



Investigating students' E-Learning attitudes in times of crisis (COVID-19 pandemic)

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Abstract

With the COVID-19 pandemic affecting the world, the vast majority of students in various educational institutions around the world have changed their learning styles from the physical classroom to digital learning education. Especially the fact that university students take their lessons with e-learning in times of crisis (COVID-19 pandemic) has forced them to spend more time with the computer. This situation will also affect their academic motivation. This research aimed to test whether the fear of contracting COVID-19 (CoVFC) had a moderating effect on the prediction of preservice teachers' academic motivation (AMOTV) with their computer self-efficacy perceptions (CSE). With a combined approach, a single model was employed to test the moderating role of CoVFC and the mediating role of Attitudes towards E-Learning (ATEL) in the prediction of preservice teachers' AMOTV with their CSE. 522 preservice teachers from 21 different branches participated in this research. As a result of the research, the CSE of preservice teachers were determined to predict their AMOTV significantly and positively. The increase in CoVFC was found to have a negative moderating effect on the prediction of AMOTV with the CSE of preservice teachers. Also, ATEL was found to have a partial mediating effect in the relationship between the CSE and AMOTV of preservice teachers.

Keywords Fear of contracting COVID-19 · Preservice teachers · Academic motivation · Attitudes to e-learning · Computer self-efficacy

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1 Introduction

Infectious diseases have usually been a disaster for humanity from past to present. With the development of medicine, the effect of many infectious diseases has died down, and they have become less frightening. Nowadays, different diseases have emerged and influenced humanity. The latest of these diseases is the COVID-19 pandemic. The COVID-19 virus was first encountered in Wuhan city of China in December 2019 and has spread rapidly all over the world since then. On March 11, 2020, the World Health Organization declared the outbreak of COVID-19 as a pandemic all over the world. A pandemic is defined as a very widespread disease that affects more than one country or continent (Hacımustafaoğlu, 2018). Fear of becoming sick, fear of virus infection in one's immediate environment, uncertainty about the future, and assessments that the place one lives in is unsafe and similar fears have caused anxiety in people (Kaya, 2020).

Accordingly, 90.1% of the lessons in the spring semester were conducted through distance education. Also, 99.2% of the universities conducted theoretical lessons through distance education, while about 89% conducted the theoretical parts of applied lessons through distance education. In addition to this, 75% of the universities carried out the applied lessons that could be taught through distance teaching during this period through distance education. In this process, 95% of the universities informed their students about the process via SMS and e-mail, 91% provided technical support, 83% created a contact portal, and 70% made new assignments (Council of Higher Education [CoHE], 2020). Accordingly, the distance education launched due to the COVID-19 pandemic has accelerated the “digitalization” process in education. Digitalization is not a simple procedure; it has complex content such as urgency, a virtual management system, readiness to deal with online teaching tools, digital fluency, and coping with feelings of fear and social isolation (Angoletto & Queiroz, 2020). It is, therefore, necessary to know that distance learning involves many difficulties and constraints rather than thinking that it is “home education”. According to Mulenga and Marbán (2020), the COVID-19 pandemic has played a mediating role in making people use digital devices, online resources, social media technology, and e-learning activities more effectively. In this regard, knowing the attitudes especially of students attending distance education towards e-learning (electronic learning), their academic motivation and computer self-efficacy levels, and the relationships between these variables, is important in managing the process appropriately.

The theory that explains academic motivation based on the causes of behavior is the theory of self-determination (Ryan & Deci, 2000). Self-determination theory (SDT) focuses on determining the factors that affect the healthy development of individuals and supporting their development and well-being by identifying these factors. The focus of SDT is the basic psychological needs of individuals. It is stated that negative consequences can occur if psychological needs are hindered (Ryan & Deci, 2000). Distance education students are afraid of contracting COVID-19, due to which the whole world continues their educational activities with distance education. The Technology Acceptance Model (TAM) is

an effective theoretical infrastructure in terms of acceptance of the use of technologies such as distance education, which has become widespread due to the COVID-19 pandemic, and its usefulness and ease of use. The TAM was derived from the Theory of Reasoned Action in 1989 by Davis et al. The aim of the TAM is to predict and explain the acceptance of information technology by measuring the perceived benefit and perceived ease of use about the system after advancing with the system (Kaşmer-Erdem, 2011). In other words, it increases the improvements in perceived ease of use, thus increasing the perceived benefit of technology (Davis, 1993; Venkatesh & Davis, 2000). For this reason, the technology acceptance model of Davis (1989) was taken as the basis in this study and the mediating role of preservice teachers' attitudes towards e-learning (ATEL) in predicting academic motivation (AMOTV) with computer self-efficacy perceptions (CSE) was also tested. The TAM states that the individual's benefits and perceptions have an effect on the formation of an individual's attitude towards e-learning. In this case, the variable that the individual perceives as a benefit is "academic motivational" and the variable perceived as convenience is "computer self-efficacy" (Chow et al., 2012). The simple perceptions of utility and use indirectly affect the behavioral intention of the individual, and these indirect effects change the individual's tendency towards real practical truth. In addition, in the light of the SDT, it was tested whether the preservice teachers' computer self-efficacy perceptions (CSE) of fear of contracting COVID-19 (CoVFC) had a regulatory role in predicting their academic motivation (AMOTV).

2 Electronic Learning (E-Learning)

Distance education is "*the method of carrying out specially designed instructional activities through various mediums connecting teachers and students in cases where the implementation of physical classroom teaching is not possible due to the limitations of traditional learning-teaching methods*" (Kaya, 2002). The concept of distance education is evolving towards e-learning and virtual instruction (Toplu & Gökçearslan, 2012). E-learning involves educational activities carried out synchronously or asynchronously using rich course materials (Başal & Gürol, 2011). E-learning is also known as computer-aided, Internet-based, web-based, network-based, and virtual learning (Kesim, 2011). In e-learning, unlike the traditional classroom, students are provided with learning at their own pace with unlimited revisions of the course presentations, regardless of time and place (Dikbaş, 2006).

It is thought that improved computer self-efficacy of students who take courses through e-learning will affect their attitudes towards e-learning positively. Learning to use the Internet is among the benefits of e-learning to the student. This is predicted to depend on the development of students' computer self-efficacy. Determining students' attitudes towards e-learning will make the lessons given in these environments more effective. The effectiveness of e-learning depends on the extent of positive attitudes people develop towards e-learning (Liaw et al., 2007). Link and Marz (2006) found that age and computer skills and experiences were important in students' attitudes towards e-learning. Also, students are expected to have high

academic motivation since they will learn at their own pace and have flexible learning conditions that are customized individually and structured based on time and purpose (Ünsal, 2004).

3 Perception of computer self-efficacy

Due to the COVID-19 pandemic, many countries around the world continue instruction with distance education instead of traditional education. Thanks to the developing technology, education, as many other activities, can be carried out through distance education using computers. Students who receive distance education on the Internet using a computer also do their assignments by using various applications. Accordingly, high computer self-efficacy perception of the students is important for their success. Bandura (1997) defined self-efficacy as individuals' self-belief in organizing events to demonstrate their performance and being successful. The perception of computer self-efficacy, on the other hand, is defined as one's self-belief in using computers (Karsten & Roth, 1998b). Studies show that the direct engagement of people in computers affects their perceptions of computer self-efficacy positively (Cassidy & Eachus, 2002; Köseoğlu et al., 2007). Also, people with low computer self-efficacy have been shown to tend to be timid and resistant towards using technology (Demiralay & Karadeniz, 2010; Kovalchick et al., 1998). Students interested in computers receive their distance education through a computer on the Internet. Therefore, it is thought that students' perceptions of computer self-efficacy will affect their attitudes towards e-learning. Besides, individuals' perceptions of computer self-efficacy are also affected by the frequency of computer use and access to computers (Aşkar & Umay, 2001). One of the most commonly used exogenous variables within the framework of the technology acceptance model in the E-learning literature is the concept of self-efficacy. Venkatesh and Davis (2000) suggested that self-efficacy, or computer self-efficacy, should be included as a determinant to explain the acceptance behavior of its users. Previous studies reveal that the concept of self-efficacy plays a critical role on the ease of using e-learning technologies and affecting perceived usefulness (Abdullah & Ward, 2016). In this respect, it is thought that students' CoVFC will affect their perceptions of computer self-efficacy, since they receive their education through distance education using a computer due to the COVID-19 pandemic. Studies show that individuals with a high perception of computer self-efficacy are more willing to participate in computer-based activities and have higher expectations from such applications (Compeau & Higgins, 1995; Hill et al., 1987). For this reason, it is thought that computer self-efficacy perceptions of preservice teachers, who have to spend more time with computers than before, will affect their academic motivation and therefore their academic success. Ryan and Pintrich (1997) suggested that motivation should be considered as a control variable in studies using computers as a material, since students who have high self-efficacy will carry out the tasks given to them efficiently because they will also have high motivation.

4 Academic motivation

Motivation is defined as the driving force in the individual to perform a task or behavior (Tuzcuoğlu, 2014). Many motivation theories have two-factor constructs that draw attention to the differences between motivated behaviors made by personal intention or choice and unmotivated behaviors performed involuntarily or involuntarily (Deci et al., 1991). However, in addition to the intrinsic and extrinsic types of motivation, Deci and Ryan (1985) proposed the term *amotivation*, which reflects a lack of motivation, as a third type of motivation. As it is applied to academic motivation, SDT can also be organized using a variety of different structures (Deci & Ryan, 2008). According to Bozanoğlu (2004), academic motivation is “generating the necessary energy for academic tasks”. In other words, it means motivating and being motivated (Ayvaşık et al., 2000). Factors affecting academic motivation are listed as non-traditional students, the field of study, the duration of the study, the social history of students, the environment, and students’ expectations (Wilkesmann et al., 2012). It is predicted that students’ academic motivation may change as their environment changes in the distance education process. Studies have shown that academic performance positively correlates with academic motivation (Coetzee, 2011; Henning, 2007; Komarraju et al., 2009). According to Bandura’s (1997) self-efficacy theory, one’s self-efficacy beliefs are related to motivating oneself. In other words, low self-efficacy means low motivation. Accordingly, it is considered that the computer self-efficacy and academic motivation of students who take lessons using a computer will be related to each other. Also, the attitudes of individuals with high academic motivation toward lessons develop positively (Ajayi et al., 2012). It is thought that there is a relationship between the academic motivation of students taking lessons through e-learning during the COVID-19 pandemic process and their attitudes towards e-learning. The computer self-efficacy perceptions of students taking all these courses through computers are also predicted to affect these variables.

5 The present study

Taking lessons through e-learning during the COVID-19 pandemic process has caused university students to spend more time with computers. This will also affect their academic motivation. Given that students have taken lessons through distance education during the COVID-19 pandemic process in Turkey, the results of this research are expected to contribute to the literature in terms of revealing the distance education experiences of preservice teachers. Therefore, in this research, whether the fear of contracting COVID-19 (CoVFC) had a moderating role in the prediction of preservice teachers’ academic motivation (AMOTV) with their computer self-efficacy perceptions (CSE) was tested (Fig. 1). Also, the mediating role of preservice teachers’ e-learning attitudes in the prediction of AMOTV with CSE was tested in the research. Accordingly, the research questions were designed as follows:

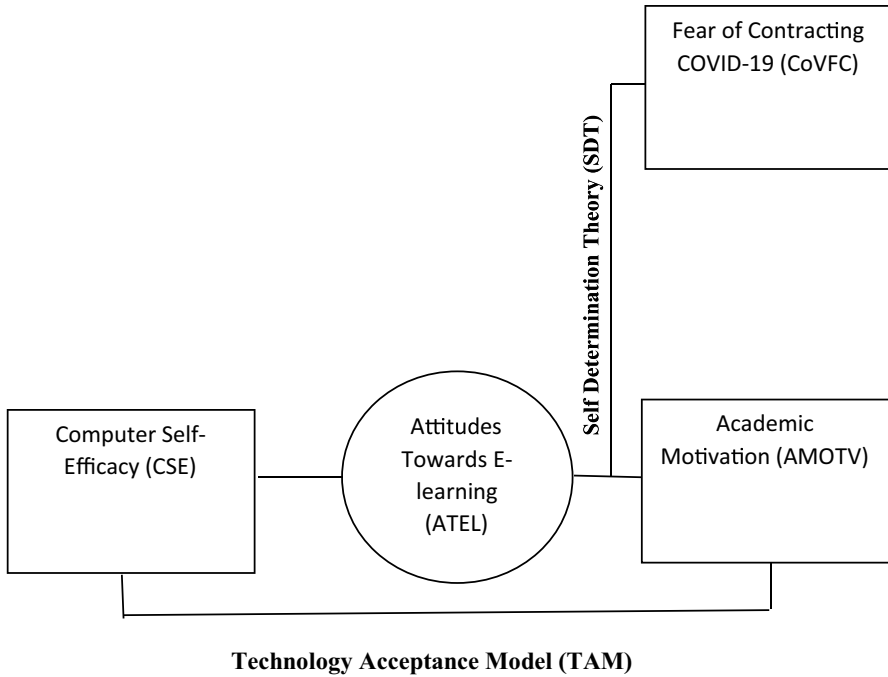


Fig. 1 The approaches on which the research was based

1. Does CoVFC have a moderating effect on the prediction of preservice teachers' AMOTV with their CSE?
2. Does ATEL have a mediating role in the prediction of preservice teachers' AMOTV with their CSE?
3. Is there a combined effect of the moderating effect of CoVFC and the mediating role of ATEL in the prediction of preservice teachers' AMOTV with their CSE?

6 Methods

6.1 The research design

This research employed a descriptive design and aimed to investigate the moderating effect of CoVFC and the mediating role of ATEL in the prediction of preservice teachers' AMOTV with their CSE.

6.2 The sample

The study group of this research consisted of 527 preservice teachers in 21 different branches (such as classroom teaching, science teaching, pre-school teaching, primary school mathematics teaching, guidance and psychological counseling,

Turkish Language teaching, the teaching of technology and design, the teaching of electronics, and the teaching of mechanics) enrolled in the Faculty of Education of a university located in the central-southern region of Turkey. However, the preservice teachers came from different regions of Turkey. Participation in the study was on a voluntary basis, and the study was carried out online. Five of the participants were not included in the study due to supplying incomplete information, and the research was conducted with the data of 522 participants. The demographic characteristics of the preservice teachers participating in the study are given in Table 1. Data belonging to these variables were collected within the scope of the research subject.

As seen in Table 1, 388 (74.3%) of the participants were female and 134 (25.7%) were male. Of the participants, 123 (23.6%) were 1st-year, 73 (14%) were 2nd-year, 65 (12.5%) were 3rd-year, and 261 (50%) were 4th-year students. Also, 352 (67.4%) of the participants had a computer, but 170 (32.6%) did not. The daily duration of participants' internet use was as follows: 19 (3.6%) participants, 0–1 h; 138 (26.4%) participants, 1–3 h; 205 (39.3%) participants, 3–5 h; 160 (30.7) participants, more than 5 h. Regarding how much the participants were scared of the COVID-19 pandemic, 44 (8.4%) were very fearful, 219 (42%) were fearful, 213 (40.8%) were slightly fearful, and 46 (8.8%) were not fearful of it at all.

Table 1 Information about the descriptive characteristics of the participants

	Frequency	Percentage (%)
Sex		
Female	388	74.3
Male	134	25.7
School year		
1st year	123	23.6
2nd year	73	14.0
3rd year	65	12.5
4th year	261	50.0
Owner of a personal computer		
Yes	352	67.4
No	170	32.6
Daily duration of internet use (hours)		
0–1	19	3.6
1–3	138	26.4
3–5	205	39.3
More than 5 h	160	30.7
Level of fear of contracting COVID-19		
Very fearful	44	8.4
Fearful	219	42.0
Slightly fearful	213	40.8
Not fearful at all	46	8.8
TOTAL	522	100

6.3 Data collection tools

6.3.1 The academic motivation scale

The scale, which was developed by Ünal Karagüven (2012), is theoretically based on the theory of autonomy. For the scale, both exploratory and confirmatory factor analysis were performed again. It is a 7-point Likert-type scale. The scale is rated on 7 categories between “strongly agree” and “strongly disagree”. The validity and reliability analyses of the scale were repeated for this research. The scale consists of 28 items and 7 sub-dimensions. These sub-dimensions are “intrinsic motivation to know”, “intrinsic motivation to accomplish”, “intrinsic motivation for stimulation”, “extrinsic motivation—identified regulation”, “extrinsic motivation—introjected regulation”, “extrinsic motivation—external regulation”, and “amotivation”. The items in the sub-dimensions explained 58.6% of the total variance. Item-total score correlation of the scale was between 0.22 and 0.64. Since the items belonging to the amotivation sub-dimension measured lack of motivation, naturally, they had a correlation with the overall scale between zero and negative values (0.00 to -0.04). All of the correlations belonging to the other sub-dimensions were positive. The values obtained as a result of the confirmatory factor analysis and model-data fit analysis were as follows: Chi-square (χ^2)=318.74; $\chi^2 / sd=3.09$; RMSEA=0.043; SRMR=0.031, IFI=0.94; CFI=0.94; GFI=0.90; AGFI=0.91; NFI=0.91. In the analyses, a χ^2 / sd proportion of less than 5 and GFI and AGFI values of greater than 0.90 are ideal findings showing the goodness of model-data fit (Marsh & Hocevar, 1988). Cronbach’s alpha internal consistency coefficients of the sub-dimensions ranged from 0.67 to 0.87. As a result, the scale was found to be reliable and valid.

6.3.2 The E-Learning attitude scale

This scale was developed by Haznedar and Baran (2012). For the scale, both exploratory and confirmatory factor analysis were performed again. It is a 5-point Likert-type scale and consists of 20 items and two sub-dimensions. The validity and reliability analyses of the scale were repeated for this research. The scale has two sub-dimensions, namely e-learning tendency and e-learning avoidance. There are 10 items in each sub-dimension. Accordingly, the factor loadings of the items were found to range between 0.51 and 0.83. The items in the sub-dimensions explained 52.2% of the total variance. After the Varimax rotation and confirmatory factor analysis, the 20 items were gathered under two factors with an eigenvalue of greater than 1. The first and second factors explained 30.7% and 21.53% of the total variance, respectively. The two factors, together, explained 52.23% of the total variance. Items containing negative attitudes were gathered under the first factor, while items showing positive attitudes were gathered under the second factor. Cronbach’s α coefficient was calculated as 0.93 for the 10 positive items and 0.84 for the 10 negative items on the scale. The values obtained as a result of model-data fit analysis were as follows: Chi-square (χ^2)=317.461; $\chi^2 / sd=2.06$; RMSEA=0.045; SRMR=0.37; IFI=0.97; CFI=0.97; GFI=0.94; AGFI=0.91; NFI=0.95. In the analyses, a χ^2 / sd proportion of less than 5, GFI and AGFI values of greater than 0.90, and SRMR

and RMSEA values of less than 0.05 are ideal findings showing the goodness of model-data fit. As a result, the scale was found to be reliable and valid.

6.3.3 The perceived computer self-efficacy scale

This scale, which was developed by Aşkar and Umay (2001), has a 5-point Likert type structure and consists of 18 items and 2 sub-dimensions. For the scale, both exploratory and confirmatory factor analysis were performed again. During the development of the original form, the scale was submitted to expert opinions for content validity, and confirmatory factor analysis (CFA) was conducted for construct validity. The validity and reliability analyses of the scale were repeated for this research. Accordingly, the first sub-dimension of the scale included 11 items showing positive self-efficacy perception towards computers, and the second sub-dimension consisted of 7 items showing negative self-efficacy perception towards computers. The factor loadings of the items ranged between 0.40 and 0.82. The items in the sub-dimensions explained 51.2% of the total variance. The first dimension explained 36.7%, and the second dimension explained 14.5% of the total variance. The values obtained as a result of confirmatory factor analysis and model-data fit analysis were as follows: Chi-square (χ^2)=320.905; $\chi^2 / sd=2.69$; RMSEA=0.049; SRMR=0.42; IFI=0.95; CFI=0.95; GFI=0.93; AGFI=. 91; NFI=0.91. Cronbach's Alpha internal consistency coefficients of the sub-dimensions ranged from 0.91 to 0.70. As a result, the scale was found to be reliable and valid.

6.3.4 The fear of contracting COVID-19 questionnaire

This questionnaire was developed by the researchers during the development of this questionnaire, strict measures against COVID-19 had not yet been taken in Turkey, and thus full lockdowns, quarantines and curfews had still not been implemented. However, the number of people who had died by contracting the disease had started to create fear in society. In this context, the researchers wished to examine the effect of CoVFC in the study group. The questionnaire consists of two sections. The first section collects demographic information about the participants. These refer to gender, grade level, duration of daily internet usage, and the presence of patients with COVID-19 in their environment. Descriptive analysis regarding CoVFC on the basis of these variables is detailed in the results section of the paper.

In the second section, we examined an individual stressor. This is the stressor subjective fear assessment. While there are a number of strategies used to assess generalized fear and anxiety in individuals (Kogan & Edelstein, 2004; Tzeng & Yin, 2008), these measurement strategies often utilize single items that could be a useful screening tool to further examine what is at the root of the fear and its manifestations. In the current study, our interest is in giving as little guidance as possible to the respondent as to how they should think about it or frame it; rather, we simply ask respondents to numerically rate on a sliding scale of 1–4 “How fearful are you of contracting COVID-19?” The response options to the question are “very fearful”, “fearful”, “slightly fearful”, and “not fearful at all”. The data obtained from

the responses to this question were used as an independent variable to determine the moderating effect.

6.4 Data analysis

6.4.1 The combined mediation and moderation procedure

The most important feature of the basic mediation model is that there should be one intermediary variable in the model and a significant relationship between the independent variable X and the dependent variable Y , as shown in Fig. 2, Panel A. Mediation, as a quantitative or qualitative variable, is defined as a criterion that affects the relational power or direction of the independent or predictive variable on the dependent variable (Baron & Kenny, 1986). In other words, the mediating variable is defined as the third variable that has a zero-order correlation with the other two variables. Mediation analysis is commonly carried out by means of regression analysis by checking whether an independent variable X has an effect on a variable M which in turn has an effect on a dependent variable Y (Fig. 2, Panel B). Mediation in path analysis is defined as an indirect effect of one variable on another (Shrout & Bolger, 2002).

Moderation has been defined by MacKinnon (2008) as a way for the researcher to explain the process of one variable affecting another. In the case of dependent, independent and mediating variables, the mediating variable acts as a mediator in the relationship between the dependent and the independent variable. In other words, with moderation, or interaction, the strength of the relationship between two variables is affected by a third variable (Morgan-Lopez & MacKinnon, 2006). The general approach in moderation analysis to what is commonly called linear-by-linear interaction (Aiken et al., 1991) is to estimate a regression model in which the dependent variable Y is regressed on the independent variable X , the moderating variable W and the product of W and X (WX) (Fig. 2, Panel C). In the research, the setting of the combined mediation and moderation model was inspired by the model 14 of Hayes (2018) and the Panel D, which was developed by Edwards and Lambert (2007). In light of these models, the model of the research was created as three-staged and then it was analyzed.

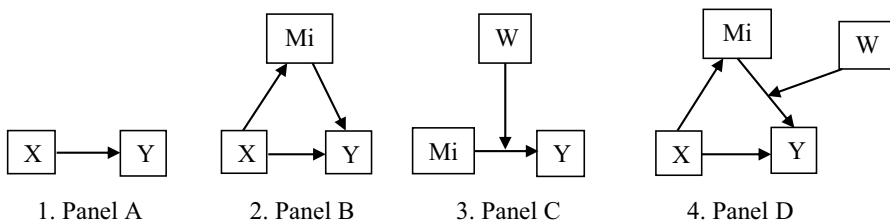


Fig. 2 The model of the research. X = CSE (Computer Self-Efficacy), Y = AMOTV (Academic motivation) M_i = ATEL (Attitudes towards E-Learning) and W = CoVFC (Fear of contracting COVID-19)

In this model, X exerts its effect on Y indirectly through M_i , independent of any other variables, but also directly, with the magnitude of the direct effect being dependent on W.

Models for calculating the mediating or regulatory effect generally contain a mediating variable or a moderating variable. However, it is quite natural for more than one variable to mediate or moderate the relationship between the two variables. In calculating the mediating and regulatory effect in such models, the effect of each variable is usually calculated in separate models. In fact, considering the correlations of each mediating or moderating variable with the independent variable and with each other, employing traditional single mediation or regulatory analysis may produce biased standard errors (Krull & MacKinnon, 2001). The current use of the term ‘mediated moderation’ was proposed by Baron and Kenny (1986; see also Morgan-Lopez & MacKinnon, 2006) and is a special case of moderated mediation. Because this model is analytically the same as a first stage moderated mediation model (see Fig. 2), it contributes to the confusion about how to differentiate mediated moderation and moderated mediation (Edwards & Lambert, 2007). The issue of testing more than one mediating effect or regulatory effect at the same time has been discussed by some researchers (Brown, 1997; Cheung, 2007; MacKinnon, 2008). These discussions mention the drawbacks of conducting independent tests in determining the mediation or regulatory effect, and claim that the structural equation model presented as an alternative, too, includes some weaknesses in measuring the mediating and regulatory effect of each variable in multi-mediation and regulatory models. In models with more than one mediating and moderating variable, the indirect effect occurring through any mediating variable is not the same as the indirect effect in the model, where this variable is the only mediating and moderating variable. The most important reason for this is that this mediating variable most probably has a correlation with other moderating variables as well. Therefore, in multi-mediation and regulatory models, whether each mediating and moderating variable has a significant effect should be calculated with a test which also includes other variables. This analysis, done with a single model, can help determine more accurately whether the independent variable has a significant effect on the dependent variable when all the variables are taken into account (Preacher & Hayes, 2008). Therefore, the SPSS PROCESS macro which was developed for SPSS by Hayes (2018) and is based on bootstrap sampling was used in the multi-mediation and regulatory model tested in this research, and the significance of a mediating and regulatory effect was tested in a single model containing all variables. Using the least squares method in regression analysis, this additional software can calculate path coefficients, standard errors, t and p values, and bootstrap confidence intervals of all variables (independent, mediating, moderating, control, and dependent) available in a research model (Hayes, 2018; Hayes & Rockwood, 2017; Hayes et al., 2017). In this respect, it is suggested that PROCESS can be used for path analysis and that many regression equations can be easily modeled by researchers (Hayes, 2018; Hayes et al., 2017). Using the PROCESS macro, the effect of the mediating and moderating variables in the model can be calculated with both the Sobel test and the bootstrap technique (Hayes, 2018). Thus, the effect of the mediating and moderating variables can also be evaluated over the bootstrap confidence interval, which is claimed to

be a stronger technique compared to the Sobel test (Preacher & Hayes, 2004, 2008; Zhao et al., 2010). The Bootstrap method is a re-sampling method. By creating sub-samples from the data obtained from the research sample, the model parameters are tested in each sub-sample and compared with the results obtained from the main sample. In this way, the significance levels of direct and indirect effects can be tested (MacKinnon, 2008; Preacher & Hayes, 2008). In this study, too, the indirect and direct effects of ATEL, the mediating variable, and CoVFC, the moderating variable, were interpreted using the bootstrap technique. In cases where the bootstrap lower limit (Boot LLCI) and upper limit (Boot ULCI) confidence interval values of the mediating variable at 95% confidence interval are both less than zero or both greater than zero, the mediation is accepted to be significant (Hayes, 2018). The role of the mediating variable in the current research was analyzed within the context of the mediation typology proposed in the study by Zhao et al. (2010). Also, the mediation role is classified as “partial mediation, full mediation, or no mediation” (Baron & Kenny, 1986). The moderating variable, on the other hand, is defined as a criterion that affects the correlational power or direction of the independent or predictor variable on the dependent variable as a quantitative or qualitative variable (Baron & Kenny, 1986). The moderating variable is defined as the third variable that has a zero-rank correlation with the other two variables. If the moderating variable consists of categorical data, the subjects should be almost equal for each category, and the homogeneity test of error variances should be performed in collecting these data. Besides, the fit of continuous variables to be used for normal distribution will also be important for the strength of the test.

The moderating variable in this study, CoVFC, is categorical. Accordingly, the homogeneity test was performed, and the normality of the distribution was tested. Skewness and kurtosis values were examined to determine the fit of the data for normal distribution. In this context, the skewness values of the variables were found to range from -0.33 to 0.21, and the kurtosis values ranged from -0.14 to 1.46. Since the values were between -1.5 and +1.5, the data were found to show a normal distribution (Tabachnick & Fidell, 2013).

7 Findings

7.1 Results of the descriptive statistics of the variables

Table 2 shows the percentages and frequencies of descriptive data for preservice teachers' levels of fear of contracting COVID-19 in line with the CoVFC questionnaire according to some variables.

As seen in Table 2, it was determined that female preservice (9.3%) were more afraid of the COVID-19 pandemic than male preservice teachers (6.0%). Also, the 4th grade (10.0%) preservice teachers feared of contracting COVID-19 more than the other grade levels. It was revealed that the preservice teachers who had a daily internet usage duration of 5 h or more (13.1%) were more afraid than the others. It was determined that preservice teachers with COVID-19 patients around

Table 2 Preservice teachers' levels of fear of contracting COVID-19 (CoVFC) according to some variables

Variables		CoVFC Level								Total
		Very fear-ful		Fearful		Slightly fearful		Not fearful at all		
		f	%	f	%	f	%	f	%	
Gender	Female	36	9.3	184	47.4	141	36.3	27	7.0	388
	Male	8	6.0	35	26.1	72	53.7	35	14.2	134
Grade Level	1	10	8.1	45	36.6	53	43.1	15	12.2	123
	2	3	4.1	41	56.2	26	35.6	3	4.1	73
	3	5	7.7	25	38.5	31	47.7	4	6.2	65
	4	26	10.0	108	41.4	103	39.5	24	9.2	261
Daily internet usage duration	0–1 h	1	5.3	5	26.3	12	63.2	1	5.3	19
	1–3 h	7	5.1	62	44.9	58	42.0	11	8.0	138
	3–5 h	15	7.3	85	41.5	86	42.0	19	9.3	205
	5+ hour	21	13.1	67	41.9	57	35.6	15	9.4	160
Having COVID-19 patients around him/her	Yes	3	8.3	13	36.1	16	44.4	4	11.1	36
	No	41	8.4	206	42.4	197	40.5	42	8.6	486

them feared of contracting COVID-19 less than those who did not have COVID-19 patients around them.

Within the scope of the research, t-test and ANOVA tests were carried out to determine whether the CoVFC of the individuals showed a significant difference according to the descriptive characteristics of the variables given above. The analysis results are given in Table 3.

As seen in Table 3, there was no significant relationship between pre-service teachers' CoVFC and their gender ($t=4.63$, $sd=520$, $p=0.054$). One-way analysis of variance (ANOVA) was conducted to test whether there was a significant relationship between CoVFC and grade levels, and it was found that there was no significant relationship ($F=1.11$, $sd=521$, $p=0.34$). As a result of the ANOVA test conducted to determine whether there was any relationship between the participants' daily internet usage duration and CoVFC, it was determined that there was no significant relationship ($F=1.22$, $sd=521$, $p=0.29$). Finally, a significant relationship was not found as a result of the t-test performed for the relationship between the participants' CoVFC and having COVID-19 patients around them ($t=0.67$, $sd=520$, $p=0.50$).

The Pearson correlation coefficient values between the CoVFC, AMOTV, ATEL, and CSE variables are presented in Table 4.

As seen in Table 4, all Pearson correlation coefficient values between the research variables were found to be statistically significant. There was a low negative correlation between the CoVFC of preservice teachers and their AMOTV ($r=-0.15$, $p<0.001$). There was a low and positive correlation between their AMOTV and ATEL ($r=0.04$, $p<0.05$) and a low and positive relationship between their AMOTV

Table 3 T-test and ANOVA results for the relationship between the participants' CoVFC and different characteristics

Characteristics	Categories	N	sd	ss	t/F	p
Gender	Female	388	520	0.43	4.63	0.054
	Male	134				
Grade Level	1	123	Between groups: 3	1.25	1.11	0.34
	2	73				
	3	65	Within groups: 518			
	4	261				
Daily internet usage duration	0–1 h	19	Between groups: 3	0.84	1.22	0.29
	1–3 h	138				
	3–5 h	205	Within groups: 518			
	5+ hours	160				
Having COVID-19 patients around him/her	Yes	36	520	0.25	0.67	0.50
	No	486				

N: Frequency, ss: Standard Deviation, t: T value, F: ANOVA test F value, $p < 0.05$

and CSE ($r=0.13$, $p < 0.001$). Also, there was a low and positive relationship between their CSE and ATEL ($r=0.25$, $p < 0.001$).

The fit indices of the model (Fig. 2, Panel D) created to reveal direct and indirect (mediating) effects on AMOTV indicated that the scheme built had goodness of fit ($X^2 / sd=3.64$, $RMSEA=0.061$, $CFI=0.96$, $NFI=0.95$, $RFI=0.92$, $GFI=0.94$, $AGFI=0.93$).

To test this moderated mediation hypothesis, we used the integration approach suggested by Mueller et al. (2005). This approach includes three regression models: moderation, mediation, and moderated mediation. First, we tested the total direct effect of CSE on AMOTV. Accordingly, the findings indicated an insignificant interaction effect of CSE and CoVFC on AMOTV ($\beta=-0.26$, $p=0.32$, see Table 3). Thus, the magnitude of the total direct effect did not change according to CoVFC. Second, we conducted multiple regression analysis and tested the mediation effect without the moderator. The results showed a partial indirect effect of CSE on AMOTV via ATEL as hypothesized ($\Delta R^2=0.02$, $p < 0.01$). Third, we tested

Table 4 Pearson's Product-Moment Correlation Coefficients for all variables ($n=522$)

Variables	1	2	3	4
1. CoVFC	1			
2. AMOTV	-0.15**	1		
3. ATEL	0.11*	0.04*	1	
4. CSE	0.14**	0.13**	0.25**	1

* $p < 0.05$, ** $p < 0.01$

CSE Computer Self-Efficacy, AMOTV Academic motivation, ATEL Attitudes towards E-Learning, CoVFC Fear of contracting COVID-19

the significance of the indirect effect using the bootstrapping technique (Shrout & Bolger, 2002). The bootstrapped confidence interval [95% CI: (0.001, 0.04)] did not yield zero. Thus, the indirect effect was significant. Finally, we tested the moderated mediation model using SPSS PROCESS Macro Model 14 (Hayes, 2018). As a result of the analysis of the moderating variable, ATEL was found to interact with the moderator CoVFC, showing an effect on the dependent variable AMOTV ($\beta = -0.12$, $p < 0.05$). Thus, the effect of ATEL on AMOTV varied depending on the level of CoVFC.

As seen in Table 5, CSE was a significant predictor of AMOTV in the direct effect models ($\beta = 0.16$, $p < 0.001$), and then ATEL was added to the model as a mediating variable, and CSE was again observed to be a significant predictor of AMOTV ($\beta = 0.14$, $p < 0.001$). However, there was a decrease in the impact value.

Table 5 The values of significance (bootstrap) regarding the moderating effect of CoVFC and the mediating role of ATEL in the prediction of AMOTV with CSE

	β	SE	T	p	LLCI	ULCI	R ²	F
Moderation analysis (moderation effect of X–Y)								
Outcome variable: AMOTV (Academic Motivation)								
Constant	2.12	0.03	671.34	0.00**	2.11	2.13	0.04	8.36
CSE	0.16	0.04	3.42	0.00**	0.06	0.23		
CoVFC	-0.08	0.02	-4.00	0.00**	-0.12	-0.04		
CSE- CoVFC	-0.26	0.27	-0.97	0.32	-0.79	0.26		
Mediation analysis								
Outcome variable: ATEL (Attitudes Towards E-Learning)								
Constant	0.90	0.14	6.42	0.00**	0.62	1.17	0.06	34.03
CSE	0.46	0.07	5.83	0.00**	0.30	0.61		
Outcome variable: AMOTV (Academic Motivation)								
Constant	1.94	0.07	24.58	0.00**	1.78	2.10	0.02	5.90
CSE	0.14	0.04	3.26	0.00**	0.05	0.23		
ATEL	0.04	0.02	1.86	0.04*	0.09	1.02		
Moderated mediation analysis								
Outcome variable: ATEL (Attitudes towards E-Learning)								
Constant	-0.81	0.14	-5.82	0.00**	-1.09	-0.54	0.06	34.03
CSE	0.46	0.047	5.83	0.00**	0.30	0.24	0.61	
Outcome variable: AMOTV (Academic Motivation)								
Constant	1.83	0.07	23.43	0.00**	1.67	1.98	0.05	6.85
CSE	0.14	0.04	3.75	0.00**	0.07	0.25		
ATEL	0.04	0.02	-1.55	0.04*	-0.01	-0.00		
CoVFC	-0.08	0.02	3.90	0.00**	-0.12	-0.04		
ATEL- CoVFC	-0.12	0.14	-0.89	0.04*	-0.40	-0.45		

* $p < 0.05$, ** $p < 0.001$

ATEL Attitudes towards E-Learning, AMOTV Academic motivation, CSE Computer Self-Efficacy, CoVFC Fear of contracting COVID-19, LLCI lower limit, ULCI upper limit, Bootstrap sample size = 5000. * $p < 0.05$, ** $p < 0.01$

Table 6 Index of moderated mediation

	Index	Boot SE	Boot LLCI	Boot ULCI
CoVFC	-0.05	0.06	-0.09	-0.06

Table 7 Results of conditional indirect effect analysis

CoVFC	Boot Effect	Boot SE	Boot LLCI	Boot ULCI
-1 SD (-0.15)	-0.008	0.01	-0.03	0.01
Mean	-0.01	0.01	-0.005	-0.04
+1 SD (0.15)	-0.02	0.01	-0.06	-0.01

Bootstrap size = 5000. *SD* Standard deviation, *LL* lower limit, *CI* confidence interval, *UL* upper limit

Therefore, ATEL could be said to play a “partial mediation” role in the relationship between CSE and AMOTV (Holmbeck, 1997). While ATEL was a significant predictor of AMOTV ($\beta=0.04$, $p<0.05$), COVID-19 PF was found to have a negative regulatory effect in the relationship between ATEL and AMOTV ($\beta=-0.12$, $p<0.05$).

Regarding the total moderated mediation effect, the index of moderated mediation (Hayes, 2015) is presented in Table 6. The effect was significant [95% CI: (-0.09, -0.06)], indicating that the indirect effect of CSE on AMOTV through ATEL was moderated by CoVFC.

The conditional indirect effect on the values of the moderator was calculated, and a mean value, one standard deviation value above -0.15, and another below +0.15, was obtained. The results are shown in Table 6. The indirect effect was significant for both mean CoVFC [95% CI: (-0.005, -0.04)] and upper CoVFC [95% CI: (-0.06, -0.01)]. However, the indirect effect was not significant for lower CoVFC [95% CI: (-0.03, 0.01)]. Thus, the indirect effect of CSE on AMOTV via ATEL was not observed when CoVFC had a low value (Table 7).

8 Discussion and conclusion

According to the CoVFC questionnaire administered to the teacher candidates, levels of fear of contracting COVID-19 (CoVFC), which is a crisis, were examined in terms of some variables. It was determined that female preservice teachers participating in the study (9.3%) were more fearful of COVID-19 than male preservice teachers (6.0%). But there was no significant relationship between pre-service teachers' CoVFC and their gender.

4th grade (10.0%) preservice teachers were afraid of contracting COVID-19 more than other grade levels. One-way analysis of variance (ANOVA) was conducted to test whether there was a significant relationship between CoVFC and grade levels, and it was found that there was no significant relationship.

It was revealed that the preservice teachers (13.1%) with a daily internet usage time of 5 h or more were more afraid of the COVID-19 pandemic than the others.

But as a result of the ANOVA test conducted to determine whether there was any relationship between the participants' daily internet usage duration and CoVFC, it was determined that there was no significant relationship.

It was determined that preservice teachers with COVID-19 patients around them were afraid of contracting COVID-19 outbreaks less than those who did not have COVID-19 patients around them. But a significant relationship was not found as a result of the t-test performed for the relationship between the participants' CoVFC and having COVID-19 patients around them.

The focus of this study is to determine the regulatory effect of CoVFC and the mediating role of ATEL in predicting preservice teachers' AMOTV with their CSE. All of the fit indices in the model of the research were accepted (Hu & Bentler, 1999). The discussion of the research questions is presented below, respectively.

First, regarding the question "Does CoVFC have a moderating effect on the prediction of preservice teachers' AMOTV with their CSE?" the CSE of prospective teachers was found to predict their AMOTV positively and significantly. Some studies show that self-efficacy affects motivation (Sharp, 2002; Zimmerman, 2000). Furthermore, Venkatesh and Davis (2000) suggested that self-efficacy or computer self-efficacy should be included as a determinant to explain the acceptance behavior of its users. According to Zimmerman (2000), self-efficacy depends on the performance skills of an individual rather than on their personal qualities, such as physical or psychological characteristics. Before carrying out an action, the individual makes a judgment as to whether it will be a success. If their judgment points to achievement upon carrying out the action, the person may attempt to do it. For example, if a student has a high self-efficacy belief at the outset that they will complete the course successfully, their academic motivation will be high, and they may decide to study. Upon successful completion of the course, their academic motivation, which carries them to success, may increase. In face-to-face education, students can benefit from teachers, friends, and the resources of the environment that make them successful. With the COVID-19 pandemic, lessons have been moved to distance education. The individual can either use these support resources remotely (electronically), or not use them at all. According to Lee (2020), replacing face-to-face teaching with online virtual teaching can affect students' experiences and student participation in the classroom. As a matter of fact, time spent by preservice teachers taking their lessons electronically using computers has increased compared to the past. The increase in time spent on the computer increases individuals' belief in computer self-efficacy (Karsten & Roth, 1998a, 1998b). Therefore, preservice teachers' perceptions of computer self-efficacy (CSE) were thought to positively affect their academic motivation (AMOTV).

In the second stage of the first research question, CoVFC was found to have a negative regulatory effect on the prediction of preservice teachers' AMOTV with their CSE. A negative correlation was found between CoVFC and AMOTV. In other words, as the CoVFC of prospective teachers increased, their academic motivation decreased. Moreover, CoVFC was found to have a negative regulatory effect on the relationship between prospective teachers' ATEL and AMOTV. As positive attitudes towards e-learning increased, academic motivation was observed to increase as well. Some studies show that increased positive attitudes towards e-learning will increase

motivation (Çalışkan, 2002; Lin & Lehman, 1999; Ryan & Deci, 2000). When the fear of contracting COVID-19 is included, academic motivation decreases even if positive attitudes towards e-learning increase. According to the SDT, academic motivation is explained according to the reasons for the behavior. In the SDT, it is stated that negative consequences can occur if the basic psychological needs of individuals are hindered (Ryan & Deci, 2000). The study results support this theory. With the growing number of COVID-19 pandemic cases every day, social concerns and anxieties have started to increase in many countries throughout the world (Lin, 2020). During the pandemic, most people, such as teachers and students, have had to stay at home and have had more time to explore other aspects of life, such as family health and safety, employment status, and family income, which has made them more concerned (Wang et al., 2020). University students have experienced various negative emotions after learning about the pandemic and its impact on their lives in general (Sahu, 2020; Zhai & Du, 2020). In an Active Minds (2020) survey of 2,086 college students, the mental health of 80% of students was affected by the COVID-19 outbreak, 38% of students had difficulty in focusing on their studies, and 91% of students experienced stress or anxiety. In an informal survey conducted by a college-budget advocacy group completed by 521 students from 129 colleges, 75% of students reported experiencing higher levels of stress, depression and anxiety due to the epidemic (John, 2020). Accordingly, since the increase in fear of the COVID-19 pandemic causes concerns and anxiety in individuals, their motivation will decrease. COVID-19 has necessitated a more effective use of digital devices, online resources, social media technology, and e-learning activities (Mulenga and Marbán 2020). Individuals who are afraid of becoming infected with the COVID-19 virus will spend more time at home using a computer. This can increase positive attitudes towards e-learning. On the other hand, CoVFC can turn into a barrier to preservice teachers' learning of school subjects by decreasing AMOTV. As a reason, it can be interpreted that according to Maslow's hierarchy of needs (Maslow, 1954), students with pandemic fear put their learning needs in the background because they primarily consider their own health.

Finally, the attitude towards e-learning was found to have a partial mediating effect in the relationship between preservice teachers' CSE and AMOTV. As preservice teachers' computer self-efficacy increases, their positive attitudes towards e-learning increase as well. The use of computers, smartphones, laptops, and tablets that are immediately accessible at home or school has increased, and especially policymakers and different stakeholders expect learning to continue in this direction during the COVID-19 crisis (Mulenga and Marbán 2020). Preservice teachers have used technological devices such as computers more during the COVID-19 pandemic period. This situation has increased their computer use and improved their command of computers (Karsten & Roth, 1998a). As computer mastery increases, preservice teachers' academic motivation increases as well, because their learning becomes better. Universities in Turkey have compulsorily launched distance education during the COVID-19 period. As a result, preservice teachers have had to maintain learning in an electronic environment. This does not necessarily mean that every preservice teacher will have a positive attitude towards e-learning. Sahu (2020) states that the transition from face-to-face education to e-learning poses challenges for

higher education institutions in issues such as non-technology enthusiasts, infrastructure problems and access to technology. Increased e-learning does not always mean increased academic motivation. The evaluation of all these findings indicates that the fear of contracting COVID-19 is reflected in preservice teachers' learning experiences. Given that students in Turkey have taken their lessons through distance education during the COVID-19 pandemic, the results of this research are thought to contribute to the literature in terms of revealing preservice teachers' distance learning experiences.

9 Limitations and recommendations

The structural equation model of this study revealed the moderating effect of CoVFC and the mediating role of ATEL in the prediction of preservice teachers' AMOTV with their CSE; however, the study has some limitations. First, the personal characteristics of preservice teachers who participated in the research and the sample size do not cover all teachers in Turkey. In future studies, the use of a larger sample and inclusion of preservice teachers from various regions of Turkey can increase the generalizability of the study. Secondly, this study used self-report scales. We also recommend using qualitative data collection methods in the data collection process. Besides, the data were collected under the effect of the COVID-19 pandemic. Future studies can be carried out in the absence of pandemic fear. Thirdly, the fact that the participants were reached during the pandemic process prevented the homogeneous distribution of some variables such as gender, because the data collection process took place online and voluntarily. Efforts were made to make up for this, but the problem could not be prevented. Finally, this research can be conducted with preservice teachers from other countries providing distance education, and thus intercultural comparisons can be made, too. During the period in which the data were collected, there were still no quarantines, lockdowns or curfews in Turkey. However, the number of people who became ill and died was increasing day by day. In this context, the data were collected accordingly by considering CoVFC, which was used as a moderator in the study, i.e., by taking into account the fears of teacher candidates of becoming ill and dying. Within the scope of the study, it was assumed that stress, quarantine or different negative psychological factors did not affect the preservice teachers' fear of contracting the disease and dying.

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