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Designing a digital escape room game: An experience of a digital learning tool in basic education

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Highlights	Abstract
• Digital educational escape room games eliminate the generation gap between teachers and students. • Digital educational escape room games redefine the concepts of 'homework' and 'school' from the student's perspective. • Digital educational escape room games are valuable as they support not only students' cognitive development but also their affective development, skill development, and personal development.	The study aims to explore the perspectives of primary school teacher candidates who attend Turkish Language Teaching courses on their experiences of developing digital educational escape room games (DEERGs). Phenomenology design, one of the qualitative research methods, was utilized. The study group comprised 48 primary school teacher candidates who were reached by the convenience sampling method. A semi-structured interview form developed by the researcher and DEERGs designed by the participants were used as data collection tools. In the 14-week study, interviews were conducted via Microsoft Teams. The findings were analysed from a holistic perspective using content analysis. Results indicated that the participants preferred Google Forms and Genially tools in game design, and they benefited from Web 2.0 tools. In first language education, games for reading and writing skills were designed, and mostly primary school and 4th-grade achievements were selected. It was observed that they considered areas of interest, individual differences, and constructs that support cognitive-emotional and skill development in scripting. It was emphasized that DEERGs contribute to attention, focus, maintaining and motivating learning, problem-solving, developing a positive attitude towards the lesson, and learning while having fun.

1. Introduction

During the Coronavirus pandemic, educators worldwide mobilized to ensure the effectiveness of distance education, leading to the widespread integration of technology in almost every aspect of the educational system. In Turkey, after the pandemic, the Kahramanmaraş Earthquake, which was coined as the *disaster of the century* (Utkucu et al., 2023), brought online education back into the spotlight. As a result, an urgent shift to remote education was implemented in all higher education institutions to enable uninterrupted learning for students (Telli & Altun, 2021). Although technology provided a significant tool to ensure continuous education, the challenges faced during the pandemic's learning process remained apparent. Therefore, educators embarked on a quest for innovation in technology-supported teaching methods, aiming

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to motivate students in the learning process, accomplish learning outcomes, and equip them with 21st-century skills.

The innovations in the teaching process have replaced the traditional memorization-based approach (Hidalgo-Cabrillana & Lopez-Mayan, 2018). Moreover, in the 21st century, the education of the digital native generation can take place in any environment with internet access, independent of time and place. Therefore, teachers adopting outdated teaching methods may fall short of meeting the interests and needs of today's students. To address this, educators need to closely monitor the latest developments in information and communication technology, redesign instructional environments by incorporating contemporary methods and techniques, and strive to enhance the quality of the education process. The International Society for Technology in Education (ISTE, 2016) emphasizes the importance of increasing students' competencies as digital citizens, knowledge producers, innovative designers, computational thinkers, creative communicators, global collaborators, and empowered learners, considering the growing role of computers and automation systems in our lives.

Although elements such as computers and automation systems, independence of learning from time and space have an important place in human life, some negativities in the distance education process should not be ignored. As it is known, distance education is different from face-to-face education. Therefore, it is very important to use materials that will attract students' interest, motivate them to learn, facilitate the process and keep them engaged in front of the screen. When the literature studies are examined, there are opinions that the number of learners who can complete the programme they are enrolled in the distance education process is limited (Levy, 2007), that they are ineffective in the learning process and that students have high dropout rates (Boston & Ice, 2011; Kim & Bonk, 2006; Park & Choi, 2009; Patterson & McFadden, 2009). When distance education studies with high dropout rates are examined; the lack of a good instructional design, insufficient opportunity for students to socialise in the course, inadequate digital literacy skills of users, limited interaction of students with peers and instructors are among the reasons that attract attention (Croxton, 2014; Dempsey & Van Eck, 2012). Considering these reasons, it should not be forgotten that the interactive teaching process as well as the technological infrastructure (Kim & Bonk, 2006) is important in increasing efficiency and success in the distance education process. Therefore, there is a need for instructional designs that encourage interaction, increase motivation level, make learning meaningful and improve digital literacy skill level.

It is crucial to explore innovative ways of learning that involve all students in the education system, to enable them to experience learning in a natural way and to provide effective learning environments are also very important in the distance education process. More importantly, it is crucial to understand the characteristics of the target student population and to discover innovative ways of learning that are appropriate to these characteristics (Waycott et al., 2010). In this process, digital tools used in the distance education process have become the biggest collaborators of educators. One of these collaborative tools, digital educational escape room games, has a scenario that is different from both traditional games and familiar digital games. The fact that the scenario is designed in a way that is suitable for the age group of the target students and arouses their interest, attracts their attention, enables them to focus on the game, and supports the achievement of educational gains by fulfilling the tasks given in the game flow. In this context, firstly, educational escape games, which are game-based learning applications, some research related to the subject and the purpose and application process of this research will be given respectively.

2. Literature

Implementing sufficient online pedagogical approaches and integrating various digital tools into the instructional process has become a priority in educational systems. Maintaining students' interest and persistence in learning is crucial to online education. One possible approach to creating engaging and

interactive learning environments, using students' energy and enthusiasm for educational purposes, is to incorporate game-based learning activities and gamify different parts of the educational process. Based on this, it is possible to say that gamification is defined as the application of game mechanics to make learning more attractive and increase learner motivation (Moncada & Moncada, 2014, p. 9). Juul (2003) defines games used in this learning experience process as rule-based systems with measurable outcomes, where players try to influence the outcome, and their emotional connection is tied to the results. Salen and Zimmerman (2003) add that games have pre-established rules and measurable outcomes, and players experience the process by solving a problem or facing a challenge together. Educational games, developed to impart a learning objective to individuals, support students' motivation in the learning process, providing them with a flow state (Paras & Bizzocchi, 2005).

In this context, Game-Based Learning (GBL) involves students playing physical or digital educational games to achieve the lesson's learning outcomes. GBL refers to any learning environment or activity that uses games to support teaching and learning (Chang et al., 2017). Bondar et al. (2016) state that GBL enhances cognitive and social skills, and the interactive nature of games serves as a motivating factor for learning. Furthermore, GBL positively influences participants' motivation and interest, thereby increasing learning opportunities (Baranowski et al., 2019; Sailer et al., 2017; Uzsen & Basbakkal, 2019). In digital game-based learning (DGBL), games not only develop students' cognitive skills, but also help them process much information at the same time. Seng and Yatim (2014) state that digital games, when appropriately supported, create a self-directed learning environment for students and therefore have a value beyond entertainment. At the same time, by encouraging visual and auditory learning, it brings the teaching and learning process to a student-centred position and, in the words of Savaş et al. (2021), enables students to develop new identity, imagination, creativity, and the opportunity to identify their interests and skills (Savaş et al., 2021).

Educational escape room games, one of the game-based learning applications, is a game based on the principle of *escape rooms*, which is played both in physical and digital environments. An escape room is a game experience that forces participants to escape from a locked room. To achieve this, they must overcome various challenges, follow certain instructions, and find the key to the exit door. Some experts view this application as part of a game-based learning methodology, while others see it as a gamification experience (Moura & Sentos, 2019). In an escape room game, players work as a team to win and not lose. They have a shared collaborative environment on a game designed to meet predefined learning outcomes. The players' main objective is to escape from a physically or virtually locked room within a limited time to achieve educational objectives. During this process, they are presented with puzzles and tasks. The process facilitates active learning, promotes social interaction, and supports collaborative learning. Players interact with each other in the context of a narrative-driven story to win the presented challenge and explore (Nicholson, 2018).

Educational escape games, based on game-based learning, positively influence student achievements (Pernas et al., 2019), contribute to the instructional process, enhance academic performance, and support subsequent problem-solving processes (Lien et al., 2019). Furthermore, they facilitate memory retention in learning (Liu et al., 2020). The increasing need for methods that enhance individuals' curiosity, keep participants in a state of flow, and support active engagement during the educational process justifies the inclusion of escape rooms among the new generation of educational methods (Yılmaz, 2020, p.111). In recent years, escape games designed for educational purposes have significantly increased the interest of researchers and educators. Studies aiming to provide students with the experience of a new game-based learning approach by breaking away from traditional classroom routines have demonstrated that educational escape games inspire high levels of motivation and commitment among learners, with many participants experiencing a state of flow. However, it is also observed that there are relatively few studies on the educational significance of such activities (Giang et al., 2019).

When examining the studies related to escape room games, it is observed that they have been investigated in various fields. Giang et al. (2019) explored whether escape games could be utilized as an educational tool in robotics education. Yachin and Barak (2019) examined the role of escape games in promoting knowledge, awareness, and motivation for healthy eating. Clune (2019) researched how a digital escape game could promote the learning of mathematical concepts. Glavas and Stascik (2017) conducted a study to cultivate a positive attitude towards mathematics among mathematics and computer science pre-service teachers. They accomplished this by implementing escape room games as a pedagogical approach. Karageorgiou et al. (2019) implemented a STEAM-focused escape room activity. Şahin and Güneş (2022) investigated the functionality of educational digital escape room games from teachers' perspectives. Huraj et al. (2022) aimed to evaluate how students perceived learning using a digital educational escape room. Taraldsen et al. (2022) presented a compilation and analysis of studies related to escape room games. Bezençon et al. (2023) worked on preventing addictive behaviours. Additionally, there is another study (Büchner et al., 2022) that investigated whether learning with a digital escape room game is more effective before or after the theoretical teaching process, and they discovered that implementing escape room games after the theoretical instruction was a more effective teaching approach. Huang et al. (2020) developed an instructional approach that included a digital escape room (DER) for primary school fourth-grade students to investigate its impact on learning performance, learning, and problem-solving abilities. In a quasi-experimental design, they found that students in the experimental group had higher scores in learning motivation and problem-solving abilities compared to the control group. Students had positive perceptions of the DER experience and believed that the DER teaching strategy was convincing and effective. The work of Makri et al. (2021) aimed to provide a systematic literature review on Educational Escape Rooms (EERs) and focused explicitly on Digital Educational Escape Rooms (DEERs) to explore the current developments and trends related to DEERs and how they enhanced learning outcomes for online learners. The researchers mentioned that they could not find any studies related to the pedagogical effects of DEERs and their research was motivated by identifying and filling the gaps in the existing literature.

While this study aims to contribute to the gap in the literature on DEERGs, it also aims to provide some learning advantages for students who continue their education with distance education and to provide an alternative experience for primary school teachers who are conducting their courses with distance education. Considering the learning advantages for students, DEERGs aims to focus students on the lesson, make the teaching process interactive, make students enjoy the learning process, support collaborative learning, and support the ability to follow the instructions while performing the given tasks in distance education. From the perspective of the classroom teacher, it aims to provide an experience that they can use in their professional life, to reflect their own evaluations about this experience and to increase their professional motivation with students who enjoy learning. DEERGs are designed for a specific group of students with learning goals. Therefore, a high success rate is targeted when the game is completed, and this level of success provides students with positive learning experiences. The fact that all puzzles have been solved is an indication that all learning objectives have been achieved. The primary goal in the design of DEERGs is to ensure that the puzzles are compatible with the curriculum, are not boring for the student and do not cause frustration. Because these elements are perceived as reasons for players to leave the game (Hermanns et al., 2018). To end the game, the puzzle results need to be verified by entering numeric or alphabetically coded passwords. Therefore, the items in the sub-problems of this study also provide the determination of whether the DEERGs designed by primary school teacher candidates include these main topics.

The research aims to find an answer to the question "What are the perceptions of prospective classroom teachers about their experiences of designing digital educational escape room games (DEERG)?". To achieve this aim, answers to the following sub-problems are sought.

i. What is the application tool preferred by primary school teacher candidates in DEERGs design and the reason for preference?

ii. What is the grade level preferred by primary school teacher candidates in DEERGs design?

iii. What is the starting point of the scenario preferred by primary school teacher candidates in DEERGs design?

iv. What are the Web 2.0 tools used by primary school teacher candidates in DEERGs design?

v. At which stage of the learning process did the primary school teacher candidates use the DEERGs designs?

vi. Which are the areas of learning outcomes in mother tongue teaching preferred by primary school teacher candidates in DEERGs design?

vii. What are the opinions of primary school teacher candidates about the use of DEERGs designs in the education process?

The study was carried out with primary school teacher candidates undergoing distance education at the faculty of education and taking the course on Turkish language teaching. These participants received seven weeks of theoretical subject knowledge training and seven weeks of training on designing physical and digital educational escape room games (DEERGs), including sample application studies. After 14 weeks of training, the participants were asked to consider how to transfer the course outcomes and learning outputs of mother tongue teaching to elementary school students more interactively and efficiently, based on the acquired knowledge. They were required to plan accordingly. Then, they determined an elementary school grade level for the game design and selected the learning outcomes from the elementary school curriculum related to mother tongue teaching (Turkish language teaching) to design DEERGs.

3. Methodology

3.1. Research Model/Design

The research has been designed using *phenomenology*, one of the qualitative research methods. According to phenomenology, phenomena are objects, events, and occurrences perceived by consciousness (Cevizci, 1999, p. 341). In this context, phenomenology is an approach that analyses everything experienced by consciousness and examines how individuals interpret their consciousness and the world they live in (Craib, 1992, p. 98). The phenomenology design focuses on phenomena we know but do not have an in-depth and detailed understanding. Phenomena can appear daily, such as events, experiences, perceptions, orientations, concepts, and situations. Although we encounter these phenomena daily, it does not necessarily mean we fully comprehend them. Phenomenology provides a suitable research framework for studies that aim to investigate phenomena that are not entirely foreign to us but that we cannot fully comprehend (Yıldırım & Şimşek, 2018, p. 69, 71). In phenomenology studies, the data sources are individuals who directly experience the phenomena rather than individuals who have experienced the phenomenon indirectly. This research's data sources rely on the participants' 14-week course experiences and online meetings planned on Microsoft Teams. The participants were introduced to the Breakout Edu, DeckToys, Genially, and Google Forms tools, which they could use to design DEERGs within the scope of the study. The researcher prepared an example application and provided training to the participants, enabling them to create their designs. Outside of class hours, the researcher communicated with the participants to check their game designs and ensure the progress of the work.

3.2. Data Collection Tools

Using the characteristics of interaction, flexibility, and probes offered by the researcher during the interviews is essential to uncover the experiences and meanings related to phenomena. Phenomenology interviews are generally lengthy because the researcher needs to engage in intense interaction with the

interviewed individual or individuals to reveal and explain the depth of the experiences (Yıldırım & Şimşek, 2018, p. 71). In this context, the researcher developed a semi-structured interview form consisting of ten questions as the data collection tool for the DEERG design, which they presented to experts for feedback before finalization. Seven interview questions, which were finalized after the expert opinions, were directed to the participants. Additionally, the data collection process involved using the DEERGs designed by the participants. The research process took place over 7+7 weeks, and the applications and interviews were conducted using the Microsoft Teams. Of the 51 participants who responded to the interview form and presented their game design, only the game designs and interview responses of 48 participants were evaluated within the scope of the research. The games of three participants were excluded from the scope of the research on the grounds that they were not prepared as a DEERG design. In the preliminary examination of the designs evaluated as DEERG, attention was paid to whether they included the following headings. a) Creating a scenario-story, b) Creating puzzles (tasks), c) Preparing clues, d) Adding distractors, e) Providing instant feedback, f) Providing opportunities for cooperation, g) Providing a reward system.

3.3. Sampling or Study Group

The study group was composed using convenience sampling method. This sampling method was chosen to expedite the research process (Yıldırım & Şimşek, 2018) and because the researcher could easily access a group of students due to a recent earthquake disaster. The study included 48 primary school teacher candidates pursuing their undergraduate education and taking the Turkish Language Teaching course at a state university in the western region of Turkey. The participants consist of 14 men and 34 women, aged 19, studying in the second year of their undergraduate studies.

3.4. Data Analysis

The data obtained from the interview form were analysed using the content analysis method. *Content analysis* is a flexible research tool that can be employed to any form of communication, focusing on the content of a text (Cavanagh, 1997). It is a method in which the content is systematically summarized by creating smaller categories through coding according to specific rules (Büyüköztürk et al., 2017). The content analysis aims to understand the case under study (Downe-Wamboldt, 1992, p. 314). "In content analysis, the main process involves grouping similar data under specific concepts and themes and organizing and interpreting them in a way that the reader can understand" (Yıldırım & Şimşek, 2018, p. 227).

3.5. Trustworthiness and Credibility

To forecast the participants' experiences with the DEERGs they designed, the researcher initially administered a semi-structured interview form to three primary school teacher candidates who were not part of the study group. This step was taken to assess the comprehensibility and suitability of the interview form. After receiving feedback, the interview questions were revised accordingly. The revised questions were then presented to a 4th-grade elementary school teacher and three academic experts in the field. Feedback from these individuals led to removing one question and merging two questions, resulting in the final version of the interview questions. To ensure the credibility of the research, a second researcher independently re-examined all the data according to the codes that were generated during the data analysis process. The codes derived from this process were compared, and repetitive or unnecessary coding was eliminated, while new codes were added where necessary, all while adhering to the research's purpose. The coding process continued until the researcher and the field expert reached a consensus on transforming the codes into categories. The research data were analysed using frequencies to demonstrate the quantitative occurrence of units and comprehend specific elements' intensity and significance (Tavşancıl & Aslan, 2001). Therefore, by quantifying the qualitative data, data security was enhanced, bias was reduced, and the opportunity to compare the obtained data was provided (Yıldırım & Şimşek, 2018). Some participants responded to multiple categories or gave multiple answers, so the frequency numbers may differ from the normal participant count. Additionally, obtaining in-depth data contributed to the consistency of the

research while incorporating quotes from the opinions of primary school teacher candidates in the study group enhanced the reliability and validity of the research findings (P23, P17 format).

3.6. Research Procedures

This research was conducted during the 2022-2023 spring semester as a 14-week educational process. Participants were asked to design DEERGs within the scope of the Turkish Language Teaching course, using the tools Breakout Edu, Deck Toys, Genially, or Google Forms, which were introduced to them. For the design of DEERGs, participants were allowed to utilize the paid and limited free access options provided by Breakout Edu, Deck Toys, and Genially. Alternatively, they could also design them entirely for free using Google Forms. The choice of tool was left to the participant's preference.

The following procedures were followed during the implementation of the research.

- Information regarding the procedure:

Due to the earthquake disaster, a nationwide state of emergency was declared, and the education process transitioned to online learning. It was announced that the Turkish Language Teaching Course would be conducted online via Microsoft Teams for both theoretical and practical aspects over 14 weeks. During the first seven weeks, it was explained that the theoretical teaching process for Turkish Language Teaching proficiency would be conducted interactively through various applications. The following seven weeks would consist of two phases: the first three weeks focused on game-based learning, gamification tools, technology integration in native language teaching, and examples of educational escape room game designs. The remaining four weeks would involve participants creating and sharing their designs and in-class implementation plans. It was emphasized that the completed work would be used in the end-of-term evaluation. Participants who filled out the voluntary consent form would also form the study group for an academic research project.

- Implementation of a rich educational process with both theoretical and practical components:

During the first seven weeks, the theoretical teaching process for native language teaching proficiency was conducted through live classes using active teaching methods and interactive applications. The second 7-week period included presentations on game-based learning, gamification tools, technology integration in native language teaching, and examples of educational escape room game designs. Figure 1 and Figure 2 present screenshots of the instructional process.
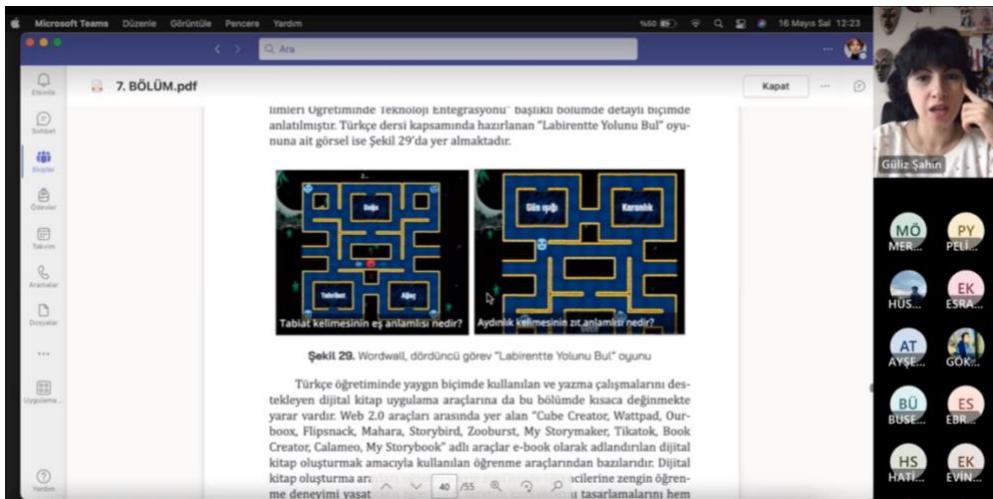

Figure 1. Introductions of Web 2.0 tools that can be used in native language teaching and sample applications related to achievements
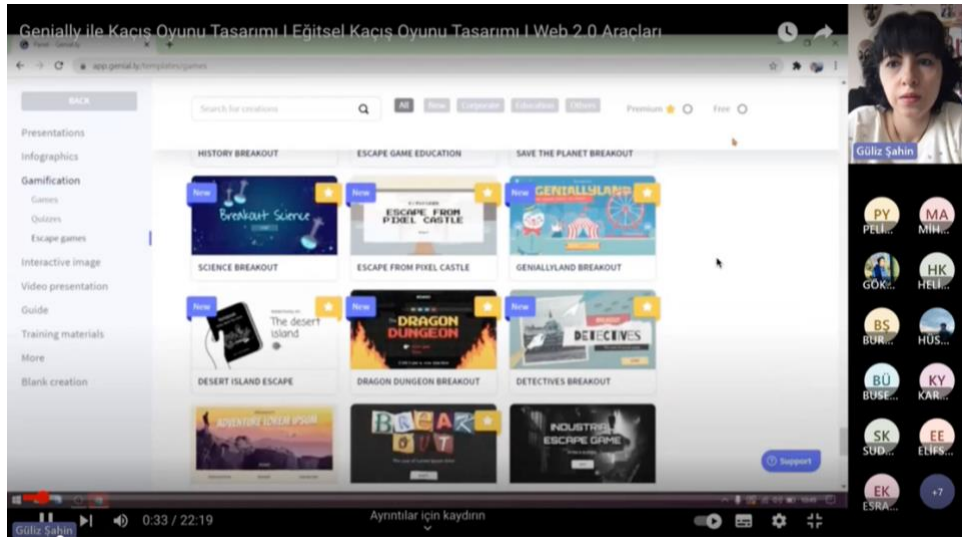
Figure 2. Genially platform, one of the applications for designing DEERGs

- Volunteer Participant Interviews

Consent forms for academic research were sent to primary school teacher candidates, and information was shared with the student group (*n=53*) taking the Turkish Language Teaching course, from which 48 individuals volunteered to participate in the study. Semi-structured interview forms were utilized as data collection tools during the interviews. Additionally, a WhatsApp group was created to facilitate effective communication, and it was informed that questions would be promptly answered via Microsoft Teams. The researcher also created a Padlet link and shared a sample game and lesson activity plan designed for the participants. The aim was to share the prepared DEERG designs by the participants and provide necessary feedback through this platform. Figure 3 presents a screenshot of the Padlet tool containing the sample design, participant designs, and feedback.

Figure 3. Feedback on the DEERGs Designed by the Participants

- Completion of Data Collection Tools and Data Analysis

In the final week of the research process, participants finalized their DEERGs designs through feedback and peer collaboration, and they uploaded their final designs to the Padlet platform. The researcher and a second expert in the field examined the designs of the students who voluntarily provided consent for the

research and participated in the interviews. Content analysis was utilized for the analysis of the collected data. Subsequently, the researcher documented the findings in a comprehensive report.

3.7. Findings and Discussions

In the research, a comprehensive analysis was conducted on the data obtained from the semi-structured interview form and the DEERGs designed by the participants. The findings about the application tool preferred by the participants in their DEERGs design are presented in Table 1.

Table 1.

Preferred Application Tool and the Reasons for its Selection in DEERGs Design

Theme	Category	Code	(f)
Google Forms (f=33)	Designer Perspective (f=14)	Convenience	8
		Competence	6
	In terms of Application Tool (f=19)	Providing space for freedom	8
		Convenience	5
		Functionality of the software	4
		Understandability	2
Genially (f=34)	Designer Perspective (f=9)	Convenience	9
	In terms of Application Tool (f=25)	Variety of templates	9
		Being improvable	4
		Variety of games	3

It can be seen Table 1, that participants mostly preferred Google Forms *(f=28)* as the application tool among the options provided to them, followed by Genially *(f=20)*. The reasons provided by the participants were analysed and categorized into two main groups: *from the designer's perspective* and *from the application tool's perspective*.

Regarding Google Forms, the reasons for its preference from the designer's perspective were coded as *ease of use* and from the application tool's perspective as *providing a space for freedom, user-friendliness, the functionality of the software*, and *comprehensibility*. On the other hand, for Genially, the reasons for its preference from the designer's perspective were coded as *ease of use* and from the application tool's perspective as *variety of templates, modifiability*, and *diversity of game options*. The participants' views regarding the findings are presented below.

P18: I thought it was easy to use, and it was a tool I was already familiar with.

P32: I chose it because preparing was more practical.

P28: I preferred it because it has an advanced interface. Since students will be playing both an escape game and a survey during the activity, I found it more suitable.

P29: I wanted it to be more detailed and comprehensive.

P24: Google Forms offers the possibility of designing more diverse tasks.

P13: I chose Genially because it had various templates.

P8: It has most of the elements needed in a game.

P22: I found it more developer-friendly in terms of use.

The findings regarding the participants' preferences for the primary school grade level in designing DEERGs are visualized and presented in Figure 4.
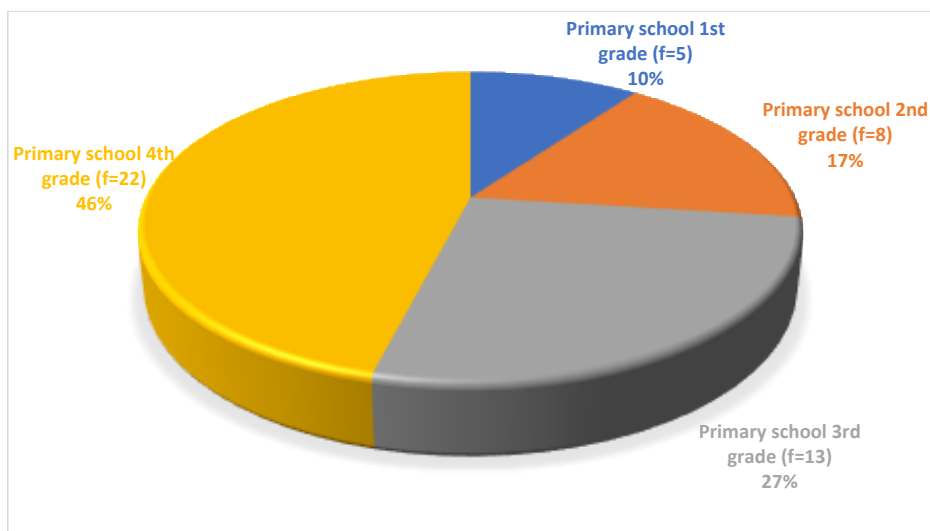

Figure. 4. The Preferred Grade Level in DEERGs Design

It can be seen Figure 4, that participants preferred to design DEERGs for the primary school grade levels as follows: 46 percent for 4th grade *(f=22),* 27 percent for 3rd grade *(f=13),* 17 percent for 2nd grade *(f=8),* and 10 percent for 1st grade *(f=5).* Most of the participants preferred to design games at the 4th grade level because they thought that their mother tongue teaching achievements were enriched at the 4th grade level of primary school, and they wanted to add diversity to their games.

Table 2 presents the data obtained regarding the elements that participants considered as starting points when creating scenarios in the storytelling aspect of their DEERGs design.

Table 2.

The Preferred Starting Point for Storytelling in DEERGs Design

Theme	Category	Code	(f)
Player-oriented *(f=102)*	Interest area *(f=46)*	**Living life**	**14**
		Travel	8
		Animal love	8
		Cartoon	7
		Adventure	5
		Children's book character	4
	Cognitive contribution *(f=21)*	**Supporting learning**	**8**
		Rights and freedoms	6
		Associating with other courses	3
		Motivation towards the lesson	2
		Course efficiency	2
	Individual Differences *(f=16)*	**Enabling the use of knowledge**	**4**
		Building a reading culture	4
		Fostering a sense of responsibility	3

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		Age-appropriateness	2
		Developing intelligence	2
		Agility/quickness/speed	1
	Skill Development *(f=13)*	**Fun-oriented**	**8**
		Developing problem-solving skills	3
		Improving attention skills	1
		Enhancing the ability to follow instructions	1
	Emotional Requirements *(f=6)*	Excitement	1
		Happiness	1
		Curiosity	1
		Healing	1
		Confidence	1
		Enhancing imagination	1
Scenario Focused *(f=2)*	Storytelling *(f=2)*	Consistency	2

It can be seen Table 2, that participants paid attention to two main aspects of the design process. Accordingly, the themes of *Player-Focused* and *Story-Focused* have been identified.

Regarding the participants who approached storytelling from a *Player-Focused* perspective, their opinions were gathered under five categories: *interest area (f=46), cognitive contribution (f=21), individual differences (f=16), skill development (f=13)*, and *emotional needs (f=6)*. In these themes, the most frequently mentioned codes in order of prevalence were *real-life scenarios (f=14), supporting learning (f=8), encouraging the use of knowledge (f=4), entertainment-oriented (f=8)*.

For the *Emotional Needs* category, codes such as *excitement, delight, curiosity, healing, self-confidence, developing imagination* were mentioned once each. Examples of participant opinions regarding this theme are provided below:

P6: I designed the story intending to improve the student's problem-solving and task-following skills. Additionally, I created a fictional story through a book to emphasize the importance of learning both the digital world and the significance of reading books.

P12: I thought the zoo theme would capture the interest of every child.

P17: To create social responsibility awareness.

P37: My focus was on books. The lack of reading habits in the new generation, or their preference for digital versions rather than direct contact with a physical book. That was the main aspect I focused on.

When examining the opinions of the participants who approached storytelling from a *Story-Focused* perspective, it was found that the theme of *Narrativization (f=2)* emerged with the code of *consistency (f=2)*. Examples of participant opinions related to this theme are presented below:

P19: I focused on the consistency of the content while designing the narrative.

P25: It should be interconnected.

The visual representation of the Web 2.0 tools preferred by the participants in their DEERGs design can be found in Figure 5.
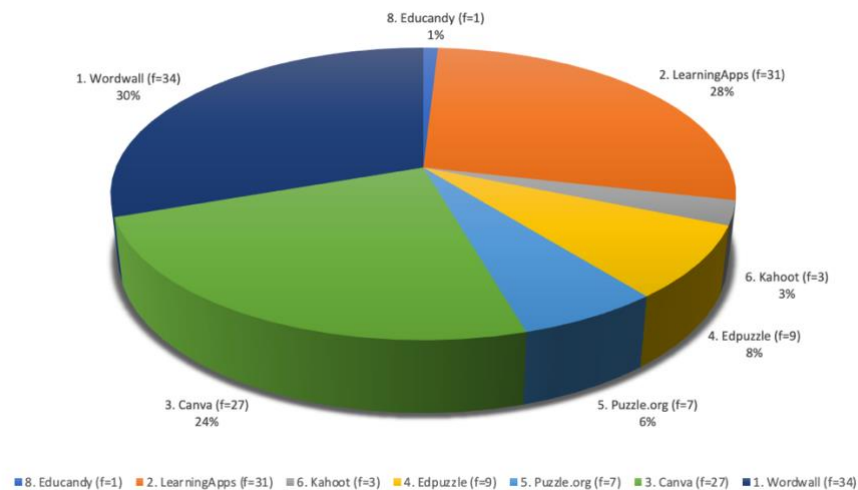
Figure 5. The Preferred Web 2.0 Tools in DEERGs Design

It can be seen Figure 5, that participants mostly used *Wordwall (f=34)* as the most preferred Web 2.0 tool in DEERGs design, while *Educandy (f=1)* was used the least. Additionally, participants used the following tools: *Learning Apps (f=31), Canva (f=27), Edpuzzle (f=9), Puzzle.org (f=9), and Kahoot (f=3)*. Below are the participants' opinions regarding the reasons for their preference for using these Web 2.0 tools:

P3: LearningApps because it offers activities for every grade level and subject.

P4: I used both Wordwall and LearningApps. They offered more functionality and a variety of game themes.

P11: I used LearningApps because the interface is clear and user-friendly. Also, it provided many ready-made activity templates, making it easier for me to implement my ideas.

P26: Canva because it consists of many elements and templates. It provided me with plenty of options to enrich my content.

The participants' responses to when they preferred to use the DEERGs design in the learning process are visualized and presented in Figure 6.
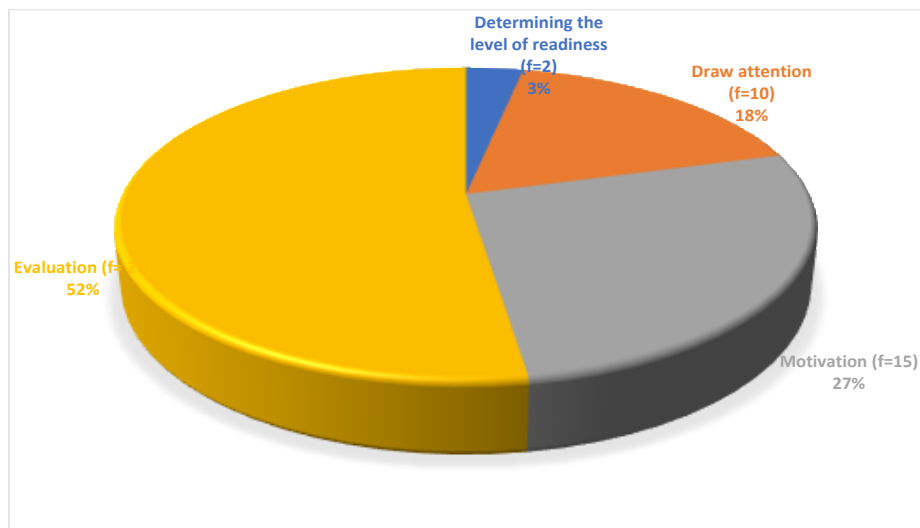
Figure 6. The Preferred Stage of Using DEERGs Design in the Learning Process

It can be seen Figure 6, that participants prefer to use DEERGs designs in the learning process, mostly during the *Evaluation (f=29)* stage. In contrast, they use it the least during the *Determining the level of readiness (f=2)* stage. Some participants also prefer to use it during the *Motivation (f=15)* and *Draw attention (f=10)* stages.

The findings regarding the learning outcomes that participants aim to achieve for students in their DEERGs design to support native language learning are presented in Table 3.

Table 3.

The Preferred Learning Outcomes in Native Language Instruction in DEERGs Design

Skills	Course outcomes related to mother tongue teaching	f
	Finding antonyms of words	**17**
	Finding synonyms of words	12
	Associating visuals with the content of the text read	10
	Understanding the contribution of idioms and proverbs to the meaning of the text	8
	Understanding written instructions	7
	Answering questions about the text they read	6
	Understand the message in short and simple digital texts	4
Reading Skill *(f=79)*	Identifying literal, figurative, and term-meaningful words in the text they read	3
	Understanding the meanings of shapes, symbols, and signs	2
	Distinguishing the meanings of homophones	2
	Reading texts written in different typefaces	2
	Understanding that colored, underlined, bold expressions in the text emphasize important points	2
	Reading texts written in different typefaces	2
	Distinguishing text types	2
	Spelling rules	**9**
	Appropriate use of capital letters and punctuation marks	**9**
Writing Skill *(f=30)*	Using homonyms correctly in text writing according to their meanings	5
	Filling out forms in accordance with the instructions	2
	Proper use of conjunctions in text writing	2
	Correctly writing abbreviations and their corresponding suffixes	2

		The use of Turkish equivalents for words borrowed from foreign languages, which have not yet been fully integrated into the language, in written texts	1

It can be seen Table 3, that participants included learning outcomes related to the skill areas of *Reading (f=79)* and *Writing (f=30)* in the context of Turkish Language Teaching. For the development of reading skills, the three most preferred learning outcomes are associated with the following: *Finding antonyms of words (f=17), Finding synonyms of words (f=12)* and *relating the content of the text with visuals (f=10).* Regarding the development of writing skills, the three most preferred learning outcomes are associated with the following: *Spelling rules (f=9), Using capital letters and punctuation marks appropriately (f=9)*, and *Using homophones correctly in their writings (f=5).*

The findings related to using participants' DEERG designs in the teaching and learning process are presented in Table 4.

Table 4.

Views on the Use of DEERGs Designs in the Teaching-Learning Process

Theme	Category	Code	(f)
Advantages *(f=135)*	Contribution to the Education Process *(f=48)*	**Facilitates learning**	**26**
		Supports long-term learning	8
		Promotes active learning	6
		Fosters collaborative learning	3
		Facilitates recall	3
		Supports interdisciplinary learning	2
	Contribution to the Affective Domain *(f=37)*	**Supports learning through fun and enjoyment**	**25**
		Increases learning motivation	6
		Awakens curiosity	3
		Experiences winning and losing emotions	3
	Contribution to Skill Development *(f=27)*	**Supports the development of attention skills**	**11**
		Supports the development of following instructions	4
		Supports the development of problem-solving skills	3
		Supports the development of creative thinking skills	3
		Supports the development of analytical thinking skills	3
		Supports the development of decision-making skills	2
		Improves hand-eye coordination	1
	Contribution to Personal Development *(f=23)*	**Eliminates generation gap**	**7**
		Supports efficient use of technology	6
		Reconstructs the definition of "homework"	4
		Reconstructs the definition of "school"	3
		Provides different perspectives	3
Disadvantages *(f=51)*	In terms of the Educational Process *(f=22)*	**Deterioration in focus during class**	**8**
		Lack of interest in other activities	6
		Excessive time consumption	4
		Lack of interest in physical play	2
		Reluctance in reading and writing	2
	From the student's point of view *(f=16)*	**Inability to cope with the loss**	**6**
		Health problems	5
		Causing addiction	4
		Distracting from a realistic perspective	1
	From the teacher's point of view *(f=13)*	**Insufficient access to technology**	**10**
		Long preparation process	3

It can be seen Table 4, that participants' views on using DEERGs designs in the teaching-learning process are grouped under two themes: *Advantages* and *Disadvantages*.

Under the *Advantages* theme, four sub-categories are identified: *Contribution to the Education Process (f=48), Contribution to the Affective Domain (f=37), Contribution to Skill Development (f=27), Contribution to Personal Development (f=23).* Considering the order of categories, the most frequently mentioned codes are: *Facilitates learning (f=26), Supports learning with fun (f=25), Supports attention development (f=11), Eliminates generational differences (f=7).* Below are some examples of participants' views related to this theme:

P4: Children are growing up surrounded by technology. Utilizing this aspect of technology to make them enjoy the lesson is very important to speak their language.

P10: It will provide great convenience in motivating the student and making the lesson enjoyable. Digital games can also be used to remind the teacher of the topic or previous subjects. Because children of this period are not unfamiliar with the digital environment.

P13: It has many contributions, such as decision-making, problem-solving, learning to win and lose, creative thinking, and adherence to rules. It improves hand-eye coordination and reinforces the learned information.

P14: It breaks the perception of school as boring and rigid and enables students to learn while having fun.

P18: It offers an education understanding that adapts to the era.

P36: Among the advantages are increasing the permanence of learned information, being familiar with developing technology, and providing a broad perspective and analytical thinking.

Under the *Disadvantages* theme, three sub-categories are identified: *From the Perspective of the Teaching-Learning Process (f=22), From the Perspective of the Student (f=16), From the Perspective of the Teacher (f=13).* Considering the order of categories, the most frequently mentioned codes are: *Decrease in focus on the lesson (f=8), Inability to cope with losing (f=6), Insufficient access to technology (f=10).* Below are some examples of participants' views related to this theme:

P5: In some games, there may be competition, and students with a competitive character may not easily accept losing the game. In such cases, the student may become upset with the lesson or show reluctance in playing the game.

P7: If used too much, it may not gather the same interest.

P22: A generation far from writing and reading skills may be formed.

P25: It can be a problem in village schools and small places where not every student has a smartboard, tablet, or computer.

P29: Both preparation and gameplay can take much time.

P38: Social skill development and friendships may be affected.

P45: Uncontrolled use can create physical and emotional dependency and lead to health problems.

As it can be understood from the participant views, the use of DEERGs in the educational process has some advantages and disadvantages. For this reason, DEERGs designs should be meticulously designed by the primary school teacher for student interests and needs at the appropriate learning time. Giving priority to making the teaching process fun can sometimes lead to ignoring the targeted gains or damaging the social relations between students. Similarly, it should be kept in mind that too frequent use of gamification in the learning process may both reduce the effect of gamification (it may cause students to get bored), cause reluctance in reading and writing, and trigger game addiction in students.

4. Conclusion and Suggestions

Based on the observations, the experience of designing digital educational escape room games was intriguing, and engaging, directed attention toward the profession, supported collaboration, and facilitated the review of subject-related learning levels from the participants' perspective.

Upon examining the results of the current study, it is observed that the participants prefer to use Google Forms and Genially, the most popular among the gamification tools provided to them during the DEERGs design process. While using Google Forms, they stated that the design process provided them with more ease, offered them a sense of freedom in game design, and made them feel more competent in using this tool. The main reason for the preference of Genially as a gamification tool was its ease during the design process and the variety of templates available. Diaz-Garcia et al. (2022) also support this finding. The main reason for the preference of Genially as a gamification tool was its ease during the design process and the variety of templates available. Diaz-Garcia et al. (2022) also support this finding. The researchers also highlight the Genially gamification tool. They point out that this tool makes it easy and quick to create visual and interactive content. In this study, the participants also stated that they preferred to use the gamification tool because it was functional and could be improved in terms of software. Sanchez and Plumettaz-Sieber (2019) also stated that they frequently used digital tools and Genially in their designed escape games. In this study, the participants also stated that they preferred to use the gamification tool because it was functional and could be improved in terms of software. Sanchez and Plumettaz-Sieber (2019) also stated that they frequently used digital tools and Genially in their designed escape games.

Themes, one of the core elements of escape room games, can be based on real-world scenarios or constructed around fantasy elements, creating a different world (Şahin, 2021). Participants have prepared different scenarios by drawing inspiration from the real world and fantasy elements. These scenarios focus on the player's interests, cognitive contributions, individual differences, skill development, and emotional needs. In addition, during the research, participants used ready-made escape room templates and Web 2.0 tools. The most frequently used applications during this process were Wordwall, LearningApps, and Canva. The participants preferred these tools due to their ability to create useful interactions, provide a variety of templates, facilitate the assessment process, and offer user-friendly interfaces. The reasons provided by the participants align with findings from other researchers' studies. For instance, Maghfiroh (2018) states that the Wordwall application provides opportunities for beneficial interactions in the educational environment. Sari and Yarza (2021) consider Wordwall an interesting assessment tool for online learning and a platform that can be used as a learning environment.

Moreover, Nissa and Renoningtyas (2021) highlight that Wordwall is an easy-to-use interactive environment that can enhance students' interest and motivation in thematic learning. In another study by Muslu et al. (2022) with pre-service teachers, LearningApps and Canva were also identified as the most preferred Web 2.0 tools for interacting with content during lesson planning. These findings support the idea presented by Dönmez-Usta et al. (2020) that teaching pre-service teachers about current Web 2.0 tools is not enough; they need to gain experience using these tools effectively with appropriate teaching approaches.

According to the participants, DEERGs contribute significantly to the educational process by facilitating learning, supporting permanent learning, promoting active learning, encouraging collaborative learning, aiding in memory recall, and supporting interdisciplinary learning. Moreover, these games are valuable for the educational process and students' affective domains, skill development, and personal growth. DEERGs are seen to support enjoyable learning, increase motivation, spark curiosity, and instill a sense of winning and losing in students. The participants' statements regarding the prepared escape room games align with descriptive research findings from various studies (Brown et al., 2019; Cain, 2019; Giang et al., 2019; Gómez-Urquiza et al., 2019; Kinio et al., 2019; Lim & Jacop, 2019). Furthermore, they contribute to skill development such as attention, following instructions, problem-solving, creative thinking, analytical thinking, decision-making, and hand-eye coordination. These games are believed to bridge the generation gap between teachers and students. By doing so, they offer a different perspective, encourage efficient use of technology, and redefine the concepts of "homework" and "school" from the student's point of view.

The participants noted that these games can also have some disadvantages. Some of the identified disadvantages from the perspective of the educational process include a decrease in students' focus on the lesson, a reluctance to participate in other classroom activities and physical games outside of the escape room, and the need for excessive time. Additionally, there were concerns about students' lack of interest in reading and writing. From the student's point of view, the participants mostly focused on the aspect of winning and losing, which indicates the possibility of experiencing anxiety and negative feelings related to competition. This finding is consistent with Hermanns's research (2018), where it was reported that players became increasingly anxious about solving the puzzles as time was running out. From the perspective of the teachers who design the games, the most significant disadvantage identified was the lack of technology access. Particularly in rural schools and small towns, class teachers and students may not always have access to computers, tablets, smartboards, and the internet, which poses a challenge for implementing these games. Studies by Kuşaksız et al. (2022) and Çapuk and Ünsal (2017) also support these findings, as they highlight the problems faced by teachers working in rural schools, such as lack of internet access and insufficient technological resources, especially the absence of computers and tablets. Furthermore, from the perspective of teachers, it was noted that the pre-preparation process for the game takes considerable time. This finding is also supported by the research of Huraj et al. (2022).

The present study was conducted with the participation of pre-service teachers enrolled in the primary school teacher education program, specifically focusing on native language instruction. Therefore, this limitation is considered an aspect of the study. The primary school teacher education program has an interdisciplinary nature. Hence, one of the recommendations for researchers is to plan similar and more advanced applications of DEERGs design that also encompass other subject areas. The emergence of new digital technologies will fundamentally transform formal and informal education regarding educational objectives, learning goals, learning environments, learning contexts, learning processes, teacher processes, and educational management and policies (Burbules et al., 2020). This situation necessitates teachers to change their teaching practices and diversify and enrich their instructional processes. Gutierrez-Garcia (2020) stated that using digital resources such as escape room games in the educational process is believed to significantly contribute to pre-service teachers' professional experiences, personal development, and social development. Creating an enjoyable classroom atmosphere can enhance intrinsic motivation and students' perceived levels of problem-solving skills (Deci & Ryan, 1985). Research findings on the educational use of escape rooms, considering their role in instructional activities, demonstrate that escape room activities can be one of the various didactic tools that teachers can use to fulfil the threefold purposes of curriculum reform initiatives (school subjects, basic competencies, and implementation of 21st century skills) in their teaching. Furthermore, using escape rooms as a didactic tool creates a space for social modelling and applying theoretical and practical knowledge and skills (Taraldsen et al., 2022).

In today's world, especially online games and social media are highly popular among students. Considering this situation, teachers and pre-service teachers need to have the knowledge, experience, and skills to adapt

to the changing learning habits of students and utilize gamification technologies to enrich learning environments. Recently, it has been noticed that in-service training programs for teachers and pre-service teachers mostly focus on introducing Web 2.0 tools (Altıok et al., 2017; Bayrak & Bayrak, 2021). Rather than introducing Web 2.0 tools, it is thought that in-service trainings should also be provided for game design that supports collaborative learning in the process of gamification in education, gamification-based training programmes should be designed in education, educators should be given the ability to use gamification designs in both physical and digital learning environments and their widespread use should be encouraged.

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