextual approach, it is argued that the learner will learn all or part of the meaning of a word randomly by using clues in the context while reading one or more sentences presented by the teacher that illustrate the meaning of the word. Young children most commonly experience contextualised language (Nagy & Scott, 2013, p. 469). Adams (2013) stated that the number of times children encounter a word strongly indicates how well they learn it. However, another factor almost as important as the number of encounters is the richness and variety of contexts in which the word occurs. Contextual factors in teaching specific words enable students to focus on rich contextual points that highlight the meanings of unknown words during reading (Antonacci & O'Callaghan, 2011). Though words have the ability to convey meaning on their own, they mediate the transfer of thought by establishing meaningful relationships with other words in communication processes (Karadağ, 2019, p. 62). Accordingly, the Turkish language is also a context-based language (Kara-Özkan & Nurlu, 2020). A contextual approach to help children increase their learning of word meanings will teach them to use context clues more efficiently in the text (Kuhn & Stahl, 1998, p. 120).

When vocabulary instruction results in only knowing the sound and dictionary meaning of the word, meaningless learning occurs. Knowing the dictionary meaning of a word does not mean that it can be used in written and spoken language. Unless the meaning represented by the word is formed in the individual's mind, the word cannot be saved from abstractness (Acat, 2008). Learning the whole meaning of words can only be achieved by appropriately using them. For this reason, it would be more appropriate to teach words with their meanings in sentences (Karatay, 2007). The effective use of the contextual approach, which aims for students to understand and learn words through contexts, in vocabulary teaching depends on the design of previously prepared target word lists and contexts (Duran & Bitir, 2017). Context is the whole that determines the place of a word in a sentence, paragraph, or text and the meaning and value of the words and sentences that come before or after it. The words to be taught are understood based on the context of the text (Ediger, 2002). Unknown words in the read or heard text are guessed based on the flow of meaning and context. An idea about the word's meaning can be developed in different contexts (Göçer, 2009). The meaning of the word is found through the context. The teacher can give clues if the context alone is insufficient to find the meaning (Arı, 2006). In parallel with this information, Göçer (2015) listed the stages of context-based vocabulary teaching as follows:

- Predicting the meaning from the context of the text / the way the word is spoken.
- The teacher gives hints to make inferences from the text/sentence context.
- Finding the meaning of the word in the dictionary.

The first step in learning the meaning of an unknown word while processing a text should not be to look it up in a dictionary. The word's meaning should be inferred

from the context of the text or the sentence in which the word appears. If inference cannot be made, the teacher should give clues; if the student cannot infer the word's meaning in this way, the dictionary should be consulted. At this stage, if more than one meaning of the word is listed in the dictionary, the teacher should ask the students how many meanings in the dictionary match the meaning in the text and make them use that meaning in different sentences to ensure that the meaning of the word is understood and learned permanently (Göçer, 2009). According to Monsell (1985), context-based vocabulary teaching improves these skills by enabling students to use prediction and inference strategies. Honeyfield (1977) makes many suggestions, such as gap-filling exercises in which words are deleted from the text, word-in-context exercises, and context enrichment exercises to improve students' ability to infer meaning from context. Although it is known that context-based vocabulary instruction produces quality outcomes, it should not be forgotten that the environment in which this instruction is carried out is also effective on students' vocabulary knowledge and motivation to learn vocabulary. Our study draws attention to the importance of the learning environment for effectively implementing context-based vocabulary teaching. Accordingly, this study aims to determine in which learning environment the outcomes of context-based vocabulary activities are maximised with both technology-assisted and traditional practices. Therefore, a new perspective is brought to the research on vocabulary learning and learning motivation, and a contribution is made to determining effective strategies in practice.

2.3 Vocabulary learning motivation

Vocabulary learning is a much more complex process than just remembering a list of words (Stahl & Nagy, 2006). Meaningful and permanent learning in vocabulary teaching can be achieved through a learning environment that is shaped according to students' interests and needs. One of the aspects to be considered for this is the student's affective state towards learning. Motivation comes to mind when affective characteristics are mentioned, along with concepts such as interest, attitude, and self-efficacy (Çiftpınar, 2011). Motivation, which enables the formation of positive behaviours such as continuity, interest, willingness, focus, and effort in the realisation of a behaviour (Akpınar-Dellal & Günak, 2009), is the driving force that enables students to actively participate in the learning process by turning to a subject or situation that interests them and makes them eager to learn (Arıkıl & Yorgancı, 2012, p.1). Students with high motivation have a high level of learning (Senemeoğlu, 2007) and, therefore, have high academic achievement (Alderman, 2004).

Students are expected to be motivated to learn vocabulary, participate in vocabulary instruction, and meet vocabulary learning standards in order to achieve the necessary success. Student motivation is a necessary step towards determining the factors that affect students' behaviours and emotions in vocabulary learning activities (Guthrie & Wigfield, 2000). For motivation to be at the desired level in the vocabulary teaching process, the individual's needs should be considered, and the words taught should be functional words that can be used in daily life. In addition, it is crucial to determine the words suitable for the age and developmental levels of the students in advance and to present them with appropriate strategies, methods, techniques, and materials

by considering individual differences. At the same time, it is necessary to be open to current trends in the vocabulary teaching process. It is also essential that the materials to be used in designing the vocabulary teaching process can serve the purpose (Dilidüzgün, 2014; Göçer, 2009; Gündoğdu, 2012; Karatay, 2007).

Difficulty in vocabulary learning can be due to various reasons, including how vocabulary is taught and students' experiences with the word (Webb & Nation, 2017). In addition, insufficient motivation to learn vocabulary is one of the obstacles to vocabulary learning. However, the rapid development of new technologies offers new opportunities to overcome the challenges in vocabulary acquisition. In recent years, the theoretical approaches to systematically implementing vocabulary instruction have been supplemented by technology-integrated infrastructures. Learners can now build their vocabulary through computers and mobile devices using language learning applications, online communication tools, computerised dictionaries, and games. The advantage of technology-assisted vocabulary learning is based on the availability of practice and the use of media such as video, pictures, and audio to support meaning-making (Yu & Trainin, 2022). The use of new and up-to-date approaches in the process of vocabulary development allows students to learn independently and individually, provides rich learning environments, makes the learning process fun, and increases interest and motivation (Arias et al., 2010; Baltrus, 2003; Wang et al., 2009). Accordingly, this study is based on the hypothesis (Genç-Ersoy & Belet-Boyacı, 2018) that employing current approaches in vocabulary teaching and supporting this process by integrating it with technology has the potential to increase students' motivation to learn vocabulary. The study emphasises the complexity of vocabulary learning and suggests that it is not limited to remembering word meanings, but should be carried out in a learning environment shaped according to students' interests and needs.

2.4 Technology-assisted vocabulary instruction

Technology-assisted education can increase student engagement, influence learning processes, and provide students with a more effective learning experience (Cuban, 2001). It can effectively support students' learning needs and performance. In 21st-century classrooms, digital technological tools provide a richer and more comprehensive information array than traditional tools (Telli & Altun, 2020). Many technology-assisted tools and applications are used by students and teachers for teaching and assessment purposes (Yaşar-Sağlık, 2022). In this study, Web 2.0 tools were used during the technology-assisted application used in the experimental process. Therefore, it is essential to discuss these tools in more detail.

Web 2.0 technology, which emerged with the popularisation of the internet and the increase in some applications based on user interaction, has made human interaction possible over internet networks (Akdoğan, 2020). Web 2.0 can be defined as a collection of open-source, interactive, and user-controlled online applications that expand user experiences and knowledge (Constantinides & Fountain, 2008). Web 2.0 allows users to delegate control over applications, extract information and data, and reuse this information and data flexibly (Tredinnick, 2006). In the early period when Web 2.0 was popularised, the number of Web 2.0 tools was relatively small. The first Web

2.0 tools included social networking sites, blogs, wikis (Wikipedia, Seedwiki), video sharing sites (YouTube), hosted services, web applications, mashups, and folksonomies. The tools also included micro-blogging (Twitter), social bookmarking, podcasts, Second Life (virtual communities), Flickr, Digg, read-write Web, RSS (Really Simple Syndication), social tagging "folksonomy", Cascading Style Sheets (CSS), Synchronised Multimedia Integration Language (SMIL), Scalable Vector Graphics (SVG), Extensible Markup Language (XML), and Google (Adeyoyin et al., 2013; Darwish & Lakhtaria, 2011; Murugesan, 2007). However, with the rapid advancement of technology, a wide variety of Web 2.0 tools serving different purposes have been developed. Today, in addition to these tools, Web 2.0 tools such as animation, surveys, robotic coding, digital boards, 3D, photography and painting, e-books, logo making, game making, poster making, cartoons, virtual reality, augmented reality, artificial intelligence, virtual tours, slide presentations, and flipped classrooms are used in many essential areas (Yaşar-Sağlık, 2022).

Due to the dynamic structure of Web 2.0 tools, the use of these tools is increasing daily. Web 2.0 tools are very suitable for creating various content in different fields due to their unique features, such as intervening and controlling the content. Due to the many advantages of Web 2.0 tools, such as ease of use, user interaction, and connection between applications, they are frequently used in the fields of advertisement, business, trade, and health, as well as in education (Reinders, 2017). Advanced computer knowledge is not required to use Web 2.0 tools. Anyone with a basic level of technology literacy can create effective content and share it with others through these tools.

In the 21st century, Web 2.0 tools have become essential in teaching and learning and have gained unprecedented popularity among students. First introduced by Tim O'Reilly in 2005, Web 2.0 tools offer productive activities for learners and teachers (Kurtoğlu, 2021). These tools are defined as the next generation of the internet and provide students with collaborative learning environments where they can communicate with each other (Dibella & William, 2015). Web 2.0 tools strengthen the relationship not only between teacher and learner but also between learner and learner by providing effective learning environments (Aşıksoy, 2018). The dynamic, student-centred, easy-to-use, social, interactive, and collaborative structure of these tools facilitates in-class teaching and learning so that students can be more active in the learning process (Borich, 2016). Web 2.0 tools used in learning and teaching processes are very numerous. However, some of these can be listed as YouTube, Kahoot, Nearpod, Educaplay, Quizlet, Socrative, LearningApps, WordWall, Pinterest, Duolingo, Movie Maker, Padlet, Canva, Prezi, Cram, Plickers, ClassDojo, Quizizz, and so on.

Due to the positive features of Web 2.0 tools, literacy has started to evolve from practices based on traditional printed materials to an online and technology-oriented dimension (Yamaç, 2018). In this context, digital story tools, technology-assisted tools for assessment and evaluation, animation and presentation, social media, cartoons, virtual classrooms, and blog tools have been widely used in language instruction. Studies have shown that Web 2.0 tools improve reading, writing, listening, and speaking skills in language teaching, increase academic achievement and vocabulary, and improve affective and cognitive characteristics related to basic language

skills (Yaşar-Sağlık & Yıldız, 2021; Yaşar-Sağlık, 2022). Several experimental studies (e.g., Başoğlu & Akdemir, 2010; Dodigovic, 2013; Hayati et al., 2013; Lu, 2008) have been conducted to investigate the effect of various technology-assisted vocabulary development applications, including digital games, mobile applications, instant messaging applications, and computer software, on vocabulary knowledge. In addition, meta-analysis studies (e.g., Chiu, 2013; Grgurovi´c et al., 2013; Yun, 2011; Zhao, 2004) have also been conducted on the subject, considering that experimental studies alone may not be sufficient to reach a conclusion. The typical results of these studies show that technology-assisted vocabulary instruction positively affects the development of students' vocabulary.

On the other hand, research on vocabulary learning motivation is limited. For example, studies in which Deng (2010) aimed to determine students' vocabulary learning motivation and their motivation in the reading process, Albodakh and Cinkara (2017) evaluated the relationship between motivation and vocabulary, Genç-Ersoy (2017) examined the effect of gamification on the vocabulary level and vocabulary learning motivation of primary school students, and Kuşdemir (2019) determined the vocabulary learning motivation of primary school students provide essential findings on the subject. In addition to these studies, there are also experimental studies in the literature that aim to learn the effect of technological tools on vocabulary learning motivation (e.g., Anjaniputra & Salsabila, 2018; Davie & Hilber, 2015; Okkan & Aydın, 2020; Sanosi, 2018) and action research studies that try to increase this motivation (Solikhah, 2020). Although some of these studies (Anjaniputra & Salsabila, 2018; Sanosi, 2018; Solikhah, 2020) found that technological applications increased motivation to learn vocabulary, others (Davie & Hilber, 2015; Okkan & Aydın, 2020) found no effect. This inconsistency among the previous studies makes it difficult to judge the subject clearly. In addition, when the studies on both vocabulary knowledge and learning motivation were examined, it was observed that they were primarily conducted in foreign language teaching and on university students, unlike the current study. Therefore, there is a need for further studies on vocabulary teaching at the primary school level and in the mother tongue, as in this study. The issues addressed in the present study evaluate the effects of technology-assisted instruction and Web 2.0 tools on vocabulary teaching and learning motivation and provide a basis for future research. Our study emphasises the importance of technology-assisted vocabulary instruction for student motivation and learning processes. The study suggests that technology-assisted instruction can increase student engagement, influence learning processes, and provide students with a more effective learning experience.

3 Method

3.1 Research model

In this study, the "pretest-posttest control group design", one of the quasi-experimental designs considered appropriate when participants cannot be randomly assigned to groups (Creswell, 2012), was used. The design approach of the study is given in Table 1.

Table 1 Pretest-posttest control group design demonstration

Group	Identifying the Groups	Matching	Pre-test	Experimental Process	Post-test
Experimental-1	M	Statistical	VKAT VLMS	Technology-assisted context-based vocabulary activities	VKAT VLMS
Experimental-2	M	Statistical	VKAT VLMS	Context-based vocabulary activities with printed materials	VKAT VLMS
Control	M	Statistical	VKAT VLMS	Activities in the current Turkish curriculum	VKAT VLMS

Notes. M: Groups were matched in terms of some variables; VKAT: Vocabulary Knowledge Achievement Test; VLMS: Vocabulary Learning Motivation Scale

Table 2 Distribution of experimental and control group students according to gender

Gender	Experimental-1		Experimental-2		Control		Total	
	N	%	N	%	N	%	N	%
Girl	17	57	15	50	17	55	49	54
Boy	13	43	15	50	14	45	42	46
Total	30	100	30	100	31	100	91	100

3.2 Study group

This study was conducted with 91 students studying in three different fourth grade classes of a primary school in Bursa province. According to the one-way analysis of variance (ANOVA) results of the scores obtained by the experimental-1, experimental-2, and control groups from the measurement tools before the implementation, it was understood that the scores did not differ significantly according to the group variable (VKAT [$F=0.08$, $p>0.05$]; VLMS [$F=1.84$, $p>0.05$]). Thirty students from the experimental-1 group, 30 students from the experimental-2 group, and 31 students from the control group participated in the study. The gender distribution of the students in the groups is shown in Table 2.

3.3 Data collection tools

The "Vocabulary Knowledge Achievement Test" (VKAT) was used to determine students' vocabulary knowledge levels, and the "Vocabulary Learning Motivation Scale" (VLMS) was used to determine their vocabulary learning motivation.

3.3.1 Vocabulary knowledge achievement test (VKAT)

Students' vocabulary knowledge was measured with the Vocabulary Knowledge Achievement Test (VKAT) developed by Yaşar-Sağlık (2022). There are five questions about the target words and five about the vocabulary outcomes in the curriculum in the VKAT. The selection of the target words used in the VKAT was based on the "level approach" proposed by Beck et al. (2013). The questions related to the target words were formed by considering the form, meaning, and context of the words. Question 1 of the test is about the form of the words, questions 2 and 3 are about the

meaning of the words, and questions 4 and 5 are about the context of the words. In this study, only questions related to the context of the text were used. The questions are scored as "1" for each correct answer and "0" for each incorrect answer. The maximum score that can be obtained from the test is 25. The content validity index of the achievement test determined according to Lawshe's (1975) technique is 0.82. Moreover, the item difficulty and discrimination of the questions in lower and upper groups are at a good level.

3.3.2 Vocabulary learning motivation scale (VLMS)

The Vocabulary Learning Motivation Scale (VLMS) developed by Genç-Ersoy and Belet-Boyacı (2018) was used to determine students' vocabulary learning motivation. There are 24 items on the scale. The answers to the scale items are three-point Likert-type. The evaluation of the answers to the scale items is as follows: "Applies to me", "Somewhat applies to me", and "Does not apply to me". The percentage of variance explained by the scale was found to be 44.73%. Cronbach's alpha reliability coefficient for the whole scale was determined as 0.85.

3.4 Data collection

The study was conducted in the first semester of the 2022–2023 academic year. Firstly, pre-tests were applied to all three groups in the same week (12–16 September 2022). Then, the implementation was carried out for seven weeks (19 September – 4 November 2022). After the end of the implementation, post-tests were applied to all three groups in the same week (7–11 November 2022). The implementation period was the same in all groups. Detailed information on the implementations is given below:

3.4.1 Content design and preparation process of contextual vocabulary teaching activities

In the context-based vocabulary activities applied to both experimental-1 and experimental-2 groups, the content used in Yaşar-Sağlık's (2022) study was utilised. Yaşar-Sağlık (2022) identified 151 target words based on the keywords of eight themes in the primary school 4th-grade Turkish textbook. Therefore, the target word content were determined based on the Turkish course curriculum. The thematic approach was taken as a basis for determining the target words. The Vocabulary Knowledge Assessment Test (VKAT) developed by Wesche and Paribakht (1996) and adapted into Turkish by İlter (2015) was used to determine the level of knowledge of these words by fourth-grade students. As a result of the analysis made according to the scale, 25 words were removed from the list of 151 words, and the remaining 126 words were determined as target words. For each word to be used in the content of the activities that will serve to teach vocabulary from the sentence context, sentences suitable for the levels of 4th-grade students were created by reviewing all course and auxiliary books at the 3rd, 4th, and 5th-grade levels of primary school and articles in TÜBİTAK's Bilim Çocuk (Science Child) Magazine. Necessary revisions were made

for the created sentences and texts by obtained expert opinion. The content design of the contextual vocabulary activities is shown in Fig. 1.

The same content was used in the context-based vocabulary activities in the experimental-1 and experimental-2 groups. Context-based vocabulary activities were carried out with technology-assisted tools in the experimental-1 group, while the same activities were carried out using printed materials in the experimental-2 group. The same target word was given to the students in both sentence and text contexts, and it was aimed to repeat the vocabulary in teaching. Different studies (Baumann et al., 2009; Beck et al., 1982; Biemiller & Boote, 2006) mentioned the number of words to be taught to students in a certain period. Graves et al. (2014) stated that it would be appropriate to teach students 8–15 words per week if they are essential or imported; however, teachers can teach 20 or more words per week if they teach students valuable and accessible words. Based on this information, considering the age level of the students, a minimum of 10 and a maximum of 20 words were taught per week in this study. Figure 2 shows an example of the activity used in the experimental-1 and experimental-2 groups for the reading text entitled "The Swift Bird, Messenger of Spring", which was produced from the target words in the nature and universe theme.

3.4.2 Implementation process of technology-assisted context-based vocabulary activities

After the preparation process for the vocabulary instruction method was completed, research was conducted on which Web 2.0 tools would be used in the implementation process. Within the scope of the research, many Web 2.0 tools were analysed. As a result of the examinations, it was decided to use five different Web 2.0 tools suitable for context-based vocabulary activities. Missing word, correction, and fill-in-the-blank text activities were conducted with the students in the experimental-1 group for

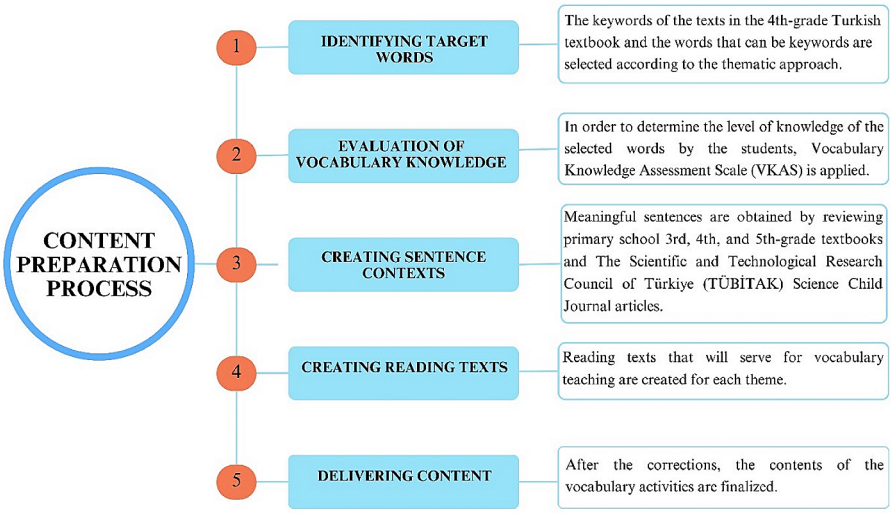

Fig. 1 Content preparation process

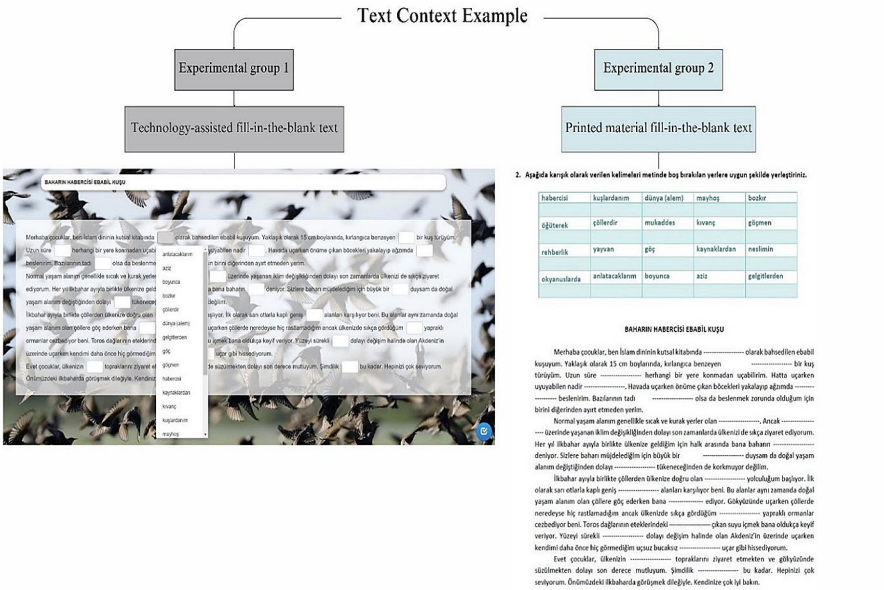

Fig. 2 Text-context activity example

seven weeks. Different activities were implemented with different Web 2.0 tools in order to prevent students from getting bored with the implementation process. Before starting the implementation process, a pilot study was conducted to clarify how long it would take the students to complete the activities and on how many days the lessons should be held. After the pilot implementation, it was decided that the lessons should be held two days a week for approximately one lesson hour. Sentence-context activities were conducted in the first lesson of the week, and text-context activities were conducted on the other day with the students in the experimental-1 group. The Web 2.0 tools used in the activities are shown in Fig. 3.

On the other hand, when the studies on the use of Web 2.0 tools were examined, it was seen that the lack of technological infrastructure, hardware, and equipment in schools seriously affected the implementation process of the studies, so it was decided to conduct the implementation through the Zoom platform. Examples of the implementation visuals for sentence and text context via Zoom are presented in Fig. 4. Both researchers participated in the implementation together. At the beginning of the implementation, the students were first given information about how to do the activities and then asked to do the activities individually. After all students completed the activity individually, the activity was repeated with the participation of the whole group. Finally, for the students who wanted to reapply for the activities later, the activity links were shared in the WhatsApp group that the students' parents were members of.

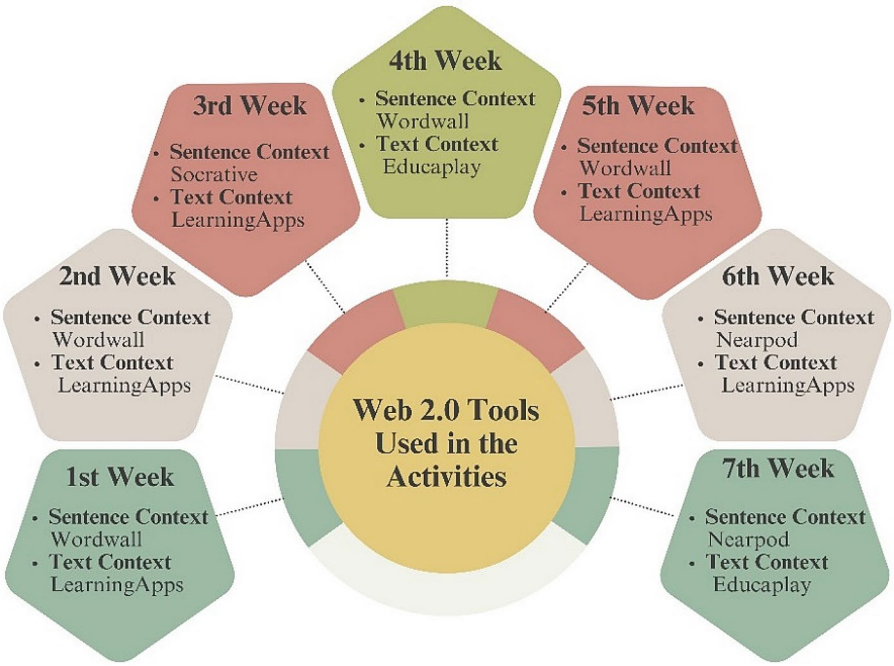

Fig. 3 Web 2.0 tools used in the implementation process

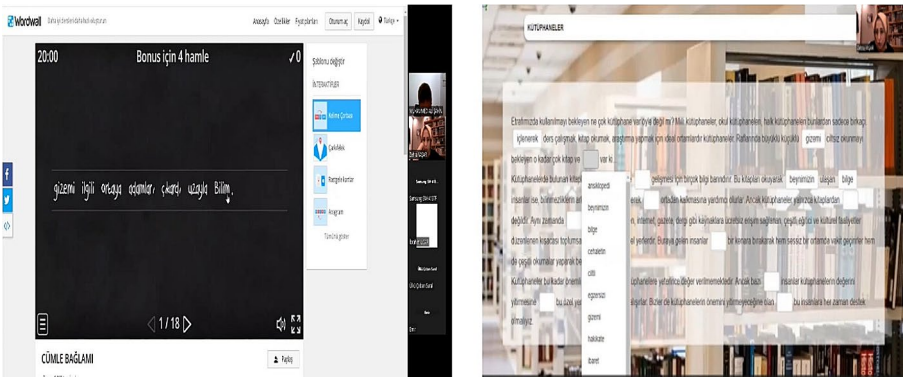

Fig. 4 Visuals of the implementation via zoom

3.4.3 Implementation process of context-based vocabulary activities with printed materials

Experimental-2 group students were engaged in missing word, correction, and fill-in-the-blank text activities using printed materials for 7 weeks. The content of these activities was the same as that of the technology-assisted context-based vocabulary activities taught in the experimental-1 group. The only difference was that the

context-based activities were implemented with printed materials in this group. Sentence-context activities were conducted in the first lesson of the week, and text-context activities were conducted on the other day. The implementation was carried out face-to-face with the experimental-2 group students. After the teacher gave information about the implementation, the printed materials were distributed to the students. Each student was first asked to complete the activity individually, and then the activity was repeated with the participation of the whole group.

3.4.4 Control group implementation process

In the control group, the lessons were taught according to the current Turkish course curriculum. In this regard, 126 target words that students are expected to learn during one academic year according to the Turkish curriculum were also taught in the control group. Therefore, the control group's content was the same as that of the experimental groups. The implementation period lasted seven weeks, as in the other groups. Thus, the learning time was taken under control. Fifty-seven of the 126 words are already included in the content of a 7-week period of the Turkish curriculum. The remaining 69 words that are supposed to be taught in the other weeks were added to the content of seven weeks for this study. The vocabulary teaching activities in the textbook were extended by adding these 69 words, considering that they comply with the text content. Since the implementations were carried out at the beginning of the academic year, all groups learned the words only with their own groups' teaching method without repetition.

The most important difference between the implementations for the control group and the experimental groups can be explained as follows: According to the Turkish curriculum, it is left to the teacher's initiative to use technological tools in vocabulary teaching. In this study, the primary education teacher did not use technological tools in vocabulary teaching in the control group. The only materials used were the Turkish textbook and the vocabulary notebook. These printed materials are not context-based, either. Therefore, they differ from the printed materials in the experiment-2 group. In the control group, vocabulary teaching was carried out through text-based activities as stipulated by the curriculum, and these activities were presented to the students through the Turkish textbook. The vocabulary activities in the Turkish textbook are repeated throughout the year using different words through an activity consisting of four steps. The steps of this activity are as follows:

1. Predicting the meaning of the word.
2. Using a dictionary.
3. Using the word in a sentence.
4. Writing the word and its meaning in the vocabulary notebook.

This activity is presented with the following instruction: "Predict the meanings of the words and check the accuracy of your predictions in the dictionary. Make a sentence with the words. Add the words to your vocabulary notebook." An example of the use of this activity from the Turkish textbook is presented in Fig. 5.

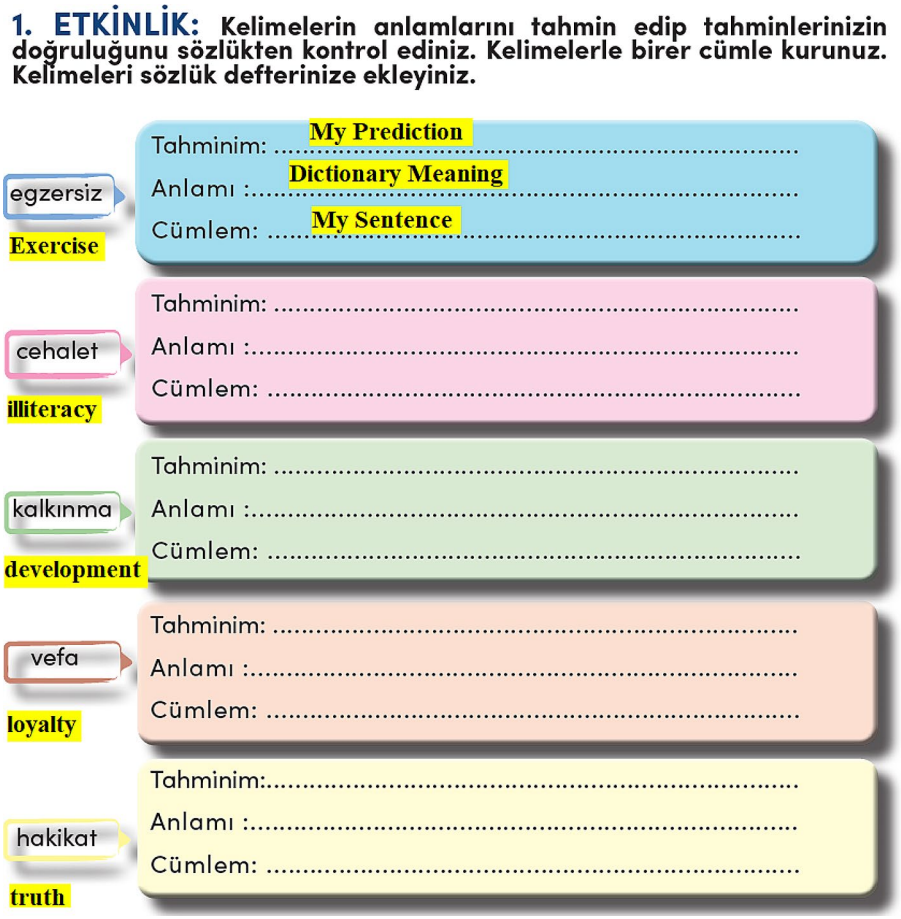

Fig. 5 An example of the most commonly used vocabulary teaching activity in the Turkish course textbook

In addition to this activity, other vocabulary teaching activities that are occasionally found in the Turkish textbook include the following:

1. Matching the word with its meaning.
2. Finding synonyms, homonyms, and antonyms of words.
3. Repetition.

3.5 Data analysis

The SPSS 22.0 software package was used for data analysis. Before the analysis, incorrect coding, outliers, and missing data were checked. During these checks, data belonging to seven students were removed from the data set. In determining the hypothesis tests to be used in data analysis, the normality of the data distribution

must first be tested. The Shapiro-Wilk test was performed to test the suitability of the data for normal distribution, and skewness and kurtosis values were examined. Levene's test was used to check if the variances were homogeneous. As a result of the analysis, it was determined that the data were distributed normally, and that the variances were homogeneous. The arithmetic mean, standard deviation, minimum, and maximum values of the data were calculated for general information about the experimental and control groups. The one-way ANOVA test was conducted to examine whether there was a statistically significant difference between the pre-test scores of the experimental and control groups. The results revealed that the pre-tests did not differ in terms of dependent variables (VKAT [$F=0.08$, $p>0.05$]; VLMS [$F=1.84$, $p>0.05$]). Moreover, ANOVA tests for the difference in post-test and pre-test scores were performed to explain the degree of change in the different groups. After finding a significant difference between the scores, we used the Tukey multiple comparison test to determine the sources of the variance. Then, the partial eta squared (η^2) value was used to calculate the effect size as a result of one-way ANOVA. The obtained effect sizes were interpreted as 0.01, 0.06, and 0.14, which are small, medium, and large, respectively (Cohen, 1988; Faul et al., 2007).

3.6 Compliance with ethical standards

Within the scope of the research, firstly, approval was obtained from Hasan Kalyoncu University Ethics Commission, dated November 01, 2023, and numbered 45,068, stating that the research is following ethical principles. After the official procedure, approval was obtained from the school administrator where the research was conducted, the teachers whose classes participated, the parents of the students in these classes, and the students, respectively. While obtaining consent, the participants were told that participation in the research was completely voluntary and that they could withdraw from the research at any time. It was also stated that their identities would be kept confidential, and that the data would not be shared with anyone other than the researchers.

4 Results

The results obtained from data analysis are presented in this part of the study.

4.1 Results on vocabulary knowledge

Firstly, the descriptive statistics obtained from the pre-test and post-test of the VKAT for the experimental-1, experimental-2, and control groups are presented in Table 3.

As seen in Table 3, the post-test scores of all three groups from the vocabulary knowledge test are higher than the pre-test scores. When the mean difference scores were examined, the largest difference between the post-test and the pre-test was found in the experimental-1 group ($M=5.50$, $SD=3.43$). This group is followed by the experimental-2 group ($M=2.50$, $SD=2.30$). The difference between the post-test and pre-test scores is the lowest in the control group ($M=0.26$, $SD=2.92$).

Table 3 Descriptive statistics of the groups' VKAT scores

Group	Measure	n	M	SD
Control	Pre-test	31	9.71	5.57
	Post-test	31	9.97	5.50
	Difference[1]	31	0.26	2.92
Experimental-1	Pre-test	30	9.93	4.46
	Post-test	30	15.43	6.38
	Difference[1]	30	5.50	3.43
Experimental-2	Pre-test	30	10.20	4.44
	Post-test	30	12.70	4.86
	Difference[1]	30	2.50	2.30

Note.[1] Difference = (Post-test) – (Pre-test)

Table 4 One-way ANOVA results for VKAT difference scores

Source	Sum of Squares	df	Mean Square	F	p	η^2	Difference (Tukey)
Between Groups	421.196	2	210.598	24.679	0.00*	0.36	2 – 1;
Within Groups	750.935	88	8.533				2–3;
Total	1172.132	90					3 – 1

Notes. $*p<0.05$; (1) Control, (2) Experimental-1, (3) Experimental-2

Table 4 shows the one-way ANOVA results for the post-test – pre-test difference scores obtained from the VKAT to explain the degree of change in different groups in the post-experiment versus the pre-experiment.

As can be seen in Table 4, there is a statistically significant difference between the groups' post-test and pre-test mean difference scores gained from the VKAT [$F(2–88)=24.679$, $p<0.05$, $\eta^2 = 0.36$]. Experimental procedures applied to the groups produced a large effect ($\eta^2 = 0.36$) on vocabulary knowledge. Since the variances of the groups were homogeneous, the Tukey post-hoc test was applied. Multiple comparisons indicated significant differences between the experimental groups and the control group ($p<0.05$). A significant difference was also found between the experimental-1 and the experimental-2 groups ($p<0.05$).

As shown in Tables 3 and 4, the vocabulary knowledge post-test and pre-test mean difference scores of the students in the experimental-1 group ($M=5.50$) are significantly higher than those of the students in the control group ($M=0.26$, $p<0.05$). In addition, the mean difference scores of the experimental-1 group students ($M=5.50$) are significantly higher than those of the students in the experimental-2 group ($M=2.50$, $p<0.05$). Furthermore, the mean difference scores of the students in the experimental-2 group ($M=2.50$) are significantly higher than those of the students in the control group ($M=0.26$, $p<0.05$). As a result, it was found that context-based vocabulary activities conducted with technology-assisted tools and printed materials were significantly more effective in improving students' vocabulary knowledge than the implementation of the Turkish curriculum. Moreover, the results revealed that technology-assisted activities were more effective in enhancing student vocabulary knowledge than the activities carried out using printed materials.

Table 5 Descriptive statistics of the groups' VLMS scores

Group	Measure	n	M	SD
Control	Pre-test	31	2.50	0.36
	Post-test	31	2.41	0.42
	Difference[1]	31	-0.09	0.34
Experimental-1	Pre-test	30	2.43	0.37
	Post-test	30	2.76	0.28
	Difference[1]	30	0.33	0.35
Experimental-2	Pre-test	30	2.33	0.28
	Post-test	30	2.29	0.30
	Difference[1]	30	-0.04	0.42

Note.[1] Difference = (Post-test) – (Pre-test)

Table 6 One-way ANOVA results for VLMS difference scores

Source	Sum of Squares	df	Mean Square	F	p	η^2	Difference (Tukey)
Between Groups	3.085	2	1.543	11.136	0.00*	0.20	2–1;
Within Groups	12.189	88	0.139				2–3
Total	15.274	90					

Notes. $*p<0.05$; (1) Control, (2) Experimental-1, (3) Experimental-2

4.2 Results on vocabulary learning motivation

The descriptive statistics obtained from the pre-test and post-test of the VLMS for the experiment-1, experiment-2, and control groups are presented in Table 5.

As shown in Table 5, only the post-test scores of the experimental-1 group from the vocabulary learning motivation scale are higher than the pre-test scores. The post-test scores of the experimental-2 and the control groups are lower than the pre-test scores. When the mean difference scores were examined, the largest difference between the post-test and the pre-test was found in the experimental-1 group ($M=0.33$, $SD=0.35$). This group is followed by the control group (M = -0.09, $SD=0.34$). The difference between the post-test and pre-test scores is the lowest in the experimental-2 group (M = -0.04, $SD=0.42$).

Table 6 shows the one-way ANOVA results for the post-test – pre-test difference scores obtained from the VLMS to explain the degree of change in different groups in the post-experiment versus the pre-experiment.

As can be seen in Table 6, there is a statistically significant difference between the groups' post-test and pre-test mean difference scores obtained from the VLMS [$F(2–88)=11.136$, $p<0.05$, $\eta^2 = 0.20$]. Experimental procedures applied to the groups had a large effect ($\eta^2=0.20$) on vocabulary learning motivation. Since the variances of the groups were homogeneous, the Tukey post-hoc test was applied. Multiple comparisons indicated a significant difference between the experimental-1 and the control groups ($p<0.05$). A significant difference was also found between the experimental-1 and the experimental-2 groups ($p<0.05$). However, there is no significant difference between the mean differences of the control and the experimental-2 groups ($p>0.05$).

As shown in Tables 5 and 6, the vocabulary learning motivation post-test and pre-test mean difference scores of the students in the experimental-1 group ($M=0.33$) are significantly higher than those of the students in the control group (M = -0.09,

$p<0.05$). In addition, the mean difference scores of the students in the experimental-1 group ($M=0.33$) are significantly higher than those of the students in the experimental-2 group (M = -0.04, $p<0.05$). As a result, it was found that context-based vocabulary activities conducted with technology-assisted tools were significantly more effective in improving students' vocabulary learning motivation than the implementation of the current Turkish curriculum and the context-based vocabulary activities conducted with printed materials.

5 Conclusion and discussion

In this study, which aims to examine the effect of context-based vocabulary activities with technology-assisted tools and printed materials on vocabulary knowledge and vocabulary learning motivation of fourth-grade primary school students, it was seen that vocabulary activities conducted with technology-assisted tools and printed materials were effective in improving the vocabulary knowledge of fourth-grade primary school students. However, the study showed that technology-assisted context-based vocabulary activities improved vocabulary knowledge more effectively than printed materials. In addition, vocabulary activities with technology-assisted tools increased students' motivation to learn vocabulary, while vocabulary activities using printed materials did not affect students' vocabulary learning motivation.

The success of the vocabulary teaching process depends on several factors, and some preparatory work needs to be done in order to manage this process effectively. This preparatory work includes selecting words to be included in vocabulary teaching, determining teaching principles, and planning assessment and evaluation methods. The most crucial factor that impacts the results of this research is the method applied. Technological applications were used as tools in the teaching process. The main reason for achieving effective results on vocabulary knowledge is the method used in the vocabulary teaching process and the content prepared. In this study, applications for the word context were included in vocabulary teaching, and it was aimed to develop vocabulary with the word repetition method. In addition, questions related to the word context were included in the vocabulary achievement test prepared for measurement and evaluation purposes. Students' vocabulary knowledge was evaluated in accordance with the method used in the implementation phase. The results of the study revealed that the applications positively affected their vocabulary knowledge. Similarly, Baturay (2007) used context and spaced repetition methods in vocabulary teaching. Her study examined the effect of vocabulary learning supported by web-based multimedia in the context model and spaced repetitions on the vocabulary of intermediate EFL learners. Learners were provided with interactive exercises such as fill-in-the-blank, multiple-choice tests, games, and puzzles to review target vocabulary intermittently. The study's results revealed that students developed positive attitudes toward learning English vocabulary and that teaching vocabulary through spaced repetition increased their vocabulary.

Research has shown that context-based vocabulary instruction is effective in developing vocabulary (Akın, 2018; Cingöz, 2019; Duran & Bitir, 2017; İlter, 2017; Nagy & Herman, 1987). Regarding the subject, Gür (2014) compared the traditional

dictionary usage technique and context-based vocabulary teaching technique, which are among the techniques that can be applied in teaching new vocabulary to primary school students, and concluded that the context-based vocabulary teaching technique was more effective than dictionary usage. Duran and Bitir's (2017) study determined that the context-based vocabulary instruction method was more successful than traditional vocabulary instruction involving finding the word's meaning from the dictionary and writing it down. It was concluded that the context-based vocabulary instruction method contributed to students' vocabulary acquisition and retention of words. Students enjoyed this method by finding it fun and different, and they wanted to continue learning vocabulary with this method. Similarly, Cingöz (2019) found that contextual vocabulary activities with narratives and novels contributed to vocabulary teaching. Furthermore, Nagy and Herman (1987) found that a group of students learned the meanings of unknown words they encountered during reading from the context at the end of context clues training, and that this increased their reading volume. The researchers argued that contextual analysis firmly supports the vocabulary learning hypothesis in light of this information. Therefore, in this study, it can be said that sentences and texts prepared for context-based vocabulary teaching are effective on students' vocabulary.

When the studies using technology-assisted content for vocabulary teaching are examined, it can be seen that parallel results were obtained with the results of this study (Akdoğan, 2020; Albaqami, 2023; Antara, 2022; Aini & Ma'rifah, 2021; Aulia et al., 2020; Canlı-Bekar, 2019; Chen & Wang, 2015; Çil, 2021; Guaqueta & Castro-Garces, 2018; Hasram et al., 2021; Huei et al., 2021; Pahamzah, 2022; Karatay et al., 2018; Solak & Çakır, 2015; Solikhah, 2020; Torres Álvarez, 2022; Tsai, 2020; Wahyuni, 2021; Yaşar-Sağlık, 2022; Yu & Luo, 2022). Albaqami (2023) obtained similar results to this study regarding the effects of technology-based and non-technology-based vocabulary learning activities on Saudi foreign language learners' vocabulary learning. It was concluded that technology-based and non-technology-based vocabulary activities improved vocabulary, but that technology-based activities improved vocabulary more. Yaşar-Sağlık (2022) stated that vocabulary teaching supported by Web 2.0 tools contributed to developing students' vocabulary, reading comprehension, and fluency. Hasram et al. (2021) showed that "WordWall" online games increased 5th-grade students' English vocabulary learning. Similarly, the study by Pahamzah (2022) showed that the use of multimedia and technology in the "Edmodo" program positively affected vocabulary learning in learners of English as a foreign language. Wahyuni (2021) stated that the "Educandy" educational game application can be used in learning environments to increase the English vocabulary of fifth-grade primary school students. The study by Yu and Luo (2022) compared the effectiveness of Quizlet and the traditional approach in vocabulary teaching. During two weeks, "Quizlet" teaching, one of the Web 2.0 tools, was applied to the experimental group of two groups of 70 university students, and the traditional instruction method was used in the control group. As a result of the research, it was found that the students in the experimental group showed a significant improvement in vocabulary scores in the post-test compared to the control group students. Similarly, Torres-Álvarez (2022) concluded that the Quizlet application positively affected vocabulary learning. Antara (2022) aimed to determine the effect of the "Educandy" applica-

tion on students' vocabulary in his doctoral thesis. The study group consisted of 24 third-grade students. The results showed that Educandy significantly impacted young students' vocabulary with moderate effectiveness. It was also observed that students' motivation, interest, and enthusiasm for vocabulary learning increased due to the intervention. These results show that technology can be used successfully in vocabulary teaching and support students' vocabulary learning.

The use of technology-supported content can also affect research results. Among the factors that determine this effect are the type and number of tools used and the level of interaction. Although many technology-supported tools are available, interactive and purposefully selected tools positively affect research results. For example, in a study by Tai et al. (2022), the Mondly virtual reality application, which provides virtual scenarios and rich contextual information, was found to be more effective than non-interactive video applications in the vocabulary learning of adolescents learning a foreign language. Although both applications were technology-supported, it was concluded that the Mondly virtual reality application was more effective than video applications. Similarly, in this study, it is thought that the selection of technological tools in accordance with the purpose impacted the results. The Web 2.0 tools used in this study are of a type that can be used in context-based vocabulary teaching. At the same time, they enable students to learn interactively and with fun. Therefore, they are considered to be effective in the vocabulary teaching process.

Research shows that technology-assisted vocabulary teaching methods have the potential to increase students' motivation as well as increase their vocabulary. Aini and Ma'rifah's (2021) action research on first-year secondary school students showed that a mobile game-based learning strategy increased vocabulary and enhanced students' motivation and interest in learning vocabulary. Similarly, the study by Mete and Batıbay (2019) showed that vocabulary teaching with Kahoot, one of the Web 2.0 tools in the Turkish course, increased vocabulary learning motivation at a high rate. Furthermore, Ni'mah's (2023) study emphasised that using the Quizlet application as a digital flashcard increased students' motivation to learn vocabulary. However, the study by Reynolds et al. (2021) showed that the Kahoot application did not affect vocabulary learning but increased motivation.

In conclusion, technology-assisted vocabulary instruction can be successfully used in native language instruction and can help students improve their language skills. It also has the potential to make vocabulary learning processes more effective. As stated by Borich (2017) and Morgan (2012), technological tools are dynamic, easy to use, social, and collaborative. These tools can be used as essential tools that facilitate classroom teaching and learning. Teachers need to ensure that students play a more active role in the learning process by using these tools effectively. Research in this field needs to be further deepened, and teachers need to apply the knowledge gained from this research. Teachers can support their students to improve their vocabulary by choosing appropriate methods for their specific needs and learning styles.

6 Recommendations

- Teachers can enrich vocabulary teaching by using technology-assisted tools more frequently. In particular, tools such as online games, interactive applications, and virtual reality can make the vocabulary learning experience more engaging and effective.
- Studies show that context-based vocabulary instruction is more effective than traditional dictionary use. Teachers can make vocabulary teaching more meaningful by allowing students to use words in real-life contexts.
- Technology-assisted vocabulary teaching can increase students' motivation. Teachers can make learning more fun by using digital tools and applications that can attract students' interest.
- Educators and researchers should conduct more research on technology-assisted vocabulary teaching. This can help identify the most effective methods and tools.
- Since technology-assisted vocabulary teaching is still an emerging field, more research should be done, and teachers should apply the findings from this research. This can provide language teachers with new opportunities to improve their students' language skills.

Acknowledgements The authors appreciate the teachers, and students who participated in this study.

Author contributions The authors confirm contribution to the paper as follows: study conception and design: [Ülkü Çoban Sural, Zehra Yaşar Sağlık]; data collection: [Ülkü Çoban Sural]; analysis and interpretation of results: [Ülkü Çoban Sural, Zehra Yaşar Sağlık]; draft manuscript preparation: [Ülkü Çoban Sural, Zehra Yaşar Sağlık]; review and editing; [Ülkü Çoban Sural, Zehra Yaşar Sağlık]; revision; [Ülkü Çoban Sural]. All authors reviewed the results and approved the final version of the manuscript.

Funding Open access funding provided by the Scientific and Technological Research Council of Türkiye (TÜBİTAK).

Data availability The data that support the findings of this study are available from the corresponding author upon reasonable request.

Declarations

Informed consent Informed consent was provided by all the participants.

Conflict of interest The authors declare that they have no conflict of interest.

Compliance with ethical standards This study was approved by the Ethics Committee at Hasan Kalyoncu University on November 01, 2023 with approval number 45,068.

Financial interests The authors have no relevant financial or non-financial interests to disclose.

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