Osmangazi Journal of Educational Research **Volume 10 (Special Issue) 2023**

100th Anniversary of the Republic of Türkiye

RESEARCH Open Access

Suggested Citation: Elbahan, H., Elbahan, M. H., & Balbağ, M. Z. (2023). Determining the level of computational thinking skills of science teacher candidates. *Osmangazi Journal of Educational Research*, *10*(Special Issue), 254-272.

Submitted: 01/10/2023 **Revised:** 26/10/2023 **Accepted:** 26/10/2023 **DOI:** 10.59409/ojer.1369711

Determining the Level of Computational Thinking Skills of Science Teacher Candidates

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Abstract. In this study, it was aimed to compare the computational thinking skills of science teacher candidates, according to some variables (gender, class level, having a computer, daily average computer usage time, following technological developments and monthly income level of families). In the study, the survey model, one of the quantitative research methods, was used. The study group of the research consists of Science Teacher Candidates studying at the Faculty of Education of a state university in Türkiye during the 2021-2022 academic year. The data collection tool of the research is the "Computational Thinking Skills Scale" developed by Dolmacı and Akhan (2020). When the results of the study were examined, it was seen that the computational thinking skills of pre-service teachers were generally high. According to the gender variable, it is seen that the statistically significant difference in sub-factors is in favour of male teacher candidates. According to the family monthly income level variable, it has been understood that the statistically significant difference is in favour of the pre-service teachers whose income level is 8001TL and above.

Keywords. Science, Science teacher candidates, computational thinking skill

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Note: A part of this research was presented as a paper at the International Education Congress (EDU CONGRESS) 2022, held on 17-19 November 2022.

Today, when technological developments are accelerating and mechanisation is increasing, it is unthinkable for societies consisting of individuals who only assume the role of consumers to take part effectively in the international race. In every period, the education policies of societies to be included in this race have aimed to raise the needed human profile. In this context, first of all, it is necessary to determine the knowledge and skills that the next generation should possess. Recently, skills such as creativity, communication, cooperation, entrepreneurship, problem solving, and analytical thinking are frequently listed as 21st century skills (OECD, 2018). In line with technological developments, "computational thinking skill", which can be defined as "problem solving using technology", has been added to this list (Gretter &Yadav, 2016).

It is understood that there is no consensus on the Turkish equivalent of the expression "computational thinking". While Aldağ and Tekdal (2015); Şahiner and Kert (2016) used the non-Turkish expression "computational thinking", Korkmaz, Çakır and Özden (2015) has come up with a Turkish equivalent for the term as "computer thinking", and which means thinking like a computer. Doğan, Çınar, Bilgiç and Tüzün (2015) used the term "computational thinking" and Özkeş (2016); Dolmacı and Akhan (2020) used the term "computational thinking" as used in this study. Barut, Tuğtekin and Kuzu (2016), and Demir and Seferoğlu (2017) translated this concept into Turkish as "information processing thinking" in their studies.

According to Wing (2006), computational thinking is critical thinking or the application of existing knowledge to solve complex problems in mathematics, science, and STEM (science, technology, engineering, and mathematics) in general. Furthermore, computational thinking is considered to include problem-solving strategies such as abstraction at different hierarchical levels, algorithmic thinking, automation, decomposition, modelling, patterning, iteration, scaling, and symbolic representation. According to Aho (2012), computational thinking is formulated as problem decomposition, logical reasoning, and algorithm creation. In a study carried out in 2011, it was emphasised that computational thinking is a process that includes various characteristics. These characteristics are oriented towards solving a problem that is encountered while;

- Formulating solutions to problems using computers and other tools.
- Analysing data by organizing it logically
- Presenting data using abstractions such as models and simulations
- Automating solutions through algorithmic reasoning

- Identifying, analysing, and implementing possible solutions to ensure efficient and effective integration of solution steps and resources.
- Transferring or generalising the applied problem-solving process to other problems (ISTE & CSTA, 2011).

Within the framework of the maker movement, which integrates do-it-yourself (DIY) projects with technology, the aim is to develop individuals' production skills with technology (Bakırcı & Kutlu, 2018). In this process, where many different skills are used, the place of computational thinking skills is very important (Grover & Pea, 2013). Considering that teachers, who will be the architects of the next generation, will have their students develop these skills, they should have sufficient mastery of these skills. In order to be one step ahead of their students always and to be a role model for them, it has become important for teachers to master comprehensive skills such as computational thinking (Dolmacı & Akhan, 2020).

According to Rahayu and Osman (2019), computational thinking can help prospective science teachers solve problems in daily life more easily. They also say that they need to have knowledge and understanding of computational thinking skills so that they are confident and ready to face the challenges of learning in the 21st century. The subject of this study is also related to computational thinking skills and it aims to examine the computational thinking skills of science teacher candidates studying in the Department of Science Education in terms of different demographic characteristics. In line with this main purpose, the following questions were sought to be answered.

1- What are the computational thinking skill levels of science teacher candidates'?

2- Do science teacher candidates' computational thinking skills differ by gender?

3- Do science teacher candidates' computational thinking skills differ by grade level?

4- Do science teacher candidates' computational thinking skills differ by having a computer?

5- Do science teacher candidates' computational thinking skills differ by average daily computer use?

6- Do science teacher candidates' computational thinking skills differ according to the following technological developments?

7- Do science teacher candidates' computational thinking skills differ according to their family income level?

Method

This study, which examined the level of computational thinking skills of science teacher candidates, used the survey model, one of the quantitative research methods. Survey models are research approaches that aim to describe a past or present situation as it exists. In addition, it attempts to define the event, individual, or phenomenon that is the subject of the research within its own conditions and as it exists (Karasar, 2009). In this study, the relational survey model was used in accordance with the purpose.

Study Group

The study group of the research consists of undergraduate students studying in the Department of Science Teaching at the Faculty of Education of a state university during the 2021-2022 academic year. Among the teacher candidates participating in the study group, 142 (72.8%) were female and 53 (27.2%) were male. According to the results frequency analysis of the participants' grade level variable, 47 of the teacher candidates were in the 1st grade (24.1%), 43 were in the 2nd grade (22.1%), 49 were in the 3rd grade (25.1%), and 56 were in the 4th grade (28.7%). Additional information about the study group is presented in Table 1.

Table 1.

Demographic Characteristics of Prospective Science Teachers

Variables		**f**	**%**
Gender	Female	142	72.8
	Male	53	27.2
Class Level	Grade 1	47	24.1
	Grade 2	43	22.1
	Grade 3	49	25.1
	Grade 4	56	28.7
Computer Ownership Status	Has a computer	170	87.2
	No computer	25	12.8
Daily Average Duration of Computer Use	Less than 1 hour	61	31.3
	1-3 hours	66	33.8
	3-6 hours	49	25.1
	More than 6 hours	19	9.7
Fallowing Technological Developments	I do not follow	9	4.6
	I rarely follow	99	50.8

	I often follow	87	44.6
Monthly İncome Level Of The Family	Less than 1000TL	5	2.6
	Between 1001-4000TL	67	34.4
	Between 4001-8000TL	93	47.7
	8001TL and over	30	15.4

Data Collection Tool

The data collection tool used in the study is the "Computational Thinking Skills Scale (CTS)" developed by Dolmacı and Akhan (2020). The scale consists of 40 items and 5 sub-dimensions and is a five-point Likert scale consisting of "strongly agree", "agree", "undecided", "disagree", and "strongly disagree" options. The sub-dimensions are: Factor 1: Ability to Use Computers (M1, M2, M3); Factor 2: Algorithmic - Analytical Thinking (M4, M5, M6, M7, M8, M9, M10, M11, M12, M13, M14); Factor 3: Creative Problem Solving (M15, M16, M17, M18, M19, M20, M21, M22, M23, M24, M25, M26, M27); Factor 4: Collaboration (M28, M29, M30, M31, M32, M33, M34); Factor 5: Critical Thinking (M35, M36, M37, M38, M39, M40). The reliability of the scale was re-tested and the internal consistency coefficient (Cronbach's Alpha) was calculated. Accordingly, the reliability coefficient values for the scale and factors are shown in Table 2.

Table 2.

Reliability Coefficient Values of the Scale and its Subdimensions

	Cronbach's Alpha	
Scale Dimensions	**Dolmacı & Akhan (2020)**	**This Research**
Computer Use Skills	.91	.77
Algorithmic- Analytical Thinking Skills	.87	.93
Creative Problem Solving Skills	.88	.87
Ability to Collaborate	.83	.92
Critical Thinking Skills	.74	.88
Total	.94	.96

Data Analysis

The analysis of the data obtained in the study was carried out through the SPSS program. Skewness and kurtosis values were examined for the normality test of the data and the results of the analysis are given in Table 3.

Table 3.

Analysis Results Regarding the Distribution of Data

Factors	Skewness	Kurtosis
Factor 1: Computer Use Skills	-.787	.722
Factor 2: Algorithmic- Analytical Thinking Skills	-.03	.418
Factor 3: Creative Problem Solving Skills	.274	-.121
Factor 4: Ability to Collaborate	-.356	.276
Factor 5: Critical Thinking Skills	-.051	.719
General	.251	.602

By analysing the results in Table 3, it has been determined that the research data is normally distributed. The fact that the skewness and kurtosis values are between - 1.5 and + 1.5 supports that the data distribution found within the study is normal (Tabachnick & Fidell, 2013). In accordance with the results of the normality test, the independent samples t-test and one-way ANOVA were used to evaluate the data.

Results

In this section, the findings obtained for the whole scale and sub-problems of the study are presented. Table 4 presents descriptive statistics related to the item averages of teacher candidates' computational thinking skills.

Table 4**.**

Descriptive Statistics Related to Item Means of Teacher Candidates' Computational Thinking Skills Scores

Computational Thinking Skills Scale				
	Articles	$\bar{X}$	**Total**	**Sd**
M1	I use technological tools to solve the problems I encounter in my daily work.	4.17	814	0.71
M2	I use computers and similar technological tools when necessary in my lessons and homework.	4.48	873	0.73
M3	I use computers and similar technological tools in all problems I encounter.	3.72	725	0.97
M4	I understand the connections and meanings between numbers and formulas.	3.92	765	0.76

M5	I try to solve problems that seem complex or of different types.	3.86	752	0.73
M6	I understand explanations using mathematical expressions.	3.94	768	0.73
M7	I solve problems using abstractions in different ways.	3.68	717	0.85
M8	I break the problem into smaller parts when necessary.	3.95	771	0.68
M9	I evaluate the variables in the right place to solve the problem.	3.88	757	0.74
M10	When faced with a problem, I construct an equation to solve it.	3.96	773	0.62
M11	I visualize the solution of the problem in my mind.	4.04	788	0.72
M12	When finalising a problem, I perform all phases step by step in a planned manner.	3.95	771	0.78
M13	I show data in different ways such as simulations or models in problem solving.	3.55	693	0.95
M14	I can apply the solution methods I have designed in order and according to their level.	3.84	749	0.81
M15	I can reformulate a problem into a problem that I know how to solve.	3.81	743	0.84
M16	When solving problems, I carry out the tasks necessary to achieve a common goal simultaneously.	3.85	751	0.76
M17	I am curious when I start researching a new topic.	4.23	824	0.65
M18	I am always prepared to discover something new.	4.06	791	0.79
M19	I find new ways to learn difficult things.	3.89	759	0.79
M20	I develop new and original ways of solving a problem.	3.74	730	0.81
M21	I enjoy thinking about the solution to a problem.	3.85	751	0.84
M22	I think about a situation in detail and come up with innovative ways.	3.83	746	0.80
M23	I read thoughtfully.	4.23	824	0.66
M24	I do not hesitate to explain my solutions to others.	3.98	776	0.88
M25	I produce many solutions to a problem in a small amount of time.	3.48	678	0.89
M26	I give my own answers to the hypotheses I generate for a problem.	3.89	759	0.65

M27	Not all information is always right for me.	4.19	817	0.67
M28	I get better results through cooperative learning approach.	3.90	760	0.83
M29	I prefer cooperative learning to solve problems.	3.69	720	0.95
M30	I come up with more ideas for solving problems in cooperative learning.	3.92	764	0.74
M31	I learn cooperatively with my friends in the group.	3.92	764	0.81
M32	I exchange ideas with representatives of different ideas in the group.	4.09	797	0.67
M33	I contribute to cooperative working.	4.15	810	0.63
M34	I increase group dynamics in cooperative learning.	3.91	762	0.83
M35	I take into account the positive and negative aspects when presenting a solution to a problem.	4.21	820	0.60
M36	I see the problem in the subject I aim to study.	4.05	789	0.58
M37	I consider the possible consequences of different ways of solving the problem.	4.01	781	0.63
M38	I structure the process of solving a problem according to the problem.	3.99	779	0.55
M39	I try to determine the most appropriate one among the possible solutions.	4.16	812	0.56
M40	I organise information from different sources appropriately to solve the problem.	4.13	805	0.62
Total		3.95	771	0.75

As seen in Table 4, the overall mean of the scale aiming to determine the computational thinking skills of prospective science teachers was found as 3.95. In the scale, 21 items (M3, M4, M5, M6, M7, M9, M13, M14, M15, M16, M19, M20, M21, M22, M25, M26, M28, M29, M30, M31 and M34) were below the mean and there were no items with a mean below 3. The item with the highest mean was item 2 while the item with the lowest mean was item 25.

In Table 5, the examination of the averages of science teacher candidates' computational thinking skills according to the whole scale and sub-dimensions is discussed.

Table 5.

Examination of the Averages of Science Teacher Candidates' Computational Thinking Skills According to the Whole Scale and Sub-Dimensions

Sub - dimension (Factors)	**N**	**Min**	**Max**	$\bar{X}$	**Sd**
Factor 1: Computer Use Skills	195	2.00	5.00	4.12	.68
Factor 2: Algorithmic- Analytical Thinking Skills	195	2.08	5.00	3.87	.57
Factor 3: Creative Problem Solving Skills	195	2.91	5.00	3.94	.51
Factor 4: Ability to Collaborate	195	1.86	5.00	3.94	.64
Factor 5: Critical Thinking Skills	195	2.67	5.00	4.09	.47
Total	195	2.65	5.00	3.95	.47

Table 5 shows the averages of science teacher candidates in the total and sub-dimensions of the scale for computational thinking skills. Accordingly, when analysed in terms of total and sub-dimensions, it is seen that all of the averages are above 3.5. When the data in the table are analysed, it could be said that the computational thinking skills of the science teacher candidates are generally high, "computer usage skills" among the sub-dimensions is higher than the other dimensions, and the lowest sub-dimension is "algorithmic - analytical thinking skills".

In the study, an answer to the question "Do the computational thinking skills of science teacher candidates differ according to gender?" has been sought. The results of the findings are given in Table 6.

Table 6.

Examination of t-test Results of Computational Thinking Skills of Science Teacher Candidates According to Gender

Factors and Total	**Gender**	**N**	$\bar{X}$	**Sd**	**Std. Error Mean**	**t**	**p**
Factor 1: Computer Use Skills	Female	142	4.09	.64	.05	-0.82	.409
	Male	53	4.18	.75	.10		
Factor 2: Algorithmic-Analytical Skills	Female	142	3.79	.52	.04	-2.98	*.003
	Male	53	4.05	.62	.08		
Factor 3: Creative Problem Solving Skills	Female	142	3.87	.47	.03	-3.11	*.002
	Male	53	4.12	.55	.07		
Factor 4: Ability To Collaborate	Female	142	3.88	.63	.05	-1.92	.055
	Male	53	4.08	.65	.09		

Factor 5: Critical Thinking Skills	Female	142	4.06	.42	.03	-1.10	.275
	Male	53	4.16	.58	.07		
Total	Female	142	3.89	.41	.03	-2.542	.013
	Male	53	4.10	.54	.07		

*p<.005

Table 6 shows the results of the independent sample t-test analysis to examine the results of the computational thinking skills scale of science teacher candidates according to the gender variable. According to the test results, there was a significant difference in Factor 2 sub-dimension (t:-2.98, p<.005) and Factor 3 sub-dimension (t:-3.11, p<.005) and this difference was in favour of male teacher candidates. There was no significant difference in the overall scale and other sub-dimensions according to gender.

Another question that an answer has been sought within the study was "Do the computational thinking skills of science teacher candidates differ according to grade level?". The results of the findings are given in Table 7.

Table 7.

ANOVA Results of the Investigation of the Computational Thinking Skills of Science Teacher Candidates According to the Grade Level Variable

Class levels		**Sum of squares**	**sd**	**Mean squares**	**F**	**p**
Computer Use Skills	Between Groups	1.353	3	0.451	0.987	0.400
	Within Groups	87.249	191	0.457		
	Total	88.602	194			
Algorithmic-Analytical Skills	Between Groups	0.179	3	0.060	0.183	0.908
	Within Groups	62.118	191	0.325		
	Total	62.297	194			
Creative Problem Solving	Between Groups	0,334	3	0.111	0.426	0.735
	Within Groups	49.905	191	0.261		
	Total	50.239	194			
Ability to Collaborate	Between Groups	0.175	3	0.058	0.139	0.937
	Within Groups	80.186	191	0.420		
	Total	80.361	194			
Critical Thinking Skills	Between Groups	0.361	3	0.120	0541	0.655
	Within Groups	42.428	191	0.222		
	Total	42.788	194			
Total	Between Groups	0.101	3	0.034	0.153	0.928
	Within Groups	42.086	191	0.220		
	Total	42.186	194			

Table 7 shows the results of one-way analysis of variance (ANOVA) in order to test the differentiation of the results of the computational thinking skills scale of science teacher candidates according to the grade level variable. When the table is examined, it is seen that there is no significant difference in all factors and the scale in general according to the grade level variable (p>.005).

In the study, an answer to the question "Do the computational thinking skills of science teacher candidates differ according to having a computer?" was sought. The results of the findings are given in Table 8.

Table 8.

Investigation of t-test Results of Science Teachers Candidates' Computational Thinking Skills According to the Variable of Having a Computer

Factors and Total	**Computer Ownership Status**	**N**	$\bar{X}$	**Sd**	**Std.Error Mean.**	**t**	**p**
Computer Use Skills	Has A Computer	170	4.20	.615	.047	4.94	*.000
	No Computer	25	3.53	.781	.156		
Algorithmic-Analytical Thinking Skills	Has A Computer	170	3.89	.560	.043	1.61	.109
	No Computer	25	3.69	.590	.118		
Creative Problem Solving Skills	Has A Computer	170	3.94	.506	.038	0.45	.648
	No Computer	25	3.89	.530	.106		
Ability to Collaborate	Has A Computer	170	3.93	.640	.049	-0.22	.826
	No Computer	25	3.96	.678	.135		
Critical Thinking Skills	Has A Computer	170	4.11	.445	.034	2.03	.043
	No Computer	25	3.91	.589	.117		
Total	Has A Computer	170	3.97	.455	.035	1.53	.126
	No Computer	25	3.81	.522	.104		

*****p<.005

Table 8 shows the results of independent sample t-test analysis in order to examine the results of the computational thinking skills scale of pre-service science teachers according to the variable of having a computer. According to the test results, it was seen that there was a significant difference in Factor 1 sub-dimension (t: 4.94, p<.005) and this difference was in favour of the pre-service teachers who had a computer. There is no statistically significant difference in the overall scale and other sub-dimensions according to the status of having a computer.

In the study, an answer to the question "Do the computational thinking skills of pre-service science teachers differ according to the average daily computer usage time?" was sought. The results of the findings are given in Table 9.

Table 9.

Analysis of ANOVA Results According to the Average Daily Computer Usage Time Variable of Science Teacher Candidates' Computational Thinking Skills

Average Daily Computer Time		**Sum of Squares**	**sd**	**Mean Square**	**F**	**p**	**Significance**
Computer Use Skills	Between Groups	9.96	3	3.32	8.06	*.000	4>1 3>1 2>1
	Within Groups	78.63	191	0.41			
	Total	88.60	194				
Algorithmic-Analytical Thinking Skills	Between Groups	2.29	3	0.76	2.43	.066	
	Within Groups	60.00	191	0.31			
	Total	62.29	194				
Creative Problem Solving Skills	Between Groups	2.39	3	0.80	3.19	*.025	4>1
	Within Groups	47.84	191	0.25			
	Total	50.23	194				
Ability to Collaborate	Between Groups	1.64	3	0.54	1.33	.265	
	Within Groups	78.71	191	0.41			
	Total	80.36	194				
Critical Thinking Skills	Between Groups	1.70	3	0.56	2.64	.050	
	Within Groups	41.08	191	0.21			
	Total	42.78	194				
Total	Between Groups	2.37	3	0.79	3.80	*.011	4>1
	Within Groups	39.81	191	0.20			
	Total	42.18	194				

*p<.005 1=Less than 1 hour 2=between 1-3 hours 3=between 3-6 hours 4=More than 6 hours

Table 9 shows the results of one-way analysis of variance (ANOVA) to test the differentiation of the results of the computational thinking skills scale of pre-service science teachers according to the variable of average time of daily computer use. When the table is examined, it is seen that there is a significant difference between Factor 1, Factor 3 and the overall scale according to the average daily computer usage time variable (p<.005). There is no statistically significant difference in other sub-dimensions.

In the study, an answer to the question "Do the computational thinking skills of pre-service science teachers differ according to the status of following technological developments?" was sought. The results of the findings are given in Table 10.

Table 10.

Analysis of ANOVA Results According to the Variable of Following Technological Developments of Science Teacher Candidates' Computational Thinking Skills

Following Technological Developments		**Sum of Squares**	**sd**	**Mean Squares**	**F**	**p**	**Significance**
Computer use skills	Between Groups	20.620	2	10.310	29.118	*.000	3>1 3>2 2>1
	Within Groups	67.982	192	0.354			
	Total	88.602	194				
Algorithmic-Analytical Thinking Skills	Between Groups	7.010	2	3.505	12.171	*.000	3>1 3>2
	Within Groups	55.287	192	0.288			
	Total	62.297	194				
Creative Problem Solving	Between Groups	5.450	2	2.725	11.681	*.000	3>1 3>2
	Within Groups	44.789	192	0.233			
	Total	50.239	194				
Ability to Collaborate	Between Groups	4.985	2	2.493	6.350	*.002	3>1 3>2
	Within Groups	75.375	192	0.393			
	Total	80.361	194				
Critical Thinking Skills	Between Groups	5.630	2	2.815	14.547	*.000	3>1 3>2
	Within Groups	37.158	192	0.194			
	Total	42.788	194				
Total	Between Groups	6.543	2	3.272	17.624	*.000	3>1 3>2
	Within Groups	35.643	192	0.186			
	Total	42.186	194				

* p<.005 1=I do not follow 2=I rarely follow up 3=I often follow up

Table 10 shows the results of one-way analysis of variance (ANOVA) to test the differentiation of the results of the computational thinking skills scale of science teacher candidates according to the variable of following technological developments. According to the data, it was seen that there was a significant difference in all factors and the scale in general according to the variable of following technological developments (p<.005). In the study, an answer to the question "Do the computational thinking skills of science teacher candidates differ according to their family income levels?" was sought. The results of the findings are given in Table 11.

Table 11.

Investigation of ANOVA Results of Science Teacher Candidates' Computational Thinking Skills According to Family Monthly Income Level Variable

Family Monthly Income Level		**Sum of Squares**	**sd**	**Mean Squares**	**F**	**p**	**Significance**
Computer Use Skills	Between Groups	9.943	3	3.314	8.048	*.000	2>1 3>1 4>1 4>2 4>3
	Within Groups	78.658	191	0.412			
	Total	88.602	194				
Algorithmic-Analytical Thinking skills	Between Groups	7.537	3	2.512	8.763	*.000	2>1 3>1 4>1 4>2 4>3
	Within Groups	54.760	191	0.287			
	Total	62.297	194				
Creative Problem Solving Skills	Between Groups	4.866	3	1.622	6.827	*.000	4>1 4>2 4>3
	Within Groups	45.373	191	0.238			
	Total	50.239	194				
Ability to Collaborate	Between Groups	3.029	3	1.010	2.493	0.061	–
	Within Groups	77.332	191	0.405			
	Total	80.361	194				
Critical Thinking Skills	Between Groups	2.940	3	0.980	4.697	*.003	4>2 4>3
	Within Groups	39.848	191	0.209			
	Total	42.788	194				
Total	Between Groups	5.140	3	1.713	8.833	*.000	4>1 4>2 4>3
	Within Groups	37.047	191	0.194			
	Total	42.186	194				

*p<.005 1: Less than 1000TL, 2: 1001-4000TL, 3: 4001-8000TL, 4: 8001TL and above

Table 11 shows the results of one-way analysis of variance (ANOVA) to test the differentiation of the results of the computational thinking skills scale of science teacher candidates according to the variable of family income level. According to the data, it was seen that there was no significant difference in Factor 4: Collaboration Skill sub-dimension according to the family income level variable (p>.005). However, there is a significant difference in Factor 1, Factor 2, Factor 3, Factor 5 and the overall scale according to the family income level variable (p<.005).

Discussion and Conclusion

When the data obtained within the study have been analysed; it has been observed that the participants have medium and high level computational thinking skills. Korkmaz et al. (2015) reached similar results in their research in which they made a research on 1245 university students. When the general averages were analysed in the context of factors, the lowest average of computational thinking skills was seen in the "analytical - algorithmic thinking skill" sub-dimension. In the study conducted by Sarıtepeci (2017) on the 10th grade students, the lowest sub-dimension was found in the "creative problem solving skill" dimension.

In the study, "computer usage skill" of computational thinking skills was found to be the highest sub-dimension skill average of the participants. The results of computational thinking skills according to gender variable showed that the mean of male participants was higher than that of female participants. However, it was concluded that this difference was not significant. Partially similar to this result, Roman-Gonzales (2017) found that there was a significant difference in favour of male participants.

In the study, it was seen that the significant difference according to the gender factor was in favour of male participants in the sub-dimensions of "analytical - algorithmic thinking skills" and "creative problem solving skills". Again, in the study conducted by Korkmaz et al. (2015) with university students, it was seen that there was a significant difference in favour of male students in the sub-dimension of "critical thinking skills".

In the analysis, it was observed that the participants with computers had higher computational thinking skills in general, and there was a significant difference in the sub-dimension of "computer usage skills" and this difference was in favour of the participants with computers. In different studies, it has been observed that "participants with high level of access to technology" have higher computational thinking skills in general. Since it is known that another definition of computational thinking skill is "computer thinking", it is thought that it is natural that the result is in this way.

Sarıtepeci (2017) examined the variable of daily technology use time in his study, and it was observed that the participants with the highest technology usage (4-6 hours) had higher averages than general results and sub-dimensions. Similarly, in this study, the computational thinking skills of participants whose computer usage time was 4-6 hours and more were significantly higher than that of students whose computer usage time was less than 1 hour.

In this study, computational thinking skills of the participants were examined according to the variables of "following technological developments" and "family monthly income level". Accordingly, when the computational thinking skill levels of individuals who "frequently" follow technological developments were examined, it was seen that they were statistically significantly higher both in general and in all sub-dimensions compared to the participants who answered as "I do not follow" and "I rarely follow" technological developments. In addition, it was seen that the computational thinking skills of individuals with a family monthly income level of 8000 Turkish Liras and above were significantly higher than the participants with lower monthly income in general average and in all sub-dimensions except the sub-dimension of "ability to cooperate".

Recommendations

As a result of this study, it is believed and recommended that qualitative research on the computational thinking skills of pre-service teachers should also be conducted, and that the subject can be enriched with studies conducted in different branches. Additionally, studies can be conducted that include different demographic characteristics that link computational thinking with 21st century skills.

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Conflict of Interest

It has been reported by the authors that there is no conflict of interests..

Funding

No funding was received.

Ethical Standards

We have carried out the research within the framework of the Helsinki Declaration.

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