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DIGITAL CITIZENSHIP EDUCATION SUPPORTED BY BLENDED LEARNING IN PRIMARY SCHOOL

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Abstract

This study aims to reveal the impact of blended learning (BL) supported digital citizenship (DC) education on students' DC, digital literacy (DL), and information communication technologies (ICT) skills. In this context, the aim was to answer the question: How does BL-supported DC education impact primary school students' DC, DL, and ICT? This research was conducted using a quasi-experimental design, one of the quantitative research designs. The research study group consisted of 82 fourth-grade primary school students, divided into control and experimental groups. The research presented BL-supported DC education activities to the experimental group and DC education activities to the control group using the direct explanation method. DC education, as an intervention, was applied to the study group for 11 weeks. Data were collected through DC, DL, and ICT scales. The data obtained through the scales were analyzed with t-tests for dependent and independent samples. According to the results, the DC, DL, and ICT scores of the experimental group, which participated in the BL-supported education, among the two groups that received DC education, were higher than the control group who participated in the education given with plain instruction. BL students' digital skills were more affected. These results underscore the significance of BL-supported DC education.

Keywords: Blended learning, digital citizenship, digital literacy, information technologies, communication technologies.

INTRODUCTION

With technology becoming an essential element in every aspect of our lives, social structures have undergone a significant transformation; these changes have also brought about new concepts related to citizenship in the 21st century. One of the most critical concepts is the concept of digital citizenship (Dilek & Gürel, 2024), followed by blended learning (BL), which plays a vital role in modern education. As digital interactions increasingly shape daily life, new dimensions of digital citizenship continue to evolve. To keep up with the digital age and cope with its challenges, individuals need to have a strong understanding of digital literacy (IT) and the use of information communication technologies (ICT). In this context, blended learning (BL) supported digital citizenship education can facilitate individuals' ability to act safely and responsibly in online environments, ensuring adaptability to the complexities of the digital world.. In addition to traditional citizenship, digital citizenship includes the skills to act consciously and responsibly on the Internet, social media, and digital commerce.

This educational model supports modern society's adaptation to the digital age by offering learners the opportunity to make the most of the opportunities of the digital world while developing a conscious attitude towards online risks (Görmez, 2017; Tutar et al., 2024; Sevigen & Yılar, 2022). The education model can be integrated with the BL approach, providing an adequate basis for digital citizenship education. Therefore, this study aims to reveal the effect of BL-supported DC education. For this purpose, we discuss the conceptual information about the study in the context of the literature and emphasize its importance.

Changing Perceptions of Citizenship

In the classical sense, citizenship is expressed as being a party to a country and having some rights arising from this partiality (Cambridge, 2022). However, recently, different meanings have been attributed to citizenship. In the literature, ecological citizenship, environmental citizenship, energy citizenship, data citizenship, etc. It is seen that there are many citizenship works and expressions. One of these current citizenship concepts is the concept of digital citizenship. In parallel with technological developments, everyone from an early age to old age has an account on social networks. In addition, the spread of digital commerce and the increase in entertainment games in digital environments have made digital tools an integral part of our lives. Considering the risk areas of the Internet and online connections, many people are at risk from "piracy activities, hacking, phishing, cyber-attacks, ad fraud, child abuse, pornography, cyberbullying, privacy violations, drug dealing, bomb-making, illegal gambling, excessive consumption habits, etc." (Gleason & Gillern, 2018). Recently, the number of people who are defrauded, abused, and whose private images are stolen on the Internet has been increasing. Considering these risks, children must be trained early to use DC., DL, and ICT effectively (Hui & Campbell, 2018). It is suggested that children should be raised as digital citizens as digital citizens early. This way, we can help children with their DL and ICT use.

Conceptual Framework

DC, DL, and ICT are the basic concepts enabling individuals to exist effectively in today's digital world. DC emphasizes ethical and responsible behavior on the Internet, social media, and other digital platforms, allowing individuals to act according to social norms in the digital world. DL, conversely, makes individuals competent in accessing, evaluating, producing, and using information effectively in digital environments. In this context, ICT stands out as a tool that supports interacting and managing information in the digital world. When these concepts come together, individuals can adapt to the complexity of the digital world and can act ethically, safely, and effectively in his environment. These skills play a critical role in modern society's adaptation to the digital age, aiming to raise individuals as conscious, responsible, and influential citizens in the digital world. At this point, we aimed to reveal whether BL effectively teaches these concepts to children. This is because in DC and DL subjects, BL offers students opportunities to learn interactively about the digital risks and ethical responsibilities they may encounter daily (Hui & Campbell, 2018). By combining classroom interaction with digital platforms, BL can increase students' active participation and allow them to experience real-world applications. Thus, BL in DC, DL, and ICT issues can effectively educate individuals as successful, informed, and responsible citizens in the digital world.

Blended Learning (BL)

This research is based on the theoretically based BL (blended learning) concept. BL emerged by minimizing the disadvantages of face-to-face learning and online learning and combining the advantages of both (Erol & Kocakülah, 2024; Çakır & Bichelmeyer, 2016; Raşit et al., 2020; Monk et al., 2020). All types of education that include some aspects of face-to-face and online learning are defined as BL in the literature (Hrastinski, 2019). In other words, BL increases the effectiveness of the teaching process by taking advantage of face-to-face and online learning. In addition, the distance learning environment, a component of blended learning, provides students with flexibility and the opportunity to make arrangements according to their learning styles (Jost et al., 2021). BL applications can also be confused with technology-enhanced learning applications because they include online and face-to-face learning environments. However, BL applications include taking advantage of the strengths of different teaching approaches beyond technology to strengthen education (Tonbuloğlu & Tonbuloğlu, 2023). BL includes but is not limited to Flipped Classroom, Active Learning, Online eLearning, and Problem-Based Learning (Bouilheres et al., 2020). We can express BL as a flexible, inclusive, and helpful learning model in this context.

In the literature, many advantages of BL are listed, such as increasing learning opportunities, supporting course management activities such as communication, grading, and providing feedback, facilitating students' access to information and resources, motivating students with cooperation and

interaction, and providing effective and efficient learning experiences (Smyth et al., 2012). When these benefits of BL are examined, they can be used effectively in digital citizenship education. Raising citizens suitable for the digital age will contribute to individuals knowing and protecting their rights. Providing digital citizenship education with technology-supported methods instead of traditional methods implicitly encourages students to use technology, digital literacy, digital access, etc., which will support these areas. BL will serve our purpose.

Digital Citizenship (DC)

Digital technologies have become essential to daily life and paved the way for forming digital societies (Schou & Hjelholt, 2018; Öngören, 2022; Öztürk, 2021). Thanks to ICT, millions of people can instantly transfer their information to each other through social networking sites (e.g., Twitter), video-sharing sites (e.g., YouTube), and blogs (Eid & Ward, 2009). In this process, the conceptual scope of citizenship was more comprehensive than the traditional one, and the concept of DC emerged (Tan & Merey, 2021; Karayakuyu & Ocak, 2024; Kim & Choi, 2018). DC is defined as an individual who uses the Internet regularly, can create digital content, and knows his rights and responsibilities effectively in the online environment (Aldemir & Avşar, 2020; Soriani, 2018; Thomas, 2018; Şen, 2025; Koç & Koç, 2021). In other words, DC means that people with access to information and communication platforms use these platforms to evaluate, criticize, and make moral decisions correctly. The common point of these definitions is that digital citizens must have internet access and digital devices that can access digital environments and must be able to use them actively and consciously (Karakuyu & Ocak, 2024). In today's conditions, where online technologies are rapidly growing, evaluating these platforms correctly and using them accordingly is essential.

DC has become essential to today's education because it requires individuals to exhibit responsible behavior in using technology (Martin et al., 2019). Because in digital environments where control is difficult, children and young people need to know their responsibilities (Saleem, 2018). DC education will guide children and young people at this point because children and young people need guidance to be responsible and respectful of the rights of others in the digital environment, where they spend most of their time using mobile technologies and social media platforms (Wang & Xing, 2018). In this regard, teachers and families have significant responsibilities. In this study, we aimed to improve the digital skills of primary school children with DC education covering DL and ICT.

Digital Literacy (DL)

With the spread of internet-based technologies, students have started to take more part in the digital world. Considering the risk areas of the Internet, students need to have some skills to use the Internet consciously. The most important of these skills is the DL skill. In our digital age, DL skills are skills that students must acquire (Stripling, 2010). DL refers to the use of technology, the process of learning and teaching about technology, individual awareness, attitudes and abilities about digital tools, access to digital resources, and the correct use of digital technology, communication tools, and networks to communicate with people. In other words, DL is defined as the competencies and skills required to navigate an information ecosystem (Blau et al., 2020). Ng (2012) defined the indicator of an individual's digital literacy as their adaptation to new or developing technologies.

DL skills are one of the most essential skills individuals must learn in the digital age. From this perspective, DL includes elements of information, media, and visual literacy (Martin, 2005). Because these skills are also necessary to survive in the digital age and to use digital technologies correctly. Meyers et al. (2013) stated that digitally literate individuals should know the appropriate use of technological tools and their skills and abilities. In this respect, DL offers a comprehensive framework to express the technological, social, and cognitive skills required in the digital environment. This shows that DL is a broader concept than ICT literacy and encompasses ICT. In this case, developing individuals' DL skills will contribute to individuals in many areas, including ICT (Mohammadyari & Singh, 2015).

Information and Communication Technologies (ICT)

Considering today's technological developments, keeping children away from technology is almost impossible. Therefore, it is necessary to equip children with 21st-century skills and prepare them for today's living conditions. At this point, students need to acquire ICT skills. ICT refers to technological tools and resources to transmit, create, disseminate, and manage information (Akinwale et al., 2017). ICT is an expression that requires the use of all computers and communication tools to create, transmit, store, interpret, and process information in various ways (Olutunu et al., 2015). ICT competence aims to understand information technologies better and develop new ICT skills and ideas rather than considering ICT from an instrumental perspective (Cha et al., 2011).

ICT, rapidly occurring in our social life, has also affected education and changed the known education methods (Wu et al., 2017). In education, when used appropriately, ICT can be an essential tool for developing students' skills by collaborating and working effectively with knowledge. When the results of the studies conducted in the literature are examined, it has been seen that high-level thinking skills, such as critical thinking, develop in students using ICT in the learning-teaching process. In addition, integrating ICT into teaching processes increases student success, improves higher order thinking skills, and increases education opportunities. According to Fu (2013), information and communication technologies, It is seen that they facilitate students' access to digital information, support student-centered learning through the constructivist education approach, and increase the quality of teaching. At this point, education to support ICT education needs to be increased. Today's individual, who has gained the freedom to obtain, produce, and disseminate information through ICT, has come to live with his citizenship rights and responsibilities in the virtual world. In other words, digital citizenship and ICT are closely related. At this point, we aimed to reveal the effect of DC-based education on ICT.

Current Study

We have briefly described BL, DC, DL, and ICT in the conceptual framework. The literature on these concepts has shown that these skills are also life skills in our age. Learning approaches that integrate technology should be used to support students' DL, DC, and ICT skills because teaching these skills in traditional ways in our age can make teaching skills difficult. Moreover, in the digital era, teachers often struggle to keep pace with rapid technological and educational advancements, making it difficult to incorporate these innovations into coherent classroom practices (Allen & Berggren, 2016). Ribble (2015) stated that the perception of DC should begin at a young age and that children of this age should be taught digital tools. In this teaching process, today's children, and young people, called digital natives, need guidance to apply citizenship principles in the digital world (Fingal, 2020).

Considering the explanations above, blended learning (BL) is an innovative educational approach that can significantly contribute to children's digital citizenship (DC) acquisition. While preserving the structured structure of traditional learning methods, BL integrates the flexibility and interaction opportunities digital technologies offer into educational processes. BL fosters engagement, interactivity, and personalization, ensuring students benefit from technology without disconnecting from traditional approaches. While the learning process in traditional methods can mostly remain teacher-centered and passive, in the BL approach, students are involved in a more active, questioning, and participatory learning process through digital tools. One of the most significant advantages of BL is that it personalizes the learning process by offering students learning opportunities independent of time and place. In addition, it allows students to develop their digital literacy (DL), digital competence (DC), and information and communication technologies (ICT) skills naturally.

In BL environments, students learn 21st-century skills such as problem-solving, critical thinking, and accessing information through digital means in a practical way. On the other hand, education processes carried out only with traditional methods may be insufficient in providing such skills because in-class activities are usually limited in time and not integrated with technology. In this context, the study's primary purpose is to examine the effect of BL-supported digital competence (DC) education on students' DC, DL, and ICT skills. In this context, two groups were created to reveal

the BL approach's effects more clearly. The control group was given the content with traditional methods, and the experimental group was given the blended learning approach. Thanks to this comparison, the effect of BL on students was revealed.

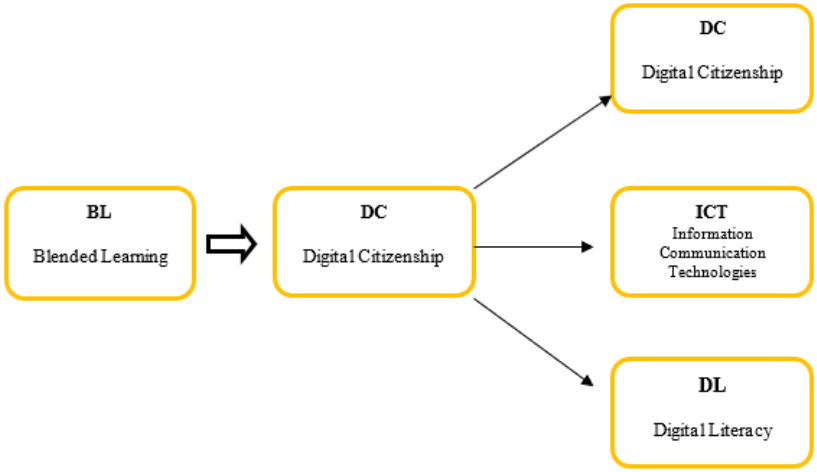

Figure 1. Conceptual model (BL supported DC education DC, ICT and DL).

METHOD

This study, which aims to reveal the effect of DC education on students' digital citizenship, DL, and ICT skills, was conducted using a quasi-experimental design with pre-post-test measurements and experimental and control groups.

Participants

The study group of this research consists of 4th-grade students studying at a public primary school in a province located in the northwestern part of Turkey in the fall semester of the 2022-2023 academic year. Participants were determined by a simple random sampling method. The average age of the students participating in the research is 8.6. There are 82 students in the study group, 41 in the control group, and 41 in the experimental group. Forty-three of the students are girls, and 38 are boys. Most students have low socioeconomic status and study in disadvantaged areas (Esenler district of Istanbul). No parents from the students' families are university or high school graduates. Additionally, the number of students who have their tablet or computer is only 4.

Data Collection Tools

Digital Citizenship Scale (DC): The researcher developed the scale for this research using data obtained from primary school students studying in Istanbul in the 2022-2023 academic fall semester. The relevant literature was scanned to develop the scale, and an item pool of 36 questions was created. The items were presented to expert opinion, five were revised, and the item pool was completed. The draft scale with 36 questions was applied to 240 primary school 4th-grade students, and exploratory factor analysis was conducted. As a result of the analysis, it was determined that the scale consisted of 3 factors and 24 items. These three factors explain 64.24% of the total variance. The factors of the scale are named "rights and responsibilities, security and ethics, communication and access, literacies" in the context of expert opinions and literature. The Cronbach Alpha reliability coefficient of the scale was calculated as .88. Sample items for the scale.

- I know my rights and responsibilities in the digital environment
- I use reliable information sources when doing research in digital environments

Digital Literacy Scale (DL): This scale was developed by Şahin et al. (2022). The research was conducted with two different study groups of 3rd and 4th grade primary school students studying in Kayseri city center in the 2020-2021 academic year. The study group determined for exploratory

factor analysis (EFA) consists of 327 students, and the study group determined for confirmatory factor analysis (CFA) consists of 207 students. EFA and CFA were conducted to test the construct validity of the scale to be developed. As a result of EFA, it was concluded that the scale has a 3-factor structure. According to the EFA results, the developed DL scale explains 54.66% of the total variance, and the eigenvalue of each factor is greater than 1. This structure obtained by EFA was tested with CFA, and it was concluded that the model was compatible. The Cronbach Alpha reliability coefficient of the DL scale was calculated as .84. As a result of the study, a valid and reliable 3-dimensional DL scale consisting of 16 items was developed for primary school students. Sample items for the scale.

- I use digital devices to play games
- I do not share the password of my digital devices with anyone

Information Communication Technologies Scale (ICT): The researcher developed the scale for this research using data obtained from primary school students studying in Istanbul in the 2022-2023 academic fall semester. In developing the scale, an item pool of 27 questions was created by scanning the relevant literature. The items we created were presented to expert opinion, five were revised, and the item pool was completed. The 27-question draft scale was applied to 240 primary school 4th-grade students, and exploratory factor analysis was conducted. At the end of the analyses, it was determined that the scale consisted of two factors. The sub-factors of the scale are named "benefits of ICT" and "harms of ICT." The scale explains 58.78% of the total variance.

Additionally, the eigenvalues for each factor are more significant than 1. The analyses resulted in a scale with two factors and 12 items. The Cronbach Alpha reliability coefficient of the scale was calculated as .79. Sample items for the scale.

- I can do my work faster with technological tools
- My eyes hurt when I spend too much time with technological tools.

Procedure

In conducting this research, two study groups, control and experimental, were randomly formed from 4th-grade students studying in a primary school in the Esenler district of Istanbul. We created these two groups mainly to reveal the difference between the group that received education within the scope of BL and those with the direct explanation method. In other words, two groups were created to understand which group the methods applied to were more effective regarding DL, DC, and ICT acquisition. The experimental process was carried out simultaneously with the national education curriculum of the Republic of Turkey in December, January, and February for both the experimental and control groups. Eleven weeks of educational content were presented to the experimental and control groups, including pre- and post-tests. Information regarding the education applied to the groups is explained below.

During the design of the DC education program, general objectives and achievements were first determined. These general goals and achievements are as follows: a) use digital tools for their intended purpose, b) take security precautions while using digital tools, and c) use digital tools economically. In the context of these achievements, educational activities appropriate to the nature of BL have been prepared. After the achievements were determined, the program was structured in three stages. In the first stage, the literature was scanned to determine the needs (Casa-Todd, 2018; Dotterer et al., 2016; Godfrey, 2016; Hui & Campbell, 2018; Kim & Choi, 2018; Pedersen et al., 2018; Preddy, 2016; Ribble, 2015) and interviews were held with 4th-grade students, their teachers, and the children's families. The DC education program was designed to meet the determined needs in the second stage. In the third and final stage, the program was given its final form by taking expert opinions about the program. The program includes a total of 9 DC activities to be implemented weekly. These activities were prepared based on Ribble's (2015) DC citizenship dimensions. The contents and implementation stages of these activities are given in Table 1.

Table 1. Education contents applied to groups.

Weekly Topics	Activity Name	Description of the Event
Introduction of Education content and collection of pre-tests	----------	----------
digital access	-My tablet	This activity taught students how to access digital networks and content. To ensure digital access, each student created an e-mail account.
digital commerce		In this event, affordable books were purchased for each student. The mistakes made in this process and what needs to be done are explained.
digital communication	-We research on the internet	Students were enabled to complete group assignments the teacher gave together through applications on the internet. During this process, students were informed about how to communicate in group studies on the Internet.
digital literacy	-I shop online	In this activity, students are taught how to access correct information from the Internet, transfer it, and determine its reliability.
digital ethics	-I do homework online with my friend.	This activity gave students a 47-page guide to using technology correctly. This guide explains to the students what needs to be done in detail. The guide includes the duties of families, society, and ourselves.
digital law	-I am doing research	It has been explained that every transaction we make in digital environments has an electronic responsibility and is sanctioned by law. News in the newspapers, such as the fight against cybercrime and internet fraud, were discussed in the classroom environment.
Digital rights and responsibilities	-A guide to using technology correctly	Students were explained what their rights and responsibilities were in digital environments.
digital health		It has been explained what kind of discomforts will be caused by constantly being dependent on technological devices and how it will affect our lives in the future.
digital security	-Digital culture	With these activities, students were taught how to avoid Internet risks. Every transaction we make on the Internet leaves a digital footprint, and we were told how to reduce this and ensure our security.
Evaluation of application effectiveness and application of post-tests	-What should we pay attention to in digital environments?	Before the post-tests were administered, students were asked to write about the positive and negative aspects of being a digital citizen. from students

This research was conducted in the 2023 academic fall semester. Before the experimental intervention, data collection tools were applied to the experimental and control groups to obtain pretest data. This application aims to demonstrate that the groups are statistically equal before the experiment and to make the necessary adjustments if the groups are not equal. After the pretest procedures, the education program prepared for 11 weeks was applied to the experimental and control groups. This program was presented to the experimental group within the scope of BL and to the control group with lecture administration. Upon completion of the DC education program education, the scales applied in the pretests to the children in the experimental and control groups were re-applied to obtain post-test data. Thus, the effectiveness of the experimental procedures was tried to be demonstrated. Assessments were conducted one-on-one with students in a quiet environment, with each test session lasting approximately 17 minutes per child. After the final testing phase, this study was concluded.

The application activities for the experimental group were administered directly by the researcher. The outcomes obtained during the process were shared with the class teacher at the beginning and end of the activities. Each week's activity was evaluated, the strengths and weaknesses of the activity planned for the next week were determined, and the effectiveness of the education increased. The

application activities were applied to the control group by the classroom teacher. The researcher and the missing aspects constantly monitored the classroom teacher's teaching process were completed within the scope of teacher feedback.

Data Analysis

The data analysis obtained within the scope of this study was structured in seven stages: 1) The data were sorted, and the data were checked; 2) a data coding guide was created and transferred to the SPSS environment for the pre-and post-test, 3) the distribution of demographic information about the participants was determined, 4) the score of the measurement tools. The averages were calculated separately for the total and sub-dimensions, 5) the normal distribution assumption was examined, 6) the statistical technique was determined, and 7) the results were reported. First, it is necessary to determine the statistical method related to the research problem in analyzing the data obtained. The normality assumption was first examined to determine the appropriate technique. As a result of the analyses, it was determined that the normality assumption was met ($p>.05$). Normality was assessed using both skewness-kurtosis values and the Shapiro-Wilk test. The results showed that the assumption of normality was met in the intervention group and the control group as the skewness (-.85) and kurtosis (.75) values remained within the acceptable range (±1.5) (2013). The Shapiro-Wilk test was insignificant ($p>.05$). Accordingly, a t-test for dependent and independent samples was used to analyze the data.

RESULTS

This section presents the findings obtained in this study. We aim to reveal the effects of BL-supported DC education and DC education in which the direct instruction method is applied to the digital skills of primary school students.

Digital Citizenship (DC)

Pre- and post-test measures of DC scores were analyzed using t-tests for independent samples. Table 2 compares the scores obtained from the DC scale by the students in the experimental and control groups.

Table 2. Comparison of DC scale pre- and post-test scores of the experimental and control groups.

DL Scale	Groups	N	Mean	Std.Dev.	S.H	t	df	p	Effect Size
Total	Experiment Pretest	41	64.97	9.63	1.50	-1.116	80	.268	----
	Control Pretest		67.49	10.71	1.67				
Cognitive	Experiment Pretest		25.80	5.08	.79	-.768		.445	----
	Control Pretest		26.70	5.55	.86				
Affective	Experiment Pretest		24.02	3.74	.58	-1.371		.174	----
	Control Pretest		25.17	3.83	.59				
Operational	Experiment Pretest		15.15	2.69	.42	-.705		.483	----
	Control Pretest		15.61	3.24	.50				
Scale	**Groups**	**N**	**Mean**	**Std.Dev.**	**S.H**	**t**	**df**	**p**	
Total	Experiment Posttest	41	96.26	11.84	1.85	9.856	80	.000	2.17
	Control Posttest		71.92	10.47	1.63				
Cognitive	Experiment Posttest		39.68	5.02	.78	9.642		.000	2.13
	Control Posttest		28,87	5.12	.80				
Affective	Experiment Posttest		33,26	4.63	.72	7.228		.000	2.15
	Control Posttest		26.19	4.22	.65				
Operational	Experiment Posttest		23.31	3.65	.57	8.070		.000	2.55
	Control Posttest		15.14	2.68	.42				

Table 2 shows no statistically significant difference between the total and subscale pretest scores of the DC scale of the experimental and control groups. In other words, the DC scores of the control and experimental groups are equal before starting the application activities. However, the DC scale total and sub-dimensions post-test scores of the control and experimental groups show a significant

difference in favor of the experimental group. In other words, BL-supported DC education affected students' DC scores more than direct instruction DC. The effect size values obtained for the total scores and all sub-dimensions of the digital citizenship scale are pretty high in the post-test comparisons. These results show that the implemented experimental intervention is quite effective in developing DC skills.

Digital Literacy (DL)

We analyzed pre-and post-test measures of DL scores using t-tests for independent samples. In Table 3, we compare the scores obtained from the DL scale by the students in the experimental and control groups.

Table 3. Comparison of DL scale pre- and post-test scores of control and experimental groups.

DL Scale	Groups	N	Mean	Std.Dev.	S.H	t	df	p	Effect Size
Total	Experiment Pretest	41	32.75	13.10	2.05	-.628	80	.532	----
	Control Pretest		34.51	12.18	1.90				
Information	Experiment Pretest		10.58	3.29	.51	-.505		.615	----
	Control Pretest		10.95	3.27	.51				
Purpose of usage	Experiment Pretest		14.04	6.46	1.01	-.785		.435	----
	Control Pretest		15.12	5.91	.92				
Privacy and Security	Experiment Pretest		8.1	3.89	.60	-.382		.703	----
	Control Pretest		8.43	3.61	.56				
Scale	**Groups**	**N**	**Mean**	**Std.Dev.**	**S.H**	**t**	**df**	**p**	
Total	Experiment Posttest	41	65.34	8.06	1.25	8.750	80	.000	1.93
	Control Posttest		42.00	15.05	2.35				
Information	Experiment Posttest		20.39	3.05	.477	9.329		.000	2.06
	Control Posttest		12.70	4.29	.671				
Purpose of usage	Experiment Posttest		28.58	3.96	.618	6.917		.000	1.52
	Control Posttest		19.02	7.91	1.23				
Privacy and Security	Experiment Posttest		16.36	2.10	.32	7.264		.000	1.60
	Control Posttest		10.27	4.94	.77				

Table 3 shows no statistically significant difference between the total and sub-dimensions pretest scores of the DL scale of the experimental and control groups. In other words, the DL scores of the control and experimental groups are equivalent before starting the application activities. However, the DL scale total and sub-dimensions post-test scores of the control and experimental groups show a significant difference in favor of the experimental group. In other words, BL-supported DL education affected students' DL skills more than plain-text DL. The effect size values obtained for the total scores of the scale and all sub-dimensions are at a very high level. These results show that the implemented experimental intervention is quite effective in developing DL. From an academic perspective, effects of this magnitude are statistically significant and provide practically meaningful and applicable results. Therefore, the study can be evaluated as strong evidence that reveals the effect of training programs on digital literacy.

Information and Communication Technologies (ICT)

We analyzed pre-and post-test measures of ICT scores using t-tests for independent samples. In Table 4, we compare the scores obtained from the ICT scale by the students in the experimental and control groups.

Table 4. Comparison of ICT scale pre- and post-test scores of control and experimental groups.

Scale	Groups	N	Mean	Std.Dev.	S.H.	t	df	p	Effect Size
ICT	Experiment Pretest		24.63	9.40	1.4	-.472		.638	----
	Control Pretest		25.58	8.8	1.38				
Benefits of ICT	Experiment Pretest	41	10.58	3.29	.51	-.306	80	.760	----
	Control Pretest		10.80	3.20	.50				
Harms of ICT	Experiment Pretest		14.04	6.45	1.00	-.527		.600	----
	Control Pretest		14.78	6.10	.95				
Scale	**Groups**	**N**	**Mean**	**Std.Dev.**	**S.H**	**t**	**df**	**p**	
ICT	Experiment Posttest		48.48	6.20	.96	8.456		.000	1.86
	Control Posttest		31.41	11.34	1.77				
Benefits of ICT	Experiment Posttest	41	20.66	3.12	.48	8.929	80	.000	1.97
	Control Posttest		13.04	4.47	.69				
Harms of ICT	Experiment Posttest		27.82	3.89	.60	6.670		.000	1.47
	Control Posttest		18.36	8.20	1.28				

Table 4 shows no statistically significant difference between the total and sub-dimensions pretest scores of the ICT scale of the experimental and control groups. The ICT scores of the control and experimental groups are equivalent before starting the application activities. However, the ICT scale total and sub-dimensions post-test scores of the control and experimental groups show a significant difference in favor of the experimental group. In other words, BL-supported DL education affected students' ICT skills more than plain-text DL. The effect size values obtained for the total scores of the scale and all sub-dimensions are at a very high level. These results show that the implemented experimental intervention is quite effective in developing ICT skills. It can be said that BL-supported DC training constitutes an important context in supporting the ICT skills of primary school students.

Control and Experimental Group Pre- and Post-test Comparisons

This heading presents t-test results for the dependent groups of the scores obtained by the study group from the DC, DL, and ICT scales. The purpose of these analyses is to reveal the change among the groups. In other words, this analysis was conducted to understand the effectiveness of the educational activities applied to the experimental and control groups.

Table 5. Comparison of DC, DL, and ICT scale pre-and post-test scores of the experimental group.

Scale	Groups	Tests	N	Mean	Std.Dev.	S.H	t	df	p	Effect Size
DC	Total	Posttest	41	96.26	11.84	1.85	14.374	40	.000	2.89
		Pretest		64.97	9.63	1.50				
	Cognitive	Posttest		39.68	5.01	.78	10.641		.000	2.75
		Pretest		25.80	5.08	.79				
	Affective	Posttest		33.26	4.63	.72	13.731		.000	2.19
		Pretest		24.02	3.74	.58				
	Operational	Posttest		23.31	3.65	.57	13.296		.000	2.55
		Pretest		15.14	2.68	.42				
DL	Total	Posttest		65.34	8.06	1.26	14.918		.000	2.99
		Pretest		32.75	13.10	2.04				
	Information	Posttest		20.39	3.05	.48	12.281		.000	3.09
		Pretest		10.58	3.29	.51				
	Purpose of usage	Posttest		28.58	3.96	.62	12.785		.000.	2.71
		Pretest		14.04	6.45	1.01				
	Privacy and Security	Posttest		16.36	2.10	.33	12.508		.000	2.63
		Pretest		8.122	3.89	.61				

Table 5 (Continued). Comparison of DC, DL, and ICT scale pre-and post-test scores of the experimental group.

Scale	Groups	Tests	N	Mean	Std.Dev.	S.H	t	df	p	Effect Size
ICT	Total	Posttest	41	48.48	6.20	.97	14.087	40	.000	2.99
		Pretest		24.63	9.40	1.46				
	Benefits of ICT	Posttest		20.65	3.12	.48	11.168		.000	3.14
		Pretest		10.58	3.29	.51				
	Harms of ICT	Posttest		27.82	3.89	.61	16.812		.000	2.58
		Pretest		14.04	6.45	1.01				

According to Table 5, there is a statistically significant difference between the pre-and post-test DC DL and ICT scales' total and subscale scores of the students in the experimental group. This significant difference favors post-test scores. BL-supported DL education increased students' DC, DL, and ICT scores. High effect size values were calculated in all scales and subdimensions in the experimental group. These results are important in showing the effectiveness of the activities carried out.

Table 6. Comparison of control group DC, DL, and ICT scale pre-and post-test scores.

Scale	Groups	Tests	N	Mean	Std.Dev.	S.H	t	df	p	Effect Size
DC	Total Puan	Pretest	41	67.49	10.71	1.67	-1.858	40	.070	------
		Posttest		71.92	10.47	1.63				
	Cognitive	Pretest		26.70	5.55	.86	-1.283		.207	------
		Posttest		28.87	5.12	.80				
	Affective	Pretest		25.17	3.82	.59	-2.878		.006	.25
		Posttest		26.19	4.22	.65				
	Operational	Pretest		15.69	3.23	.50	-3.104		.003	.33
		Posttest		16.85	3.59	.56				
	Total	Pretest		34.51	12.18	1.90	-2.938		.005	.54
		Posttest		42.00	15.05	2.35				
DL	Information	Pretest		10.95	3.27	.51	-2.467		.018	.45
		Posttest		12.70	4.29	.67				
	Purpose of usage	Pretest		15.12	5.91	.92	-1.736		.090	-----
		Posttest		19.02	7.91	1.23				
	Privacy and Security	Pretest		8.43	3.61	.56	-1.487		.145	-----
		Posttest		10.26	4.94	.77				
	Total	Pretest		25.58	8.83	1.3	-2.270		.029	.60
		Posttest		31.41	11.34	1.77				
ICT	Benefits of ICT	Pretest		10.80	3.20	.50	-1.977		.055	----
		Posttest		13.04	4.47	.69				
	Harms of ICT	Pretest		14.78	6.10	.95	-2.883		.006	.49
		Posttest		18.36	8.20	1.28				

Table 6 shows a statistically significant difference between the pre-and post-test DC DL and ICT scores of the students in the control group. Although post-test scores increased compared to pretest scores, this difference is insignificant. In other words, the control group's science, technology, and society unit achievements only affected students' DC awareness and DL skills a little. However, when the Table is examined, it is seen that there is a significant difference between the pre-and post-test data of the control group students in favor of the post-test data, according to the ICT scale data. According to these data, the educational contents applied to the control group positively affected the students' ICT skills. Additionally, there is a statistically significant difference between the pre-and post-test DC, DL, and ICT scores of the students in the experimental group. In other words, the DC

education contents received by the experimental group positively affected the students' DC, DL, and ICT skills.

DISCUSSION, CONCLUSION, and SUGGESTIONS

This study aims to reveal the effect of BL-supported DC education on students' skills in using DC, DL, and ICT. The BL-supported DC education we implemented for this purpose has positively increased students' DC, DL, and ICT scores. These findings show that BL-supported DC education is more effective in developing students' digital citizenship skills and produces more positive results than traditional teaching methods. BL's ability to provide flexible learning environments may have allowed students to develop DC skills more effectively. These findings may encourage more widespread adoption of BL-supported DC education in educational practice and contribute to studies in the field of digital citizenship education because BL provides flexibility to students, instructors, and educational institutions in sequential and simultaneous planning of the design and structuring of time, space, speed, and route (Tonbuloğlu & Tonbuloğlu, 2023). BL played an essential role in developing students' digital skills. On the other hand, DC education is practical in DL and ICT because DC covers DL and ICT (Buchholz et al., 2020). In this context, DC education can improve many students' digital skills. DC education is one of the most important ways to prepare students for the digital age.

The DC scale includes cognitive, affective, and action citizenship sub-dimensions. Therefore, the effect of BL education is positive on these sub-dimensions. BL-supported DC education statistically affected students' cognitive, affective, and action citizenship scores. These results support similar research results in the literature. For example, Holland (2017), in his DC perception study, found that DC activities contributed to students, especially in the dimensions of digital ethics, digital communication, and DL. Similarly, Gleason and Von Gillern (2018) educated DC students about social media. It has been determined that as students' online spending habits increase, they find, evaluate, and share information responsibly in online environments. In addition, efforts have been made to ensure effective communication with different people and their online participation in a safe, ethical, and legal manner. Finally, the study suggested that social media can improve both in-school and out-of-school dimensions of digital citizenship. This can be achieved by integrating it into the curriculum. Brandau et al. (2021) found in their study that approximately 60% of young people in the USA were harassed in virtual environments, and they aimed to develop an effective DC program to raise awareness of young people against these behaviors and encourage digital citizenship. As a result of the research, the average DC scores of the participants were statistically significant and increased by 2.96 points. As a result, they revealed a need for cost-effective programs that support social-emotional learning and digital citizenship. Martin et al. (2019) and Capuno et al. (2022) revealed that DC education is needed at the K-12 level and should be integrated into educational programs. Considering the findings we obtained in this study, BL-supported education programs may offer opportunities to support students' digital skills.

The DL scale includes sub-dimensions, such as information, intended use, privacy, and security. The ICT scale includes sub-dimensions, such as knowledge and purpose of use. Therefore, the effect of BL education on these sub-dimensions is positive. BL-supported DC education statistically positively affected students' knowledge and purpose of use scores. ICT skills in students can be supported through DC education. Hollandsworth et al. (2011) stated that because of the time young people spend in digital environments and their usage rates are increasing rapidly, they think too individually. They should be made aware of their responsibilities regarding their behavior. Thus, educational institutions should play an active role in imparting rights and responsibilities in digital environments and making students active members of the digital society (Krutka & Carpenter, 2017). Students should be encouraged to DC to ensure their correct behavior and safe daily life habits when using computer and communication technologies. Lauricella et al. (2020) stated in their study that with the widespread use of the Internet and technology at home, primary school students should be supported to become safer, more responsible, and more collaborative digital media users. Additionally, researchers emphasized

that educational programs should be developed to support students' digital skills in primary school. In this context, the BL-supported DC education program developed in this study will contribute to this deficit. This study reveals essential results as it contributes to children's acquisition of ICT skills. In terms of teaching ICT, technology-supported learning and teaching methods such as BL provide more effective results than plain instruction.

Research results in the literature support these results. For example, Martinez et al.'s (2022) study emphasized that globalization, economic inequality, and the COVID-19 pandemic caused potential rifts among citizens. Their study revealed that while students are aware of these issues, they often lack the necessary skills to critically analyze and discuss them. At this point, schools have evaluated the usability of the BL method and DC curriculum to help students solve social dilemmas and engage in thoughtful dialogue. According to the research results, it was determined that students developed positive perceptions about the program by being exposed to social dilemmas and multiple perspectives through collaborative dialogue.

Additionally, it was emphasized that students with different perspectives build knowledge together and positively perceive conflict. These findings indicate that the BL method and DC curriculum can effectively teach students valuable skills. Considering the study of Blaj-Ward and Winter (2019), it was stated that students needed help to reconcile themselves with the concept of DC because they grew up in technology and only adapted. Although they used e-mail and social networks in lessons, it turned out that the digital native concept was not sufficiently associated with the concept of DC. In this context, it has been determined that university students see digital citizenship as an obligation and cannot reconcile participation in digital spaces with digital citizenship.

In conclusion, the findings of this study indicate that BL-supported DC education can be an effective tool in increasing students' digital skills and can create positive effects on both DL and ICT thanks to the broad scope of DC education. Such educational programs can improve the quality of the education system by preparing students for the needs of the digital age. All these findings emphasize that the BL method and DC curriculum can play an essential role in raising students' awareness about digital citizenship and that more efforts should be made in education in this field.

Limitations and Future Directions

This study also has some limitations. It was primarily conducted in a primary school with a low socioeconomic level, and thus, the findings are limited to the characteristics of this specific working group. This contextual specificity may not reflect the broader student population, affecting the study's external validity. Moreover, the limited number of experimental group participants restricts the findings' generalizability to wider populations. Therefore, overgeneralization was deliberately avoided when interpreting the results. Another factor that may influence external validity is the experimental setting itself; ignoring the characteristics of the environment in which the intervention took place and generalizing the results to other educational settings may lead to inaccurate conclusions.

Several limitations that could affect external validity should be highlighted in more detail in this context. First, the socioeconomic background of the school may have influenced the students' familiarity with and access to technology, which could impact their responsiveness to the technology-supported educational content. Second, the study only involved a single school and a limited number of students, which may not capture the diversity of learning needs and contexts in other regions or educational levels. Third, the duration of the intervention was limited, and longer-term effects were not observed. These limitations reduce the extent to which the findings can be applied to other populations, settings, or timeframes.

To address these limitations in further studies, researchers could replicate the study with a more diverse sample that includes schools from different socioeconomic backgrounds and regions. Increasing the number of participants and conducting the study across multiple schools would enhance the generalizability of the findings. Additionally, longitudinal studies could be designed to assess the long-term impact of technology-supported interventions on students' digital citizenship

(DC), digital literacy (DL), and ICT competencies. Varying the experimental environments and including different educational levels (e.g., secondary or high school students) would further strengthen the external validity of future research. Furthermore, Choi (2016) emphasized that despite the growing importance of fostering socially responsible digital citizenship, especially in the Internet age, there is still a lack of research on how digital citizenship can be effectively defined and operationalized. The present study contributes to addressing this gap in the literature by exploring technology-supported education's role in developing digital competencies.

Based on this study's findings and limitations, we offer the following suggestions: Technology-supported educational content, such as blended learning (BL), can be further developed and used to enhance students' digital citizenship skills. Further studies could also integrate mobile learning and augmented reality tools into the curriculum to improve students' DC, DL, and ICT performance more comprehensively across different learning environments and student profiles.

This research shows that BL-supported DC education can be more effective than the traditional lecture method in the development of digital citizenship (DC), digital literacy (DL), and information and communication technologies (ICT) skills. Findings reveal that the BL approach further increases the acquisition of DC educational content. Also, BL facilitates educators' instructional processes and contributes to higher student performance outcomes. The analysis revealed that while direct explanation methods led to improvements in DC, DL, and ICT scores, the increase observed in BL-supported education was significantly higher. However, this increase was more limited than the increase in BL-supported education. Therefore, this study emphasizes the importance of BL-supported education and reveals that this method should be preferred to enhance students' digital skills. As a result, it was concluded that the digital skills children acquire can be developed more effectively with technology-supported education. This study's emphasis on applying BL technology in education is essential for future educational strategies because a technologically and pedagogically well-structured BL process will significantly reduce education inequalities (Bozkurt & Sharma, 2021).

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Ethics and Conflict of Interest
Research permissions were obtained from two institutions. The first permission was obtained from the Ethics Committee of Yıldız Technical University Rectorate. The permission was obtained from the Ethics Committee of Yıldız Technical University with the letter dated 29.07.2023 and numbered 2023.7. The author declares that they have no conflict of interest.

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

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