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An Examination of the Effects of Information Technology Course on Computational Thinking Skills and Technology-Mediated Learning

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The study aimed to determine the effect of the information technologies course on students' computational thinking skills and technology-mediated learning process. The study was conducted on 237 first-year students of the Faculty of Education who were enrolled in the information technology course, and a one-group pretest-posttest design was used. Dependent t-test, independent t-test, and correlation analysis were used to analyze the data. In the results obtained from the study, it was found that the information technologies course did not make a significant difference on the students' computational thinking skills, while it made a significant difference on the effect of technology-mediated learning on the learning process. When the effect of the information technologies course on computational thinking skills and technology-mediated learning process in terms of gender factor was considered as pre-test and post-test, there was a significant difference in favor of male students in terms of computational thinking skills and technology-mediated learning process within the scope of pre-test data, while there was no significant difference within the scope of post-test data. The study also showed that there was a positive and moderate relationship between students' computational thinking skills and their attitudes toward the technology-mediated learning process. In the context of this finding, it can be stated that technology-enhanced learning environments can have a positive effect on the development of computational thinking skills, and that lessons delivered in such learning environments can contribute to the development of students' creativity, algorithmic thinking, critical thinking, problem solving and collaborative working skills.

Introduction

In the information age, where information and communication technologies are effectively utilized in many fields, it is evident that the numerous innovations and changes emerging have a transformative effect on individuals and society. In this information age, commonly referred to as the 21st century, changes have also occurred in the skills and competencies expected from individuals. However, educational requirements, philosophy and competencies have also changed with changing learning needs on the one hand and rapidly advancing technology, which has become inevitable in education as in many other areas of

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life (Gülmez & Somyürek, 2022). International Society for Technology in Education (ISTE) standards come to mind when changing education and learning requirements with information technologies. ISTE (2016) states that today's students should be empowered learners, digital citizens, knowledge constructors, innovative designers, computational thinkers, creative communicators and global collaborators. Indeed, it is considered vital for each individual to possess the knowledge and skills required by the era. Acquiring proficiency in computational thinking, one of the skills mentioned has become necessary for forming an information society. Given the use of digital technologies in every field, mastering computational thinking is crucial for individuals to compete in the digital age, associate their real lives with their academic endeavors, and achieve successful outcomes (Computer Science Teachers Association [CSTA] & ISTE, 2011a). Computational thinking has emerged alongside developments in information technology and is recognized as a cognitive skill or thinking competency. The significance of this skill in the teaching process for various levels has been emphasized in numerous studies (Alsancak Sırakaya, 2019; Dong, Li, Sun & Liu, 2024; Gülbahar, Sert & Kalelioğlu, 2019; Üzümcü & Bay, 2018; Su & Yang, 2023; Zeng, Yang & Bautista, 2023). Therefore, it has become an important goal to teach and develop this skill, which has garnered significant interest in every area of learning. Furthermore, it is deemed important to address the impact of information technologies in articulating this skill (Cheng et al., 2023; Stamatios, 2024; Sun, Guo & Hu, 2023). Information technologies possess a transformative power over the skills that individuals need to have, and they also have the potential to impart these skills to individuals. Consequently, imparting these skills without leveraging the related technologies does not present a rational and effective approach. Therefore, the use of information technologies in learning and teaching environments emerges as a significant necessity.

As information technologies have become accessible to individuals in society, their use for learning purposes has also become widespread. In this context, many studies have been conducted on the use of information and communication technologies in teaching-learning processes. When the literature is examined, many concepts reveal the relationship between the possibilities of technology and learning (Aziz et al., 2009; Bhat, 2023; Gupta & Goel, 2024; Wieking, 2016). It has been studied in many different frameworks such as technology-supported/based learning, internet-supported/based learning, use of technology for educational purposes, and technology integration in education. These studies have reported results indicating a positive effect on learning across various variables. It is seen that as a result of the use of information technologies for learning purposes, learners' motivation increases, lessons become more interesting, course participation increases, provides permanent learning, and facilitates the student's knowledge construction process (Kruchinina et al., 2016, Ferrer et al., 2022; Cuave & Inga, 2022). Nowadays, as the literature on the use of information technologies, particularly internet and web-based technologies for educational purposes, expands, various perspectives are also presented. One of these is technology-mediated learning (TML). TML refers to the idea that technology enhances the learning process. It provides evidence of how technological tools and resources can improve educational outcomes. According to Wang et al. (2018), it is expressed as an indispensable concept in higher education today. The use of digital technologies in education provides an important understanding for students to acquire digital skills as well as other skills that are important for the 21st century (Hylén, 2015). It can be said that the information technologies course is crucial for integrating digital technologies into education and acquiring the knowledge and skills needed for their effective use.

The information technologies course is offered during the first term in all departments of education faculties. It aims to equip teacher candidates with knowledge and skills related to information technologies, specifically those used in education. Additionally, the course focuses on developing technology literacy skills among students. Considering the course's objectives, it provides an effective learning environment and process for students to develop both computational thinking skills and TML. Therefore, the Information Technologies course plays a crucial role in providing these two concepts to students. In this context, the effect of the information technologies course on attitudes toward computational thinking and TML was determined within the scope of the study.

Theoretical Framework

Computational Thinking

Computational thinking was first articulated by Papert (1980). In his book published in 1980, Papert argued that computers would change the way of accessing information and thus improve thinking. Later, Wing (2006) defined this phenomenon as computational thinking. According to Wing (2006), computational thinking skill is a combination of problem formulation, problem-solving, iterative thinking, abstraction, parsing, error correction, and reasoning skills. Kert et al. (2022) defined it as a concept that emerged with the synthesis of different sub-thinking skills and a skill that is frequently employed in the process of solving problems encountered in daily life. Computational thinking skills include problem-solving skills that individuals will need throughout their lives. According to ISTE (2016), one of the leading organizations in the field, computational thinking is among the skills that today's students should have in the developing technological environment and defined as 21st-century learner skills. According to ISTE (2016), today's students should be able to develop and use strategies to understand and solve problems in a way that leverages the power of technological methods to develop and test solutions to a problem. ISTE and Computer Science Teachers Association (CSTA) (2011a) describe computational thinking as a problem-solving process that includes but is not limited to the following characteristics:

- Formulate problems in a way that enables the use of computers and other tools to help solve them
- Logically organizing and analyzing data
- Presenting data through abstractions such as models and simulations
- Automating solutions through algorithmic thinking (a sequence of sequential steps)
- Identify, analyze, and implement possible solutions to reach the most efficient and effective combination of steps and resources
- Generalizing and applying this problem-solving process to a wide variety of problems

The concept of computational thinking has been accepted and studied by many educators and trainers since the day it was defined. Studies on computational thinking skills, which first emerged with the widespread use of computers and then came to the fore with the widespread use of information technologies, have become widespread in the subject areas of computer science. There are many studies in areas such as programming, coding, and robotic coding (Mills et al., 2024; Taylar et al.,2020; Tikva & Tambouris, 2021). In the literature review conducted by Yang et al., (2020), it was stated that the number of studies increased over the years and most studies were concentrated in the fields of programming education and robotic coding. In the literature review conducted by Top and Arabacıoğlu (2021), it was concluded that almost half of the studies conducted in Türkiye consisted of research on coding and robotic coding. It is concluded that the studies conducted in these fields are effective in gaining computational thinking skills and have a positive effect on the development of students' computational thinking skills (Akgün, 2020; Alsancak Sırakaya, 2018; Kılıç, 2022; Kwon et al., 2022; Oluk et al., 2018; Pellas & Peroutseas, 2016; Yünkül et al., 2017).

Technology-Mediated Learning

When today's education system is considered, students both learn in learning environments where instructional technologies are utilized in their schools and use information technologies in learning activities outside the school. Students both take part in learning environments where instructional technologies are utilized in their schools and use information technologies in out-of-school learning activities. Many students engage in distance education, online learning, or blended learning environments. Information technologies can play a mediating role in learners' efforts to achieve their learning goals (Bower, 2019). in this context, learning through technology can be defined as the application or application area of learning activities prepared using information technologies. In addition, it is defined as a technology-enhanced learning space and an environment in which student interactions with learning materials (readings, assignments, exercises, and alike), peers, and/or instructors are realized through advanced information technologies (Alavi & Leidner, 2001).

TML focuses on the relationship between cognitive information processing and the instructional process (Wang et al, 2018). Alavi and Leidner (2001) believe that learners' cognition and information processing is the most important learning process in TML. The effectiveness of TML refers to whether the ICT applied in the teaching process affects students' information processing and subsequently improves student performance. Especially in TML, technologies are positioned as mediators between participants (Bower, 2019). The possibilities offered by information technologies, such as preparing and presenting different types of learning materials, enabling student-teacher-content interaction, and using multimedia, can enhance learning and help learners in the information-processing process. The organization of technologies and the way they are used affect learning. The effectiveness of TML refers to the extent to which ICT supports the conditions under which students' information processing takes place, in other words, the extent to which ICT supports instructional activities that facilitate learning (Wang et al, 2018). In this case, teachers and students must identify and effectively use the opportunities offered by ICTs. In particular, the teacher's skill level in the use and utilization of these technologies can influence students' information processing. The role of the teacher in TML is to maximize the design and implementation of learning tasks based on student feedback (Bower, 2019). Ultimately, the affordances of technologies and their recognition by users will influence how they are used and therefore the learning that takes place (Conole & Jones, 2010). In this case, teachers need to select technologies that can help the learning process and create appropriate learning environments.

Purpose of the Study

Within the scope of the study, it was aimed to investigate the effect of the information technologies course carried out in faculties of education on individuals' computational thinking skills and the learning process of learning through technology. For this purpose, the research questions were determined as follows.

a. Does the information technologies course make a significant difference to students' computational thinking skills?

b. Does the information technologies course create a significant difference in students' attitudes towards technology-mediated learning?
c. Does the information technologies course make a significant difference to students' computational thinking skills according to gender?
d. Does the information technologies course create a significant difference in students' attitudes towards technology-mediated learning according to gender?
e. Is there a significant relationship between computational thinking skills and the impact of technology-mediated learning on the learning process?

Method

Research Design

In the study, quasi-experimental design, one of the experimental design types among quantitative research methods, was used. Quasi-experimental design consists of single group designs without random assignment and comparative group designs without random assignment and matching (Büyüköztürk et al., 2012). Within the quasi-experimental structure, a single-group pretest-posttest design was considered. In the study, a 14-week experimental process was planned for 3 hours a week. This process was carried out within the scope of the information technologies course given to pre-service teachers. In this 14-week process, the content of the information technologies course program in the The Council of Higher Education (YÖK) teacher training undergraduate programs was covered. The course was conducted face-to-face in the computer laboratory. At the same time, a class was created through the Microsoft Teams program and used to communicate with students and share materials. During the teaching process in the computer lab, various materials prepared with Web 2.0 tools and Microsoft Office applications were presented and then students were provided with the opportunity to practice using computers. In the processes outside the lesson, both the materials presented in the lesson and additional materials were presented through Microsoft Teams and continuous communication was provided with the students. In the study, pre-tests were conducted with the tools specified in the data collection tools before starting the experimental process regarding the effect of TML on the learning process and computational thinking skills of the students, and post-tests were conducted at the end of the experimental process. In the study, pre-test and post-test scores were compared, and pre-test and post-test scores related to the scales were discussed within the scope of various variables. In order to determine the relationship between the effect of TML on the learning process and computational thinking skills of students, a correlation type relational screening model was used.

Sample

The sample of the study consists of pre-service teachers studying at the Faculty of Education of a state university and taking the Information Technologies course in the fall semester of the 2022-2023 academic year. The sample group includes a total of 237 pre-service teachers, 180 females and 57 males. The sample group was collected by convenient sampling method, one of the non-random sampling methods. The convenient sampling method considers preventing labor loss as the main purpose (Büyüköztürk et al., 2012).

Data Collection Tools

"Computational Thinking Scale", 'Scale of the Effects of Technology-Mediated Learning on the Learning Process' and Personal Information Form were used to collect the data. *Personal Information Form* includes demographic information such as gender, the program of study, average daily internet usage time for educational purposes, average daily internet usage time, computer hardware knowledge, and computer software knowledge.

Computational Thinking Skills Scale: The scale developed by Korkmaz, Çakır, and Özden (2017) consists of 29 items and five factors. The "*Creativity*" factor consists of 8 items and its internal consistency coefficient is 0.843, the "*Algorithmic Thinking*" factor consists of 6 items and its internal consistency coefficient is 0.869, the "*Collaboration*" factor consists of 4 items and its internal consistency coefficient is 0.865, the "*Critical Thinking*" factor consists of 5 items with an internal consistency coefficient of 0.784 and the "*Problem-Solving*" factor consists of 6 items with an internal consistency coefficient of 0.727. The internal consistency coefficient for the whole scale is 0.822.

Effects of Technology-Mediated Learning on the Learning Process Scale: The scale developed by Wang et al. (2018) and adapted into Turkish by Babacan and Güler (2022) consists of a total of 30 items and 8 sub-dimensions. As sub-dimensions, 4 items are "*Attracting Attention*", 4 items are "*Informing Learners about the Goal*", 4 items are "*Presenting Stimulating Materials*", 3 items are "Recalling Prior Knowledge", 4 items are "*Providing Learning Guidance*", 3 items are "*Eliciting Performance*", 4 items are "*Receiving Feedback from Others*" and 4 items are "*Receiving Self-Feedback*". As a result of the experience obtained from the pilot application of the scale and previous studies, the researchers decided that a 5-point Likert type would be more useful instead of the 7-point Likert type applied in the original study. While the internal consistency coefficient of the original scale was .80, the internal consistency coefficient was found to be .93 in the Turkish adaptation study.

Data Collection and Analysis

The data were collected voluntarily from the first-year students of the Faculty of Education in the fall semester of the 2022-2023 academic year. Before analyzing the data obtained from the sample, Cronbach's Alpha reliability coefficient was calculated for the pre-test and post-test data to determine the internal consistency coefficients of the scales, and it was found that the scales were reliable for the relevant sample (Table 1).

Table 1. Cronbach's alpha values for the scales and sub-factors

Cronbach's Alpha Coefficient		Pre-test	Post-test
Computational Thinking Skills Scale	Scale Overall	.87	.85
	Creativity	.70	.77
	Algorithmic Thinking	.92	.93
	Collaboration	.89	.87
	Critical Thinking	.80	.77
	Problem-Solving	.83	.84
Effects of Technology-Mediated Learning on the Learning Process Scale	Scale Overall	.96	.96
	Attracting Attention	.77	.83
	Informing Learners about the Goal	.85	.85
	Presenting Stimulating Materials	.84	.88
	Recalling Prior Knowledge	.84	.85
	Providing Learning Guidance	.77	.84
	Eliciting Performance	.85	.85
	Receiving Feedback from Others	.87	.89
	Receiving Self-Feedback	.83	.86

To determine whether the data were normally distributed, Skewness and Kurtosis values were examined, and it was found that the values were in the reference range of "-1.5 and +1.5" and showed a normal distribution (Tabachnick & Fidell, 2013). In order to examine the effects of the information technologies course on computational thinking skills and the learning process of TML, pre-test and post-test scores were compared with paired sample t-test. Since the scale sub-dimensions did not meet the MANOVA prerequisites, the scale sub-dimensions were analyzed separately with t-tests and Bonferroni adjustment was made for each of them. Bonferroni adjustment is performed by setting a stricter alpha level in order to reduce the possibility of finding a significant result by chance when multiple comparisons are made on the same group (Amstrong, 2014). Generally, the alpha level (.05) chosen at the beginning of the study is divided by the number of comparisons to be made and the new value obtained is accepted as the critical alpha level (Akbulut, 2010). The correlation analysis performed to determine the relationship between both scales provides numerical information about the strength and direction of the linear relationship between two quantitative variables. Pearson correlation coefficient (r) takes a value between -1 and +1 and the obtained value is accepted as a low-level relationship if it is 0.00-0.29, a medium-level relationship if it is 0.30-0.69, and a high-level relationship if it is between 0.70-1.00 (Büyüköztürk et al., 2012).

Findings

Investigation of the Effect of Information Technologies Course on Computational Thinking Skills

A paired sample t-test was conducted to determine the computational thinking skills of the students taking the Information Technologies course and the findings are presented in Table 2.

Table 2. Pre-test and post-test values for the effect of information technologies course on computational thinking skills

Variable	Group	n	$\bar{X}$	SD	df	t	p
Computational Thinking Skills	Pre-test	237	103.08	14.043	236	-.761	.448
	Post-test	237	103.72	13.330			
Creativity	Pre-test	237	33.90	3.956	236	1.732	.085*
	Post-test	237	33.40	4.196			
Algorithmic Thinking	Pre-test	237	15.64	6.384	236	-3.879	**.001***
	Post-test	237	16.95	6.488			
Collaboration	Pre-test	237	15.48	3.397	236	.392	.696*
	Post-test	237	15.38	3.356			
Critical Thinking	Pre-test	237	17.13	4.129	236	-2.453	.015*
	Post-test	237	17.77	2.285			
Problem-Solving	Pre-test	237	20.93	4.939	236	1.964	.051*
	Post-test	237	20.22	5.025			

* This test was interpreted by taking p=0.05/5=0.01 as reference with Bonferroni Adjustment

As a result of the general evaluation of the effect of the Information Technologies course on students' Computational Thinking Skills, it is seen that there is no significant difference between the pre-test and post-test data (t_{236}= -.761, p>.05). As a result of this finding, it can be stated that the Information Technologies course does not have any significant effect on students' computational thinking skills for this sample group. Similarly, it was determined that there was no significant difference in terms of Creativity (t_{236}= 1.732, p>.001), Collaboration (t_{236}= .392, p>.001), Critical Thinking (t_{236}= -2.453, p>.001) and Problem-

Solving (t_{236}= 1.964, p>.001) factors. In addition, it can be stated that there is a significant difference in terms of Algorithmic Thinking (t_{236}= -3.879, p<.001) sub-factor and that the İnformation technology course has a significant effect on these factors.

Investigation of the Effect of Technology-Mediated Learning on the Learning Process of Information Technologies Course

A paired sample t-test was conducted to determine the effects of TML on the learning process of the students taking the Information Technologies course. The findings are presented in Table 3.

Table 3. Pre-test and post-test values for the effect of technology-mediated learning on the learning process in Information Technologies course

Variable	Group	n	$\bar{X}$	SD	df	t	p
The Effects of Technology-Mediated Learning on the Learning Process	Pre-test	237	113.13	17.947	236	-3.370	**.001**
	Post-test	237	117.54	18.233			
Attracting Attention	Pre-test	237	14.52	2.957	236	-2.937	**.004***
	Post-test	237	15.17	3.039			
Informing Learners about the Goal	Pre-test	237	14.65	3.175	236	-3.370	**.001***
	Post-test	237	15.44	2.750			
Presenting Stimulating Materials	Pre-test	237	15.35	2.765	236	-1.938	**.054***
	Post-test	237	15.80	2.999			
Recalling Prior Knowledge	Pre-test	237	11.71	2.282	236	-.790	.430*
	Post-test	237	11.85	2.285			
Providing Learning Guidance	Pre-test	237	15.08	2.752	236	-2.722	.007*
	Post-test	237	15.78	2.889			
Eliciting Performance	Pre-test	237	11.24	2.418	236	-4.147	**.001***
	Post-test	237	12.00	2.096			
Receiving Feedback from Others	Pre-test	237	15.35	3.009	236	-1.715	.088*
	Post-test	237	15.75	3.071			
Receiving Self-Feedback	Pre-test	237	15.22	2.820	236	-3.021	**.003***
	Post-test	237	15.86	2.826			

*This test was interpreted by taking p=0.05/8=0.006 as reference with Bonferroni Adjustment

As a result of the general evaluation of the effects of the information technologies course on the learning process of TML, there is a significant difference between the pre-test and post-test data (t_{236}=-3.370, p<.05). It can be stated that this significant difference is in favor of the post-test data and that the students can make more sense of the effects of the Information Technologies course on the learning process of TML. Similarly, when the sub-dimensions of the scale are examined, it can be stated that there is a significant difference in terms of the factors of Attracting Attention (t_{236}= -2.937, p<.006), Informing Learners About Goals (t_{236}= -3.370, p<.006), Eliciting Performance (t_{236}= -4.147, p<.006) and Receiving Self-Feedback (t_{236}=-3.021, p<.006) and this difference is in favor of the post-test data. Regarding this difference, it can be stated that the information technologies course can significantly affect these sub-dimensions. In addition, it is seen that there is no significant difference between the pre-test and post-test data in terms of the sub-factors Presentation of Presenting Stimulating Material (t_{236} = -1.938, p>.006), Recalling Prior Knowledge (t_{236}= -.790, p>.006), Providing Learning Guidance (t_{236}=-2.722, p>.006) and Receiving Feedback from Others (t_{236} = -1.715, p>.006).

Investigation of the Effect of Information Technologies Course on Computational Thinking Skills in Terms of Gender Variables

The effect of the information technologies course on students' computational thinking skills was analyzed in terms of gender variables. The pre-test data obtained before the ICT course and the post-test data obtained after the ICT course were analyzed with an independent sample t-test within the scope of gender variable and the findings obtained are shown in Table 4.

Table 4. Pre-test and post-test values for the effect of information technologies course on computational thinking skills according to gender

Variable	Group		n	$\bar{X}$	SD	df	t	p
Computational Thinking Skills	Pre-test	Female	180	101.84	13.590	235	-2.444	**.015**
		Male	57	107.00	14.835			
	Post-test	Female	180	103.13	13.228		-1.220	.224*
		Male	57	105.60	13.596			
Creativity	Pre-test	Female	180	34.00	3.709	235	.650	.503*
		Male	57	33.60	4.675			
	Post-test	Female	180	33.49	4.002		.601	.549*
		Male	57	33.11	4.783			
Algorithmic Thinking	Pre-test	Female	180	14.73	6.123	235	-4.040	**.001***
		Male	57	18.53	6.384			
	Post-test	Female	180	16.23	6.377		-3.097	.002*
		Male	57	19.23	6.361			
Collaboration	Pre-test	Female	180	15.29	3.462	235	-1.472	.142*
		Male	57	16.05	3.142			
	Post-test	Female	180	15.46	3.444		.662	.508*
		Male	57	15.12	3.077			
Critical Thinking	Pre-test	Female	180	16.57	4.057	235	-3.814	**.001***
		Male	57	18.89	3.881			
	Post-test	Female	180	17.48	3.578		-2.260	.025*
		Male	57	18.68	3.219			
Problem-Solving	Pre-test	Female	180	21.25	4.401	235	1.767	.079*
		Male	57	19.93	6.287			
	Post-test	Female	180	20.47	4.715		1.183	.240*
		Male	57	19.46	5.580			

*This test was interpreted by taking p=0.05/5=0.01 as reference with Bonferroni Adjustment

When the effect of the information technologies course on students' computational thinking skills was examined in terms of gender variable, it was found that there was a significant difference (t_{235}= -2.444, $p<.05$) in favor of males for the overall scale for the pre-test data, while there was no significant difference (t_{235}= -1.220, $p>.05$) for the post-test data. Similarly, in the "Algorithmic Thinking" dimension, which is a sub-factor of the scale, a significant difference (t_{235}= -4.040, $p<.001$) was found in favor of males in the pre-test data, a no significant difference was found in the post-test data (t_{235}= -3.097, $p>.001$). As another significant finding regarding the pre-test and post-test data, while a significant difference (t235= -3.814, p<.001) in favor of males emerged in the pre-test data for the "Critical Thinking" sub-factor, a no significant difference (t235= -2.260, p>.001) in favor of males emerged in the post-test data.

Investigation of the Effect of Technology-Mediated Learning on the Learning Process of Information Technologies Course in Terms of Gender Variables

The effect of the information technologies course on the learning process of TML was analyzed in terms of gender variable. The pre-test data obtained before the ICT course and the post-test data obtained after the ICT course were analyzed with an independent sample t-test within the scope of gender variable and the findings obtained are shown in Table 5.

Table 5. Pre-test and post-test values for the effect of technology-mediated learning on the learning process in the Information Technologies course according to gender

Variable	Group		n	$\bar{X}$	SD	df	t	p
The Effects of Technology-Mediated Learning on the Learning Process	Pre-test	Woman	180	111.78	16.998	235	-2.077	**.039**
		Man	57	117.40	20.233			
	Post-test	Woman	180	118.01	17.334		.691	.490
		Man	57	116.09	20.924			
Attracting Attention	Pre-test	Woman	180	14.38	2.827	235	-1.348	.179*
		Man	57	14.98	3.319			
	Post-test	Woman	180	15.21	3.062		.380	.704*
		Man	57	15.04	2.988			
Informing Learners about the Goal	Pre-test	Woman	180	14.52	3.137	235	-1.112	.267*
		Man	57	15.05	3.281			
	Post-test	Woman	180	15.36	2.788		-.772	.441*
		Man	57	15.68	2.633			
Presenting Stimulating Materials	Pre-test	Woman	180	15.14	2.707	235	-2.106	.036*
		Man	57	16.02	2.863			
	Post-test	Woman	180	15.86	2.944		.580	.563*
		Man	57	15.60	3.184			
Recalling Prior Knowledge	Pre-test	Woman	180	11.57	2.275	235	-1.712	.088*
		Man	57	12.16	2.266			
	Post-test	Woman	180	11.93	2.270		.903	.367*
		Man	57	11.61	2.336			
Providing Learning Guidance	Pre-test	Woman	180	14.80	2.694	235	-2.826	**.005***
		Man	57	15.96	2.771			
	Post-test	Woman	180	15.80	2.775		1.103	.271*
		Man	57	15.32	3.219			
Eliciting Performance	Pre-test	Woman	180	11.08	2.411	235	-1.899	.059*
		Man	57	11.77	2.383			
	Post-test	Woman	180	12.08	1.952		1.143	.254*
		Man	57	11.72	2.498			
Receiving Feedback from Others	Pre-test	Woman	180	15.12	2.932	235	-2.179	.030*
		Man	57	16.11	3.149			
	Post-test	Woman	180	15.78	2.925		.238	.812*
		Man	57	15.67	3.522			
Receiving Self-Feedback	Pre-test	Woman	180	15.18	2.706	235	-.390	.697*
		Man	57	15.35	3.176			
	Post-test	Woman	180	15.98	2.637	235	1.087	.281*
		Man	57	15.46	3.349			

*This test was interpreted by taking p=0.05/8=0.006 as reference with Bonferroni Adjustment

When the effect of the information technologies course on the learning process of TML of students was examined in terms of gender variable, a significant difference (t_{235}= -2.077, p<.05) in favor of males was found for the overall scale for the pre-test data, while no significant difference was found for the post-test data (t_{235}= 691, p>.05). Similarly, in the sub-factors of the scale, Providing Learning Guidance (t_{235}= -2.826, p<.006) has a significant difference, while there was no significant difference in the posttest data (t_{235}=1.103, p>.006).

Investigating the Relationship between Computational Thinking Skills and Technology-Mediated Learning

Pearson correlation analysis was performed to determine the relationship between computational thinking skills and TML and pre-test and post-test data and presented in Table 6 and Table 7.

Table 6. The relationship between computational thinking skills and the effect of technology-mediated learning on the learning process pre-test data

	The Effects of Technology-Mediated Learning on the Learning Process	Computational Thinking Skills
Computational Thinking Skills	.345**	1
The Effects of Technology-Mediated Learning on the Learning Process	1	345**

** Correlation is significant at .01 level

There was a positive and moderate (r=.345; p=.01) relationship between students' computational thinking skills and TML pre-test data scores.

Table 7. The relationship between computational thinking skills and the effect of technology-mediated learning on the learning process post-test data

	The Effects of Technology-Mediated Learning on the Learning Process	Computational Thinking Skills
Computational Thinking Skills	.331**	1
The Effects of Technology-Mediated Learning on the Learning Process	1	331**

** Correlation is significant at .01 level

When the post-test data on students' computational thinking skills and the effect of TML on the learning process were analyzed, it was seen that there was a positive and moderate (r=.331; p=.01) relationship between the post-test scores similar to the pre-test finding.

Discussion and Conclusion

In this study, the effects of the information technologies course on computational thinking skills and TML on the learning process were examined, and also it was aimed to examine the relationship between these two phenomena. Within the scope of the research, firstly, the effect of the information technologies course on computational thinking skills was examined. In the findings obtained, it was determined that the information technologies course did not have any effect on students' computational thinking skills, while it was seen that it had a significant effect in terms of its sub-dimension that algorithmic thinking. In this context, when the findings are evaluated, it cannot be said that providing students with knowledge and skills related to the use of relevant technologies in the information technologies course contributes to the development of computational thinking skills, but it does not create a significant difference at a sufficient level. On the other hand, when the literature was examined in the context of computational thinking skills, it was seen that the most studied subjects were information technologies subjects (Hsu, Chang, & Hung, 2018; Top & Arabacıoğlu, 2021; Usta & Düzalan, 2021). Considering that this skill emerges with the effect of information technologies, it can be considered as normal to witness these subject areas as the frequently studied ones . When the literature is examined within the scope of the results of the studies, it is seen that some studies on computational thinking skills report the finding that information technologies do not have any change on computational thinking skills (Atiker, 2019; Çakır & Yaman, 2018; Çimentepe, 2019; Ergin & Arıkan, 2023; Kukul, 2018;

Paf & Dinçer, 2021; Yolcu & Demirer, 2023), studies are reporting that computational thinking skills are developed or acquired (Akkaya & Akpınar, 2022; Bal, 2019; Delal & Oner, 2020; Gündoğdu, 2020; Karaçam Duman, 2020; Gunbatar & Turan, 2019; Uğur & Çakıroğlu, 2024; Üzümcü & Bay, 2021; Yünkül, Durak, Çankaya, & Mısırlı, 2017). In this study, it was found that while there was no significant impact on computational thinking skills, the information technologies course had a notable effect on students' development of the specified competencies in algorithmic thinking. In other words, it is seen that the algorithmic thinking skill of the participants have improved along with the increase in their knowledge and skill to use information technologies within the scope of the effect of the course. In the findings obtained, the fact that the information technologies course has a significant effect on students' algorithmic thinking skills can be considered as an important situation. Giving algorithm information within the scope of the course and making examples related to the subject may have enabled students to increase their knowledge and skills in this regard. However, within the scope of the information technologies course, providing algorithms and flowcharts for the development of algorithmic thinking in the course content and having sample applications in this context can contribute to the development of students' algorithmic thinking skills (Doğan & Kert, 2016; Gonda, Ďuriš, Tirpáková & Pavlovičová, 2022; Malik, Shakir, Eldow & Ashfaque, 2019; Oluk et al., 2018). In this regard, Demir and Cevahir (2020) stated that programming teaching contributed to the development of 21st-century skills and had a significant effect on algorithmic thinking skills, similarly, Malik et al. (2019) stated that flowchart and coding techniques contributed to the development of algorithmic thinking skills. As a matter of fact, computational thinking skill, which is accepted as a high-level skill, requires a holistic perspective and is associated with the development of different types of skills such as algorithmic thinking, creativity and critical thinking, abstraction, data literacy, and automation usage skills (Hsu, Chang, & Hung, 2018; Korkmaz, Çakır, & Özden, 2017; Toksik-Gün & Güyer, 2019; Yağcı, 2019). It can be said that in order to see an increase in computational thinking skills, there should be improvements in all related skills. In this context, the information technologies course, which increases technology literacy, can be considered as a start for computational thinking skills (Top & Arabacıoğlu, 2021) and can be said to make significant contributions to the development process. To improve computational thinking skills, it is important to include activities that will provide development in other dimensions in the course design or to carry out activities to cover different courses.

Within the scope of the findings obtained from the research, it was seen that the information technologies course affects the effect of learning through technology in the learning process in a way that there is a significant difference. It was determined that there was a positive effect on the learning process of the students who took the information technologies course in the application carried out after learning through technology within the scope of the course. It is seen that the education and training carried out with the participants to use information technologies increased this effect positively. As is known, technology is at the center of transforming education and teachers can make the lesson process more effective with the use of technology (Funk, 2021). Within the scope of the possible effects of using technology in the lesson, it allows students to be more participatory in the lessons and the information learned can be retained for a longer period (Kılıç, 2022). The recognition of the possibilities provided by technologies in many areas by users can affect how they are used and thus the learning that takes place (Conole & Jones, 2010). When the literature is examined, it is seen that individuals' attitudes towards TML vary according to their level of computer use (Babacan & Güler, 2022). It can be said that students who have advanced experience with information technologies have an attitude that technology contributes positively to learning processes. It can be stated as an acceptable situation that their attitudes towards TML increase with the acquisition and development of knowledge and skills related to information technologies. TML is a type of learning that is realized by using information technologies as a tool. Within the scope of the information technologies course, pre-service teachers both experienced the use of these technologies in the learning environment and their technology literacy levels increased. In addition, they gained an understanding of the value of technology in the context of learning and the relationship between technology and the learning process. In this context, it is normal for them to develop positive attitudes towards TML. Similarly, when the sub-dimensions of TML are examined, it is seen that the information technologies course creates a significant positive difference in the dimensions of attracting the attention of the learners, informing learners about the goals, eliciting the performance, and giving self-feedback. It can be stated that students' cognitive, affective, and behavioral competencies are developed and revealed in many aspects during the learning process. As a matter of fact, in the literature on the possible effects of technology on the learning process, it is recommended that instructional designs be made by the TML approach in the courses and this recommendation can be found in different studies (Hardaway & Scamell, 2005).

In the study, when the effect of the information technologies course on computational thinking skills was examined in terms of gender variable, it was seen that there was a significant difference between males and females in the pre-test findings of computational thinking skills, and this significant difference disappeared in the post-test findings. In light of this finding, it can be stated that the information technologies course creates a significant difference in computational thinking skills in favor of female participants and that the computational thinking skills of female and male students have similar competence within the scope of post-test data. It can be said that female, who were not as competent as male in computational thinking skills before the ICT course, equalized their competence levels with the increase in their knowledge and skills about information technologies within the scope of the course. Similar to the findings of the study, Atmatzidou and Demetriadis (2016), in their study examining computational thinking skills according to gender and age variables, concluded that female students should receive more education for the computational thinking skill levels of female and male students to be the same. On the other hand, Atman Uslu et al. (2018) stated that there was no significant difference in the pre-test, mid-test, and post-test scores of students' computational thinking skills in the student group in which visual programs activities were applied and that the scores generally increased, while a non-significant difference was observed in male students in terms of post-test score. Sun et al. (2022), while stating that gender is widely discussed within the scope of programming education and computational thinking skills, pointed out that the gender factor in programming and computational thinking skills differs in research and this issue should be investigated. Again, in this regard, Hu (2022), in his meta-analysis study to determine the effect of gender factors on computational thinking skills, emphasized that gender factor has a significant effect on computational thinking skills, this difference also varies within the scope of geographical regions, on the other hand, this difference has gradually decreased in recent studies.

When the effect of the information technologies course on the learning process of TML is examined in terms of gender variable, it is seen that the significant difference between male and female in the pre-test results disappeared at the end of the process. In this case, it can be said that the effect of the information technologies course on the learning process of TML process creates a significant difference in favor of female. In explaining this difference, it would not be wrong to say that both the content of the course and the technology-mediated training had positive effects on the skills, attitudes, and perceptions of female participants towards the use of technology. Regarding gender, which is an important variable in explaining individuals' behaviors toward the use of technology, Cai et al. (2017) emphasized that male still have more positive attitudes toward the use of technology than female in their meta-analysis study conducted to investigate this issue, but such differences would be characterized as small effect sizes. Regarding this issue, Yılmaz et al. (2015) stated that the technology use perceptions of prospective primary school teachers did not show a significant difference in male and female students, while Ece and Çendek (2022) stated that there was no significant difference in the attitudes of male and female students towards the information technologies and software course in their study. On the other hand, it may be possible to state that utilizing technology in the education of digital natives, also referred to as Generation Z in today's information age, and seeing the effect of technology in the learning process may help to develop positive attitudes towards both learning and the use of information technologies regardless of gender.

The study also examined the participants' TML and computational thinking skills in terms of pre-test and post-test data. In this context, it is seen that there is a positive and moderate relationship between TML and computational thinking skills pre-test scores. TML briefly focuses on the relationship between cognitive information processing and the teaching process. TML examines whether the information technologies applied in the teaching process affect students' information processing process and then improve students' performance. In this context, computational thinking skills, which are defined as problem-solving using technology, can play a critical role in learning through technology. As a matter of fact, individuals who benefit from information technologies and use them effectively in problem solving processes may be expected to have high information processing competencies and learning performances in the context of TML. On the other hand, in this study, it is seen that the relationship is not high based on the expected assumption and is at a moderate level. As a reason for this situation, it can be suggested that the characteristics of the sample group (cognitive and psychological) should be taken into consideration. This may also be due to the fact that in the TML process, the learners focused on the use of technology and learning certain applications, in short, on the teaching process, and did not engage in any problem-solving skills to develop computational thinking skills. In this context, to make suggestions for the studies planned to be carried out, first of all, it is possible to say that there is a need for studies that examine these two phenomena and investigate how they should be handled. In addition to this, how computational thinking and technology-mediated learning are/can be related to learning performance can be investigated in more detail in future research.

Conflict of Interest

There are no conflicts of interest regarding the publication of this article.

Informed Consent

Participants were informed about the study’s objectives, procedures, and potential risks. They were informed that participation was voluntary and that they could withdraw from the study at any point if they felt reluctant without any consequences. All personal information was anonymized to protect participants' confidentiality.

Data Availability

The data are not publicly available due to privacy or ethical restrictions.

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