Prospective classroom teachers' views on instructional technologies and web-based digital educational tools

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Article Info

ABSTRACT

This study examined prospective classroom teachers' perceptions of instructional technologies and the web-based digital tools they actively use. Using a case study design with semi-structured interviews, data were collected from 15 prospective teachers who had completed an instructional technology course. The findings show that participants strongly emphasized the necessity of technology integration in education. The most commonly used tools included assessment, visual–infographic design, coding, drawing–shaping, augmented and virtual reality, animation, interactive presentations, and artificial intelligence. These tools were found to significantly support effective and efficient learning, enhance motivation, and promote sustainable learning. Accordingly, the study recommends the systematic use of web-based digital tools to support digital transformation in education.

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1. INTRODUCTION

Advances in information and communication technologies (ICT) have become an integral part of daily life, influencing many fields, particularly education [1]. The widespread use of digital technologies has transformed education globally, shifting learning from traditional methods to technology-enhanced approaches [2]. In response to rapid scientific and technological change and global competition, countries now prioritize the development of individuals with 21st-century skills. Accordingly, education systems continue to adapt by integrating science and technology to prepare a skilled and competitive workforce [3].

Technology-based instruction has become a core requirement of modern education, placing teachers at the center of educational transformation [4]. In addition to 21st-century skills such as critical thinking, problem solving, collaboration, and innovation, teachers are expected to possess strong information, media, technology, and web literacy to actively engage students in digital learning environments [5]. Instructional technology refers to the purposeful use of technological tools to enhance, enrich, and systematically support the teaching–learning process [6].

Teachers play a critical role in helping students learn about technology and how to use it; teachers guide students on their path to technology [7]. Thus, due to the many benefits of technology (facilitating teaching or attracting attention), learning materials have started to take shape in the direction of digitalization [8]. Digital contents and interactive applications created and designed in line with this idea increase the quality of education and the sustainability of the created contents saves time. In addition, the visual, auditory and kinesthetic preparation of digital content contributes to students' effective and permanent learning, active and interested participation in the lesson as well as learning by having fun [2]. Within the scope of all these

benefits and opportunities, the problem of this research is to determine the perspective of prospective classroom teachers (PCT) about instructional technologies and to determine the web-based digital education tools they use.

The developments of instructional technologies over time are of great importance in the field of education. With the combination of technology and education, learning processes have become more comprehensive, interactive and accessible, making the education more effective and quality [9]. Web-based digital education tools offer notable advantages such as flexibility, accessibility, and interactive content; however, they differ markedly from traditional and hybrid learning approaches. In contrast to face-to-face instruction, which facilitates immediate, personal interaction and fosters social learning, web-based digital education places greater demands on learners' intrinsic motivation and digital literacy. When the literature on the use of technology in education is examined, many studies have been conducted to reveal the situations of school administrators, teachers, and teacher candidates regarding the use of technology [2], [10]–[14].

Lin *et al*. [11] concluded in their study that digital learning has a significantly positive effect on learning motivation and lasting learning outcomes compared to traditional teaching. In the study to determine the views of primary school teachers on the use of tools and equipment in education, the use of technological tools and equipment in lessons has positive aspects for teachers and students [8]. In addition, it has been stated in many studies that the use of web tools has positive effects on students' academic achievement, high-level cognitive thinking skills, and technological literacy levels [15]–[18]. Studies examining teachers' views on the use of Web 2.0 applications in educational environments, classroom teachers' perceptions and self-efficacy levels towards the use of technology, and classroom teachers' views on the use of technology within the scope of a specific course are available in the literature. In addition, studies on Web 2.0 and in-class applications to examine teachers' views are available in the literature. Since there are limited studies examining the perception of instructional technologies in the sample of PCT and determining the web-based digital education tools used by PCT, it is thought that the research will make a unique contribution to the field [19]. A study of PCT's use of instructional technologies and web-based digital educational tools is important as it provides insight into the readiness of future educators to integrate technology into their teaching and the technological practices and programs they are currently using. In the context of this importance, this study can help to identify strengths and gaps in the digital competencies of future teachers by revealing the state of teacher education programs and ultimately contributing to more effective, technology-enhanced learning environments.

In the 21st century, web-based education is of great importance to follow the rapid developments and to provide an up-to-date educational environment based on creativity. Web tools offer new opportunities and capabilities by providing a constructivist approach and skill-oriented learning opportunities beyond traditional teaching methods. These opportunities allow students to integrate their education with daily life, to put it into practice and to learn more easily and permanently [20]. Web technology tools and applications have an important role to play in making learning and teaching processes in education more effective and efficient to achieve a wide range of goals and objectives in many fields and environments. Web technology tools bring a new dimension to the educational process, enrich the learning environment and support students' active participation in the learning process [21]. In this process, students can experience the roles of producing, organizing, designing, reproducing, and sharing information by leaving the role of passive reader through web tools. In line with this information; it is necessary to train teachers who aim to train teachers with technological skills that are required by the age, who can follow the ever-changing technology, and who are successful in this process [22]. In line with this idea, it is important to investigate the thoughts and perspectives of PCT who will be the teachers of the future. The purpose of this study was to examine the views of PCT about instructional technologies and to determine the web-based digital education tools they use. In line with this purpose, answers to the following questions are sought:

i) What are the views of prospective classroom teachers on the use of technology in education?
ii) What are the web-based digital education tools used by prospective classroom teachers?

2. METHOD
2.1. Research design

This study examined the views of PCT on instructional technologies and identified the web-based digital education tools they use, employing a case study design from qualitative research methods. Qualitative research techniques were used to analyze social events, phenomena, and changes where quantitative methods are insufficient [23]. In the case study design, the researcher examined the experiences of individuals living in a specific context through observation, interview, and document collection, and subjective or social reality was explored [24]. In this research, a case study was adopted in 15 PCT who are continuing their education and have completed the instructional technologies course were interviewed. It was

made to determine the opinions of PCT about the use of technology in education, what they pay attention to when preparing and using digital content, which technological applications they will integrate into their education in the future, and the web-based digital education tools they currently use in their education processes. PCT designed websites, created digital content, created educational games, and designed digital materials in the 'instructional technologies' course.

2.2. Participants

The participants of the research consisted of 15 PCT students studying at Bartın University in the spring term of the 2023-2024 academic year. To be suitable for the purpose of the research, the purposive sampling method was preferred in sample selection [25]. In the selection of PCT, attention was paid to the fact that they had successfully completed the instructional technology course by designing technological applications, creating digital content using educational technologies and applications, and creating platforms. The participants consisted of 2nd, 3rd, and 4th-grade students (9 were females, while 6 were males).

2.3. Data collection

A semi-structured interview form consisting of five open-ended questions developed by the researcher and finalized by taking an expert perspective was used as a data collection tool. In the interviews, the participants were asked questions about the importance of technology use in education, the necessity of instructional technologies, which technological applications they will integrate into education in the future when they become teachers, and what web-based digital education tools they currently use in their education and training processes. Interviews were recorded with the permission of the participants. The interviews were conducted face-to-face with 15 PCT and lasted 15-20 minutes.

2.4. Data analysis

The data obtained, which was conducted to examine the opinions of PCT regarding the use of technology in education and to determine the web tools used by PCT, were analyzed by content analysis [26]. The MAXQDA program was used to analyze the data. MAXQDA is a qualitative data analysis program that uses a hierarchical grading system, can add weight points to the text, can take short and different types of notes, is easy to use and store data, and can make visual mapping [27]. After the written texts were transferred to the program, they were divided into meaningful sections as codes and categories for each section. In addition to the software-based analysis, a manual review of the coded data was conducted to ensure consistency and accuracy. The coded data were categorized and tabulated in systematic ways. In the results section, the opinions of the PCT are presented as PCT1-PCT15. Prior to the research, the necessary permissions were obtained from Bartın University Social and Human Sciences Ethics Committee regarding the ethical suitability of the research. Various measures were taken by the researchers in order to minimize or eliminate the factors that affect and threaten data validity and reliability in the research [24].

3. RESULTS AND DISCUSSION

The words emphasized in the word cloud in Figure 1 reveal which concepts the PCT attach importance to about instructional technologies and their general perceptions of instructional technologies. On the other hand, the visual analysis method with word clouds allows qualitative data to be interpreted more clearly and easily. As can be seen in Figure 1, the concepts and word structures related to instructional technologies that emerged in line with the opinions of PCT through visual mapping are technology, instruction, permanent, Web 2.0, digitalization, integration, and digital transformation. It can be concluded that these concepts and lexical structures cover current concepts related to educational technology.

Figure 1. Word cloud

3.1. Prospective teachers' views on the use of technology in education

The data obtained from the opinions of PCT about the use of technology in education are given in Figure 2. As it can be seen in Figure 2, prospective teachers' views on the use of technology in education are grouped under the categories of "education" (45), "student" (17), "course" (7), "intelligence type" (6), and "teacher's digital skills" (3). The "education" category, which is the first category formed in line with the opinions of PCT, was grouped under ten titles as remarkable (11), education technology integration (9), effective and permanent learning (7), rich learning environment (4), concretization (4), easy learning (3), teaching with games (2), visual learning (2), learning by doing and experiencing (2), time and cost saving (1). The prospective teachers mostly expressed opinions on the code "remarkable". Sample participant expressions related to the codes belonging to the education category are:

"*Technology is developing very fast, children are curious, and technology attracts their attention. I think it is important to use technology in the lesson with technology being the main focus.*" (PCT12)

"*First of all, we are in the digital age and we can now call students "children of technology". Since students spend most of their day at school and live a life integrated with technology, technology should be integrated into education and students should interact with technology.*" (PCT8)

"*I think technology will be a tool for learning, I mean saving time and cost and contributing more to the lessons, I think technology is necessary for effective and efficient lessons.*" (PCT13)

"*During the education, directing the students to technology to make them focus on the lesson, including content that can attract their interest, and teaching them more easily and gamified in this way will make the education fun and I think the subject-content will attract more attention.*" (PCT10)
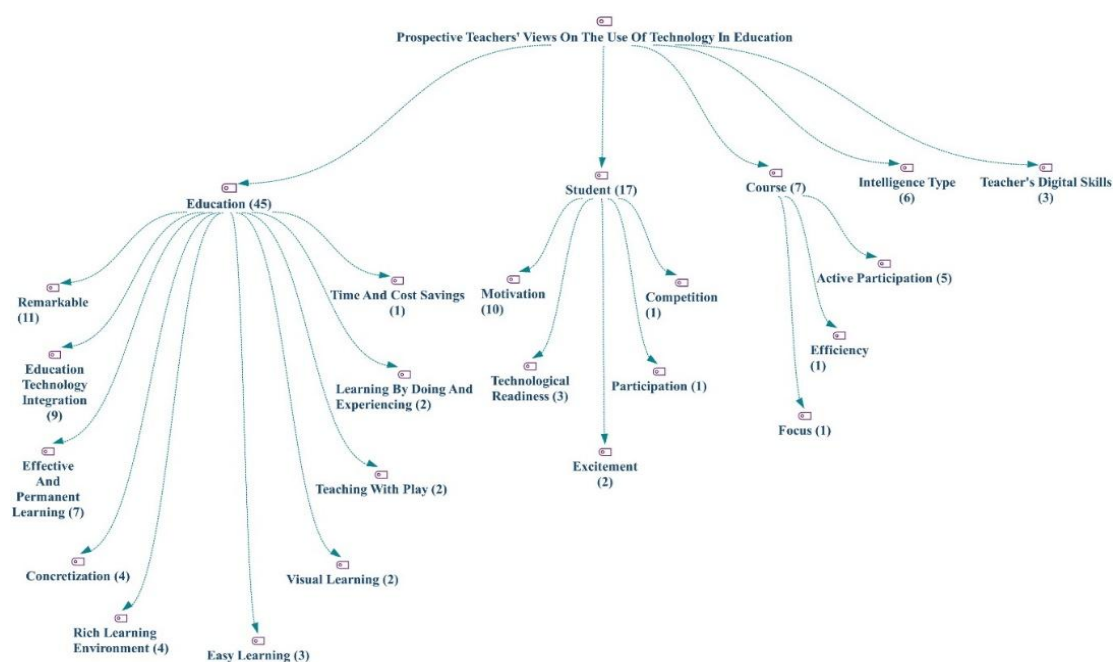

Figure 2. Prospective classroom teachers' views on the use of technology in education

As can be seen from the expressions, participants are largely positive about the use of technology in education and this is associated with various dimensions that contribute to the educational process. Opinions are generally concentrated under the code "remarkable", which emphasizes the potential of technology to attract students' attention and increase focus on the lesson. In addition, it is stated that technology integration supports effective and permanent learning, enriches the learning environment and makes the lesson more effective and fun with methods such as gamification and visual learning. Participants emphasize that technology offers students the opportunity to learn more easily and cost-effectively and that the use of technology in education is inevitable in line with the requirements of the age.

The "student" category was categorized under five headings: student motivation (10), technological readiness (3), excitement (2), class participation (1) and in-class competition (1). The statements of PCT were mostly concentrated in the "student motivation" code. The participant expressions related to the codes belonging to the student category are:

> "*When we go to schools for internship, when you use technological applications, children are better motivated, they focus on the lesson and their readiness increases. As they use digital content and web 2.0 tools on the smart board, they get excited and their motivation for the lesson increases.*" (PCT12)
> "*In classrooms where technology is used, active participation of students increases and motivation level increases. For example, we prepared a digital wheel in the Word Wall application and we prepared a content in which we determined who would participate in the lesson with this wheel, in this way we taught a student-centered lesson. In this way, active participation in the lesson increased for all students and a sense of excitement occurred in all students.*" (PCT8)
> "*Some of our students grow up without self-confidence and remain passive in terms of class participation. As a solution to this situation, we can overcome this negative situation by integrating technology into our lessons.*" (PCT5)

As can be seen in the statements of the participants in the second category, they emphasize the positive effects of technology on increasing the motivation of students and strengthening their participation in the lesson. Especially the views gathered under the 'student motivation' code indicate that technology increases students' interest in the lessons and their focus on the lesson. Technological applications provide students with excitement and motivation, and at the same time encourage in-class interaction and active participation. It is stated that students become more courageous and participatory when they interact with technology, which creates a more effective and student-centered learning experience in education. It is also emphasized that students with low self-confidence can be more active in class participation with the help of technology. These results show that the use of technology reinforces a student-centered approach in education.

The third category "lesson" was categorized under three headings: active participation (5), focus (1), efficiency (1) in line with the statements of the PCT. The prospective teachers mostly produced the code "active participation". In this direction, direct expressions from the opinions of prospective teachers representing the course category are given:

> "*The use of technological applications-tools in lessons definitely affects active participation in the lesson. For example, we played the code.org, which is a coding application, to the children and all students actively participated in the lesson, they focused on the lesson and we had a very productive lesson.*" (PCT1)
> "*Actually, I think we should create more opportunity areas for technology and it will be effective in terms of efficiency. This situation affects active participation in the lesson and increases efficiency of the lesson. On the other hand, digital contents increase students' focus and concentration.*" (PCT6)
> "*The use of digital content in lessons facilitates memory, perception and concentration. In addition to providing students with effective lessons, it encourages active participation in lessons.*" (PCT14)

As can be seen in the statements of the participants in the third category, technology-supported applications increase active participation, focus, and efficiency in lessons. According to the statements of PCT, especially the use of digital content and technological tools increases students' interest in the lesson and makes the learning process more effective. The most emphasized element is the increase in active participation. This shows that technology integration contributes positively to the lesson processes and is an important factor that increases teaching efficiency. In the fourth category, "type of intelligence", the following direct quotations representing the statements of PCT were given:

> "*...The fact that the visual intelligence type of the new generation is dominant reveals that they are more prone to technology. Thus, it is very important to teach the subjects visually by concretizing them through digital content.*" (PCT1)
> "*I think that students learn and remember the technological applications and digital contents they see more easily because of their visual intelligence and memory.*" (PCT9)

As emphasized in the participant statements, today's students have predominantly visual intelligence and this increases their predisposition to technology. According to the statements of participants, it is seen that students understand better and remember what they have learnt more easily when visual materials and digital contents are used in the learning process. Therefore, supporting the subjects with visual elements by concretizing them in the teaching process stands out as an important factor that increases learning efficiency. In the fifth category, the statements of PCT for "digital skills of the teacher" are given:

"*The teacher's ability to use technology directly affects the student. Because the teacher is a role model for the student. A teacher needs to improve himself/herself rapidly in technology. Because a teacher who follows the technology raises students who can use technology and produce content.*" (PCT6)

"*The teacher's ability to use technology makes a big difference and development in students. The technological competence level of the teacher will improve the students in direct proportion.*" (PCT8)

Teachers' digital skills have a direct and significant impact on students. According to the statements of PCT, the more proficient teachers are in using technology, the more their students' predisposition to technology and their productivity increase. In addition, the teacher's competence in the use of technology is directly proportional to the development of students. Therefore, teachers' continuous improvement of their digital skills is a critical factor for students to use technology effectively and consciously.

According to the findings obtained for the first sub-problem; the majority of PCT emphasized the necessity and importance of technology use in education. They stated that technological readiness will be ensured in students with technology integration in education; it will contribute to the easy learning of the student and increase student motivation and participation in the lesson. Thanks to the use of digital education tools; it has been stated that education can continue at home as well as attracting attention, permanent and effective learning, class participation, and students' commitment to school will increase. Studies have shown that in classrooms where digital education tools are used, students' interest and motivation towards the lesson increases, they do not get bored in lessons, and they support easier and permanent learning [21]. It was stated that the web tools used by the students made the lessons more fun, active and remarkable, enabled students to participate more effectively in the lessons and supported learning positively [28]. In addition, it was concluded that digital education tools used during the lesson will create a competitive environment in the classroom and rich learning environments can be provided by appealing to different types of intelligence, especially visual learning.

In this process, students can experience the roles of producing, organizing, reproducing and sharing information by leaving the role of passive reader through digital education tools. In addition, it has been stated in many studies that positive effects have been observed on students' academic achievement, high-level cognitive thinking skills and technological literacy levels [16]–[18], [20], [29]. Considering the age and generation of students who are educated in the age of technology, it is stated that the lessons taught with web tools increase the academic achievement of the students and also increase their motivation and interest [20]. Akgün [30] emphasized the necessity of instructional technologies in education and training processes and also stated that instructional technologies are necessary for teachers to process the lessons more effectively, for students to comprehend the subject better and to increase their interest in the lesson, and to make the lesson more effective and efficient by concretizing and visualizing the information.

3.2. Web-based digital education tools used by prospective teachers

In line with the answers given by the PCT to the interview questions, the web-based digital education tools they use in their education and training processes are given in Figure 3. When Figure 3 is analyzed, 30 different digital educational tools frequently used by PCT were included. In line with the data obtained, a total of 102 digital education tools were identified. As can be seen in Figure 3, frequently used web-based digital education tools and applications: Wordwall (14), Kahoot (11), Canva (9), Powtoon (9), Pixton (7), Prezi (6), Storyjumper (5), ClassDojo (5), Plotagon (5), Cody (5), Scratch (5), Thinker cad (4), AlgoDigital (4), Wix (3), Padlet (3), Quiver (2), Arloopa (2), Zoom (2), EdPuzzle (2), Thinglink (2), Voki (2), Animaker (2), ChatGPT (2), Google Classroom (2), Emaze (2), QR Code (2), Artsteps (2), Chatterpix (2), Heygen (2), and Jigsawplanet (2).
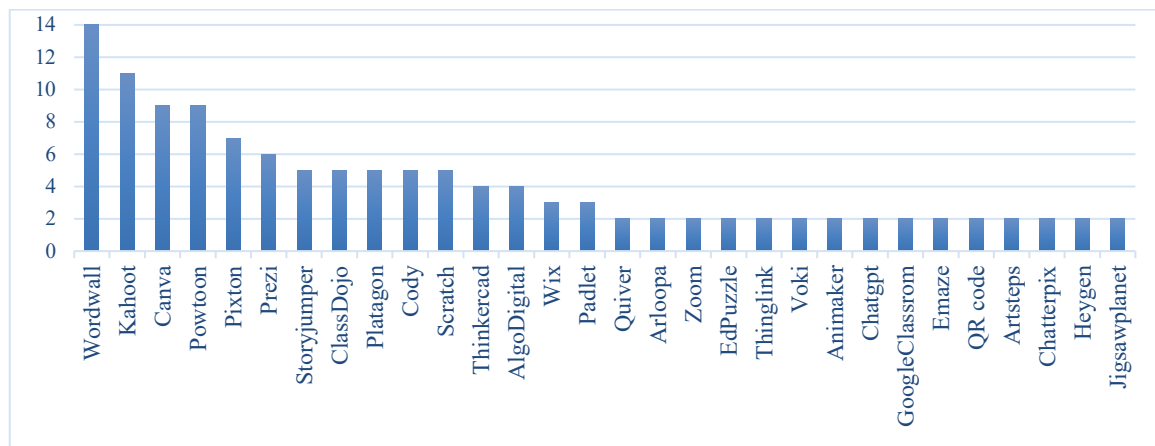
Figure 3. Web-based digital education tools used by prospective classroom teachers

The participant statements regarding the data obtained as a result of the questions asked about the web-based digital education tools used by PCT are:

"*The Suno app is a very efficient and functional program. Children often learn with songs and music. Considering primary school students, students have a lot of fun in the lesson with Suno application and they learn by having fun. I think that web 2.0 tools are very educational tools*." (PCT15)

"*I create animations in every subject and content with Powtoon, an animation creation program. Children like animations very much, they watch them like cartoons.*" (PCT13)

"*I use the Word Wall application as a fun assessment and evaluation tool. We also experience artificial intelligence with the online education platform EBA. We visited "peri bacaları" with EBA, which also provides virtual reality. And thus, permanent learning is provided without time and space limitations. Finally, we can access many educational materials with 3D applications that I frequently use.*" (PCT9)

"*I always use Prezi in every lesson. Because Prezi is a very useful presentation tool, it saves us from the traditional and boring PowerPoint.*" (PCT4)

"*Class Dojo is a very logical application for creating a virtual classroom. It is a very efficient virtual classroom application both in terms of using technology and in terms of assigning homework and following the development of students. In this way, it combines technology with education at home.*" (PCT2)

"*Digital story preparation programs are very productive for primary school students. When I open a digital story, the content of which I prepared myself, on the smart board, I make both a visual presentation and an auditory presentation to the students, so it is beneficial for children in terms of both auditory, visual and sensory aspects. In addition, there are digital games, interactive content and interactive applications in Derslig, which is an online smart education platform, is very efficient for students.*" (PCT12)

"*I frequently use Scratch application for both gamification and coding. It is very important to write e-books with Story Jumper application, which is another digital tool. I can also make the book's voiceover, so it attracts children's attention more.*" (PCT11)

Within the scope of the second research question, the web-based digital education tools used by PCT were classified according to the types of tool groups as displayed in Figure 4. As can be seen in the figure, it was found that PCT used measurement and assessment tools such as WordWall, Kahoot, Quizizz; visual and infographic design tools such as Canva, Pixton, Visme; coding tools such as Scratch, AlgoDigital, Cody: Mindmup, Mindmaps, Popplet; and drawing and shape making tools. On the other hand, they used augmented and virtual reality tools such as Quiver, Arloopa, EBA VR; animation design tools such as Powtoon, Platagon, Animaker; collaboration and group work tools such as Google Classroom, Clasdojo, Edmodo; interactive presentation tools such as Prezi, Emaze, Padlet; artificial intelligence applications such as ChatGPT, Gemini; e-book creation tools such as Storjumper, Storybird; web design tools such as Wix, Google Sites; meeting applications such as Zoom, Microsoft Teams. In addition, digital education tools such as Edpuzzle, Heygen, Artspteps, QR Code, Chatterpix and Jigsawplanet, which are included in several

categories and have multiple functions, were also used by PCT. There are many studies in the literature that reach similar results and indicate that similar digital education tools are used in education [21], [31]–[33].

In parallel with the research findings, there are studies that conclude that in the classroom learning process: measurement and evaluation tools, infographic design tools, coding tools, drawing and shape creation tools, augmented and virtual reality tools, animation design tools, collaboration and group work tools, interactive presentation tools, artificial intelligence applications, e-book creation tools, web design tools, meeting applications are used [34], [35]. From this point of view, it can be concluded that web-based digital education tools are increasingly developing and increasing in popularity in the world of education Thus, it can be inferred that it is important to use various new technologies in educational environments in order to attract the attention of new generation students [36].
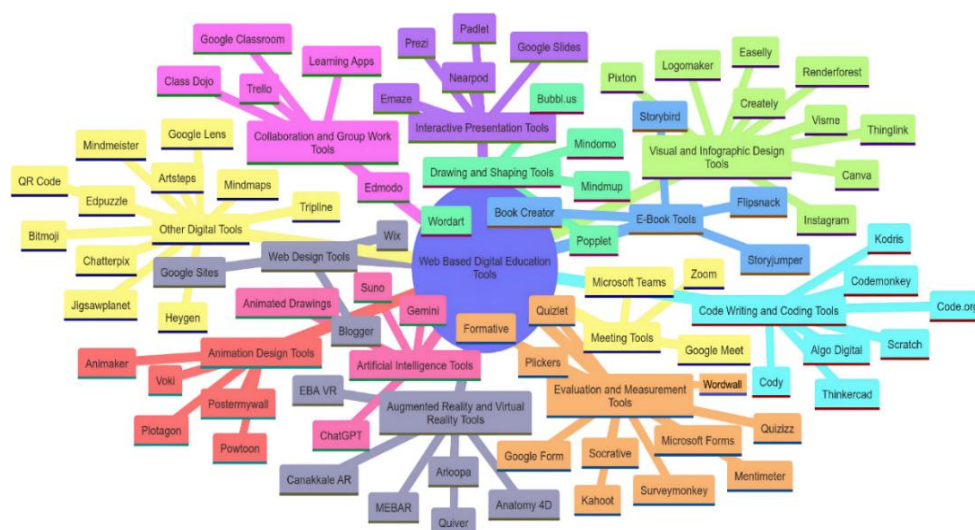

Figure 4. Types of web-based digital education tools used by prospective primary school teachers

4. CONCLUSION

This study demonstrates that web-based digital tools play a crucial role in enhancing student engagement, motivation, and learning effectiveness while offering flexible, visually rich, and efficient instructional support. Pre-service teachers show strong potential to integrate these technologies into future practice, though further development of digital competencies remains necessary. Accordingly, continuous professional development, systematic integration of web tools into teaching, and ongoing engagement with educational technology research are strongly recommended to support effective, dynamic, and personalized learning environments.

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Elvan Subaşıoğlu		✓	✓	✓	✓	✓		✓		✓				

C : **C**onceptualization	I : **I**nvestigation	Vi : **Vi**sualization
M : **M**ethodology	R : **R**esources	Su : **Su**pervision
So : **So**ftware	D : **D**ata Curation	P : **P**roject administration
Va : **Va**lidation	O : Writing - **O**riginal Draft	Fu : **Fu**nding acquisition
Fo : **Fo**rmal analysis	E : Writing - Review & **E**diting	

CONFLICT OF INTEREST STATEMENT
Authors state no conflict of interest.

INFORMED CONSENT
We have obtained informed consent from all individuals included in this study.

ETHICAL APPROVAL
The research related to human use has been complied with all the relevant national regulations and institutional policies in accordance with the tenets of the Helsinki Declaration and has been approved by the authors' institutional review board or equivalent committee.

DATA AVAILABILITY
The data that support the findings of this study are available on request from the corresponding author [GA]. The data, which contain information that could compromise the privacy of research participants, are not publicly available due to certain restrictions.

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