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Cyber Security Skills of Pre-Service Teachers as a Factor in Computer-Assisted Education

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Abstract

The present study aimed to determine the effect of individual cyber security skills of pre-service teachers on their attitudes towards computer-assisted education. Thus, the present research was designed as a correlational study. The study participants included 241 senior pre-service teachers in different departments at Manisa Celal Bayar University, Faculty of Education during the 2019-2020 academic year the fall semester. The data were collected with the "Personal Cyber Security Provision Scale" and "The Attitude Toward Computer-Assisted Education Scale." Based on the study findings, pre-service teachers should improve their competency in cyber security. Furthermore, pre-service teachers who owned a personal computer had higher scores in maintaining personal cyber security and had better attitudes towards computer-assisted education. Besides, it was observed that there were differences between personal cyber security scores of pre-service teachers and their attitudes towards computer-assisted education based on their departments. Furthermore, it was identified that the personal cyber security achievement score was a significant predictor of the attitude towards computer-assisted education. In the final section of the study, various recommendations are presented for future studies and applications on the subject.

Introduction

In current times, digitalization became prominent in all areas of life. Information and communication technologies provide convenience in all fields, especially in transportation, health, communications and trade, and the quality of life of individuals improves every day. On the other hand, digitalization has introduced various risks and threats such as cyber-piracy, technology addiction, cyberbullying, intellectual property violations, besides its advantages (Atanasova, 2019; Lazarinis, Alexandri, Panagiotakopoulos, & Verykios, 2020; Orhan-Goksun, Haseski, & Ozan-Leymun, 2019). The need for protection against the risks that concern all who step in the virtual world has led to the introduction of the concept of cyber security.

Cyber security is a concept that aims to protect the data and assets that belong to individuals and institutions in the virtual world (Prasad & Rohokale, 2020; Van Schaik et al., 2017; von Solms & von Solms, 2018). In this context, Mack (2018) defined cyber security as the techniques of protecting computers, networks, software and data from unauthorized access or attacks that aim exploitation. With the increase in the production of digital data and the appreciation of the value of information, individuals and groups who desire illegal access to information have emerged. These malevolent individuals could harm other individuals, institutions or states using various methods in the virtual environment (Walters, Trakman, & Zeller, 2019; Wirtz, 2017). Consistent with the increasing number of cyberattacks around the world, cybercrime will be a significant concern for the years to come, and approximately $5.2 trillion in global value would be at risk due to cyber-attacks (World Economic Forum, 2019). The most common cyber threats include malicious software (malware) such as viruses, keyloggers and trojans, and techniques such as phishing and social engineering designed to harm individuals financially or mentally and to steal personal information (Chakraborty, 2019; Erbschloe, 2019; Kara & Aydos, 2019; Prem & Reddy, 2019). Against the above-mentioned risks, individuals should possess adequate knowledge and skills to maintain personal cyber security to safely meet all their needs and operate for various purposes without being harmed in the virtual environment (Furnell & Vasileiou, 2017; Kemper, 2019; Smith & Ali, 2019). In other words, the competence to maintain cyber security has become a sine qua non for anyone with a presence in the virtual environment for various purposes.

One of the fields affected by digitalization is the field of education. The use of information and communication technologies in education is considered important, especially to achieve individual, enjoyable and permanent learning (Owusu, Monney, Appiah, & Wilmot, 2010). The concept of computer-assisted education, introduced by technological advances, is a significant approach for systematic and effective education and to provide active learning (Sharma, 2017; Wentworth & Earle, 2013). Jonassen (2000) defined computer-assisted education as the employment of computers in education to make learning easier and more effective. In other words, this approach entails certain applications based on the active use of computers in education to provide better educational opportunities (Daintith & Wright, 2008; Tripathi, 2019). In this context, pre-service teachers, trained in the information age, should possess the skills that would allow them to utilize educational information and communication technologies actively and effectively and be competent in technology-based applications such as computer-assisted education (List, 2019; Maher, 2019).

In Turkey, computer-assisted education implementations date back to 1984. In this context, 1100 computers were purchased for high schools in Turkey in 1984 (Engin, Tösten, & Kaya, 2010). In time, thanks to the widespread adoption of information and communication technologies, the use of computers at all educational levels started to increase in Turkey, and the various training seminars and courses were provided for teachers on computer use. In 1998, computer-assisted education was introduced in Turkish universities (Dinçer, 2015). Furthermore, in the same year, Computer Education and Instructional Technology (CEIT) Departments were established in faculties of education to promote computer use in education and implement computer-assisted education in Turkey (Bardakçı, Kılıçer, & Özeke, 2017). The teachers who graduated from this department aimed to instruct primary and secondary school students how to use computers, and to develop a culture of computer-assisted education in educational institutions. Thus, computer courses were included in the primary and secondary education curricula (Seferoğlu, 2007), and since 2006, computer-assisted instruction software has been developed and utilized in Turkish schools (Dinçer & Doğanay, 2017). In 2010, the FATİH (Movement of Enhancing Opportunities and Improving Technology) project was introduced for the implementation of computer-assisted education in all schools in Turkey (Dinçer, 2015). The project aimed to redesign all classrooms in schools as smart classes introduced a smart board in each class, and distributed tablet computers to all students and teachers (Keleş, Öksüz, & Bahçekapılı, 2013). Furthermore, the EBA (Educational Information Network) portal was introduced in 2012; and thus, educational multimedia content and software that could be used in every course at primary, middle and high schools were developed and provided to the teachers and students via this portal (Aktay & Keskin, 2016). On the other hand, the teacher training program curricula were structured to reflect these developments in Turkey.

Teachers are trained in faculties of education in Turkey. Thus, individuals who want to be trained as teachers, should take the university admission exam and score adequate points for admission to a faculty of education. During the four-year undergraduate education, pre-service teachers take various theoretical and applied courses based on their department, vocational and general culture courses in faculties of education (Cengiz, 2019). Furthermore, pre-service teachers take teaching practicum course for teaching experience (Kırçiçek & Yüksel, 2019). At the end of the four-year undergraduate education, pre-service teachers graduate as teachers. In Turkey, the teacher training curricula include "Computer I", "Computer II", "Information Technology" courses to improve pre-service teachers' computer skills. Although high school curricula include courses that aim to develop computer skills, it is important to renew and improve these skills in teacher training. Furthermore, the teacher training curricula include the "Instructional Technology" course to improve the competence of the pre-service teachers in the active use of instructional technologies and implementation of computer-assisted education in Turkey (İlic, 2019; The Council of Higher Education, 2018). These courses aim to improve the readiness of pre-service teachers for instruction in technology-supported educational environments.

Several studies in the literature investigated the current skills of pre-service teachers in computer-assisted education and their competence in maintaining cyber security (Al Shamsi, 2019; Musmar, 2018; Teotia, 2019; Yazlık, 2019; Yerby & Floyd, 2018). These studies investigated the impact of computer-assisted education on academic achievements in various courses such as English, mathematics, and biology, and its contribution to the development of various literacy skills (Habib, Mustapha, & Ali, 2019; Kutluca, 2019; Musmar, 2018; Teotia, 2019). It was reported in these studies that computer-assisted education had positive effects, it improved students' academic achievements in mathematics and biology and their reading skills in English. Similarly, Prabhu and Subramonian (2018) reported that computer-assisted instruction was an effective instructional method and it should be adopted to improve the quality of instruction.

Furthermore, Adıyaman and Sert (2018) investigated the computer self-efficacy perceptions of pre-service science teachers and their attitudes towards computer-aided education. In the study, it was determined that the attitudes and self-efficacy perceptions of pre-service science teachers towards computer-aided education were

positive and a positive correlation was determined between the attitudes of pre-service science teachers towards computer-aided education and their self-efficacy perceptions. Also, Celik and Yesilyurt (2013) reported that attitude towards technology, perceived computer self-efficacy and computer anxiety were important predictors of pre-service teachers' attitudes towards computer-assisted education. Similarly, Yeşilyurt, Ulaş and Akan (2016) expressed that teacher self-efficacy, academic self-efficacy, and computer self-efficacy were significant predictors of teachers' attitudes towards applying computer-supported education. Furthermore, Karakuş-Tayşi (2019) revealed that the use of computer-assisted material had a positive effect on the attitudes of secondary school students towards the Turkish language course. Also, Yazlık (2019) determined that secondary school mathematics teachers think considered it necessary to use information and communication technologies in mathematics instruction due to its benefits such as the concretization of mathematical concepts, active participation, facilitating learning, providing permanent learning, facilitating solutions for questions and making the lesson fun. On the other hand, Ok, Bryant and Bryant (2020) stated that well designed computer-assisted instruction offers educational advantages; however, it could lead to failure without sufficient support and careful strategic planning.

Various studies in the literature investigated cyber security in education (Cameron & Marcum, 2019; Jin, Tu, Kim, Heffron, & White, 2018; Rahman, Sairi, Zizi, & Khalid, 2020). In these studies, it was revealed that the game-based cyber security training approach was effective in improving the computer security skills and awareness of students (Alqahtani & Kavakli-Thorne 2020; Jin, Nakayama, & Tu, 2020). Furthermore, Syamsuddin (2019) designed a virtual laboratory and trained students on cyber security. The study results demonstrated that virtual laboratory training was effective and inexpensive. Certain studies reported that m-learning and e-learning applications provided interactive learning opportunities independent of time and place in higher education; however, lecturers and students did not know how to prevent possible security threats in these platforms. (Adejo, Ewuzie, Usoro, & Connolly, 2018; Elsawy & Ahmed, 2019; Korać, Damjanović, & Simić, 2020). Furthermore, certain studies that investigated the current status of cyber security training and compared the current status with cyber security objectives determined the current status of students, teachers and lecturers on cyber security at different educational institutions including primary, secondary and tertiary schools (Al Shamsi, 2019; Pencheva, Hallett, & Rashid, 2020; Yerby & Floyd, 2018). These studies reported that the cyber security skills of students, teachers and lecturers were not adequate, and they should be supported to improve their competencies.

Although there are several studies on computer-assisted education and cyber security in literature, no study that investigated the associated competencies of pre-service teachers and the correlation between these skills. Thus, the theoretical structure of the present study was based on Maslow's hierarchy of needs theory. Maslow (1943) categorized individuals' needs within a hierarchy. According to Maslow, individuals' needs included physiological needs, safety needs, social belonging, self-esteem, self-actualization. In this hierarchical order, when the individual cannot fully satisfy her or his needs in a category, he/she cannot move to a higher-level category (Maslow, Frager, & Fadiman, 1987). Thus, the individual who cannot meet the security requirement could not satisfy his/her higher needs such as education. Therefore, it is important to determine whether the cyber security needs of individuals have an impact on their attitudes towards technology-assisted education approaches. Thus, the present study aimed to determine the impact of the personal cyber security skills of pre-service teachers on their attitudes towards computer-assisted education. In this context, the following research questions were determined:

1) What are the personal cyber security scores of pre-service teachers and their attitude scores towards conducting computer-assisted education?
2) Based on personal computer ownership of pre-service teachers,
   a) Is there a difference between their personal cyber security scores?
   b) Is there a difference between their attitude scores towards conducting computer-assisted education?
3) Based on the educational departments of the pre-service teachers,
   a) Is there a difference between their personal cyber security scores?
   b) Is there a difference between their attitude scores towards conducting computer-assisted education?
4) Are there significant correlations between the attitude scores towards conducting computer-assisted education and personal cyber security subdimension scores?
5) Is the personal cyber security score a significant predictor of the attitude score towards conducting computer-assisted education?

It is thought that the present study findings will shed light on planning and application activities that aim to improve the quality of teacher training.

Method

Research Model

The present study was designed as a predictive correlational study based on the research objectives. The purpose of the predictive research design is to identify the variables that would predict an outcome or criterion (Creswell, 2012). Thus, the current study aimed to determine whether pre-service teachers' cyber security scores predicted their attitudes towards computer-assisted education. In the study, two quantitative variables were determined, data were collected with two scales, correlation and regression analyzes were conducted, the findings, interpretations and conclusions based on these findings were reported (Creswell, 2012).

The Study Group

In the study, the criterion sampling and convenience sampling methods were used to assign the participants. Thus, the four inclusion criteria were determined. These included attendance in the senior class at Manisa Celal Bayar University, Faculty of Education during the 2019-2020 academic year fall semester, attendance in the computer course, and attendance in different departments that admit students with different types of achievement scores in the university admission exam. Furthermore, due to the convenience sampling method, students attending easily accessible departments were selected. Thus, the study group included 251 pre-service teachers attending Teacher Training in Social Studies, Primary School Level and Sciences departments. The study was conducted with senior year pre-service teachers since they were the group closest to graduation. Furthermore, the Department of Teacher Training in Social Studies admits students with higher weighed verbal skill scores, the Department of Teacher Training at Primary School Level admits students with higher balanced numerical and verbal skills scores, and Teacher Training in Sciences Department admits students with higher numerical skill scores. Furthermore, all participants had taken Computer I, Computer II and Instructional Technology courses, which are compulsory in the teacher training curricula in Turkey. The above-mentioned courses include the instruction of both theoretical and practical knowledge and are offered four hours per week in different semesters. In the Computer I course, the students learn about computer hardware, software, operating systems, computer networks and internet, digital data security, Microsoft Windows and Microsoft Word. Also, the participants are trained in Microsoft Excel, Microsoft PowerPoint, Movie Maker, Google Drive, Google Sites and email in the Computer II course. The students learn about educational material design, computer-assisted education, courseware, distance education in the Instructional Technology course.

All attending students were invited to participate in the study since it was possible to reach all pre-service teachers included in the target population. No feedback was received from six participants in the study group during the data collection process. Furthermore, during the development of the analysis data set, four participants were excluded from the data set since the data provided by these participants were considered as outliers. Thus, the present study was carried out with 241 pre-service teachers. The demographical distribution of participating pre-service teachers based on their departments, gender, age and personal computer (PC) ownership as determined with descriptive statistics are presented in Table 1.

Table 1. Participant Demographics

Department	*f*	%	Age	*f*	%
Teacher Training in Social Studies	83	34.40	21	15	6.22
Teacher Training at Primary School Level	80	33.20	22	154	63.90
Teacher Training in Sciences	78	32.40	23	72	29.88
Gender	*f*	%	PC Ownership	*f*	%
Male	84	34.85	Yes	188	78.00
Female	157	65.15	No	53	22.00
Total	241	100.00	Total	241	100.00

Based on Table 1, it could be suggested that the distribution of the participants based on their department was similar. Furthermore, it was observed that more than half of the participants in the study group were female students (65.15%). Besides, it was determined that the age of the participants varied between 21 and 23 and most participants owned a personal computer (78.00%). Pallant (2007) reports that at least 40 participants are required per predictor variable in regression analysis, while Tabachnick and Fidell (2013) suggest that the minimum number of individuals in the study group should be calculated with the formula $N > 50 + 8m$, where m is the number of independent predictor variables. Based on these specifications, it could be argued that the number of participants in the present research that included a single predictor variable is adequate.

Data Collection Instruments

In the present study, the data were collected with a personal information form and two scales. The personal information form developed by the author included open-ended questions and it aimed to determine the gender, age, department, and personal computer ownership of the participants. "Personal Cybersecurity Provision Scale" (PCSPS) developed by Erol, Şahin, Yılmaz, and Haseski (2015) was used to determine the personal cyber security provision levels of pre-service teachers (see Appendix). The scale was preferred since it served the purpose of the study and was a measurement instrument with confirmed validity and reliability. PCSPS is a 5-point Likert type scale that explains 48% of the total variance and includes 25 items under 5 factors. Furthermore, there are 10 reverse items on the scale. Cronbach's alpha coefficients were calculated for of PCSPS in the present study and during the scale development study and are presented in Table 2. Based on the findings presented in Table 2, it could be suggested that the data collection instrument was generally reliable (DeVellis, 2012; Taber, 2018).

Table 2. PCSPS Cronbach's Alpha Coefficients

PCSPS	Current Study	PCSPS Development Study*
Subdimensions		
Protecting Privacy	.750	.763
Avoiding the Untrusted	.769	.701
Precaution	.700	.704
Protection of Payment Information	.815	.829
Leaving No Trace	.551	.557
General	.731	.735

*(Erol et al., 2015).

In the present study, "The Attitude Towards Conducting Computer-Assisted Education Scale" (ATCCAES) developed by Arslan (2006) was used to determine the attitudes of pre-service teachers towards computer-assisted education (see Appendix). The scale was selected since it is a valid and reliable data collection instrument and was adequate for the aim of the present study. ATCCAES is a 5-point Likert type measurement instrument that includes 20 items in a single factor that explained 33% of the total variance. There are 10 positive items and 10 negative items on the scale. The internal consistency coefficient (Cronbach's Alpha) is .930 for the ATCCAES (Arslan, 2006). It was also determined that the Cronbach's alpha reliability coefficient for ATCCAES was .871. It could be suggested that the scale is a highly reliable data collection instrument (Kline, 2000; Taber, 2018).

Data Collection and Analysis

The data were collected personally by the author. The author reached the pre-service teachers in the study group and explained the aim, content and confidentiality principles of the study. Furthermore, individual informed consent forms were signed by the pre-service teachers stating that their participation in the study was voluntary. Thus, the participants were encouraged to respond to the data collection tool sincerely and they were prepared to contribute to the study. Then, data collection instruments were presented to pre-service teachers in printed form. The above-mentioned data collection process was conducted within three weeks, aiming to reach the maximum number of participants.

The data collected in the study were transferred to the SPSS 25 statistical analysis software by the author. Then, the responses given to the reverse and negative items in both data collection instruments were coded in reverse. After this process, the missing data in the data set were investigated. It was determined that the rate of missing data was less than 5% of the whole data set and the missing data were completed using the arithmetic averages of the associated items (Scheffer, 2002).

In the next step, the arithmetic means of the participant scores for PCSPS and ATCCAES were calculated with the statistical analysis software. Then, to check and determine dataset outliers, the mean score of each participant in the scales was converted to standard Z scores. Thus, the analysis demonstrated that Z scores of four participants were out of the -3 and +3 score range (Mertler & Reinhart, 2016) and were excluded from the data set. After this process, the normality statistics of the data collection instruments were calculated and the results are presented in Table 3.

Table 3. PCSPS and ATCCAES Statistics

Data Collection Instrument	n	Min	Max	$\bar{X}$	SD	Skewness	Kurtosis
PCSPS	241	2.88	4.68	3.81	.38	-.359	-.263
ATCCAES	241	3.00	4.85	4.15	.39	-.241	-.227

In addition to the total scale score statistics presented in Table 3, normality statistics (Skewness (S) and Kurtosis (K)) were calculated for PCSPS subdimensions. Thus, the normal distribution for Protecting Privacy (S = -.522, K = .074), Avoiding the Untrusted (S = -1.287, K = 1.466), Precaution (S = -.500, K = .568), Protecting Payment Information (S = -1.072, K = 1.061) and Leaving No Trace (S = -.388, K = .336) subdimension scores were analyzed. In the literature, George and Mallery (2010) reported that Skewness and Kurtosis values should be between -2 and +2 for normal distribution. Furthermore, Hair, Black, Babin, and Anderson (2014) and Byrne (2016) reported that Skewness should be between -2 and +2, and Kurtosis should be between -7 and +7 for normal distribution. It could be suggested that the total mean PCSPS and ATCCAES scores and PCSPS subdimension scores of the participants exhibited normal distribution. Several parametric analyses were conducted at .05 significance level with the statistics software to respond to the research questions. Thus, the analyses conducted for each research question are listed in Table 4.

Table 4. The Analyses Conducted for Each Research Problem

Research Question	Analysis
1st Research Question	Descriptive Statistics
2nd Research Question	Independent Samples t-test
3rd Research Question	One-way ANOVA
4th Research Question	Pearson Correlation
5th Research Question	Simple Linear Regression

The results of the analyses conducted for each research question listed in Table 4 are presented in the findings section.

Results

ATCCAES and PCSPS Scores of the Participants

In line with the first research question, ATCCAES and PCSPS scores of the participants were calculated and the results are presented in Table 5.

Table 5. The Mean Scores of the Participants in the Study Scales

Department	ATCCAES	PCSPS	PCSPS Subdimension Scores				
			Protecting Privacy	Avoiding the Untrusted	Precaution	Protection of Payment Information	Leaving No Trace
1	4.19	3.78	3.70	4.23	3.54	4.05	3.73
2	4.04	3.71	3.54	4.10	3.57	3.88	3.83
3	4.24	3.95	3.78	4.43	3.83	4.11	3.97
Total	4.15	3.81	3.67	4.25	3.65	4.01	3.84

1= Teacher Training in Social Studies, 2= Teacher Training at Primary School Level, 3= Teacher Training in Sciences

The findings presented in Table 5 demonstrated that the participants with the highest ATCCAES mean score was from the Department of Teacher Training in Sciences ($\bar{x}$ = 4.24). Furthermore, these participants were followed by the participants from the Teacher Training in Social Studies Department ($\bar{x}$ = 4.19) and the participants from the Department of Teacher Training at Primary School Level ($\bar{x}$ = 4.04), respectively. It could be suggested that all participants had positive attitudes towards conducting computer-assisted education since the participant scores were above 4.00.

The analysis of the PCSPS scores of the participants demonstrated that the mean score of the participants from the Department of Teacher Training in Sciences was the highest ($\bar{X}$ = 3.95). This department was followed by the participants from the Department of Teacher Training in Social Studies ($\bar{X}$ = 3.78) and the participants from the Department of Teacher Training at Primary School Level ($\bar{X}$ = 3.71), respectively. Furthermore, it was determined that the participants had the highest scores in PCSPS subdimensions "Avoiding the Untrusted" and "Protecting Payment Information", respectively. It was suggested that this was due to the security priorities of the participants based on their habits in the virtual environment. Furthermore, although the scale scores of the participants in cyber security provision were above the 5-point Likert scale median, it could be suggested that they should improve themselves in this regard.

The Scale Scores Based on Personal Computer Ownership

On the second research question, the results of the independent-samples t-test, which was conducted to determine the differences between the participant scores in PCSPS based on personal computer ownership, are presented in Table 6.

Table 6. PCSPS Scores Based on Personal Computer Ownership

Group	n	$\bar{X}$	SD	df	t	p
Personal computer owners	188	3.84	.36	239	2.567	.011
Those without a personal computer	53	3.69	.44			

The findings presented in Table 6 demonstrated that the participants who owned a personal computer were more successful in personal cyber security provision ($t_{(239)}$ = 2.567; p<.05). It was suggested that this was due to the fact that these students had the opportunity to spend more time with the computer, which allowed them to be experienced in taking precautions against possible security risks. The results of the independent samples t-test conducted to determine the differences between ATCCAES scores of the participants based on personal computer ownership are presented in Table 7 within the scope of the second research question.

Table 7. ATCCAES Scores Based on Personal Computer Ownership

Group	n	$\bar{X}$	SD	df	t	p
Personal computer owners	188	4.19	.39	239	2.785	.006
Those without a personal computer	53	4.02	.38			

The findings presented in Table 7 indicated that the attitudes of the participants with personal computers towards computer-assisted education were statistically significantly higher ($t_{(239)}$ = 2.785; p<.05). It was considered that this was due to the fact that the personal computer owners had better opportunities to use this technology for educational purposes.

The Scale Scores Based on the Departments

On the third research question, the results of the One-Way ANOVA and Tukey Test conducted to determine the difference between the PCSPS scores of the participants based on their department are presented in Table 8.

Table 8. ANOVA Results on the PCSPS Scores Based on the Student Department

	Source of Variance	Sum of Squares	df	Mean Square	F	p	Significant Difference (Tukey)
PCSPS	Between Groups	2.440	2	1.220	8.759	<.001	3 > 1
	Within Groups	33.149	238	.139			3 > 2
	Total	35.589	240				

1= Teacher Training in Social Studies, 2= Teacher Training at Primary School Level, 3= Teacher Training in Sciences

As seen in Table 8, the mean PCSPS score of the participants in the Department of Teacher Training in Sciences ($\bar{x}$ = 3.95) was higher when compared to the mean scores of both the participants in the Department of Social Teacher Training in Sciences ($\bar{X}$ = 3.78) and the participants in the Department of Teacher Training at Primary School Level ($\bar{X}$ = 3.71) ($F_{(2, 238)}$ = 8.759; p<.05). It was suggested that this was due to the fact that the participants in the Teacher Training in Sciences department were more familiar with digital technologies and spend more time on these technologies due to their discipline area; and thus, they had more experience in cyber

security. The results of the One-Way ANOVA and Tukey Tests conducted to determine whether the student department led to differences between ATCCAES scores of the participants within the context of the third research question are presented in Table 9.

Table 9. ANOVA Results on the ATCCAES Scores Based on the Student Department

	Source of Variance	Sum of Squares	df	Mean Square	F	p	Significant Difference (Tukey)
ATCCAES	Between Groups	1.722	2	.861	5.707	.004	1 > 2
	Within Groups	35.898	238	.151			3 > 2
	Total	37.620	240				

1= Teacher Training in Social Studies, 2= Teacher Training at Primary School Level, 3= Teacher Training in Sciences

The findings presented in Table 9 revealed that the ATCCAES scores of the participants in the Department of Teacher Training in Sciences ($\bar{X}$ = 4.24) and the Department of Teacher Training in Social Studies ($\bar{X}$ = 4.19) were higher when compared to those of the participants in the Department of Teacher Training at Primary School Level ($\bar{X}$ = 4.04) ($F_{(2,\ 238)}$ = 5.707; p<.05). It was suggested the difference was due to the higher requirement for computer assistance in the fields of science and social sciences to present the topics or the encouragement of these participants by faculty members to utilize computer-assisted education.

The Correlations Between ATCCAES and PCSPS Subdimensions

On the fourth research question, Pearson Correlation analysis was conducted to determine the correlations between the ATCCAES and PCSPS subdimensions and the results are presented in Table 10.

Table 10. Pearson Correlations Between the ATCCAES and PCSPS Subdimensions

	PCSPS Subdimensions				
	Protecting Privacy	Avoiding the Untrusted	Precaution	Protection of Payment Information	Leaving No Trace
ATCCAES	.185*	.241*	.276*	.283*	.265*

* p<.01

The findings presented in Table 10 demonstrated that there were statistically significant and weak positive correlations between ATCCAES scores of the participants and their PCSPS subdimension scores (Hemphill, 2003; Miles & Banyard, 2007).

Personal Cyber Security Provision Skill as a Predictor of Attitude towards Computer-Assisted Education

Within the context of the fifth research question, Simple Linear Regression analysis was conducted to determine whether the PCSPS score was a significant predictor of the ATCCAES score. The model achieved with this analysis is presented in Table 11.

Table 11. The Summary of the Simple Linear Regression Model

				Overall Model Test			
Model	R	R^2	Adjusted R^2	F	df1	df2	p
1	.419	.176	.172	51.018	1	239	<.001

The findings presented in Table 11 demonstrated that the regression model was statistically significant. Thus, it was determined that the level of personal cyber security provision explained 17% of the variance in attitudes towards computer-assisted education (R^2 = .176; $F_{(1.239)}$ = 51.018; p<.05). It was suggested that this was due to the fact that personal cyber security provision skill is among the basic competencies that individuals need to conduct active computer-assisted education. The model coefficients obtained with the conducted analysis are listed in Table 12.

Table 12. Simple Linear Regression Coefficients

		B	Std. Error	Beta	t	p
Model	Constant	2.511	.231		10.854	<.001
1	Cyber security score	.431	.060	.419	7.143	<.001

The simple linear regression equation achieved based on the values presented in Table 12 could be expressed as Attitude Towards Computer-Assisted Education score = 2.511 + .431 x Personal Cyber Security Provision score.

Discussion and Conclusion

The present study aimed to determine the impact of the personal cyber security provision skills of pre-service teachers on their attitudes towards computer-assisted education. Thus, it was designed as a correlational study, and in this context, two scales were applied to 241 senior pre-service teachers attending Manisa Celal Bayar University, Faculty of Education in Turkey. The data collected within the scope of the research were analyzed and various results were obtained. It is considered that the study findings will contribute to future researchers, practitioners and decision-makers to acquire an in-depth understanding of the subject.

Despite the fact that the study results were interesting, the present study had certain limitations. It is necessary to consider these limitations when assessing the study findings. The study data were limited by the employed measurement instruments. Furthermore, the underlying research design, the participants, and the quality of the computer education instruction at the faculty where the study was conducted were the additional limitations of the study. In addition, the sampling methods used in research could be considered as another limitation of the study. Thus, the determination of the participants with the criterion sampling method was limited by the selection criteria, and the convenience sampling method has limitations in the representation of the population. Also, the selection of all participants from the same educational institution was among the limitations of the research.

Similar to previous study findings in the literature, it was determined that both the personal cyber security scores of pre-service teachers and their attitudes towards computer-assisted education differed based on their departments in the study (Yaylak, 2019; Yiğit & Seferoğlu, 2019). Furthermore, it was observed that the attitudes of the pre-service teachers towards computer-assisted education were positive. In similar studies, it was determined that pre-service teachers had positive views and attitudes towards the use of information and communication technologies in education (Duru, Peker, & Birgin, 2012; Ilhan, 2014; Yılmaz & Alıcı, 2011). It could be suggested that this was due to the fact that pre-service teachers thought that technology use was important in education, due to the impact of the courses offered on the use of information and communication technologies in education, and the encouragement of the faculty members on the subject. On the other hand, field-specific instructional applications could be conducted to improve the attitudes of pre-service teachers and to close the gap between the departments. Furthermore, it was determined that the personal cyber security provision scores of the pre-service teachers differed based on their department and were slightly above average. The studies on the current cyber security provision levels of college students and pre-service teachers reported contradicting findings. In most studies on the topic, it was reported that the cyber security provision skills, awareness and knowledge of pre-service teachers and college students were not adequate (Akgün & Topal, 2015; Aksoğan, Bayer, Gülada, & Çelik, 2018; Çakır, Hava, Gülen, & Özüdoğru, 2015; Gökmen & Akgün, 2015; Topal, Geçer, Akkaya, Güzel, & Of, 2019). Furthermore, Subramaniam (2017) determined that the cyber security awareness of college students was at a moderate level. On the other hand, Karacı, Akyüz, and Bilgici (2017) reported that students in computer education-oriented undergraduate programs such as Computer Engineering and Computer Education and Instructional Technology Department in the faculty of education exhibited high levels of personal cyber security provision. The reason for this difference might be due to the factors determined by the data collection tools utilized in the measurement of variables and the limitations of the sampling methods. Furthermore, the difference might be due to the professional qualifications of various instructors who lectured the computer courses and instructional technology courses in different departments in the faculty of education. Based on the present study and previous research findings, further studies on different samples and contexts that would investigate the current levels of pre-service teachers on cybersecurity could be suggested. Furthermore, it was determined that avoiding the untrusted and protecting payment information subdimension scores of the pre-service teachers were relatively higher. On the other hand, it was also determined that not leaving a trace, personal privacy and precaution subdimension scores were relatively low. It was suggested that this was due to the fact that pre-service teachers prioritized security in the activities that they conducted the most in virtual environments. Similarly, Yiğit and Seferoğlu (2019) reported that college students prioritized protecting their payment information and avoiding the untrusted sites in personal cyber security provision, followed by not leaving a trace, personal privacy, and precaution subdimensions. Furthermore, considering that the personal cyber security provision skills are indispensable for individuals (Bodea, Dascalu, & Cazacu, 2019; Neumann, 2017), it could be suggested that pre-service teachers' training was not adequate for

the improvement of knowledge and skills on the topic and they should be supported to improve their cyber security skills.

It was determined that pre-service teachers who owned personal computers had higher personal cyber security skills and attitudes towards computer-assisted education. Similarly, in previous studies, it was reported that individuals who owned personal computers exhibited better attitudes towards educational computer use and higher digital security skills (Akgün & Topal, 2015; Chiua & Hob, 2019; Gökal, Sönmez, & Ercan, 2019; Rahimi, 2011). It was suggested that this was due to the fact that personal computer ownership contributed to spending more time with related technologies, increasing the knowledge and skills on the topic and contributing the development of a positive attitude. On the other hand, it could be suggested that the relatively higher attitudes of the pre-service teachers who owned and did not own a personal computer towards computer-assisted education could be associated with the availability of courses on the educational use of information and communication technologies in the teacher training process and the encouragement of the faculty members to use computer-assisted education. On personal cyber security provision, it was considered that adequate training was not provided for pre-service teachers and the related skills of pre-service teachers should be improved, even the skills of those who owned a personal computer.

It was determined that the personal cyber security skills of the pre-service teachers in the Department of Teacher Training in Sciences were higher when compared to the other pre-service teachers. This could be explained by the consistency of the required skills with their field of study or the support and incentives of the faculty members in this department on technology use. Furthermore, the reason for this difference could be due to the extensive personal experiences of the pre-service teachers in cyber security in their personal lives or the limitations of sampling method employed in the study. Previous studies reported that the information communication technologies and cyberbullying perception scores of the pre-service teachers in Teacher Training in Science department were relatively higher when compared to those in Teacher Training in Social Studies and Teacher Training at Primary School Level departments and their digital literacy skills were adequate in general (İnam & Öztürk, 2018; Şad & Nalçacı, 2015; Üstündağ, Güneş, & Bahçivan, 2017) and it could be argued that the related findings of the present study were consistent with previous study results. Furthermore, it was determined that the attitudes of the pre-service teachers in Teacher Training in Science department and Teacher Training in Social Studies towards computer-assisted education were higher when compared to the pre-service teachers in Teacher Training at Primary School Level. Previous studies reported differences between departments in attitudes towards computer-assisted education; however, it was also reported that pre-service science teachers, pre-service social studies teachers, and pre-service primary school teachers exhibited positive attitudes towards computer-assisted education (Arslan, 2008; Baturay, Gökçearslan, & Ke, 2017; Berkant, 2013; Duru et al., 2012; Topkaya, Tangülü, Yılar, & Şimşek, 2015). On the other hand, it was suggested that further studies should be conducted on attitudes towards computer-assisted education to determine the reasons for the differences between the departments and to acquire a more comprehensive idea on the topic. Considering the limitations of this study, future research could collect data from pre-service teachers attending different departments in different faculties of education, utilize different data collection instruments to measure the same variables.

Weak and positive correlations were determined between the attitudes of pre-service teachers towards computer-assisted education and personal cyber security competency subdimension scores. It was also determined that the personal cyber security provision skill was a significant predictor of attitudes towards computer-assisted education. This study finding was significant in the contribution of the present study to the literature. It was suggested that this was due to the fact that the safety requirement is considered as one of the basic individual needs and it is an indispensable method to fulfill high-level requirements such as education (Maslow, Frager, & Fadiman, 1987). Thus, it is considered that individuals tend to develop a positive attitude towards computer-assisted education based on the feeling of security in the virtual environment. Accordingly, in the faculty of education where the present study was conducted, courses on personal cyber security should be provided for pre-service teachers in addition to the activities and courses conducted to improve their competencies in computer use and computer-assisted education.

Recommendations

Further studies could be conducted on the topic based on the limitations of the present study. Accordingly,

1) Similar studies could be conducted in different faculties of education and with pre-service teachers attending different departments.

2) Future studies could be conducted with pre-service teachers at different grade levels. Thus, pre-service teachers' cyber security skills and their attitudes towards computer-assisted education could be determined for different seniority levels.
3) Similar studies could be carried out using different data collection tools developed to determine the level of cyber security and to measure the attitudes towards computer-assisted education, allowing the comparison of the findings.
4) Future empirical studies could be conducted to investigate the impact of cyber security skills on computer-assisted education in more detail by controlling the variables such as the education conditions and the prior-knowledge of pre-service teachers about cyber security and computer-assisted education.
5) Future qualitative research could be conducted to determine the views of pre-service teachers on their current competencies, problems and requirements associated with cyber security and computer-assisted education.
6) Future action research could be designed to improve the current levels of pre-service teachers in cyber security and computer-assisted education.

In case the findings of future studies would support the findings of the present study, an action plan could be developed to improve pre-service teachers' cyber security skills. Thus, a team of field experts and curriculum development specialists could review the content of the current computer courses in the teacher training program based on cyber security content. Furthermore, experts could conduct surveys to determine the current status and cyber security needs of pre-service teachers. Based on the existing computer course content and pre-service teachers' associated needs, computer course content could be improved in terms of cyber security. The effectiveness of the updated computer course content could be tested in selected faculties of education in Turkey in a pilot study. Based on the pilot study findings, the course content could be revised and the revisions could be implemented in all education faculties in Turkey. Furthermore, if deemed necessary, a new course on cyber security could be developed with a similar systematic and included as a compulsory course in education faculty curricula.

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Appendix. Data Collection Instruments

1. Personal Cyber Security Provision Scale (PCSPS)

	1-Never	2-Rarely	3-Sometimes	4-Often	5-Always
1. I check connection security (https://) and certificates on web pages.					
2. I update the software that I use.					
3. I have antivirus software on my computer.					
4. I avoid using weak passwords.					
5. I make sure all my internet passwords are the same.					
6. I change web browser security settings.					
7. I reply to authentication messages (requests such as username, password, etc.) received by e-mail.					
8. I pay attention not to store my personal information on computers other than my personal computer.					
9. I ignore online money and credit requests.					
10. I do not accept friendship requests from people I do not know on social networks.					
11. I do not subscribe to websites that I do not trust.					
12. I communicate with people I don't know using a webcam.					
13. I share my personal information (Identity no, Date of birth, GSM no, etc.) on the internet, when necessary.					
14. I delete web browser history.					
15. I conduct internet banking transactions using my personal computer.					
16. I shop online using my personal computer.					
17. I open email attachments from people who I do not know.					
18. I share my personal information on social networks.					
19. I declare my location on the internet.					
20. I shop by clicking the ads on social networks.					
21. I log out of my accounts such as social media, e-mail when I finish my work.					
22. I do not download files from websites that I do not trust.					
23. I change the passwords that I use on the internet.					
24. I set easy to remember passwords.					
25. I respect and respond to e-mails (requests such as card numbers, passwords, etc.) from sites such as banks, online shopping sites, etc.					

2. The Attitude towards Conducting Computer-Assisted Education Scale (ATCCAES)

	1- Strongly Disagree	2- Disagree	3- Neither Agree nor Disagree	4- Agree	5- Strongly Agree
1. Computers cannot be used effectively in education.					
2. I use the computer willingly and fondly in courses.					
3. Unless compulsory, I do not use the computer to support instruction.					
4. Computer-assisted education is important to me.					
5. Students cannot improve their creativity in courses instructed with computer-assisted education.					
6. I look for ways to use the computer more effectively in courses.					
7. I cannot associate education with computers.					
8. Students learn better using their computer in courses.					
9. I do not conduct computer-assisted instruction.					
10. Teachers should be encouraged to use computers.					
11. Computer-assisted education is a waste of time.					
12. Computers are effective tools that attract student interest.					
13. Students learn less in computer-assisted education when compared to other methods and techniques.					
14. Classes are fun when computers are used.					
15. The benefits of computer-assisted education do not worth the effort.					
16. Computers should be actively used in every course.					
17. I do not intend to use computers in instruction.					
18. I think the computer is an effective instructional tool.					
19. I want to stop using the computer as soon as possible.					
20. I try to use the computer in my courses.					