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Examining the Ability to Use Information and Communication Technologies in Primary School Life Sciences Course in the Context of Computer Ethics

İlkokul Hayat Bilgisi Dersi Bilgi ve İletişim Teknolojilerini Kullanma Becerisinin Bilişim Etiği Bağlamında İncelenmesi

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Abstract: The aim of this research is to examine the skill of using information and communication technologies in the context of computer ethics in the primary school life sciences course. In line with this aim, the research was conducted using a qualitative method, and a case study design was preferred. The study group consisted of 21 primary school teachers from the provinces of Antalya (2), Aydın (1), Afyonkarahisar (1), Bursa (14), Gaziantep (1), Kahramanmaraş (1), and Şırnak (1) in Türkiye. The research data were collected through semi-structured interview forms and documents. Both content analysis and descriptive analysis methods were used in the analysis of the data. According to the findings of the research, it was revealed that there were no unethical behaviors in the context of computer ethics related to the skill of using information and communication technologies in the life sciences curriculum. However, it was understood that primary school teachers included unethical behaviors in the context of computer ethics, even though they were not included in the curriculum, considering the safety of students. Based on these results, it is recommended that the Ministry of National Education include unethical behaviors in the context of computer ethics in the life sciences curriculum.

Keywords: Life science lesson, primary school, technology, computer ethics

Öz: Bu araştırmanın amacı ilkokul hayat bilgisi dersi bilgi ve iletişim teknolojilerini kullanma becerisini bilişim etiği bağlamında incelemektir. Bu amaca bağlı olarak araştırma nitel yöntem ile yürütülmüştür. Nitel araştırma deseni olarak durum çalışması tercih edilmiştir. Araştırmanın çalışma grubunu Türkiye'nin Antalya (2), Aydın (1), Afyonkarahisar (1), Bursa (14), Gaziantep (1), Kahramanmaraş (1) ve Şırnak (1) illerinden araştırmaya katılan 21 sınıf öğretmeni oluşturmuştur. Araştırmanın verileri yarı yapılandırılmış görüşme formu ve dokümanlar aracılığı ile toplanmıştır. Verilerin çözümlenmesinde hem içerik analizi hem de betimsel analiz yöntemi kullanılmıştır. Araştırmanın bulgularından elde edilen sonuca göre hayat bilgisi öğretim programında bilgi ve iletişim teknolojilerini kullanma becerisi ile ilişkili olarak bilişim etiği bağlamında etik dışı davranışlara yer verilmediği ortaya çıkmıştır. Buna rağmen sınıf öğretmenleri tarafından öğrencilerin güvenliği düşünülerek öğretim programında yer almasa bile bilişim etiği bağlamında etik dışı davranışlara yer verdikleri anlaşılmıştır. Bu sonuçlara bağlı olarak Millî Eğitim Bakanlığı tarafından hayat bilgisi dersi öğretim programında bilişim etiği bağlamında etik dışı davranışlara yer verilmesi önerilmektedir.

Anahtar Kelimeler: Hayat bilgisi dersi, ilkokul, teknoloji, bilişim etiği

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Introduction

Life sciences is a course taught in the 1st, 2nd, and 3rd grades of primary school, aiming to provide students with fundamental knowledge, skills, and values related to individuals, society, and nature (MEB [MoNE], 2018). In this context, the ability to use information and communication technologies is among the basic life skills aimed to be gained. As stated in the 2018 Life Studies course curriculum, the important thing is to use information and communication technologies skills by primary school students in accordance with their purpose (MoNE, 2018). Computer ethics is used in the use of this skill in accordance with its purpose. Computer ethics is an applied ethical field that examines the behaviors individuals exhibit during the use of information and communication technologies, as well as the written and unwritten rules that individuals should adhere to in this process (Leymun, 2018; Tıngöy, 2009). Also known as computer ethics, information technology ethics is now a highly regarded and vibrant field (Müller, 2022). The aim in computer ethics is to ensure that individuals experience a safer and smoother process in using information and communication technologies (Fidan, 2016).

Therefore, it is considered important for primary school students to be aware of ethical and unethical behaviors in the context of computer ethics, starting from the first grade. In the context of information ethics, there have been studies conducted for students in Türkiye from primary school to university level (Karadeniz, 2015; MoNE, 2014; MoNE, 2018). In the 19th National Education Council held in 2014, under the topic of school security, a recommendation was made to conduct educational activities for students, teachers, and parents on the ethical use of information technologies to ensure psychological safety in schools and to prevent the inappropriate use of mobile phones at school (MoNE, 2014). As of the first semester of the 2018-2019 academic year, the Ministry of National Education updated the curriculum for the 1st, 2nd, 3rd, 4th, 5th, and 6th grades of primary education in the field of Information Technologies and Software Course and added the Ethics and Security unit to its content (MoNE, 2018). In the study conducted by Paksoy (2015), the compliance of middle school students with computer ethics rules in performance tasks was examined. Çelik and Gündoğdu (2019) aimed to develop a scale to determine the attitudes of high school students towards ethical values in the field of information technology. Since 2014, Anadolu University has made the computer ethics course compulsory for all

postgraduate students and started offering this course through distance education (Karadeniz, 2015). In the study conducted by Söylemez and Balaman (2015), the factors that are thought to affect students' ethical use of information and communication technologies were tried to be determined.

The primary school period is considered a critical period for the development of many cognitive and social skills (Levinson et al., 2020). During this period, students acquire the skill of using information and communication technologies in life sciences courses while also being aware of ethical issues they may encounter. It is anticipated that their awareness of what is ethical and unethical while exhibiting behaviors related to this skill will contribute to their safer and more ethical use of this skill. In this context, when research conducted abroad is examined, Masrom et al. (2012) examined ethical problems in information and communication technology in primary schools in Malaysia and found cybercrimes, cyberbullying, internet fraud, and hacking were among the ethical problems identified. However, cyberbullying was seen as the main ethical issue in Malaysian primary schools. In the research conducted by Varlan and Tomazei (2018), four categories of ethical problems were defined in the use of information and communication technologies as general ethical problems, software piracy, plagiarism and cheating, and computer security. In the literature, the issue of IT ethics is seen as so important that Paltiel et al. (2022) review and discuss the issue of IT ethics education, emphasizing the importance of teaching IT ethics to students to prevent them from experiencing ethical problems.

When the research conducted in the context of computer ethics in primary schools was examined, it was seen that there were mostly studies on the ethical dimension of primary school teachers' use of information technologies (Baysa, 2020; Baysan & Çetin, 2019; Ersoy, 2014). In the study conducted by Baysan and Çetin (2019), it was aimed to develop a measurement tool with psychometric properties to determine the ethical use of information and communication technologies in education for teachers.

When the literature was examined, it was observed that there was no direct research on the relationship between the ability to use information and communication technologies and computer ethics in the 2018 life sciences curriculum. However, Armağan Erbil and Doğan (2019) determined the needs that emerged according to the teachers' opinions for the primary school life sciences course curriculum, and in this context, it was revealed that classroom teachers emphasized the importance of effective and correct use of information and communication technologies. IT ethics can be inferred from the emphasis on correct use. Kılınç and Ersoy (2013) evaluated the 2009 life sciences curriculum in the context of developing ethical awareness in general according to teacher opinions, but this study also did not address computer ethics. In addition, it should not be ignored that the ICT competencies of classroom teachers constitute an important dimension in the process of supporting the development of students' skills in using ICT in life science teaching. The competence of classroom teachers in the field of information and communication technologies positively affects the reflection of this competence on students (Redecker, 2017). In this context, studies conducted to determine the bit competencies of classroom teachers were examined. In these studies, it was determined that the ICT competencies of classroom teachers were at a high level (Aydoğmuş & Karadağ, 2020; Dağlıoğlu, 2023; Dikmen et al, 2021). This finding can be inferred that classroom teachers are competent in information and communication technologies, and in this context, they can adequately support the development of their students' skills in using information and communication technologies in life science teaching. In the context of these evaluations, the purpose of this research is to examine the ability to use information and communication technologies in the primary school life sciences curriculum in a computer ethics context. The study aims to answer the questions, in this context, "Is computer ethics included in the life science curriculum? Are students informed about unethical behaviors by teachers while gaining the ability to use information and communication technologies in life science teaching? If so, what unethical behaviors in the context of computer ethics are brought to the students' attention, and how are the reasons explained by the teachers?"

The purpose of the research

The aim of this research is to examine the ability to use information and communication technologies in the primary school life sciences course within an ethical context. The sub-objectives determined in line with this general purpose are as follows:

1. How is the inclusion of computer ethics in the ability to use information and communication technologies in the life sciences course curriculum?
2. How do 2nd grade teachers include computer ethics in the process of gaining the ability to use information and communication technologies in teaching life sciences?

Methodology

The Research Design

The study was designed using the qualitative research method of a case study. According to Yıldırım and Şimşek (2016), the purpose of a case study is to comprehensively analyze one or several cases within their own boundaries (context, time, etc.). At the same time, this method allows for the individual description and interpretation of these situations. In this research, the life sciences curriculum and the opinions of primary school teachers regarding the computer ethics situation in the use of life sciences information and communication technologies will be individually described and interpreted within their own boundaries; hence, this method was chosen. Additionally, Merriam (2013) defines a case study as "an in-depth description and examination of a limited system". According to her, this limited system can be an individual, a group, an institution, a policy, or even a program. The crucial aspect is specificity, meaning the study should focus on a particular event, phenomenon, or program. In this research, the specific and limited system is the relationship between the ability to use information and communication technologies and information ethics in the context of the opinions of primary school teachers and the life sciences curriculum. This relationship has been examined and described.

Table 1. Demographic information about the study group

Sequence No	Code	Age	Gender	Years of Service	Grade Level Taught	Province of Employment
1	T1	32	Male	7	1	Bursa
2	T2	55	Male	35	1	Bursa
3	T3	40	Male	17	2	Bursa
4	T4	31	Female	8	2	Bursa
5	T5	35	Female	15	3	Bursa
6	T6	38	Female	16	1	Bursa
7	T7	31	Female	8	1	Bursa
8	T8	32	Female	6	1	Bursa
9	T9	47	Female	27	1	Bursa
10	T10	39	Female	17	3	Bursa
11	T11	33	Male	10	1	Bursa
12	T12	31	Female	10	1	Bursa
13	T13	46	Male	23	3	Bursa
14	T14	39	Female	19	1	Bursa
15	T15	32	Male	9	2	Gaziantep
16	T16	28	Female	2	1,2,3 (Multigrade class)	Şırnak
17	T17	34	Female	12	3	Afyonkarahisar
18	T18	33	Female	12	2	Antalya
19	T19	24	Female	3	1	Antalya
20	T20	34	Male	12	1	Aydın
21	T21	36	Male	8	1	Kahramanmaraş

The Study Group

The research aimed to evaluate the ability to use information and communication technologies in the context of computer ethics in a primary school life sciences course. For this reason, the study group consisted of primary school teachers who taught life sciences courses in the 1st, 2nd, and 3rd grades in the second semester of the 2022-2023 academic year. A total of 21 primary school teachers were reached within this context. These teachers were included in the research from various provinces in Türkiye, including Antalya (2), Aydın (1), Afyonkarahisar (1), Bursa (14), Gaziantep (1), Kahramanmaraş (1), and Şırnak (1). Demographic information about the study group is presented in Table 1. The selection of teachers was primarily based on voluntariness. Among the volunteers, participants were selected using the criterion sampling method, which is a type of purposeful sampling. In the criterion sampling, the criterion used was teaching 1st, 2nd, and 3rd grades.

Data Collection Tools

Case studies are studies in which data are collected from multiple sources and analyzed in depth (Creswell, 2012). In this context, the research data was collected through a semi-structured interview form and documents. Before finalizing this form, pilot interviews were conducted with three different participants. During the pilot interviews, a total of 15 different unethical behaviors encountered in the process of using information and communication technologies in the context of teaching life sciences were presented under the question "Do you include any or all of the following unethical behaviors - included in the Ministry of National Education resources - in teaching the ability to use information and communication technologies in a life skills course? Why?" Participants ticked the checkboxes next to the behaviors they included in their lessons and were asked to provide examples and reasons at the bottom. During the pilot interviews, it was observed that the first question was understood differently, and it was unclear which item the participants should address in their responses to the second and third questions. Additionally, to account for the possibility that participants might express new views beyond these questions, another question was added to the form. As a result, the final semi-structured interview form consists of two sections. The first section was created to collect information related to the participants, such as age, gender, years of service, the grade level they teach, and the province where they work. In the second section, two different questions are included: "1. While teaching the ability to use information and communication technologies in a life science course, do you discuss the wrongness of the following unethical behaviors - as found in the Ministry of National Education resources? Please tick 'yes' if you do or 'no' if you don't. Why?" "2. Besides the behaviors related to information ethics mentioned above, are there any specific behaviors that you wish to see in children for the development of their information and communication technology skills? If so, what are they?" Under the first question, there is a table that lists 15 different unethical behaviors considered within the scope of computer ethics. For each behavior, there are options for "yes," "no," and an explanation ("why"). When a participant selects "yes" or "no," they are also asked to provide an explanation for their choice. The 2018 life sciences curriculum, which was valid for the 2022-2023 academic year, was used as a document source.

Data Collection Process

The data was collected between June 1, 2023, and June 15, 2023, during the second semester of the 2022-2023 academic year. The data was collected in two different ways: through face-to-face interviews and online interviews. Participants were first provided with preliminary information about the research, given a participant consent form to read, and those who voluntarily wished to participate in the research signed and dated the consent form to confirm their participation. Before online interviews, the consent form was also confirmed by participants, scanned, and sent to the researcher via email. All interviews were conducted by the researcher personally,

and each interview lasted an average of 10 minutes. After each interview, the researcher asked participants if they wanted to add anything beyond the data provided in the interview form, and the interviews were completed in this manner.

The Data Analysis

The data obtained from interviews and documents was first converted into text. Before data analysis, the answers given by a total of 23 participants were reviewed, and the answers given by two participants were removed from the data because they could not be related to the research. Each participant was assigned a code to ensure clarity and comprehensibility in data analysis. For example, participant number one was coded as "T1." Within the scope of the analysis of the data related to the first sub-objective of the research, the 2018 life sciences curriculum was examined from two different perspectives. The first perspective involved determining whether the concept of ethics was mentioned at any point in the context of the ability to use information and communication technologies. The second perspective examined whether the unethical behaviors mentioned in the second sub-objective of the research were addressed in the curriculum.

The data obtained from the interviews was analyzed using both content analysis and descriptive analysis methods. In content analysis, codes/themes were created based on the responses provided by the participants. In the second sub-problem, the reasons why teachers did not mention unethical behavior to their students during the life sciences lesson about using information and communication technologies were analyzed using content analysis. Codes/themes were created based on the responses of the participants, and definitions explaining these themes were also provided. The data obtained through the descriptive method was summarized and interpreted according to the predetermined themes. Data related to the second sub-problem of the research, which focused on the justifications for the unethical behaviors related to computer ethics that teachers make students aware of during the development process of the ability to use information and communication technologies in life skills course, were coded and defined according to the dimensions of computer ethics (Fidan, 2016). In the first stage, multiple definitions were created, and in the second stage, similar definitions with related meanings were combined. In both methods, the analyzed data were supported with direct quotations.

Validity and Reliability

Meriam (2013) suggests five different strategies for validity in qualitative research, which include triangulation, participant validation, ensuring appropriate and sufficient participation in data collection processes, specifying the researcher's stance, and expert examination. In this research, all five strategies were used. Triangulation, a type that involves the participation of more than one researcher, was employed (Seale, 1999). Miles and Huberman's (1994) formula for reliability was used, which is stated as: Reliability = Agreement/ (Agreement + Disagreement). According to Miles and Huberman (1994), this ratio should be at least 80%. As a result, it was found that the agreement was 84%. Secondly, the primary school teachers who were interviewed were contacted again, and feedback on the findings was requested. All participating primary school teachers provided feedback that confirmed their opinions. Thirdly, in the findings and discussion section, the opinions of teachers regarding unethical behaviors included and not included in the development of information and communication technology skills in life sciences course were presented. This was done to ensure adequate participation and to search for data supporting alternative explanations (Patton, 2014) in line with data collection processes. The researcher's perspective, biases, and assumptions, which are part of the researcher's stance (Maxwell, 2012), were provided in the next section. Lastly, the findings and conclusions of this research were presented to an expert in the fields of life sciences course and computer ethics for their input.

Meriam (2013) suggests that four strategies can be used to ensure reliability in qualitative research. The previous paragraph emphasized the use of three of these strategies (triangulation, expert examination, and researcher's position). The fourth strategy is the audit technique, which allows readers to replicate the researchers' results using their methods (Lincoln & Guba, 1985). In this context, efforts have been made to include direct statements that support the findings. Detailed information about how these findings were obtained can be found in the data analysis section (Dey, 1993). Lastly, the validity and reliability of a study are significantly dependent on ethical considerations. Ethical considerations and, in this context, validity and reliability have been ensured in the research. Details regarding ethical considerations will be provided in the next section.

The Role of the Researcher and Ethical Considerations

There are several studies on the ethical aspects in primary education conducted by the researcher. In this context, it can be inferred that the researcher has a strong tendency towards ethical considerations. Therefore, the researcher has been personally involved in all stages of the research, from the design and planning to the implementation and report writing. The researcher has managed all phases of the research.

While preparing the research proposal, a sample of the semi-structured interview form and participant consent form required for scientific ethics committee approval were attached to the application petition. Thus, ethics committee approval was obtained without any problems in the application. Before the interviews, each participant signed and approved the consent form without writing their name and surname. The explicit consent of the participants was obtained. No non-voluntary participants were included in the study. Although it was stated in the consent form, the research data would not be shared with third parties for other purposes.

It was stated that coding would be performed on the participants' responses in the research report. It was also mentioned that if, for any reason, a participant did not wish to continue the interview, it would not pose a problem for the researcher. The emphasis was placed on the importance of the participant feeling comfortable during the interview and expressing their views without any form of bias or influence, which was considered ethical. Throughout the interview, the researcher did not make any interventions to create bias or to change the participant's perspective. All these ethical procedures were applied in online interviews as well.

Findings

1. The Findings related to the First Sub-Purpose of the Research

The answer to the first sub-purpose of the research aimed to determine whether the 2018 life sciences curriculum included the topic of computer ethics. In this context, the life sciences curriculum was examined from two different perspectives. The

first perspective involved whether the concept of "ethics" was mentioned at any point in the curriculum in the context of using information and communication technologies. The second perspective was whether unethical behaviors, as mentioned in the second sub-purpose of the research, were included in the curriculum. In this regard, the life sciences curriculum was examined under the headings specified in its content.

The paragraph discussing "Taking Initiative and Entrepreneurship" under the competency section includes the statement, "It also includes being aware of ethical values and supporting good governance." This statement generally emphasizes ethical values. Based on this, it can be inferred that computer ethics is not included in this context.

One of the special aims of the life sciences course is "Use information and communication technologies in accordance with its purpose." This statement does not directly imply computer ethics. When considered in the context of appropriate use, it can be interpreted as emphasizing correct usage. Again, it can be observed that computer ethics and unethical behaviors related to computer ethics are not directly addressed in this context.

In the fourth article under the heading "Aspects that Teachers Should Pay Attention to When Implementing the life sciences Curriculum," it is stated that "Students should be allowed to use living and non-living beings in their environment as teaching materials with attention to ethical issues." This statement does draw attention to ethics but is not in the context of computer ethics.

Under the heading, "First Grade Learning Outcomes and Descriptions" in the "Safe Life" unit, there is the learning outcome "LS.1.4.6. Uses technological tools and equipment safely." This learning outcome focuses on the safe use of electronic devices such as computers, televisions, mobile phones, tablets, game consoles, and electric household appliances. It also highlights the importance of being cautious in situations that could lead to technology addiction, such as the internet and computer games. It is worth noting that while the text emphasizes safe use, it does not explicitly address ethical considerations.

Under the heading "Second Grade Learning Outcomes and Descriptions" in the "Safe Life" unit, there is the learning outcome "LS.2.4.5. Becomes sensitive to the safe use of technological tools and equipment." The description related to this learning outcome emphasizes that the students should focus on warning those around them, within the framework of courtesy rules, when necessary, about the safe use of technological products. This highlights not only safe usage but also encourages students to consider etiquette and politeness when addressing these issues. In this context, it can be inferred that the aim may indirectly be to create awareness about ethical usage.

Based on all these evaluations, it can be inferred that the primary school social studies curriculum lacks specific content regarding the need for students to be aware of computer ethics they should adhere to and the digital unethical behaviors they should avoid when it comes to the skill of using information and communication technologies.

2. The Findings related to the Second Sub-Purpose of the Research

The second sub-purpose of the research aimed to investigate whether primary school teachers included computer ethics in the process of supporting the development of students' skills in using information and communication technologies in the life sciences course. In this context, Table 2 presents which of the 15 different unethical behaviors in the context of computer ethics were addressed in the development of skills related to using information and communication technologies in the life sciences course, along with their justifications.

According to the data in Table 2, in the process of enhancing the development of life skills using information and communication technologies in the life sciences course;

The teachers who participated in the research expressed the unethical behaviors they found as follows: Of the 21 teachers,

20 of them have stated that using the Internet or social media with the intent to harm others,

14 of them believe that obtaining all the information for a project assignment from internet websites while preparing project assignments,

10 of them think that posting a photo taken by our friend on our social media account as if it's our own,

14 of them find sharing private information that our friend has shared exclusively with us on our social media account as,

10 of them consider hacking into the social media accounts of our friends or other individuals as,

15 of them think that unauthorized copying and distributing of personal data,

10 of them consider copying software that we haven't paid for and using it as if it's our own property,

7 of them believe that deceiving users by creating fake content,

14 of them believe that creating and disseminating content contrary to public morality,

11 of them consider downloading movies without permission by using our neighbor's wireless network,

9 of them view deleting or altering photos on our friend's social media account without their permission, after accessing their account from our computer,

3 of them see creating a fake web journal (blog) for a company with the intention of causing harm to the company,

10 of them consider using content without proper attribution or citation,

13 of them believe that people create fake profiles by hiding their real identities,

2 of them say that companies pay blog writers to prepare biased content to increase their reputation.

Of the 15 different unethical behaviors that are included in the development of skills in using information and communication technologies in the life sciences course, the most frequently mentioned is using the internet or social media to harm people. The least frequently encountered behavior is having companies pay web journalists (blog writers) to prepare biased content to enhance their reputation.

Table 2. Unethical behaviors covered in the life sciences course and their justifications.

S.N	Unethical behavior	Grade level	The justifications (Dimensions of Computer Ethics)												
			Theme/Code												
			Privacy and security			Cyberbullying		Basic principles					Communication and social impact	Cybercrimes	
			Definitions												
			To ensure the safety of children on the Internet	In order for them to use information and communication technologies	To protect the rights of those who seek to access accurate information	Because it hinders people's fundamental rights and freedoms	Violation of privacy	Violation of personal rights and being a crime	The unethical aspect of sharing someone's private information	The teacher's concern for ethical behavior individually.	Having technology usage rules	Because it is unethical behavior	Because moral rules apply in the digital realm, too, when explaining ethical principles	Because it is legally a crime	
1	Using the internet or social media with the intent to harm others	1 (10) 2 (5) 3 (4) Multigrade Class (1,2,3) (1)	T1, T4, T6, T10, T12, T11, T13, T17	T16, T18, T21		T7, T20				T14	T15	T3, T8, T19	T2, T5		
2	Obtaining all the information for a project assignment from Internet websites.	1 (6) 2 (5) 3 (2) Multigrade Class (1,2,3) (1)	T6, T13									T19			
3	Showing the photo taken by our friend as our own on our social media account.	1 (7) 2 (1) 3 (2)	T6, T20, T21				T2, T5, T7, T11					T3, T9, T17			

4	Sharing private information that our friend has shared with us exclusively on our social media account.	1 (10) 2 (1) 3 (3)	T6, T13					T2, T7, T11, T17, T20	T3, T5, T8, T9, T18, T21	T14									
5	Hacking our friends' or other people's social media accounts.	1 (6) 2 (2) 3 (2)	T6					T2, T3, T5, T7, T11, T17, T18, T20					T21						
6	Copying and distributing personal data without permission.	1 (8) 2 (4) 3 (3)	T6					T2, T4, T5, T7, T10, T18, T20		T14	T1, T15							T3, T11, T17, T21	
7	Copying and using software without paying for it as if it's our own.	1 (5) 2 (2) 3 (2) Multigrade Class (1,2,3) (1)	T6			T20												T10, T18 T2, T5, T11, T16, T21	
8	Deceiving users by creating and using fake content.	1 (5) 2 ( ) 3 (2)	T6	T21				T2, T7, T10						T5, T20					
9	Creating and disseminating content that goes against general morality.	1 (7) 2 (3) 3 (4)	T6, T13					T2, T7, T10, T18			T11, T15		T5, T8, T17, T19, T20, T21						
10	Downloading movies without permission by using our neighbor's wireless network.	1 (6) 2 (3) 3 (2)						T2, T5, T7		T14	T15	T3, T8, T17						T18, T20, T21	

11	Deleting or altering photos on our friend's social media account without their permission, after accessing their account from our computer.	1 (7) 2 () 3 (2)	T6, T13					T2, T5, T7, T9, T20		T14			T21			
12	Creating a fake web journal (blog) for a company with the intention of causing harm to the company.	1 (2) 2 () 3 (1)						T21				T5			T2	
13	Using content without proper attribution or citation.	1 (6) 2 (2) 3 (1) Multigrade Class (1,2,3) (1)	T6					T5, T7		T16	T4, T17, T16, T20	T2, T18	T21			
14	Creating fake profiles by concealing individuals' real identities.	1 (7) 2 (1) 3 (5)	T6					T7, T13, T17		T14			T2, T8		T3, T5, T10, T11, T20, T21	
15	Creating biased content by paying blog writers to enhance the reputation of companies.	1 (2) 2 () 3 ()											T2, T21			
		Frequencies of the items (f)	25	3	1	2	5	41	6	7	10	14	16		21	

In the context of teachers enhancing the development of information and communication technology skills in life sciences course, they address the reasons for unethical behavior within the framework of computer ethics. These reasons are categorized under the themes of computer ethics dimensions, such as privacy and security, cyberbullying, basic principles, communication and social impact, and cybercrimes. Among the reasons most frequently emphasized for making students aware of each unethical behavior, the following stand out: Within the context of cyberbullying, the attack on personal rights and its criminal nature (41); under the theme of privacy and security, the goal of ensuring the safety of children in the online environment (25); the fact that these unethical behaviors are also considered illegal under the theme of cybercrimes; it has been understood that, under the theme of communication and social impact, moral rules remain valid in the digital realm when discussing ethics (16). The least frequently emphasized reasons include the protection of the right of those seeking accurate information under the theme of privacy and security (1) and the prevention of the fundamental rights and freedoms of individuals under the theme of cyberbullying. Below are the quotations supporting these findings.

"I am conducting an information and awareness campaign for safe internet usage for the safety of children." (T6, 1)

"To prevent them from experiencing cyberbullying within their age group." (T13, 1)

"I am sensitive in my use of the Internet and social media because I value ethical behavior on an individual level." (T14, 1)

"I emphasize the importance of using technology or tools for the benefit of humanity, regardless of what they use, and I value raising awareness about the purposes and intentions behind their Internet use. Even if they use the internet solely for homework, I always make sure to discuss the various uses and purposes of the Internet." (T16, 1)

"I tell them that not all information from internet websites is accurate, so they should also search for knowledge from books, magazines, or older family members. I encourage them to express the information they acquire in their own words." (T18, 2)

"I always explain it. The reason is the interference with personal privacy." (T11, 3)

"Because it's not right to share people's private information." (T3, 4)

"Because it's not only morally wrong but also illegal." (T3, 5)

"This issue is of great significance in today's conditions. That's why I emphasize that intruding into any kind of account, not just on social media, is wrong and is regarded as theft. I explain that instead of becoming hackers, we should aim to have our own legitimate earnings." (T18, 5)

"I teach within the context of personal rights and freedoms and the rules of technology usage." (T15, 6)

"I'm saying that personal information is private and should not be shared with anyone because it belongs to individuals. To explain this, I use an example from myself: when Ayşe's mother asked me for Ali's mother's number, I first tried to obtain Ali's mother's permission before sharing it. I emphasize that neither our personal identity numbers nor our parents' card numbers or passwords should be given to anyone." (T18, 6)

"I had used an internet-based application in our class. I explained that this application was created by people and we can use it for free to the extent that they allow, but certain features are paid for because there is effort involved. Just like a farmer charges for the product they grow in their field when selling it to a buyer, I emphasized that when using an application in the online environment, there is also someone's effort behind it, and it's a form of production. I want them to realize the importance of recognizing the value of labor and to be individuals who do not engage in labor theft." (T16,7)

"It does not comply with moral values." (T5,8)

"I'm talking about it being unethical and immoral." (T3, 10)

"Permission must be obtained, but it should also be understood that it may harm the internet company. I do not agree with this." (T17, 10)

"Using things that don't belong to us without permission is theft. That's why we talked about the importance of getting permission before using them." (T18, 10)

"It means entering private space. It is disrespectful and a crime." (T5, 11)

"Because I care about my students realizing where they obtained this information when they prepare any research assignments. It is important for me that they realize they've taken this information without permission if they don't mention the source of the information." (T16, 13)

"We talked about the need to indicate where we obtained the information we received while preparing the project assignment. During the lesson, to set an example, if I make a quotation myself, I explicitly mention where I got it from. If we write a poem, I always make sure to mention the author of the poem." (T18, 13)

Table 3 shows which of the 15 different unethical behaviors that the participants did not include in the development of the skill of using information and communication technologies in the life sciences course and their reasons in the context of information ethics.

According to the data in Table 3, 1 out of the 21 teachers who participated in the research did not mention that using the internet or social media to harm others is wrong and unethical in the process of supporting the development of life skills and information technology usage skills in life sciences courses. The justification provided was that first-grade students do not have a need for it due to their age.

"It is not observed in children at this age due to their age." (T9, 1)

Out of the 21 teachers who participated in the research, six did not mention that obtaining all the information for a project assignment from internet websites is wrong and unethical in the process of supporting the development of life skills and information technology usage skills in a life sciences course. The justification provided included the young age of the students, the lack of project assignments in primary school, and the guidance for students to use different sources.

Table 3. Unethical behaviors not covered in the life sciences course and their justifications.

			Justifications								
		Definitions	The students' young age and the fact that a 2nd-grade student may not have the knowledge to prepare content.	The students not being social media users.	The students not knowing how to post photos on social media.	Not feeling the need to provide information due to the nature of life skills class topics, as it may not have a corresponding learning outcome.	Because it was taught in Turkish lesson	Lack of project assignments in primary school	Guiding students towards parents, books, and the lack of sufficient skills in accessing accurate information on internet websites.	The students not having direct interaction with the internet and social media.
S.N	**Unethical behaviors**	**Code/Theme Grade level**	Students' age	Social media		Curriculum		Using different sources.		The socio-economic background of the students
1	Using the internet or social media with the intent to harm others.	1 (1) 2 () 3 ()	T9							
2	Obtaining all the information from websites while preparing the project assignment.	1 (5) 2 () 3 (1)	T12, T14					T7	T1, T8, T10	
3	Showing the photo taken by our friend as our own on our social media account	1 (4) 2 (4) 3 (2) Multigrade Class (1,2,3) (1)	T8, T12, T14, T15	T4, T10, T18	T1	T19				T13, T16
4	Sharing private information that our friend has shared with us exclusively on our social media account.	1 (2) 2 (3) 3 (1) Multigrade Class (1,2,3) (1)	T12, T15	T1, T4, T10		T19				T16
5	Hacking our friends' or other people's social media accounts.	1 (4) 2 (3) 3 (2) Multigrade Class (1,2,3) (1)	T4, T8, T9, T12, T14, T15	T1, T10		T19				T13, T16
6	Copying and distributing personal data without permission.	1 (3) 2 (1) 3 (1) Multigrade Class (1,2,3) (1)	T8, T9, T12			T19				T13, T16

7	Copying and using software without paying for it as if it's our own.	1 (6) 2 (4) 3 (2)	T1, T3, T4, T7, T8, T9, T12, T14, T17			T15, T19				T13
8	Deceiving users by creating and using fake content.	1 (6) 2 (5) 3 (1) Multigrade Class (1,2,3) (1)	T1, T3, T4, T8, T9, T11, T12, T14			T15, T18, T19				T13, T16
9	Creating and disseminating content that goes against general morality.	1 (3) 2 (2) 3 () Multigrade Class (1,2,3) (1)	T1, T3, T4, T9, T12, T14							T16
10	Downloading movies without permission by using our neighbor's wireless network.	1 (3) 2 (2) 3 (3) Birleştirilmiş Sınıf (1,2,3) (1)	T1, T4, T6, T9, T12			T10, T11, T19				T13, T16
11	Deleting or altering photos on our friend's social media account without their permission, after accessing their account from our computer.	1 (4) 2 (5) 3 (2) Multigrade Class (1,2,3) (1)	T1, T8, T12, T15, T17	T3, T4, T18		T10, T11, T19				T16
12	Creating a fake web journal (blog) for a company with the intention of causing harm to the company.	1 (9) 2 (6) 3 (3) Multigrade Class (1,2,3) (1)	T1, T3, T4, T6, T7, T8, T9, T11, T12, T14, T15, T17, T18, T20			T10, T19				T13, T16
13	Using content without proper attribution or citation.	1 (6) 2 (3) 3 (2)	T1, T2, T8, T9, T12, T14			T10, T11, T19	T15			T13
14	Creating fake profiles by concealing individuals' real identities.	1 (3) 2 (4) 3 () Multigrade Class (1,2,3) (1)	T1, T4, T9, T12, T15			T18, T19				T16
15	Creating biased content by paying blog writers to enhance the reputation of companies.	1 (9) 2 (5) 3 (3) Multigrade Class (1,2,3) (1)	T1, T3, T4, T5, T6, T7, T8, T9, T11, T12, T14, T15, T20			T10, T18, T19				T13, T16
			90	11	1	25	1	1	3	20

Among the 21 teachers who participated in the research, 11 of them did not include the unethical behavior of presenting a photo taken by a friend on our social media account as if it were our own in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included student age, students not being social media users, the behavior not being in the curriculum, and students' socio-economic background not being suitable.

"My students do not use social media (T4, 3)

"I don't talk about these topics because they are in a younger age group." (T8, 3)

"I didn't feel the need to because they don't have social media accounts. (T10, 3)

"It wasn't considered necessary based on the class level and socio-economic background." (T13, 3)

"I don't talk about social media-related topics because their ages are young, and I don't want to encourage social media usage. I only provide them with technology usage rules." (T15, 3)

"I haven't discussed this topic, I believe, because my students are not directly engaging with the Internet and social media. Since they are not involved in social media trends and interactions, it didn't seem meaningful to address this. It might feel superficial and not relevant to them." (T16, 3)

Among the 21 teachers who participated in the research, 7 of them did not include the unethical behavior of sharing private information that our friend shared only with us on our social media account in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included the students' young age, the fact that students were not social media users, and the students' socio-economic background.

"I didn't feel the need to because they don't have social media accounts." (T10, 4)

Among the 21 teachers who participated in the research, 11 of them did not include the unethical behavior of hacking into the social media accounts of friends or other individuals in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included the students not being of an age where they might engage in this behavior, the students not being social media users, and the students' socio-economic background, which might limit their access to the necessary equipment for the internet and social media in their homes.

"I didn't talk to this age group about it because they are too young." (T4, 5)

Among the 21 teachers who participated in the research, six of them did not include the unethical behavior of unauthorized copying and distributing personal data in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included the belief that students were not of an age where they might engage in this behavior, the lack of this behavior in the life sciences curriculum, and the students not having a sufficient socio-economic background.

Among the 21 teachers who participated in the research, 12 of them did not include the unethical behavior of copying and using software that we haven't paid for as our own in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included the belief that students had not reached the age limit required to exhibit this behavior, the absence of this unethical behavior in the life sciences curriculum, and the socio-economic background of the students.

"A question that is not appropriate for my 2nd grade student's level." (T3, 7)

Among the 21 teachers who participated in the research, 13 of them did not include the unethical behavior of creating fake content to deceive users in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included the belief that students were not of an age where they might engage in this behavior, the absence of this unethical behavior in the life sciences curriculum, and the inappropriateness of the students' socio-economic background.

Among the 21 teachers who participated in the research, 10 of them did not include the unethical behavior of downloading movies without permission by using our neighbor's Wi-Fi network in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included the belief that students were not of an age where they might engage in this behavior, the lack of this unethical behavior in the life sciences curriculum, and the inappropriateness of the students' socio-economic family structure.

"I don't remember mentioning this as a direct internet network. As I mentioned, my students do not have a wireless network; they use mobile internet, and they sometimes use their parents' phones for limited periods, rarely for homework and occasionally for games. I guess I didn't think of mentioning it because it's not part of their daily life." (T16, 10)

Among the 21 teachers who participated in the research, 12 of them did not include the unethical behavior of deleting or changing the photos in the account of our friend who logged into our computer's social media account without permission in the process of supporting the development of information and communication technology skills in the life sciences course. Their reasons for not addressing this behavior included the belief that students were not of an age where they might engage in this behavior, the absence of this unethical behavior in the life sciences curriculum, and the inadequacy of the students' socio-economic family structure.

"I didn't mention it because it didn't come up in the curriculum. I didn't mention it because it's not covered in the developmental stages." (T11, 11)

"It's not a problem my students have encountered at their age." (T17, 11)

18 of the 21 teachers who participated in the research did not mention that it was wrong and unethical to create a fake blog (blog) of a company to harm companies in the process of supporting the development of skills in using information and communication technologies in life sciences course. The justification was stated that the students were not old enough to exhibit this unethical behavior, this unethical behavior was not included in the life sciences course curriculum, and the students' socio-economic family structure was inadequate.

"I don't think it's necessary, especially at the primary school level, because they wouldn't harm company accounts." (T7, 12)

"It hasn't come up at the primary school level. (T11, 12)

Of the 21 teachers who participated in the study, 11 of them did not mention that using content without citing sources is wrong and unethical in the process of supporting the development of information and communication technology skills in life sciences course. They stated that students are not at an age where they can exhibit this behavior, the life sciences curriculum does not address this behavior, it is addressed in the primary school Turkish lessons, and it is not in line with the socio-economic family structure of the students.

Of the 21 teachers who participated in the study, 8 of them did not mention that creating fake profiles by concealing their real identities is wrong and unethical in the process of supporting the development of information and communication technology skills in life sciences courses. They provided the rationale that students are not at an age where they can exhibit this unethical behavior, the life sciences curriculum does not address this behavior, and it is not in line with the socio-economic family structure of the students.

Of the 21 teachers who participated in the study, 18 of them did not mention that having paid writers create biased content for web logs (blogs) to enhance the reputation of companies is wrong and unethical in the process of supporting the development of information and communication technology skills in life sciences courses. They provided the rationale that students are not at an age where they can exhibit this unethical behavior, the life sciences curriculum does not address this behavior, and it is not in line with the socio-economic family structure of the students.

"Because my second-grade student doesn't know how to prepare content." (T3, 15)

"It contains information beyond the level. (T5, 15)

In the development of information and communication technology skills in the life sciences courses, the unethical behaviors that were least frequently addressed among the 15 different ones were creating a fake blog for a company to harm its reputation and paying blog writers to create biased content to enhance a company's image. The behavior that was addressed least frequently was using the internet or social media to harm individuals.

The teachers who participated in the research were asked if they had any recommendations for behaviors related to computer ethics beyond the unethical behaviors included in the interview form. In this context, teachers with codes T1, T3, T4, T5, T6, T7, T8, T9, T10, T11, T13, T14, T15, T16, T17, T18, T19, T20, and T21 found the unethical behaviors that needed to be emphasized to students in the context of computer ethics, as presented in the interview form, to be sufficient. Only participant T2 suggested adding the behavior of developing and selling game cheats to the 15 different unethical behaviors examined in the research. It can be concluded that, except for participant T2, all teachers considered the 15 different ethical behaviors examined in the research to be sufficient. Supporting quotes for these findings are directly provided below.

"Developing and selling game cheats is an inappropriate behavior." (T2)

"I think the content above is sufficient." (T4)

"The above examples are sufficient." (T5)

Results, Discussion And Recommendations

In this research, two main questions have been explored: First, how is the inclusion of computer ethics in the ability to use information and communication technologies in the life sciences course curriculum? Second, how do 2nd grade teachers include computer ethics in the process of gaining the ability to use information and communication technologies in teaching life sciences? The study attempts to find answers to these two questions based on the findings obtained from the research.

It was understood that while ethical values were emphasized under the competencies heading in the life sciences course curriculum, computer ethics was not included. Although the curriculum highlights the appropriate use of information and communication technologies among its specific objectives, it does not address computer ethics. Furthermore, while the curriculum emphasizes the importance of ethics in its implementation, it does not incorporate computer ethics. Under the title of first grade achievements and explanations in the life sciences course curriculum, there is an emphasis on safe use of information and communication technologies under the title of "learning outcomes and explanations." Considering the relationship between safe use and the ethical dimensions of privacy and security (Fidan, 2016), it can be interpreted that the life science curriculum partially addresses computer ethics in two of its first-grade learning outcomes. However, it is worth noting that these two learning outcomes are inherently part of the "safe life" unit in the life sciences curriculum. In the second-grade section of the life sciences curriculum, there is a discussion of safe use and etiquette rules related to information and communication technologies. However, the curriculum lacks detailed explanations regarding safe use and etiquette rules. Considering the importance of etiquette rules in the use of information and communication technologies, this can be evaluated within the framework of fundamental principles in the context of computer ethics. Based on all these evaluations, it is determined that the life sciences curriculum does not directly include computer ethics or unethical behaviors that students should avoid in relation to computer ethics. Interestingly, according to the 2009 life science curriculum, which was in effect prior to the 2018 curriculum, teachers considered the learning outcomes related to ethics, personal qualities, and life skills to be sufficient for developing ethical awareness (Kılınç & Ersoy, 2013). However, in the primary school 1st, 2nd, 3rd, and 4th grade Information Technologies and Software class curriculum, there is a theme for ethics and security as the second theme. Among the specific learning outcomes of the curriculum is the need for students to use technology ethically and safely. The learning outcomes within the ethics and security theme include understanding the importance of respecting the rights of others when using technology, taking responsibility when using technology, explaining behaviors on the internet that may disturb others, and recognizing the ethical rules to follow when using the internet (MoNE, 2018). In light of all these assessments, it is recommended that the MoNE consider including discussions of ethical and unethical behaviors within the context of computer ethics in the life knowledge curriculum. Addressing unethical behaviors in the context of information and communication technology skills contributes to the development of individual ethical awareness and consciousness. The ability for this awareness and consciousness to be formed in the individual at a young age depends on the quality of ethical education given in primary schools (Çelen, 2012; Duymaz, 2013; Fidan, 2016; Kılınç & Ersoy, 2013).

In the process of developing the skill of using information and communication technologies in the life sciences course,

primary school teachers' inclusion of computer ethics in the context of unethical behavior was examined. As a result of this examination, it was found that among the fifteen different unethical behaviors, the most frequently addressed ones by primary school teachers in life sciences courses were using the internet or social media to harm people, unauthorized copying and distribution of personal data, sourcing all information from internet websites while preparing a project assignment, sharing our friends' private information that they only shared with us on our social media accounts, creating and disseminating content that goes against general morality. On the other hand, the least frequently addressed unethical behaviors were found to be paying bloggers to create biased content to improve a company's reputation and creating a fake company blog to harm companies.

The fact that teachers address these unethical behaviors in life sciences courses despite their absence from the curriculum is an important finding. Similarly, Hur, Kim, Song, and Lee (2009) examined the necessity of information and communication ethics education in primary schools and defined a narrative approach that could be used for such education. The content of the narrative approach includes topics like protecting personal information, copyright, the information society, and cyber etiquette. Among the reasons for this result in the current study, frequently emphasized opinions by primary school teachers include the view that engaging in these behaviors is considered an attack on personal rights and a crime, prioritizing the safety of their children in the online environment, and the belief that societal moral standards should also apply in the digital realm.

In the process of developing the skill of using information and communication technologies in the life sciences course, the extent to which primary school teachers address unethical behaviors in the context of information ethics was examined. As a result of this examination, it was found that among the fifteen different unethical behaviors, the least frequently addressed ones by primary school teachers in life sciences courses were creating a fake company blog to harm companies and paying bloggers to create biased content to improve a company's reputation. On the other hand, the most frequently unaddressed unethical behaviors were using the internet or social media to harm people, sourcing all information from internet websites while preparing a project assignment, and unauthorized copying and distribution of personal data. The reasons frequently emphasized by primary school teachers for not addressing unethical behaviors in the context of the development of information and communication technology skills among students include: students not reaching the required age level to engage in these behaviors; the lack of these unethical behaviors in the life sciences curriculum and students not having a socio-economic background that provides them with sufficient access and knowledge to use information and communication technologies effectively. Less frequently mentioned reasons include: students not knowing how to post photos on social media, the teacher addressing these unethical behaviors in the Turkish language class and the absence of project assignments in primary school. These reasons collectively contribute to the lack of emphasis on addressing unethical behaviors related to information and communication technologies in the classroom. In the current research, emphasizing students' awareness of age-appropriate unethical behaviors is in line with the findings of Dill and Anderson (2003). When examining policies related to the ethical and legal use of technology in schools in the United States, it is notable that one of the most important areas of concern is similar to restricting students' access to materials that are only suitable for adults. In this context, although the life sciences curriculum does not explicitly include discussions of unethical behaviors in the context of information and communication technology skills, it is evident that primary school teachers consider the needs of students when addressing these issues in the life sciences course. Given the importance of children's safety and well-being, it is recommended that primary school teachers incorporate discussions of computer ethics in the development of information and communication technology skills, even when not explicitly stated in the curriculum. This approach can help students become more aware of ethical considerations and ensure their safe and responsible use of technology. In addition, classroom teachers can be given awareness training on information security in the context of information ethics.

When the results of both sub-problems of the research are compared, it can be seen that unethical behaviors, which are included in the Ministry of Education resources under the title "Guide for Ethical Use of Technology" (MoNE, 2023), are not included in the life sciences course curriculum, but they are considered in the context of computer ethics by the majority of primary school teachers. It is an extremely important result for the safety of the students that they include these unethical behaviors that should not be done in the life sciences course in the development process of the ability to use information and communication technologies. Similarly, in a study conducted by Armağan-Erbil and Doğan (2019), it was observed that teachers emphasize the appropriate and effective use of information and communication technologies from a young age. These findings highlight the importance of teachers in guiding students to use technology ethically and responsibly. In the current research, the insights of primary school teachers and the analysis of the life sciences curriculum were used to arrive at conclusions. In future research, including the perspectives of primary school students and an examination of life sciences textbooks would make the research more comprehensive and stronger.

Author Contribution

The author declares that no other author has contributed to the study and that he has read and approved the final version of the study.

Ethical Declaration

The purposes and procedure of the current study were granted approval from the ethical committee of Bursa Uludağ University. (Session Date: 31 July 2023; Session Number: 2023-03-65).

Conflict of Interest

The authors declare that there is no conflict of interest with any institution or person within the scope of the study.

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