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Teacher self-efficacy, academic self-efficacy, and computer self-efficacy as predictors of attitude toward applying computer-supported education

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ABSTRACT

There is a large body of research regarding teacher self-efficacy, academic self-efficacy, computer self-efficacy, and attitude toward applying computer-supported education of teachers and prospective teachers. However, no study has been conducted on the correlation among the effects of teacher self-efficacy, academic self-efficacy, computer self-efficacy, and attitude toward applying computer-supported education and which additionally explains their relationships to one other. This research is conducted in order to test the effect levels among the latent variables of teacher self-efficacy, academic self-efficacy, computer self-efficacy, and attitude toward applying computer-supported education and these latent variables' ratios to each other. For this, eight hypotheses were developed in light of theoretical information by reviewing the literature. This research is done by using Academic Self-Efficacy Scale, Teacher Self-Efficacy Scale, Computer Self-Efficacy Scale, and The Attitude Scale Toward Applying Computer-Supported Education. The participant group of the research consists of 323 prospective teachers. Exploratory factor analyses of scales were analyzed via SPSS 16.0 software. For the confirmatory factor analyses of scales and the structural equation modeling, AMOS 20.0 software was used. The most significant finding of this study is that teacher self-efficacy, academic self-efficacy, and computer self-efficacy are important predictors of prospective teachers' attitude toward applying computer-supported education.

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1. Introduction

Today, the individual qualities needed by societies has changed. The changes and developments in education, science and technology constitute the main reason for this situation. One of the most important outcomes of development taking place in technology is the computer as well. As to the computer, on the one hand, it transforms into a more functional structure inspired by science, while on the other hand it provides speed and other contributions to the development of science. As an expected result of this situation, the computer has begun to be used in industrial, medical, military, agriculture, engineering, and every other area of life. One of the most important computer usage areas is education. Through the use of computer in education, the concept of "computer-supported education" has been replaced in the literature. The philosophy of progressivism, lifelong learning, student-centered approach, distance learning, constructivist theory etc. which are the important elements of today's education system bring the importance of computer-supported education and function to the forefront.

Alessi and Trollip (2001) arrange in order the most important benefits of computer-supported education as; increasing the quality of teaching, overcoming the problem of time, presenting the content in different formats, the creation of flexible learning environments and increasing the academic achievement of students. Indeed, many studies conducted on the subject have revealed that computer-supported education improves students' academic achievement (Cavanaugh, 2001; Demir & Basol, 2014; Dockery, 2006; Drost, 2002; Li & Ma, 2010; Liao, 2007; Shachar, 2002; Tienken & Wilson, 2007; Wong, 2001; Zhou et al., 2005). It has been found that computer-supported education has not had a

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significant impact on students' academic achievement; however, as a result of some research even if only a small number of studies (Palmer, 2009; Papanastasiou, Zemblyas, & Vrasidas, 2003; Steele, Battista, & Krockover, 1983). It was found from researches conducted on the subject that the most important determinant why teachers apply computer-supported education is the training and attitude that they have received in computer technology (Dupagne & Krendi, 1992; Torkzadeh, Pflughoeft, & Hall, 1999).

When the person wants to reveal his knowledge, faiths and beliefs, he makes it clear with his behaviors. The skills of the person by creating an integrated structure determine the tendency to behave in a specific manner, in other words they determine the attitude. When considered from this point of view, the belief, self-efficacy and attitude are directly or indirectly related to each other (Demirtas, Comert, & Ozer, 2011). Indeed, the studies that have examined the relationship between self-efficacy and attitude reveal that there is a positive relationship between self-efficacy and positive attitude (Li, 2012; Sarikaya, 2004). On the other hand, it was revealed among the results of the studies conducted by Ozkal (2013) and Tarkin and Uzuntiryaki (2012) that self-efficacy strongly predicts the attitude, to increase self-efficacy level is also increasing positive attitudes, the high self-efficacy contributes to exhibit positive attitude. The concepts of self-efficacy and attitude both affect each other and are influenced by each other (Akay & Boz, 2011; Bandura, 1997; Kutluca & Ekici, 2010; Perepiczka, Chandler, & Becerra, 2011; Saracaloglu, Yenice, & Ozden, 2013; Sezgin, 2013). Based on these studies, it can be said that academic self-efficacy, teacher self-efficacy, and computer self-efficacy are important predictors of the attitude toward computer-assisted learning and they affect the attitude toward computer assisted learning in a positive and significant way.

1.1. The research questions

The purpose of this study was to determine the teacher self-efficacy, academic self-efficacy, and computer self-efficacy as predictors of attitude toward applying computer-supported education. Therefore, the research questions that focus our study are:

RQ1. Do the teacher and computer self-efficacy together affect attitude toward applying computer-supported education?

RQ2. Do the teacher and academic self-efficacy together affect attitude toward applying computer-supported education?

RQ3. Do the teacher, academic, and computer self-efficacy together explain attitude toward applying computer-supported education?

1.2. Importance of the study

Computer-supported education and online learning (eLearning) have become a global phenomenon as many educational institutions worldwide have entered the field in an attempt to enhance the students' experience of learning. While numerous studies have focused on the effectiveness and benefits of eLearning, few have focused on understanding and measuring the user experience and relating this to the actual student usage of the eLearning system (Davis & Wong, 2007). On the other hand, there are many studies regarding academic self-efficacy, teacher self-efficacy, computer self-efficacy, and the attitude toward applying computer-supported education of teachers and prospective teachers (teacher candidates/pre-service teachers) (Arastaman, 2013; Becker & Maunsaiyat, 2002; Caprara, Barbaranelli, Steca, & Malone, 2006; Celik & Yesilyurt, 2013; Chemers, Hu, & Garcia, 2001; Erdem, 2015; Eroglu & Unlu, 2015; Frantom, Green, & Hoffman, 2002; Hoy & Spero, 2005; Oakes & Martin, 2002; Pajares & Graham, 1999; Pajares, 1996; Sam, Othman, & Nordin, 2005; Schumacher & Morahan-Martin, 2001; Semerci & Semerci, 2004; Shapkaa & Ferrarib, 2003; Skaalvik & Skaalvik, 2010; Yesilyurt, 2013a, 2013b, 2014). In general, these studies were conducted in order to put forward opinions of participants regarding academic self-efficacy, teacher self-efficacy, computer self-efficacy, and computer-supported education. On the other hand, those studies have concentrated on only one of these themes. It is theoretically known that academic self-efficacy, teacher self-efficacy, and computer self-efficacy influence attitude toward applying computer-supported education. But no research has been found, confirming the statistical accuracy of this theoretical information. In the related literature part, it seems that the relationship between the attitudes toward computer-assisted training examined as the dependent variable and the independent variables, and the effect etc. are separately discussed. In this context, being tackled together the attitude related to computer-supported education which is an independent variable in comparison with the other independent variables is regarded important in terms of evaluating in a broad perspective the attitude related to computer-supported education in the study.

In this study, academic self-efficacy, teacher self-efficacy, and computer self-efficacy level of impact on attitude toward applying computer-supported education both separately and together, their explaining ratio and their statistical significance are dwelt upon. This situation also reveals this study's biggest difference from similar studies in the literature. On the other hand, no study has been conducted on the link between and effect of academic self-efficacy, teacher self-efficacy, computer self-efficacy, and the attitude toward applying computer-supported education and their ratio to each other. For this reason, it is important to detect which variables affect prospective teachers' attitudes toward applying computer-supported education and to what extent changes in these attitudes are explained under which variables and it is also important to put forward a concrete model in this subject. In addition to this, by beginning to use high-level analysis software (AMOS etc.) in the social sciences, the level of affect and explaining ratio more independent variables more dependent variables can be detected.

2. Theoretical framework

2.1. Computer-supported education

Arslan (2006) defines computer-supported education as benefiting from the computer as a tool to help the teacher enhance the quality of training during education activities. The definition “transferring the instructional content or activities through computer” defined by Hannafin and Peck (1988) is one of the most widely accepted definitions of computer-supported education. With reference to definitions, it can be said that the common point in computer-supported education is the transfer of educational content or activities through computer. The use of a computer by a teacher in the educational process is an issue directly related to her attitude about how to carry out computer-assisted education. In other words, effective computer-supported education is partly made possible by having a positive attitude about practicing computer-supported education. Cuceloglu (1998) defines the attitude as “the tendency of long-term feelings, beliefs and behaviors quite organized.” The most important factor for achieving success in the application of computer-supported education, is the attitudes and self-efficacy of teachers and prospective teachers toward computer-supported education (Kutluca & Ekici, 2010; Shashaani,

1993). In this regard, the attitude adopted in pre-service education process is very important since the teachers have a positive attitude towards computer-supported education.

2.2. Self-efficacy

Self-efficacy, defined as "a person's own judgment in regarding to realize the capacity to successfully organize necessary events to achieve the objectives given" has a power that can affect individuals ' preferences towards a specific area and their behaviors (Bandura, 1997). One of the factors that also negatively or positively affects the success in education is the students ' self-efficacy about related topics. Self-efficacy developed by Bandura (1977) and for using effectively the skills that people have is the key concept of social learning theory advocating the having confidence in the relevant area (Pajares, 2002). Self-efficacy consists of the regulation of cognitive, social, emotional and behavioral skills required in order to perform a task and applying effectively to the situation. In addition, self-efficacy is not only about the multiplicity of skills that the person has, but it is also related to the belief on what he can do with these skills in a given situation (Bandura, 1997). The studies conducted on the subject have revealed that self-efficacy has a positive and significant relationship on academic achievement (Abali Ozturk & Sahin, 2015; Akengin, Yildirim, Ibrahimoglu, & Arslan, 2014; Gold, 2010; Kelesoglu, 2011; Li, 2012; Lodewyk, Gammage, & Sullivan, 2009; Margolis & Mccabe, 2006; Mutlu, 2012; Pajares, 1996; Saunders, Davis, Williams, & Cribbs, 2002; Schweinle & Mims, 2009; Woolfolk & Hoy, 1990). People with low self-efficacy are also timid against technological innovations and may put up resistance against using computers, as well (Chou, Hsiao, Shen, & Chen, 2010; Holden & Rada, 2011).

2.3. The teacher, academic, and computer self-efficacy

It has been seen that the concept of self-efficacy developed in social psychology has been adapted in many areas and used in different disciplines. Individuals have self-efficacy on many issues including the behaviors that they should show in their daily life (Kutluca & Ekici, 2010). In this context, teacher self-efficacy, academic self-efficacy and self-efficacy of the computer can be regarded as a special type of self-efficacy. In general terms, teacher self-efficacy is the judgment on whether the desired results such as commitment and learning at students the skills that the teacher have (Tschannen-Moran & Hoy, 2001). Self-efficacy is the answer of a teacher to the question; can I plan and apply the necessary thoughts and actions to fulfill my duties? Teacher self-efficacy can be described as a concept associated with teacher effectiveness or successful teaching (Goddard, Hoy, & Hoy, 2004). The studies conducted on the subject have revealed that self-efficacy belief of the teacher is effective in many aspects such as classroom management, teaching methods and techniques and use of the computer and instructional tools (Gurol, Altunbas, & Karaarslan, 2010). One of the areas of self-efficacy is academic self-efficacy. Academic self-efficacy defines the belief of the teacher or the student in own their competence to perform activities relating to the school (Linnenbrink & Pintrich, 2002; Schunk, 1991). Academic self-efficacy beliefs of individuals affect their learning and increases their success. The more the knowledge about a subject increases, the more academic self-efficacy on the same subject increases, as well at the same time (Brannick, Miles, & Kisamore, 2005). One of the areas where the concept of self-efficacy used is computer self-efficacy. Computer self-efficacy is defined as "the judgment of an individual's ability to use a computer" by Compeau and Higgins (1995). Computer self-efficacy is an important structure that affects the teachers' use of computer in the classroom. The studies conducted on this subject show that individuals with high computer self-efficacy are more willing to participate in activities related to the computer and have higher expectations from such studies. In addition, when these individuals face with any difficulty about the computer, it is easier to deal with the difficulty of the question (Askar & Umay, 2001).

2.4. Research hypotheses

The purpose of the research is to test the relationship among the latent variables of academic self-efficacy, teacher self-efficacy, computer self-efficacy, attitude toward applying computer-supported education and their effect on each other and the levels of explanation. In the light of this purpose, the hypotheses which are based on theory were tested. In addition to this, path diagram related to the hypothesis of this study is shown in Fig. 1.

H1. The teacher self-efficacy affects computer self-efficacy.

H2. The teacher self-efficacy explains computer self-efficacy.

H3. The teacher self-efficacy affects attitude toward applying computer-supported education.

H4. The teacher self-efficacy affects academic self-efficacy.

H5. The teacher self-efficacy explains academic self-efficacy.

H6. The teacher and computer self-efficacy together affect attitude toward applying computer-supported education.

H7. The teacher and academic self-efficacy together affect attitude toward applying computer-supported education.

H8. The teacher, academic, and computer self-efficacy together explain attitude toward applying computer-supported education.

3. Method

3.1. Research model

A relational descriptive model was utilized in conducting this research. A relational descriptive model is a research model that aims to determine the presence and extent of covariance among

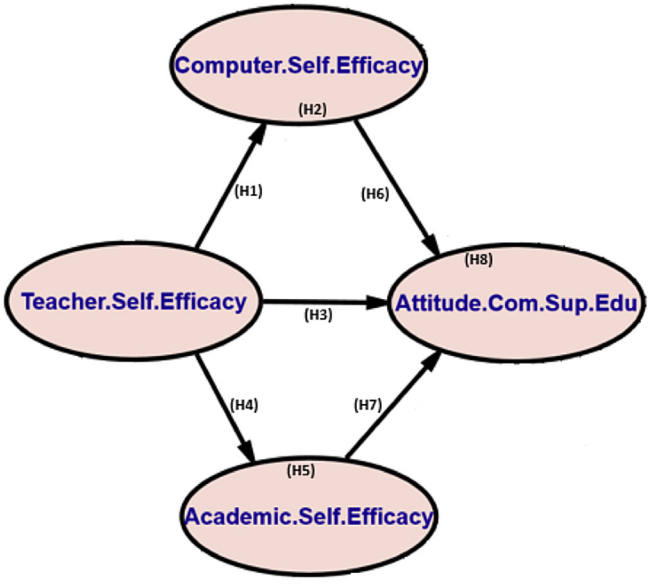


Fig. 1. Path diagram related to study hypothesis.

two or more variables. Since relational descriptive models are used for research models aiming to determine the change or the degree of the change among two or more variables in general descriptive research group (Karasar, 2012), these models are suitable to our study, too. Relational descriptive model was applied to this research according to structural equation model. Structural equation model is explained in data analysis section. In this context, the effect of teacher candidates' attitudes toward using computer-supported education, academic self-efficacy, teacher self-efficacy, and computer self-efficacy on each other and their relation to each other are considered in this research.

3.2. Participants

The participant group of the research consists of 323 prospective teachers who receive education at the first, second, third and fourth year level at the faculty of education, at a private university in the Anatolian part of Turkey, in the spring semester of the 2014–2015 academic year. A participant group with substantial numbers (200 and above) is necessary for complex models in structural equation modeling (SEM). The p (p+1)/2 formula with p being the number of variables (items that are present in the scales) can be used to determine the number of participants (Bayram, 2010; Schermelleh-Engel, Moosbrugger, & Müller, 2003). In this regard, the "teachers' sense of efficacy scale", which has the maximum number of items among the scales used as part of the research, was taken into account. The number of items in the scale is 24. Thus, the number of participants should be 24 (24 + 1)/2 = 300 or above in the scope of this research. Due to the fact that the research participant group consists of 323 people, this number is suitable for the research objective and statistical analysis. The demographic features of the participants are as follows: in terms of gender, 78.3% (f = 253) of participants are women, 21.7% are men (f = 70). In terms of year level, 48.0% (f = 155) of participants are first year, 24.8% (f = 80) second year, 20.4% (f = 66) third year, 6.8% (f = 22) fourth year. In terms of the type of program studied, 16.7% (f = 54) of participants study in the department of psychological counseling and guidance, 23.2% (f = 75) study in the department of computer education and instructional technologies teaching, 35.0% (f = 113) study in the department of pre-school education, 11.1% (f = 36) study in the department of English teaching, 13.9% (f = 45) study in the department of Turkish teaching.

3.3. Data collection process

Permission was obtained from scale owners for using scales in line with the research objective and participants voluntarily attended the scale implementation process. The goal of the scales and the form of the implementation were explained to the participants. The implementation period of scales was applied between 6th and 24th of April 2015 and lasted 25 min on average per person.

3.4. Data analysis

The data in this study were first entered in the SPSS 16.0 software package and the demographic characteristics of the participants and exploratory factor analyses of scales were analyzed via this software. AMOS 20.0 program was used for the confirmatory factor analyses (CFA) of scales and the structural equation model (SEM) in order to examine the relationships among the constructs within the proposed model (Arbuckle, 2009). CFA is a method which is generally applied after exploratory factor analysis studies. On the other hand, this analysis takes into consideration the contributions to the model and "modification indices" of all correlations. Modification indices do not exist in researcher's mind but are possible considering the data set in question (Simsek, 2007). CFA reveals more real statistical outcomes (Kline, 2005). In addition, a structural equation model (SEM) was generated in line with the research hypotheses. SEM is widely employed in scientific studies due to the fact that it considers measurement errors regarding observed variables and direct and indirect impacts of variables in the model and enables researchers to develop, predicts and tests multiple-variable complex models (Bayram, 2010). SEM is a very useful model for, in particular, for its following benefits that first it guides exploratory and confirmatory research in a manner combining self-insight and modeling skills with theory. Works well under the philosophy of discovery or the philosophy of confirmation; and second, it is useful in experimental or survey research, cross-sectional or longitudinal studies, measurement or hypothesis testing endeavors, within or across groups and institutional or cultural contexts (Bagozzi & Yi, 2012). In general, every SEM analysis goes through the steps of model specification, data collection, model estimation, model evaluation, and (possibly) model modification. Most SEM analyses are conducted using one of the specialized SEM software programs. AMOS is one of them. AMOS is its capability for producing bootstrapped standard error estimates and confidence intervals for parameter estimates. An alternative full-information maximum likelihood estimation method for missing data is also available in AMOS (Lei & Wu, 2007). The above mentioned properties also put forward the reasons for using CFA and SEM in this study. In order to estimate model parameters in CFA, the maximum likelihood estimation method was used. In addition, we adopt the maximum likelihood method to estimate the model's parameters where all analyses were conducted on variance–covariance matrices (Hair, Black, Babin, Anderson, & Tatham, 2010). The Root mean square error of approximation (RMSEA), the standardized root mean square residual (SRMR), the goodness of fit index (GFI), the comparative fit index (CFI), the adjusted goodness of fit index (AGFI), the normed fit index (NFI) and the chi-square/degrees of freedom (X2/sd = CMIN/DF) and the level of significance (p) fit indexes were taken into consideration in the evaluation of the model goodness of fit. With RMSEA value being between 0 and 0.08; SRMR value being between 0 and 0.10; AGFI value between 0.85 and 1.00; X2/sd (CMIN/DF) value between 0 and 3 and p value being between 0.01 and 0.05, and the values of GFI, CFI and NFI between 0.90 and 1.00 indicate good fit indexes (Barrett, 2007; Bayram, 2010; Byrne, 2001; Hu & Bentler, 1999; Kline, 2005; Raju, Laffitte, & Byrne, 2002; Reisinger & Mavondo, 2006; Schermelleh-Engel et al., 2003; Simsek, 2007). In exploratory and confirmatory factor analysis, the lower boundary of factor loads is accepted as 0.30. If there is a limited number of items in a scale prepared in the field of social sciences, the boundary value can be reduced to 0.30 for factor load. Moreover, if the factor load of an item is below 0.30 considerably affects the content validity of the scale; in this case analyses can be conducted without omitting the respective item from the scale (Buyukozturk, 2007; Costello & Osborne, 2005). In addition, the critical ratio is based on being below 10 in normality testing for CFA and SEM. According to Kline (2005) and Mardia (1974) the critical ratio is somehow a normalized estimation of multivariate kurtosis, to wit z value. A problem possible occurs in kurtosis value of distribution, if a critical ratio being absolutely higher than 10.

3.5. Data collection instruments and confirmatory factor analyses

3.5.1. Academic self-efficacy scale

The scale developed by Jerusalem and Schwarzer (1981) consists of seven items and one factor. The scale was adapted to Turkish by Yilmaz, Gurcay, and Ekici (2007). The items were prepared and analyzed in the form of a 4-point Likert type scale with 4:

Completely agree, 3: Agree, 2: Disagree, and 1: Completely disagree. The following two items were provided as an example to items situated in this scale. I always achieve high success when I am adequately prepared for the exam (ASE2). I cannot think of failing any exam (ASE5). Factor loadings of the items range between 0.829 and 0.500. The Cronbach Alpha reliability value of the scale was determined to be 0.79. If the Cronbach Alpha value is 0.70 or higher, reliability is considered valid (Buyukozturk, 2007).

Negative items in the scale were transformed into a positive item and analysis was continued. Exploratory factor analysis of the scale revealed factor load was determined to be 0.092 for ASE7. Based on Buyukozturk (2007), the factor load of the substance must be at 0.30 and above. Therefore, related item removed from the scale and rebuilt analysis scale. As a result of the analysis conducted on the data obtained from this study, the Cronbach Alpha reliability value of the scale was detected at 0.780. According to Buyukozturk (2007), Cronbach Alpha value of 0.70 or higher is considered reliable. In addition, as a result of exploratory factor analysis, factor loadings of the items appearing in the scale were detected to be between 0.628 and 0.385 and all coefficients were found to be within acceptable limits. Also, the diagram for confirmatory factor analysis of the scale is shown in Fig. 2.

As a result of confirmatory factor analysis and taking normality tests into consideration, the critical ratio (c.r.) turned out to be 8.288 in terms of multivariate (Mardia) values. However, due to the fact that the model fit index was not within acceptable limits, the error values of two items were combined. In this case, considering confirmatory factor analysis results, the fit index of the scale was as follows: RMSEA = 0.062, SRMR = 0.032, CMIN/DF (X2/sd) =2.255, GFI=.982, CFI=.978, AGFI=.951, and NFI=.962. This result demonstrates that the model fit index is at an acceptable and desired level.

3.5.2. Teacher self-efficacy scale

The data of this study was obtained by “teacher self-efficacy scale” which was developed by Tschannen-Moran and Hoy (2001) and adapted into Turkish by Capa, Cakiroglu, and Sarikaya (2005). This scale consisted of three factors which were “student engagement”, “instructional strategies”, and “classroom management” and 24 items. The following three items were provided as an example to items situated in this scale. How much can you do to help your students think critically? (TSE2), to what extent can you use a variety of assessment strategies? (TSE18), and how well can you establish a classroom management system with each group of students? (TSE16). Reliability value of the factors were 0.82, 0.86 and 0.84 respectively. Besides, confirmatory factor analysis of the scale is made and result illustrates that the scale fit index is at an acceptable and desired level. The items appearing in the scale were prepared and analyzed using a 5-point Likert type scale in the form of 5: A Great deal, 4: Quite a bit, 3: Some influence, 2: Very little and 1: Nothing.

As a result of analysis conducted on the data obtained from this study, the Cronbach's Alpha value of the scale was detected to be 0.793 for student engagement, 0.816 for instructional strategies, 0.790 for classroom management and 0.894 for all scale. Factor loads of items in the scale were detected to be between 0.677 and 0.389. Besides, the diagram for confirmatory factor analysis of the scale is displayed in Fig. 3.

As a result of confirmatory factor analysis and taking normality testing into consideration, critical ratio (c.r.) appeared to be 17.723 in terms of multivariate (Mardia) values. Therefore, items with a critical ratio bigger than 10 were not analyzed in the next step. However, due to the fact that the model fit index was not within acceptable limits, the error values of eight items were combined. In this case, considering confirmatory factor analysis results of the “Teacher Self-Efficacy Scale”, which consists of 21 items, fit index occurred as RMSEA = 0.068, SRMR = 0.054, CMIN/DF (X2/sd) = 2.470, GFI = 0.908, CFI = 0.962, AGFI = 0.857, and NFI = 0.904. This result demonstrates that the model fit index is at an acceptable and desired level.

3.5.3. Computer self-efficacy scale

Computer self-efficacy scale, which consists of a single factor and 18 items developed by Askar and Umay (2001), was employed to measure computer self-efficacy of the teacher candidates. The following two items were provided as an example to items situated in this scale. I think that I am able to effectively use computer (CSE3). I believe that I have a special gift toward using a computer (CSE10). The reliability coefficient for the instrument of measurement was calculated via the Cronbach's Alpha and was found to be

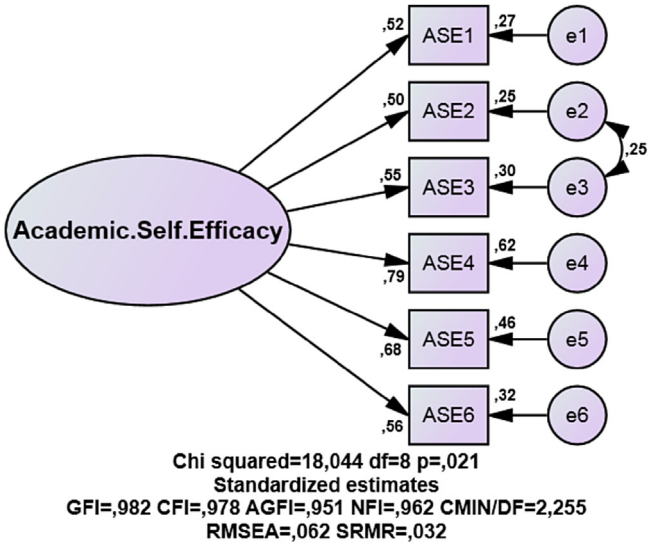


Fig. 2. Diagram for confirmatory factor analysis of the academic self-efficacy scale.

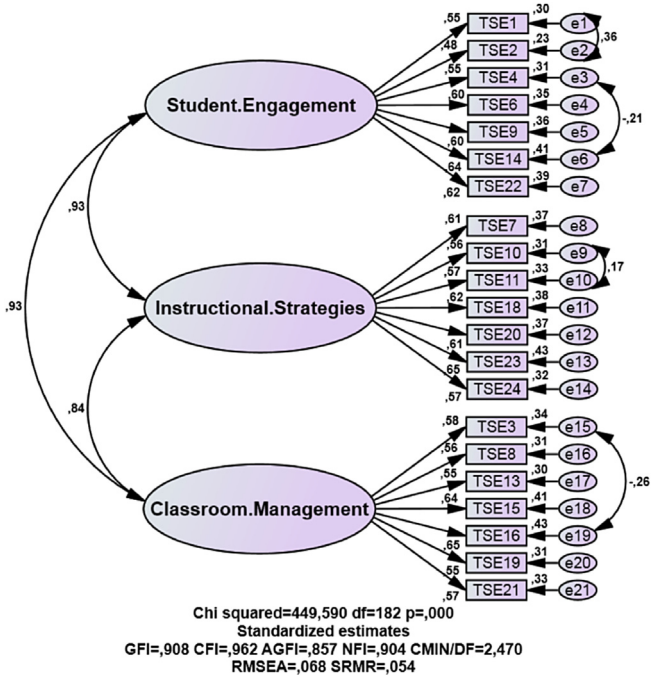


Fig. 3. Diagram for confirmatory factor analysis of the teacher self-efficacy scale.

0.71. Five-point Likert-type questions appeared in the computer self-efficacy scale and items were assessed with a 5-point rating expressed as “always” (5), “usually” (4), “occasionally” (3), “rarely” (2) and “never” (1).

In this study, it appeared that Cronbach's Alpha reliability coefficient of the scale was 0.895 and factor loads of items were between 0.790 and 0.545. Besides, the diagram for confirmatory factor analysis of the scale is displayed in Fig. 4.

As a result of confirmatory factor analysis and taking normality testing into consideration, critical ratio (c.r.) appeared to be 13.534 in terms of multivariate (Mardia) values. Therefore, items with a critical ratio bigger than 10 were not analyzed in the next step. However, due to the fact that the model fit index was not within acceptable limits, the error values of six items were combined. In this case, considering confirmatory factor analysis results of the “Computer Self-Efficacy Scale”, which consists of 10 items, fit index occurred as RMSEA = 0.075, SRMR = 0.036, CMIN/DF (X2/sd) = 2.829, GFI = 0.946, CFI = 0.969, AGFI = 0.907, and NFI = 0.953. This result demonstrates that the model fit index is at an acceptable and desired level.

3.5.4. The attitude scale toward applying computer-supported education

The attitude scale toward applying computer-supported education, which consists of single factor and 20 items developed by Arslan (2006) was used to measure the teacher candidates' attitudes toward applying computer-supported education. The following two items were provided as an example to items situated in this scale. I willingly and lovingly use a computer in lessons (ACSE1). Computer-supported education is a crucial subject for me (ACSE4). The reliability coefficient of the instrument of measurement was calculated using Cronbach's Alpha and was found to be 0.93. Five point Likert-type questions appeared in the Attitude Scale Toward Making Computer-Supported Education and items were assessed with 5-point rating expressed as “Strongly Agree” (5), “Agree” (4), “Undecided” (3), “Disagree” (2) and “Strongly Disagree” (1).

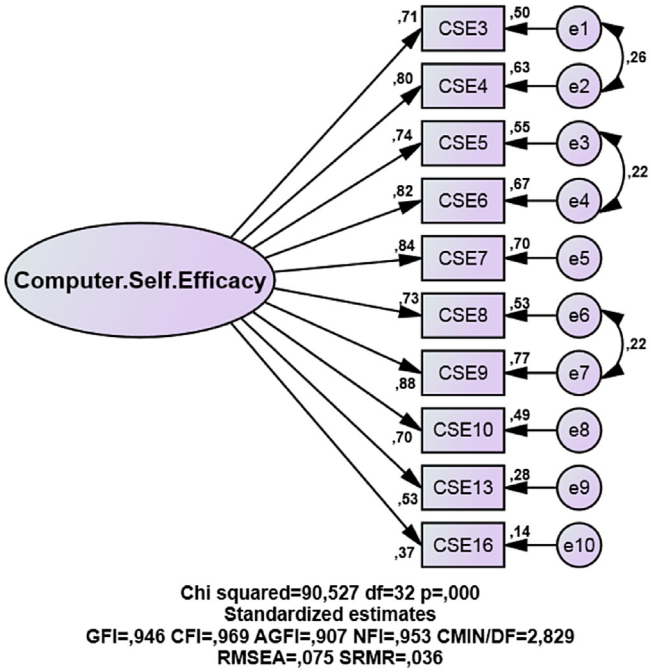


Fig. 4. Confirmatory factor analysis diagram of the computer self-efficacy scale.

Negative items in the scale were transformed into positives and analysis was continued. As a result of analysis conducted on the data obtained from this study, the Cronbach's Alpha value of the scale was detected to be 0.864 and factor loads of items in the scale were detected to be between 0.612 and 0.469. Besides, the diagram for confirmatory factor analysis of the scale is displayed in Fig. 5.

As a result of confirmatory factor analysis and taking normality testing into consideration, the critical ratio (c.r.) appeared to be 17.435 in terms of multivariate (Mardia) values. Therefore, items with a critical ratio bigger than 10 were not analyzed in the next step. In this case, considering confirmatory factor analysis results of “the Attitude Scale Toward Making Computer-Supported Education”, which consists of 16 items. However, due to the fact that the model fit index was not within acceptable limits, the error values of six items were combined. In this case, considering confirmatory factor analysis results, the fit index occurred as RMSEA = 0.070, SRMR = 0.057, CMIN/DF (X2/sd) = 2.599, GFI = 0.904, CFI = 0.958, AGFI = 0.871, and NFI = 0.956. This result demonstrates that model fit index is at an acceptable and desired level.

4. Results

As a result of research, a model was put forward which shows the effect level of the latent variables of teacher self-efficacy, academic self-efficacy, computer self-efficacy, and the attitude toward computer-supported education on each other and their ratios to each other. While forming this model, testing the study hypotheses was taken into consideration. Structural equation modeling built

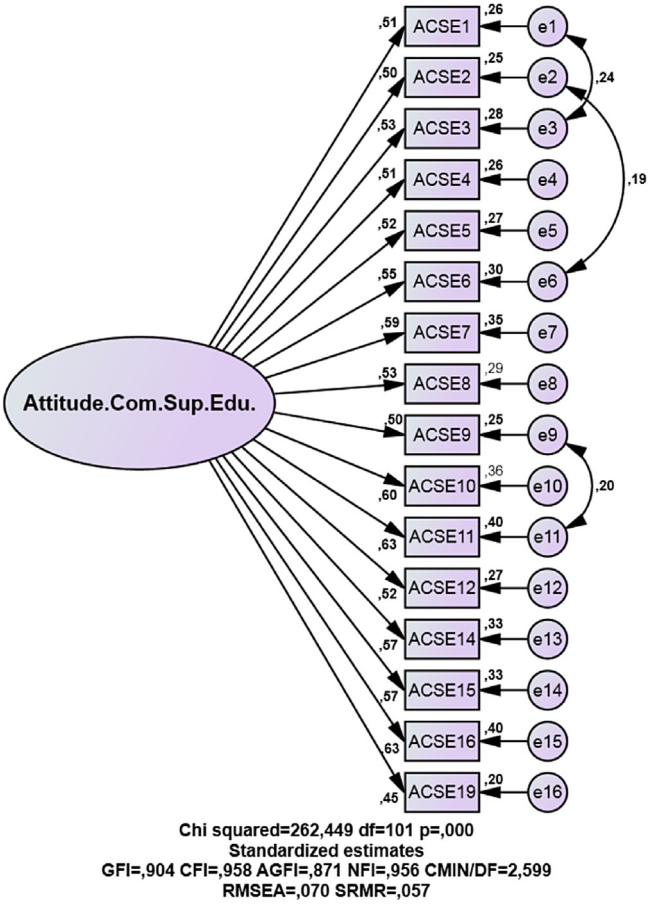


Fig. 5. Confirmatory factor analysis diagram of the attitude scale toward applying computer-supported education.

for this purpose is present in Fig. 6.

The fit index of the model built was obtained as follows: RMSEA = 0.056; SRMR = 0.095; CMIN/DF = 2.002; GFI = 0.911; CFI = 0.956; AGFI = 0.863; NFI = 0.912; Chi squared = 2628.288; df = 1313and p = 0.000. This result illustrates that the model fit index is at an acceptable and desired level.

Teacher self-efficacy scale has three latent variables and 21 observed variables. While TSE16 and TESE23 have the highest effect coefficient hierarchically among the observed variables, TSE1 and TSE7 have the lowest effect coefficient. The effect coefficients of the latent variables that are present in this scale range between 0.99 and 0.90.

Academic self-efficacy scale has six observed variables. While ASE4 and ASE5 have the highest effect coefficient hierarchically among the observed variables, ASE2 and ASE6 have the lowest effect coefficient. The effect coefficients of the observed variables that are present in this scale range between 0.79 and 0.51.

Computer self-efficacy has 10 observed variables. While CSE9 and CSE7 have the highest effect coefficient hierarchically among the observed variables, CSE16 and CSE13 have the lowest effect coefficient. The effect coefficients of the observed variables that are present in this scale range between 0.89 and 0.42.

The attitude scale toward applying computer-supported education has 16 observed variables. While ACSE1 and ACSE16 have the highest effect coefficient among the observed variables, ACSE19 and ACSE9 have the lowest effect coefficient. The effect coefficients of the observed variables range between 0.78 and 0.54.

Taking the research hypotheses into consideration, the following results were attained.

As can also be seen in the model which was obtained as a result of the research and is present in Fig. 5, it was detected that teacher self-efficacy positively and significantly affects computer self-efficacy at a level of 0.47. This result shows the accuracy of the hypothesis that appears in.

H1 that "The teacher self-efficacy affects computer self-efficacy". Moreover, teacher self-efficacy explains computer self-efficacy at a ratio of 22%. In other words, the change taking place in computer self-efficacy can be said to depend on teacher self-efficacy at a ratio of 22%. This result confirms the hypothesis in H2 that "The teacher self-efficacy explains computer self-efficacy".

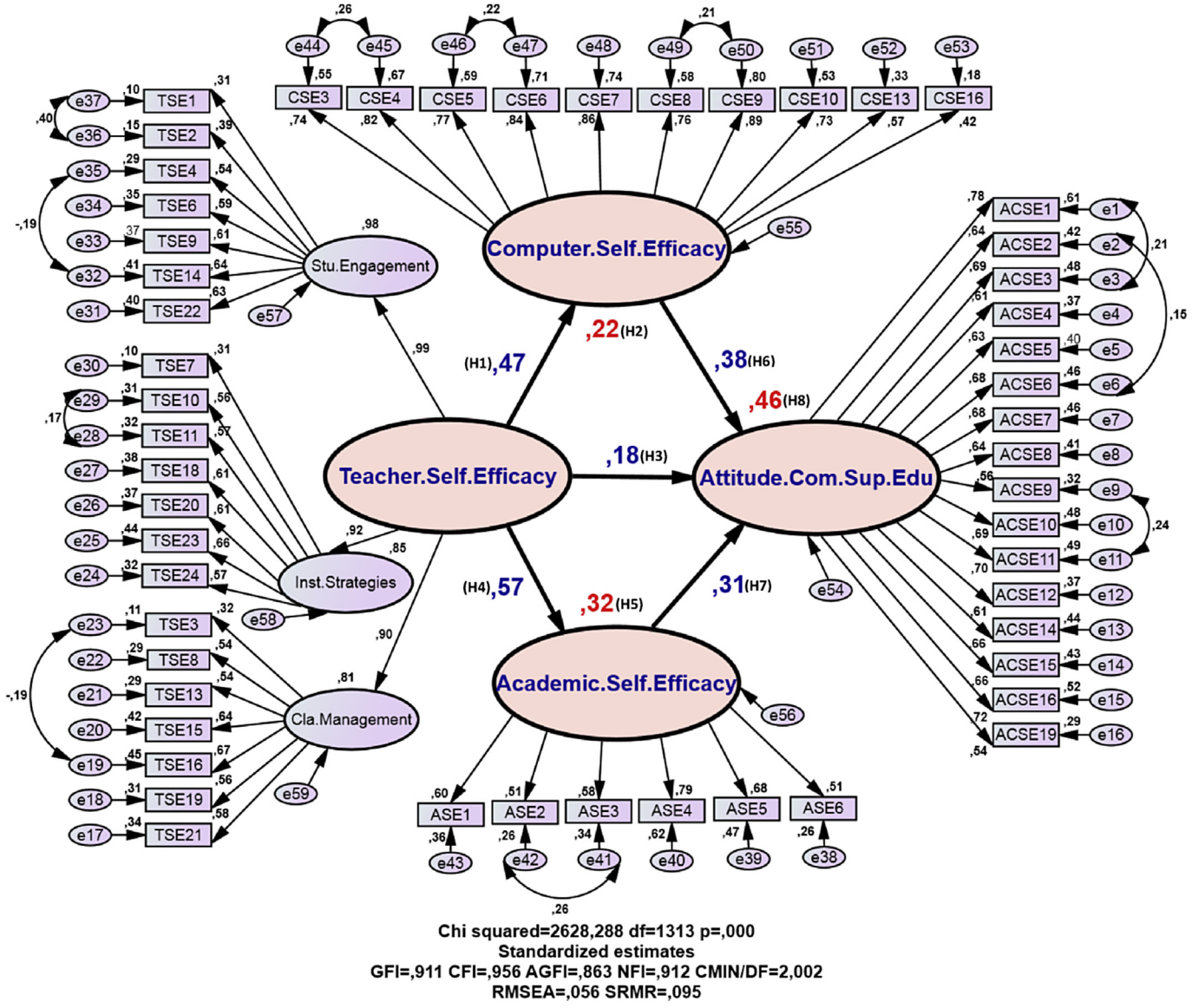


Fig. 6. Structural equation modeling and analysis results of hypothesis.

With regard to the third research hypothesis, it appeared that teacher self-efficacy positively and significantly affects the attitude toward applying computer-supported education at a level of 0.18. This result attained indicates the accuracy of the hypothesis stated in H3 that "The teacher self-efficacy affects attitude toward applying computer-supported education." However, as is also seen in the model in Fig. 5, it was detected that teacher self-efficacy affects academic self-efficacy at the highest level and the attitude toward applying computer-supported education at the lowest level.

The research results also indicate that teacher self-efficacy affects academic self-efficacy positively and significantly at a level of 0.57. This result displays the accuracy of the hypothesis stated in H4 that "The teacher self-efficacy affects academic self-efficacy". Furthermore, the following result emerged that teacher self-efficacy explains academic self-efficacy at a ratio of 32%. In other words, the change taking place in academic self-efficacy stems from teacher self-efficacy at a ratio of 32%. This result which emerged verifies the hypothesis in H5 that "The teacher self-efficacy explains academic self-efficacy".

Also present among the results reached is that teacher self-efficacy and computer self-efficacy together affect the attitude toward applying computer-supported education positively and significantly at a level of 0.38. This result proves the accuracy of the hypothesis that appears in H6 that "The teacher and computer self-efficacy together affect attitude toward applying computer-supported education". As a result of the research, it was detected that teacher self-efficacy and academic self-efficacy together positively and significantly affect the attitude toward applying computer-supported education at a level of 0.31. This result asserts the accuracy of the hypothesis stated in H7 that "The teacher and academic self-efficacy together affect attitude toward applying computer-supported education".

With regard to the last research hypothesis, it was detected that teacher self-efficacy, academic self-efficacy, and computer self-efficacy together significantly explain the attitude toward applying computer-supported education at a ratio of 46%. This result verifies the hypothesis that is present in H8 that "The teacher, academic, and computer self-efficacy together explain attitude toward applying computer-supported education".

5. Discussion

As part of this research, the effect levels among the latent variables of teacher self-efficacy, academic self-efficacy, computer self-efficacy, and attitude toward applying computer-supported education and these latent variables' explain ratios between each other were tested. For this, eight hypotheses were developed in light of based on theory. In this section, the results obtained by taking the order of hypotheses into account are discussed and compared with other research results attained regarding the subject.

With regard to the first research hypothesis, it appeared that teacher self-efficacy of prospective teachers positively and significantly affects computer self-efficacy. On the other hand, regarding the second research hypothesis, it was detected that teacher self-efficacy of prospective teachers significantly explains computer self-efficacy. There are also some researches, confirmatory quality to these results and revealing that there is a positive and significant relationship between teacher self-efficacy and computer self-efficacy (Karadeniz, 2011; Maskan, 2010; Orhan, 2005; Tekinarslan, 2011).

Regarding the third research hypothesis, it appeared that teacher self-efficacy of prospective teachers positively and significantly affects attitude toward applying computer-supported education. Results of the research conducted on this subject show the characteristic of supporting this outcome. Arslan (2008), who attained a similar result, put forward the idea that prospective teachers perceived computer self-efficacy and attitudes toward doing computer-supported education are high, but there is a medium-level and positive correlation between attitude and perceived self-efficacy. On the other hand, the studies (Oguz & Topkaya, 2008; Secgin & Basbay, 2013) revealing that there is a moderate, positive and significant relationship between teacher self-efficacy and the attitude toward teaching are such as to support the results obtained from this study.

With regard to the fourth research hypothesis, the result was detected that teacher self-efficacy of prospective teachers positively and significantly affects academic self-efficacy. On the other hand, regarding the fifth research hypothesis, it was inferred that teacher self-efficacy of prospective teachers significantly explains academic self-efficacy. A parallel outcome was obtained as a result of a study carried out by Basoglu (2007). According to the aforementioned study, there was a negative correlation between self-efficacy and test anxiety. In his study, Gore (2006) found that self-efficacious belief is an important predictor of the academic performances and achievement of university students. As a result of a study performed by Eryenen (2008), a significant correlation was detected among the academic achievement levels, goal orientations, academic self-efficacy and teacher self-efficacy of prospective teachers.

With regard to the sixth research hypothesis, it was detected that teacher self-efficacy and computer self-efficacy of prospective teachers together positively and significantly affect attitude toward applying computer-supported education. On the other hand, concerning the seventh research hypothesis, it was inferred that teacher self-efficacy and academic self-efficacy of prospective teachers together positively and significantly affect attitude toward applying computer-supported education. The research conducted have showed that individuals with high computer self-efficacy are more willing to participate in the activities related to computer, and more successful to solve the problems that they encounter (Chou et al., 2010; Holden & Rada, 2011; Orhan, 2005). The result obtained from this research shows a consistency with results of other studies in the literature part. Indeed, studies conducted on the subject (Arslan, 2008; Celik & Bindak, 2005; Cetin & Gungor, 2014; Ipek & Acuner, 2012) show that there is a moderate positive and significant relationship between the attitude of teachers and prospective teachers toward computer assisted education and their computer self-efficacy. On the other hand, Yenilmez and Turgut (2012) with Ulper and Bagci (2012), amongst the results of relevant researches, it is stated that teacher candidates whose academic achievement level is high have a higher self-efficacy perception. The results of research characteristically support the accuracy of these hypotheses.

With regard to the eighth research hypothesis, the following result emerged that teacher self-efficacy, academic self-efficacy, and computer self-efficacy of prospective teachers together significantly explain attitude toward applying computer-supported education. Common results of research conducted regarding the subject (Akcay, Aydogdu, Yildirim, & Sensoy, 2005; Aykanat, Dogru, & Kalender, 2005; Garrote, Pettersson, & Christie, 2011; Kwon, Liu, & Johnson, 2014; Morgil & Evrim, 2006; Ponce, López, & Mayer, 2012) emphasize that computer-supported education has a positive effect on increasing the success of students, students' attitudes toward computers, the permanency of learning and the development of skills such as conducting research and teamwork, establishing communication, written and oral communication, problem solving and personal development. While this situation also put forwards the positive aspects of computer-supported education, the results of some research performed have the characteristic of supporting results obtained from the eighth hypothesis. The results

of hierarchical multiple regression showed that the attitude is a significant predictor towards the level of use on using instructional computer technology, after controlling for the influence of teacher's gender and teaching experiences. Further data analysis using mediating analysis technique revealed that self-efficacy fully mediates the relationship between attitudes and the level of use on using instructional computer technology (Dafaei, Ismail, Samsudin, & Shakir, 2013). Indeed, as a result of the common studies on the teachers and prospective teachers related to the computer assisted education, it has been concluded that there is a positive, moderate and significant relationship between self-efficacy and the attitude (Allinder, 1994; Berkant, 2013; Cayak, 2014; Celik & Bindak, 2005; Cetin & Gungor, 2014; Demirtas et al., 2011; Gong, Xu, & Yu, 2004; Ipek, Tekbiyik, & Ursavas, 2010; Kutluca & Ekici, 2010; Rots, Aelterman, Vlerick, & Vermeulen, 2007; Sorgo, Verckovnik, & Kocijancic, 2010; Watters & Ginns, 1995). This case indicates that a positive or a negative change which may arise in the attitude and self-efficacy would affect each other.

It was concluded that teacher self-efficacy positively and significantly affects academic self-efficacy, computer self-efficacy, and attitude toward applying computer-supported education. Besides, it was detected that teacher self-efficacy and computer self-efficacy and teacher self-efficacy and academic self-efficacy together positively and significantly affect the attitude toward applying computer-supported education. On the other hand, it appeared that teacher self-efficacy, academic self-efficacy, and computer self-efficacy are important predictors and latent variables of the attitude toward applying computer-supported education, which is among the most important outcomes of this research and also confirms H8. This result was verified both theoretically and statistically, also was concretized by structural equation model. This situation puts forward the originality of this research, and its differentiation from similar researches.

In conclusion, it appeared that teacher self-efficacy, academic self-efficacy, and computer self-efficacy together significantly affect and serve to explain the status of attitude toward applying computer-supported education. In other words, it was detected that teacher self-efficacy, academic self-efficacy, and computer self-efficacy are important predictors of prospective teachers' attitude toward applying computer-supported education. In this respect, prospective teachers' completion of pre-service (undergraduate) education in such a way that they have a heighten their teacher self-efficacy, academic self-efficacy, and computer self-efficacy will be a crucial gain for them in terms of acquiring a positive attitude toward the application of computer-supported education. On the other hand, teachers and prospective teachers have teacher self-efficacy, academic self-efficacy, and computer self-efficacy are high-level to perform attitude toward application of computer-supported education, which is an indispensable element of the present education world, in a way that suits its purpose. This situation will contribute to the fact that the attitude toward applying computer-supported education of prospective teachers are at a desired level both in the pre-service education process and in their professional life.

The most significant result of this study is that pre-service teachers' academic self-efficacy, teacher self-efficacy, and computer self-efficacy are important predictors of their attitude toward applying computer-supported education. Therefore, to develop positive attitudes toward computer-supported education, to attach importance to its use in professional life, and to apply it effectively, it is necessary for the pre-service teachers and teachers to have high levels of academic self-efficacy, teacher self-efficacy, and computer self-efficacy. In this sense, effective instruction of the courses “Computer I”, “Computer II”, and “Instructional Technologies and Materials Design” offered to the students during their undergraduate education can make great contributions to their computer self-efficacy. On the other hand, effective instruction in Educational Psychology, Principles and Methods of Instruction, Teaching Methods, Testing and Evaluation, Scientific Research Methods, School Experience, Teaching Practice may positively affect the academic self-efficacy and teacher self-efficacy of the pre-service teachers.

Some suggestions can be provided for the future studies. For example, research can be conducted on variables other than the academic self-efficacy, teacher self-efficacy, and computer self-efficacy which are the predictors of the attitude toward computer-assisted education. It can be researched whether academic self-efficacy, teacher self-efficacy, and computer self-efficacy are mediating variables in the attitude toward computer-assisted education; and, SEM studies can be conducted on alternative models. It can be researched whether the attitude toward computer-assisted education is a predictor of the academic self-efficacy, teacher self-efficacy, and computer self-efficacy.

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