

Exploring Student and Teacher Experiences in the 'Fun Science Tasks at Home' eTwinning Project

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Abstract

The Covid-19 pandemic has made the use of digital tools mandatory by rapidly shifting the education system to remote learning environments. In this context, eTwinning projects conducted online have provided valuable learning experiences for both teachers and students. This study aims to introduce the 'Fun Science Tasks at Home' eTwinning project, which includes educational and digital games, and to examine the project's contribution to students' interest in science lessons and the digital skills of both students and teachers. A total of 10 science teachers from different provinces of Turkey and 49 middle school students in grades 7 and 8 participated in the study. The research design was determined as a Case Study. Quantitative data was collected through self-assessment forms, while qualitative data was gathered through Padlet responses and observation notes. The findings indicate that the project increased students' interest, motivation, and participation in science classes, strengthened cooperation among students, and positively supported the digital skills of both students and teachers. Additionally, the project contributed to students reinforcing scientific concepts in collaboration with their families and provided important insights into teacher-student interaction in remote science education.

Keywords: eTwinning, middle school students, science teachers, digital skills

1. Introduction

The global education sector is undergoing a rapid digital transformation, which is making the integration of technology into learning environments even more critical. Digital tools not only facilitate students' access to information but also enrich their learning experiences through interaction, promoting stronger collaboration among students and between students and teachers (Yıldız-Durak & Kamali-Arslantaş, 2025). The opportunities offered by digitalization are particularly enabling the reshaping and enhancement of student-centered approaches like Project-Based Learning (PBL) in digital environments. These types of digital PBL environments enhance students' metacognitive awareness by developing their skills in planning, executing, and evaluating their own learning processes, and by allowing them to take on active roles in the learning process (Papanikolaou & Boubouka, 2010; Susantini et al., 2021). When supported by e-learning platforms, these digital approaches also help instructors overcome traditional challenges they face when effectively implementing project-based learning (Meng et al., 2023). Additionally, online project-based learning applications are highly effective in increasing student motivation and active online participation (Hira & Anderson, 2021; Hung et al., 2012). Global PBL applications using video conferencing and learning management systems enhance students' communication and collaboration skills, particularly in STEM fields (Owens & Hite, 2020). In conclusion, project-based learning environments that strategically integrate digital tools enable students to develop a learning experience where they are more active, engaged, and utilize higher-order thinking skills (Fitzgerald & Evans, 2024; Yıldız-Durak & Arslantaş, 2025).

Various studies have shown that students' digital literacy and learning motivation significantly contribute to their academic achievement and participation in online learning environments (Pan, 2023; Holm, 2024; Zheng et al., 2024; Huang & Derakhshan, 2025; Zhang & Miao, 2025). These findings highlight the importance and potential impact of integrating digital tools and online learning platforms into the learning process (Zou et al., 2025). Digital technologies offer new opportunities to increase student engagement, support collaborative learning, and reinforce scientific concepts. However, the effective use of these tools

requires a careful planning and guidance process (Haleem et al., 2022). In this context, eTwinning projects, which integrate digital tools into the teaching process with an innovative approach, create an important learning environment for teachers and students. eTwinning enables teachers and students from different regions to conduct joint online educational activities, share experiences, and develop their digital competencies together (Donatella et al., 2023). Overall, eTwinning projects have created effective learning communities that strengthen digital literacy, communication, and collaboration for both students and teachers (Şahin et al., 2024). eTwinning is supported by the European Commission under the Erasmus+ Program and is run in partnership with the European Schoolnet. In Turkey, eTwinning projects are implemented through the eTwinning Turkey National Support Service within the Ministry of National Education's Directorate General of Innovation and Educational Technologies and has been working effectively with teachers across the country since 2009 (eTwinning Turkey, 2023). This allows participants to develop both their subject knowledge and digital literacy.

eTwinning applications create supportive learning environments that enhance students' learning performance, enable the development of differentiated teaching activities, and facilitate the discussion of acquired knowledge and skills in the context of the classroom or personal life (Crişan, 2013). The platform creates professional networks among teachers through Web 2.0 tools and digital collaboration environments and supports fast and efficient access to information (Akdemir et al., 2024). Teachers support their professional development and enrich their students' learning experiences by gaining insights into different educational practices from their European colleagues (Uslu-Kaplan & Alkan, 2023). eTwinning projects not only improve teachers' pedagogical skills but also increase students' motivation and interest in the subject; they enable the experience and development of 21st-century skills such as communication, collaboration, problem-solving, and critical thinking (Todhunter, 2013; Broadbent & Poon, 2015; Lim & Richardson, 2016). Furthermore, projects contribute to the development of intercultural skills and enable collaborative, project-based digital literacy education in a safe online environment (Αλεξίου, 2019; Izgi-Onbaşılı et al., 2022; Dobi-Barišić & Moslavac-Bičević, 2022). In these respects, eTwinning offers a model platform for online project-based learning and embodies the pedagogically meaningful use of digital tools.

The global pandemic has led to the replacement of face-to-face education practices with online learning processes, making the effective use of digital tools mandatory for both teachers and students (Abaci et al., 2021; Sum & Oancea, 2022). While distance education has been implemented as an alternative to traditional classroom instruction in many countries worldwide, it has had negative effects, particularly on school-aged children (Akpen et al., 2024; Champeaux, 2022). Teachers and students attempted to continue teaching and learning processes at home using technological tools; however, research indicates that participation in online classes was insufficient and student motivation significantly decreased (Akpen et al., 2024; Champeaux, 2022; Ertan-Kantos et al., 2022; Hollister et al., 2022; Meşe & Sevilen, 2021). For example, Hollister et al. (2022) emphasize that the participation and interaction rates of university students in live classes decreased during the pandemic, and that low interaction negatively affected online learning experiences. Similarly, Meşe ve Sevilen (2021) stated that online education reduces both intrinsic and extrinsic motivation, with the main reason being the decrease in teacher-student and student-student interaction. While digital tools offer various opportunities in distance education, they also bring challenges such as lack of motivation and low participation in online teaching (Engel et al., 2023; Pozo et al., 2024). This situation highlights the need for alternative learning activities that will increase students' interest in online learning and encourage their participation. Additionally, the pandemic process has shown that students need to use digital tools more effectively and teachers need to know how to use online resources pedagogically (Crompton et al., 2021). In this context, eTwinning projects that effectively integrate technology into learning environments and offer collaborative learning experiences provide important opportunities for both students and teachers. This study aims to introduce the eTwinning project titled 'Fun Science Tasks at Home', which integrates educational and digital games from the perspectives of students and teachers, and to examine participants' experiences with this project. In this regard, the research seeks to answer the following questions:

RQ1. What is the impact of the eTwinning project on students' interest in science lessons and their digital skills?

RQ2. What is the impact of the eTwinning project on teachers' digital skills?

2. Methodology

The research design was determined as a Case Study. This design is recognized as a powerful method, particularly for understanding complex and context-specific educational practices (Yin, 2018; Creswell & Creswell, 2018). The case study provides an opportunity to holistically evaluate the implementation process of the eTwinning project 'Fun Science Tasks at Home' and its impact on participants through observation and analysis. This method is ideal for deeply understanding participants' experiences and perceptions of the project process and making contextual inferences.

2.1 Participants

This study involved 10 science teachers working in different provinces of Turkey and a total 49 middle school students in 7th and 8th grade. 28 of the students are female and 21 are male. 8 teachers are female, and 2 teachers are male. Students and teachers participating in the study were selected using a purposive sampling method, taking into account the project's target audience and research question eligibility criteria. The project was conducted among 10 teachers from different cities in Turkey who came together online. Nine of the participating teachers had not previously participated in any eTwinning projects.

One teacher with previous eTwinning experience was designated as the project founder; the other founder was selected voluntarily from within the group. The project name and game-based science teaching theme were determined through an internal group survey. One of the founders prepared a short introductory text containing the project name, purpose, and target age group. The project was then submitted via the eTwinning platform, and a topic was opened in the Partner Search Forum. After the second partner accepted, the project was forwarded to the National Support Service. Following the completion of the approval process, the National Support Service created a TwinSpace with the project name. TwinSpace is a dedicated area where project members can communicate with each other, manage the project, share documents, and interact with students. The founders invited eight teachers to participate in the project via the platform, and those who accepted were added as project members. Subsequently, students of similar age groups were identified on the system and included in the project.

2.2 Data Collection

In this study, quantitative data were collected via self-evaluation forms completed by students and teachers. Qualitative data were collected via participants' responses on the Padlet platform and observation notes. Self-evaluation forms were developed, taking into account a literature review, and finalized after consultation with a science teacher and a field expert. The student self-assessment form consists of ten questions. The triple scale used in the form is 'agree', 'neutral' and 'disagree'. Forty-nine students completed the student self-assessment form. The teacher self-assessment form consists of nine questions. The five-point scale used in the form is 'strongly agree', 'agree', 'neutral', 'disagree' and 'strongly disagree'. Ten teachers completed the student self-assessment form. Forms were applied via google forms and used for pre- and post-testing.

In this study, students' and teachers' opinions about the eTwinning project were collected using the Padlet application. Participants were given one week to submit their opinions in writing, with a total 49 students and 10 teachers providing their feedback. Students were asked four basic questions: how they thoughts about the project process, what they gained from the project, what they found challenging, and whether they would participate in similar projects again. Similarly, the four main questions posed to teachers covered the process, the benefits to themselves and their students, the challenges encountered and ways to overcome them, and their willingness to participate again. Teachers' monthly feedback on the activities was collected separately through regular webinars, but the overall project evaluation was gathered via Padlet. During the five-month project duration, the project founder observed the students and teachers. Important dialogues between teachers and students and observed behaviors during the project and activities were recorded as unstructured observations.

2.3 Data Analyses

Quantitative data obtained from student and teacher self-assessment forms were analyzed using SPSS. Due to the non-normality of pre-test and post-test scores and the small sample size of teachers, the Wilcoxon Signed-Rank Test, a non-parametric test, was applied to detect significant changes in scores. The analysis of qualitative data was conducted in four basic steps: organizing the data, coding, thematization, and reliability, following the method described by Miles and Huberman (1994). At the beginning of the analysis, the texts collected via Padlet and the observation notes were converted into an analyzable text format. The data were then read independently by two researchers and coded based on meaningful statements and concepts related to the research questions. Following independent coding, the researchers thoroughly discussed the codes and categories created to identify common themes and reached consensus. This systematic process ensured that the main themes and categories reflecting the project's effects emerged reliably.

2.4 Implementation Process

The 'Fun Science Tasks at Home' eTwinning project comprised monthly activities. Ten teachers and 49 students took part in the online project for five months, with each session lasting 90 minutes. In addition to the science course's learning outcomes, activities were also integrated that covered the learning outcomes of courses such as values education, information technologies, science applications, technology design, writing skills and visual arts. At least one of the prepared activities was a skill-based game, at least one was a competition that could be carried out with students in live lessons and at least one was an activity that students could carry out at home. Suggestions from students and teachers in forums were prioritized when determining monthly activities and mixed school team activities. The project process is shown in Figure 1.

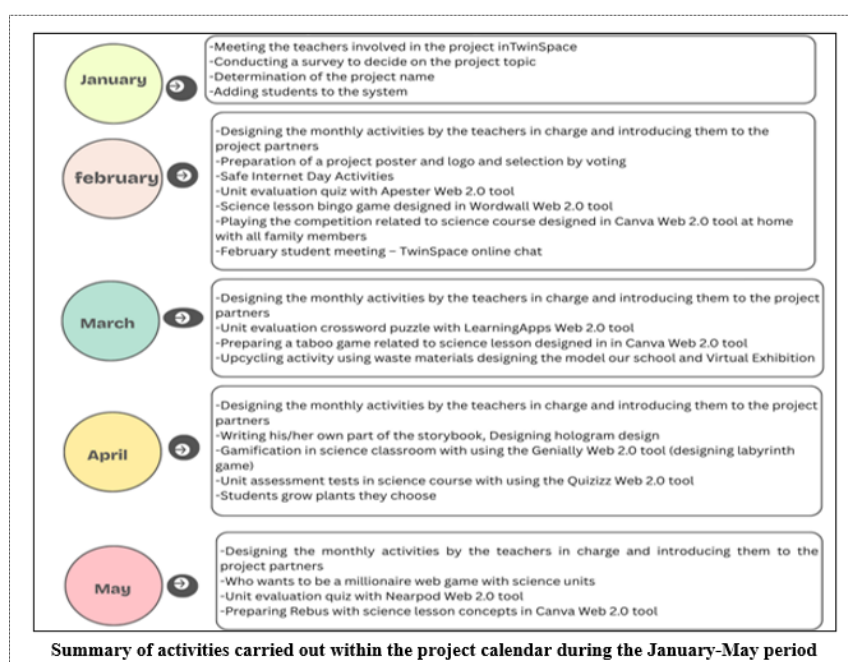


Figure 1. The project process

Prior to the students' involvement, opening project meetings were held on the TwinSpace portal, attended by all teachers. The students and teachers then designed logos and banners for the project's final logo and poster were chosen through a survey. Meetings with students and end-of-project evaluation meetings took place in the TwinSpace online chatroom. Teachers and students discussed ideas for activities, content, and gamification tools in the forum. Monthly webinars were organized to present the prepared activities and the web 2.0 tools to be used. We distributed tasks among the teachers to ensure cooperation between the partner schools. This meant that each teacher made a collaborative contribution to the project. Various techniques such as brainstorming, discussion, and role-playing, as well as various Web 2.0 tools, were used for this project. In addition to Web 2.0 tools used by teachers and students to create collaborative products, Figure 2 also shows Web 2.0 tools used individually by students within the scope of the project.

WEB 2.0 TOOLS				
Tools	Purpose of use	Web tools that teachers use for collaborative product creation	Web tools that students use for collaborative products creations	Web tools used by individual students
Apester quiz	Quiz tool	✓		✓
Artseps	Project final virtual exhibition			
Canva	Poster-logo design, writing game instructions	✓		✓
Chatterpix	Speak avatar			✓
Clipchamp	Video editing	✓		✓
Emaze	March recycling exhibition	✓		
Genially	Online maze game for April	✓		✓
Google docs	Curriculum association table	✓		
Google form	Creation of questionnaires	✓		
Jamboard	Taboo activities	✓		
Jigsaw planet	Slogan puzzle	✓		✓
Learningapps	Puzzle activities	✓		✓
Momentcam	Create avatar			✓
Nearpod	Activities in May	✓		✓
Padlet	Adding maps and content		✓	
Pixiz	Photo collage			
Pixon	Creating a cartoon		✓	
Pubhtml5	Creating magazines from Rebus	✓		
Quizizz	April activities	✓		✓
Renderforest	Video editing	✓		
Storyjumper	Creation of common product story		✓	
Team maker	Creation of groups	✓		
Tricider	Theme survey of mixed school teams	✓		✓
Video editor	9 May eTwinning day	✓		
Vivavideo	23 April video merger	✓		
Wordwall	Bingo game material			✓
Zoom	Mixed school team activities student meetings	✓	✓	✓

Summary of the Web 2.0 tools used in the project and their purposes

Figure 2. The web 2.0 tools used during the project

Some of the ways in which Web 2.0 tools were used include designing posters and logos and writing game instructions with Canva, creating speaking avatars with Chatterpix, editing videos with Clipchamp, creating a March recycling exhibition with Emaze, designing Taboo activities with Jamboard, creating slogan puzzles with Jigsaw Planet, creating avatars with MomentCam, creating cartoons with Pixon, creating a common product story with StoryJumper, creating Bingo game materials with Wordwall, etc. The project logo and poster, board preparation, teacher webinars, student activities, and storybook are shown in Figure 3.



Figure 3. Some visuals related to the project

Mixed school teams were established in the project, including a cartoon club, an environmental action club,

an experiment club, and a silent storytelling club. The project founders mentored all the clubs, and the clubs' online meetings took place in the TwinSpace chat room. The final joint products of the project are a storybook on environmental issues and cartoons from the cartoon club. The 'Five Cities' storybook about environmental issues was written using the station technique. Additionally, the various games designed and played in the project are shown in Figure 4.



Figure 4. Visuals related to the games

Some of the science concepts considered when designing the games are: 'Expresses the names and symbols of the first 18 elements in the periodic table and some of their uses. It also expresses the formulae, names, and usage areas of common compounds. It shows that the same or different atoms come together to form molecules. It classifies pure substances as elements or compounds and provides examples of each. It classifies mixtures as homogeneous or heterogeneous and provides examples of each. It applies the methods that can be used to separate mixtures, selecting the appropriate one.' The project was presented on the YouTube live stream 'eTwinners projects are presented.' To promote the project, regular posts were made on the blog, website, Facebook group, and Instagram accounts.

3. Results

3.1 Results obtained from the student self-assessment forms

The results regarding the statistical analyses of the pre- and post-tests of the student self-assessment form are given in Table 1. Since the research group comprised 49 students ($n < 50$), a Shapiro-Wilk normality test was performed.

Table 1. Statistical results from the student self-assessment form

	N	Mean	Median	Std. deviation	Shapiro-Wilk	Wilcoxon (Z)	p	Effect size (r)
Pre- test	49	24.14	27.00	6.29	0.832	-5.292	<0.001	0.76
Post-test	49	26.31	28.00	4.37	0.805			

The results of this test showed that the pre- and post-test scores were not normally distributed ($p < 0.001$). For this reason, the analysis used the Wilcoxon signed-rank test. It was determined that the post-test scores were statistically significantly higher than the pre-test scores ($Z = -5.292$, $p < 0.001$) (see Table 1). The effect size was also calculated using $r = Z/\sqrt{N}$ and $r = 0.76$. The distribution of students' responses before and after the test is shown in Figure 5.

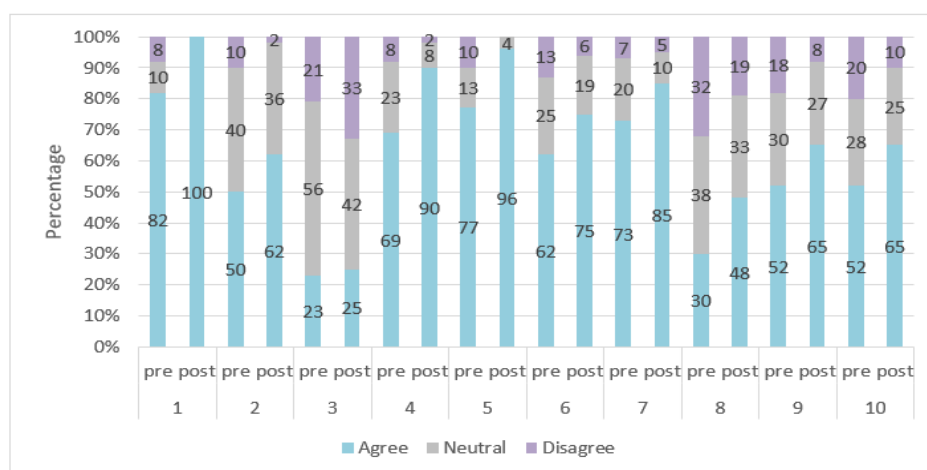


Figure 5. Percentages of students' responses in the pre- and post-tests

The general and significant increase was observed in students' self-assessment scale scores after the application (see Figure 5); this indicates that the implemented project created a strong and positive change in students' perceptions. In the interest and motivation category, the participation rate of students agreeing with the statement 'Science classes are very enjoyable' increased by 18%, and their belief in the usefulness of science classes in daily life rose by 12%. The sharpest increases were recorded in the digital competence and participation area: The participation rate for the statement 'The presence of digital games in science lessons encourages me to participate actively' rose from 77% to 96%, showing the most significant change. This finding is supported by significant increases in the statements 'I use various Web 2.0 tools' (18% increase) and 'I can effectively present my experiments in a digital environment' (13% increase). In the social skills and collaboration category, the statement 'I share my ideas with my friends by participating in group work' showed the highest increase at 21%, while participation in the statement 'I like to take responsibility for science' increased by 12%. In the self-confidence and experimental competence category, participation in the statement 'I feel safe when conducting experiments' increased by 13%. However, the 12% increase in the rate of non-participation in the statement 'I enjoy writing scientific stories' was the only negative trend, indicating that the vast majority of students found the story-writing process challenging.

3.2 Results obtained from the teacher self-assessment forms

The results regarding the statistical analyses of the pre- and post-test of the teacher self-assessment form are given in Table 2.

Table 2. Statistical results from teacher self-assessment form

	N	Mean	Std. deviation	Shapiro-Wilk	Wilcoxon (Z)	p (Asymp.)	p (Exact)	Effect size (r)
Pre- test	10	32.30	7.646	0.986	-2.677	0.007	0.004	0.846
Post-	1	41.3	3.802	0.086				

Although the Shapiro-Wilk test showed that the normality assumption was met at the 0.05 significance level for both the pre-test ($p=.986$) and the post-test ($p=.086$), the Wilcoxon signed-rank test was applied due to the small sample size ($n=10$) and variance heterogeneity at the $p<0.001$ statistical significance level. For this reason, the analysis employed the Wilcoxon signed-rank test. It was found that students' post-test scores were statistically significantly higher than their pre-test scores ($Z = -2.68$, $p = 0.007$) (see Table 2). The two-sided exact p-value of 0.004 supports the significance of the increase. The effect size was also calculated using $r = Z/\sqrt{N}$. The resulting effect size ($r = 0.85$) indicates large practical significance. This finding demonstrates that the project has an impact on teachers' digital skills. The distribution of teachers' responses before and after the test is shown in Figure 6.

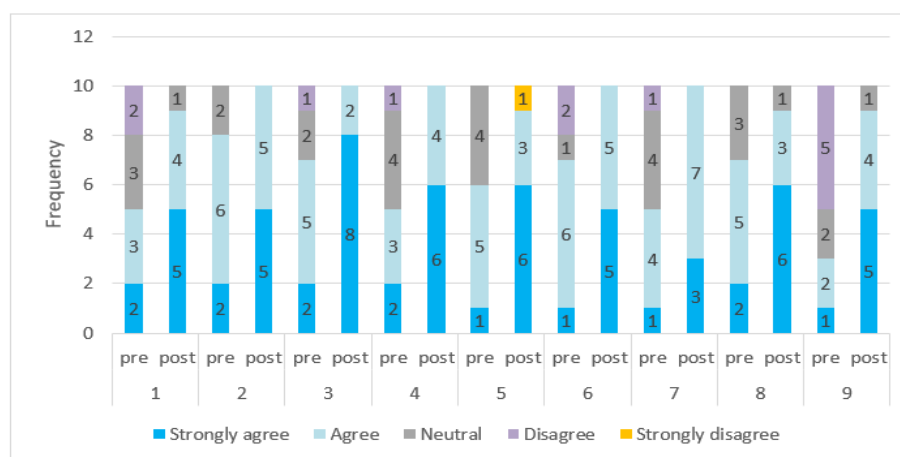


Figure 6. Frequencies of teachers' responses in the pre- and post-tests

The general and significant increase was observed in teachers' self-assessment scale after the application. Significant and positive developments were observed in the areas of digital competence, methodological diversity, and student participation (see Figure 6). In terms of digital competence, the number of teachers who stated that they had the knowledge to use Web 2.0 tools in their lessons rose to 9. In addition, all teachers who stated that they used different websites and search engines to enrich their lesson content demonstrated that they had acquired this skill. All 10 teachers who assigned digital resource and Web 2.0 tool-based activities as homework to their students have also adopted this digital integration. In the area of methodological development, there has been a sharp increase in the number of teachers using the scientific storytelling method in their lessons, rising to 10. The ability to design original games using the gamification method has also developed significantly. The number of teachers who believe their students can design games at home with simple tools has risen to 6. In the context of student participation, while the majority of teachers responded positively to integrating physical and digital games into their lessons to encourage active student participation, one teacher did not prefer this method because lessons involving games made classroom management difficult. Finally, the increase in the number of teachers who stated that students have high presentation skills for design activities carried out in digital environments to 9 reflects confidence in students' digital presentation competencies.

3.3 Teachers' and students' general evaluations of the project

Teachers' and students' overall assessments of the project are listed in Tables 3 and 4 under the headings of project process, project contributions, project challenges, and willingness to participate in the project again. Teachers' overall evaluations of the project are shown in Table 3.

Table 3. Teachers' evaluations regarding the project

When	Categories	Subcategories	Code	f
	Project process	Positive	A pleasant /fun process	9
			An efficient process	4
		Negative	An exhausting process	1
		Content	Opportunity to recognize and use Web 2.0 tools	9
			Fun learning	9
			Making the lesson effective	4
			Creating new products	4
			Following innovative approaches	2
		Awareness raising	Giving importance to values such as respect and cooperation	2
			Increasing interest in science	6
		Motivation	Gaining a sense of responsibility	6
			Activating the student/increasing interest	4
			Developing communication skills	8
		Development of various skills	Social skill development	6
			Developing digital competences	4
			Gaining awareness skills	4
			Developing presentation skills	3
			Media literacy	2
		Socially	Providing cooperation between students	6
			Ensuring cooperation between teachers	5
			Opportunity for student and parent collaboration	5
			Communication between teachers and students	4
		Time management	Providing time management	2
	Difficulties in the project	Anxiety	Using Web 2.0 tools for the first time	6
	Participating in similar projects	Request	Willingness to participate in eTwinning projects	10
			Willingness to co-operate/communicate with new people	7

examining teachers' views on the project process, it was found that the vast majority found the process enjoyable and productive. Among the positive aspects of the project, the fact that it was a fun and effective process stood out, while only a very small number of teachers found the process tiring. Within the scope of project contributions, teachers found the opportunity to learn about and use Web 2.0 tools and the possibility of enjoyable learning important, while gains such as making lessons more effective and creating new products also attracted attention. Furthermore, teachers stated that they took steps to follow innovative approaches. In terms of awareness, teachers responded positively to the emphasis on values such as respect and cooperation.

In terms of motivation, effects such as increased interest in science, the development of a sense of responsibility among students, and an overall increase in student participation were observed. The project process also developed various skills among teachers; progress was recorded particularly in communication, social skills, digital literacy, awareness, and presentation skills. Teachers also stated that they had developed in the area of media literacy. In terms of social collaboration, cooperation among students and between teachers, as well as opportunities for student-parent collaboration, were among the important gains of the project. Teacher 1 (T1) summarized these contributions: *"I discovered Web 2.0 tools and learned how to*

make my lessons more enjoyable. Despite their initial reluctance, my students became more actively involved in the process. Thanks to the games, their attitude towards the lesson became more positive, and they learned to respect each other through collaboration."

While positive feedback was received regarding time management, the difficulties encountered during the project process were also reported. Teachers mentioned the anxiety caused by using Web 2.0 tools for the first time. In addition, it was determined that there was a great desire to participate in similar projects and that motivation to collaborate with new people was high. Overall, teachers stated that the project provided significant gains in both pedagogical and social dimensions and that they felt more competent in using digital tools. Students' overall evaluations of the project are shown in Table 4.

Table 4. Students' evaluations regarding the project

Categories	Subcategories	Code	f
Project process	Positive	A pleasant /fun process	29
		Instructive	8
		Efficient	5
		Intriguing	2
	Negative	An exhausting process	5
Project contributions	Content	Learning science topics	14
		Learning various computer applications	11
		Providing learning by having fun	10
		Reinforcing what has been learned	4
		Opportunities to do more activities at home	2
	Experience	Learning the project process	6
	Motivation	Increasing interest in science	6
		Gaining responsibility	3
		Increasing self-confidence	3
	Development of various skills	Developing digital competences	9
		Communication skill	5
		Ability to express oneself	4
		Presentation skill	3
	Socially	Cooperation between students/students and teachers	19
		Making friends/meeting new people	13
		Cooperation with the family	8
Difficulties in the project	Application	Exhausting	5
Participating in similar projects	Request	Willingness to participate in similar projects	47
	Socially	Desire to meet new people	19
	Content	Desire to learn by having fun	11
	Interest	Interest in using a computer	10

The findings show that the 'Fun Science Tasks at Home' eTwinning project had generally positive effects on students and teachers. Participants rated the project process as largely enjoyable and fun ($f = 29$), and its educational, productive, and interesting aspects were also highlighted. In terms of the project's contributions, students emphasized opportunities to learn science topics, use various computer applications, and reinforce knowledge in an enjoyable way. The project also enabled participants to develop their digital literacy, strengthen their communication and presentation skills, and increase their capacity for self-expression. On the social level, cooperation between students and teachers increased, new friendships were formed, and collaboration with families was achieved. For example, student (S37) said, *"We conducted experiments, gave presentations using different tools, and played fun games. We achieved good results by exchanging ideas with our families. The project provided an environment in which I could express myself. We met new friends and teachers at our meetings. Making new friends motivated me to put in more effort. I enjoyed the*

time very much and found that learning by having fun made me like science lessons even more” The main difficulty mentioned by participants was that some stages of the process were tiring ($f = 5$). However, participants showed high motivation to participate in similar projects ($f = 47$), particularly motivated by learning while having fun, meeting new people, and using computers. Overall, the findings reveal that the project increased learning motivation, contributed to the development of various skills, and strengthened social interaction.

3.4 Observation Results Related to the Project

The observation results provide an in-depth look at the experiences of students and teachers during the ‘Fun Science Tasks at Home’ eTwinning project (see Table 5). These findings highlight how students participated in online activities, collaborated with their peers, and developed their digital and cognitive skills. Furthermore, the observations reflect teachers' efforts in planning, implementing, and supporting project activities, as well as their professional development through Web 2.0 tools and collaborative applications. Observation data is given in Table 5.

Table 5. General Summary of Observation Results Related to the Project

Theme	Category	Code	Notes
Student Participation	Active Participation	Online activities, Web2 tools, Games	Students actively participated in the project; they shared their ideas in forums and discussions.
	Motivation	Fun activities, personalized tasks	The activities captured the students' interest; the opportunity to present their own designs increased motivation.
	Digital Skills	Use of Web2 tools, game design	They learned and applied various digital tools; they designed their own games
Social Interaction	Peer Collaboration	Teamwork, discussion activities	Students collaborated with each other; they participated in group work and discussions
	Inclusion	Participation of diverse students	Social interaction was supported through teams formed with diverse students
Activities	Curriculum Alignment	Science topics, skill-based activities	Activities were aligned with the curriculum; students reinforced their knowledge
	Skill Development	Presentation, writing, environmental awareness	Presentation, writing, digital literacy, and environmental awareness skills developed
Challenges	Technical Issues	System login, tool usage	Initially, some students struggled to use Web2 tools; they learned as they went along.
Teacher Development	Digital Competence	Use of Web2 tools, activity preparation, webinars	Teachers learned to use the tools; their activity preparation and implementation skills improved
	Collaboration	Monthly event planning, group work	Teachers worked together, shared their experiences, and felt a sense of belonging and responsibility for the project.
Family Participation	Participation	Home activities, family games	Families supported students' participation in activities; contributed to movement and technology use
Project Results	Participation and Learning	Fun science activities, games,	Students' motivation and participation increased; teachers'

Students who initially struggled to access the system quickly learned to manage the process independently. By logging into the project page with their own passwords, they took an active role in forums and exchanged ideas with peers from different provinces. Through various activities, they became familiar with different Web 2.0 tools and designed their own games. Being able to be active, have fun, and present their own designs increased the students' motivation. The monthly announcements of games sparked students' curiosity and encouraged their participation in class. The fact that family members also took on the 'classroom' role at home supported students' participation in activities. Online games and collaborative activities enabled students to discuss their ideas, reinforce their learning, and develop their digital and cognitive skills.

Teachers participating in eTwinning projects for the first time and using Web 2.0 tools to prepare materials initially experienced anxiety. To overcome this, the tools were introduced according to their intended use, and webinars were organized on creating sample activities and digital games. Each teacher contributed to the creation of monthly activities, presenting and implementing their ideas in their area of expertise to the project. Despite initial difficulties such as activity planning, tool introduction, and linking to learning outcomes, teachers reported that the project process made significant contributions to their professional development. Discussing the project's shortcomings and different dimensions in meetings brought out different perspectives and created an environment for productive communication among teachers. Thus, the project enabled teachers to experience an innovative educational approach by allowing them to use digital tools effectively.

4. Discussion

In this study, digital games increased students' physical and mental engagement in lessons, heightened their interest in science classes, and positively influenced their motivation. Students who participated more in the project and presented their work gained self-confidence, enthusiastically took part in collaborative activities, and stated that working with peers from different provinces improved their communication and teamwork skills. The project offered activities that enabled students to learn while having fun, take responsibility, and gain confidence in themselves. The students' dedicated collaboration in the project demonstrates their adoption of the eTwinning approach. The vast majority of students stated that using Web 2.0 tools to conduct activities and present their experiments in a digital environment was beneficial; these tools provide an engaging learning environment through effective and purposeful use of information technology (Galvin et al., 2007; eTwinning Turkey, 2023). Previous studies have also shown that eTwinning projects increase student motivation and develop digital literacy, communication, and collaboration skills (Pereira-Coutinho & Rocha, 2007; Esen & Öztuna-Kaplan, 2024). The project process offered students individual and social learning opportunities, encouraged them to share their ideas, and family members also provided classroom-like support at home. For example, the janissary game played at home played an important role in reinforcing students' science topics; thus, the home environment became an important learning space for students (Dominke & Steffensky, 2024).

Throughout the project, various Web 2.0 tools were used to develop activities. It was seen that most teachers adopted these tools and began to use digital content to enhance their lessons. There was also an increase in the number of teachers who said they had designed original games using the gamification methods learnt during the project. Teachers said that Web 2.0 tools made their work easier and helped them manage their time more effectively. The number of teachers who stated that their students were quite capable of presenting designs or activities in digital environments also increased. The fact that students were constantly interacting throughout the project also contributed to the development of their presentation skills. Conversely, one teacher who said the project was tiring stated that he did not like using physical and digital games in his lessons. This may be because lessons involving games were noisier, making classroom management more difficult.

As well as acquiring new knowledge through the eTwinning project, teachers developed their collaboration and communication skills by sharing their knowledge with students and colleagues. Online learning communities support teachers' professional development in their day to day working and are a useful substitute for traditional teacher training. They encourage reflection on experiences while facilitating collaboration with peers from various nations and regions (Holmes, 2013). The majority of teachers stated that the project was productive for their students, who had fun, learned new information and how to use web 2.0 tools, gained responsibility, socialized and increased their self-confidence and interest in school. Students who participated in eTwinning projects positive changes in attitude, becoming more receptive to new experiences and more engaged in school life, according to Aurora-Nicoleta et al. (2010). Crişan (2013) concluded that eTwinning inspires and motivates educators and learners, thereby fostering professional growth.

As part of the project, teachers who had not previously participated in eTwinning projects were given the opportunity to use the platform and work with different students. All teachers expressed their desire to participate in eTwinning projects again, demonstrating that teachers embraced the project and were interested in it. Teachers found the project useful in terms of increasing student motivation and developing their responsibility, self-confidence, and self-expression skills (Kaya-Usta et al., 2025; Fat, 2012). Scientific storytelling was integrated more into lessons during the project process, and teachers stated that they found this method useful. However, it was observed that students enjoyed writing scientific stories the least and found the process difficult. On the other hand, it was seen that students who actively participated in experiments such as atmospheric pressure, density, and electrification showed increased interest in science experiments. It was determined that some students lacked confidence in conducting and presenting experiments in a digital environment, which may be due to the limited number of experiments within the scope of the project; therefore, it is recommended that more experimental activities be added in the future. Only one teacher mentioned that the project was exhausting and time-consuming. Previous studies have shown that eTwinning projects encourage teachers and students to use Web 2.0 tools collaboratively and provide flexible, student-centered applications (Gouseti, 2013; Acar & Peker, 2024). However, the time and effort required have emerged as a challenge in terms of time management for teachers and students (Esen & Öztuna-Kaplan, 2024; Delen et al., 2021).

5. Conclusion

The 'Fun Science Tasks at Home' eTwinning project has enabled students to achieve significant gains in social, emotional, and digital skills. During the project process, students' interest and motivation in science class increased; their responsibility, self-expression, cooperation, and communication skills developed. Web 2.0 tools and game-based activities have supported students' digital skills and helped them gain confidence in presenting their experiences in digital environments. When scientific activities and experiments are moved to a digital environment, students' participation in the experimental processes and their learning responsibilities have increased. Positive attitudes, responsible behavior, and participation in teamwork are aligned with the student-centered and interactive nature of the eTwinning approach. However, the scientific storytelling process has posed challenges for some students, and there have been students who were shy when presenting experiments in a digital environment; this indicates that supportive activities in these areas should be increased during the project development phase. Teachers stated that the project significantly improved interdisciplinary collaboration, digital competencies, and professional development. Especially teachers participating in eTwinning projects for the first time have gained valuable experience in effectively using the platform, collaborating with participants from different regions, and sharing experiences. Overall, the project has contributed to the development of 21st-century skills for both students and teachers by creating a fun, motivating, and collaborative learning atmosphere in remote and blended learning environments.

6. Recommendations

This study is limited to data obtained from 49 middle school students in grades 7 and 8 and 10 teachers. The relatively small sample size limits the generalizability of the findings. The research was conducted using a Case Study design, with quantitative data on the project process collected through self-assessment forms and qualitative data gathered through observations and participant responses on Padlet. However, the research

was conducted over a period of only five months, which may not adequately reflect the long-term effects of the project. Considering these limitations, it is recommended that future studies use larger and more balanced samples, be applied in different contexts, and examine long-term effects.

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Disclosure statement

No potential conflict of interest was reported by the author(s).

Ethical Approval and Informed Consent

Throughout the research process, the participants' voluntariness, confidentiality, and anonymity were fully ensured. Participation in the study is entirely voluntary. Participants were provided with the necessary information about the research's purpose, process, the use and access of the collected data before the application. Participant consent was obtained through the eTwinning participant information and consent forms were also obtained.

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