Journal of Computer and Education Research
October 2024 Volume 12 Issue 24 (ISSN:2148-2896)
http://dergipark.org.tr/jcer

Research Article

The Examination Affecting ICT Self-Efficacy and Online Information Practices via Structural Equation Modeling: PISA 2022 Türkiye Sample

Berk DÜNDAR [1] Melek Gülşah ŞAHİN [2,*]

[1] *Gazi University, Türkiye, berk.dundar@gazi.edu.tr*

[2] *Gazi University, Türkiye, mgulsahsahin@gazi.edu.tr*

[*] *Corresponding Author: mgulsahsahin@gazi.edu.tr*

Article Info

Received: *19 March 2024*
Accepted: *29 May 2024*

Keywords: PISA 2022, ICT self-efficacy, online information practices, structural equation modeling

10.18009/jcer.1455199

Publication Language: English

Abstract

In this study, it is aimed to examine the relationship between ICT self-efficacy perceptions and online information practices in PISA 2022 student questionnaire and ICT related factors. A predictive correlational research design was preferred to examine the variables predicting students' self-efficacy perceptions and online information practices towards information and communication technologies. PISA 2022 Türkiye data was used in the study. Research data was obtained from 8 data collection tools that were indexed by OECD and converted into 6 variables. Structural equation model was established with this data and MLR was used as the estimation method. In the tested structural equation model, the RMSEA value was calculated as .04, SRMR as .02, CFI as .99 and TLI as .96. As a result of the analysis, all path coefficients were significant and the values of the fit indices indicated perfect fit.

To cite this article: Dündar, B. & Şahin, M.G. (2024). The examination affecting ICT self-efficacy and online information practices via structural equation modeling: PISA 2022 Türkiye sample. *Journal of Computer and Education Research, 12* (24), 370-382. https://doi.org/10.18009/jcer.1455199

Introduction

Today, information and communication technologies (ICT), which we encounter in almost every aspect of life, are becoming important stakeholders in the education sector. ICT, which refers to electronic tools used in the creation, modification, storage, and sharing of information, includes technologies such as the internet, computers, and telephones, as well as radio, television, audio and video recording devices, and satellites (Peña-López, 2009). These technologies, which affect every aspect of life in some way, create dynamic changes in society, and the effects of these changes on education are increasing daily (Mikre, 2011). While societies that can use ICT effectively in the process of creating and using knowledge develop economically and socially (Erdal, 2012; Miller & Atkinson, 2014), the use of ICT in the learning-teaching process is a requirement for raising individuals who will be a part of

the information society. Technology nowadays plays a vital role in the interaction between society and knowledge (Hernandez, 2017). Since the new members of society are born and grow up in technology, it can be said that the new generation cannot be considered in isolation from ICT. In addition, ICT literacy also appears as a part of 21st century skills, which are referred to as the qualities required in today's business life (Eryılmaz & Uluyol, 2015). For all these reasons, technology is being adapted to the education system every day and teachers are trying to keep up with technological developments through pre-service and in-service training programs (Ekici, et al., 2012). However, although ICT is being incorporated into students' lessons, homework and even their lives, there is no guarantee that these skills will be used in the necessary situations and conditions. According to Sakız (2013), having a skill and being able to exhibit that skill in necessary situations are different concepts and she explains this difference with Bandura's (1997) statement that these skills will not be functional unless individuals have the belief that they can exhibit their skills under appropriate conditions. The concept of belief emphasized in this statement is conceptualized as individuals' self-efficacy. The self-efficacy is related with the principle of mutual determination, one of the social cognitive principles developed by Albert Bandura. According to this principle, individuals' behaviors are affected by their personal characteristics, the environment, and previous behaviors (Öztuczu & Mısırlı, 2023).

Self-efficacy has a direct relationship with people's competencies because people tend to perform actions that they think they can be successful (Tang et al., 2022). In this respect, ICT self-efficacy can be associated with online information-seeking behaviors (Halverson, et al., 2010), which are a product of complex processes such as identifying, scanning, processing, and organizing information with different sources in the internet environment that hosts a wide variety of information, because it is known that there is a positive relationship between individuals' internet self-efficacy and online information practices strategies (Şenyuva, 2017). Bandura (1997) defined one of the four sources of self-efficacy as active mastery experiences. These experiences are considered as the primary source of self-efficacy since they create authentic evidence of a sense of achievement in the individual (Palmer, 2006). Since online information-seeking practices also require active use of ICT, it may be a predictor of ICT self-efficacy in the context of active mastery experiences.

PISA (Programme for International Student Assessment), one of the international study that has an important role in education and is the source of changes in education, also

provides data on ICT. PISA, which assesses the knowledge and skill levels that 15-year-old children will need while to keep up with modern society (OECD, 2023), started to collect data on ICT for the first time in 2000 by using the computer familiarity questionnaire in addition to reading skills, mathematics and science literacy. PISA, where ICT questionnaire implementation were diversified and continued in the following years, played an important role in the dissemination of ICT in the field of educational sciences with the published data (Acar, 2015; Drenoyianni, 2006; Freddano & Diana, 2012; Juhanak et al., 2018; Lennon et al., 2003).

In the literature, ICT self-efficacy and online information- seeking practices have been the subject of different studies. In a study conducted by Hori and Fujii in 2021, the researchers created a structural equation model using PISA 2018 data and found that one of the best predictors of ICT self-efficacy is the frequency of using ICT for school-related activities outside of class hours. In the same study, another variable explaining ICT self-efficacy is the diversity of ICT resources. There are also studies showing the effect of ICT resources on ICT use and online information practices skills, and the effect of ICT for school activities outside of the classroom ICT competence and online information practices skills (Facer et al., 2003; Livingstone & Helsper, 2007). Wong and Yang (2017) found that ICT-mediated feedback improves students' engagement, collaborative knowledge construction behavior and autonomy, while Hatziapostolou and Paraskakis (2010) argue that ICT-mediated feedback increases students' engagement and motivation. Martinez-Argüelles et al. (2011) focus on the capacity of ICT to provide personalized feedback, which facilitates learning and increases motivation.

Considering the value of ICT skills in today's world as well as their increasing value day by day, it seems important to reveal the interactions and qualities of the variables that are part of these skills. As a result of the literature review, no study was found that examined the relationships between the variables addressed in this study In this study, it is aimed to examine the relationship between ICT self-efficacy perceptions and online information practices in PISA 2022 student questionnaire and the variables that explain them. In line with this purpose, the research problem can be stated as "What are the relationships between the variables of ICT self-efficacy, online information practices, ICT resources, use of ICT for school activities outside of the classroom, support or feedback through ICT, and views of regulated ICT use in schools and the fit values of the structural

equation model established with these variables?". The study will also provide suggestions for the development of ICT skills by examining the relationships between these variables.

Method

Study Design

In this study, predictive correlational research design was used to examine the variables predicting students' self-efficacy perceptions and online information practices towards ICT. Predictive correlational research designs aim to reveal the value of the dependent variable by focusing on predictor variables. (Creswell & Guetterman, 2018).

Study Group

The data was consisted of PISA 2022 Türkiye data. In PISA 2022, 7250 students selected by stratified sampling from 15-year-old students studying in Türkiye participated (OECD, 2023; MoNE, 2023).

Data Collection Tools

Research data was collected with 8 different data collection tools. These instruments were explained in Table 1 with their codes and contents in PISA 2022 data set (OECD, 2023).

Table 1. Instructions and sample items of measurement tools

Measurement Tools	Number of Items	Statements	
ST250 ST253 ST254 (ICTRES)- ICT resources	11	Instruction	Which of the following are in your home? How many digital devices with screens are there in your home? How many of the following [digital devices] are in your home?
		Sample Items	Laptop computers or notebooks
			Educational Software or Apps
			Internet access
IC175 (ICTFEED)- Support or feedback via ICT	4	Instruction	This school year, how often did you use digital resources for the following activities?
		Sample Items	Read or listen to feedback sent by my teachers regarding my work and academic results
			Read or listen to feedback sent by other students on my work
			Work on drill and practice exercises using an educational software or App
IC176 (ICTOUT)- Use of ICT for school activities outside of	8	Instruction	This school year, how often did you use digital resources for the following activities?
		Sample	Communicate with my teacher

the classroom		Items	Browse the Internet for schoolwork
			Browse the Internet to follow up lessons
IC179 (ICTREG)- Views of regulated ICT use in school	6	Instruction	To what extent do you agree or disagree with the following statements?
		Sample Items	Students should not be allowed to bring mobile phones to class.
			The school should set up filters to prevent students from going on social media.
			Teachers should monitor what students do on their laptops.
IC180 (ICTINFO)- Students' practices regarding online information	6	Instruction	To what extent do you agree or disagree with the following statements?
		Sample Items	When searching for information online I compare different sources
			I discuss the accuracy of online information with my teachers or in class.
			I try to flag wrong information when I encounter it online.
IC183 (ICTEFFIC)- Self-efficacy in digital competencies	14	Instruction	To what extent are you able to do the following tasks when using digital resources?
		Sample Items	Collaborate with other students on a group assignment
			Create a computer program
			Create a multi-media presentation

Table 1 shows the 8 different data collection tools used in the study. Instruments were coded ST250, ST253 and ST254 measure students' access to ICT resources at home, instrument coded IC175 measures the frequency of receiving support and feedback through ICT, instrument coded IC176 measures the frequency of using ICT for course activities outside school hours, instrument coded IC179 measures students' views on the rules regarding ICT in schools, instrument coded IC180 measures students' behaviors in accessing information online, and instrument coded IC183 measures students' self-efficacy perceptions towards ICT (OECD, 2023).

Data Analysis

Table 1 shows that while the variable coded ICTRES was obtained by using 11 items from the 3 measurement tools coded ST250, ST253 and ST254, the data obtained from each measurement tool were used to calculate the index scores of ICTFEED, ICTOUT, ICTREG, ICTINFO and ICTEFFIC variables. In the analysis of the data, SPSS was used to check the assumptions and Mplus 8.3 package programs were used to test the structural equation

model. Before starting the analysis, missing values were first analyzed. The Analyze Patterns module can be used in the SPSS package program to examine the missing data pattern in missing values (Akbaş & Koğar, 2020). When the missing data pattern was examined in the data set, it was understood that missing values were seen in seven percent of the total participants and three percent of the total data. If the missing data rate is low, the list-based deletion method can be used (Field, 2013) and is considered as a good alternative (Büyüköztürk et al. 2021). In this study, participants with missing data in the data set were excluded from the study. After examining the missing values, extreme values were checked. For the control of outliers, the highest and lowest values were analyzed by calculating the z scores of the data. Data with an absolute value above 3.29 were considered outliers (Tabachnick & Fidell, 2013) and excluded from the data set. After the missing and extreme values were excluded from the analysis, 552 data were deleted, and the analysis continued with 6698 data.

Pearson correlation coefficients were calculated to determine whether there is a multicollinearity problem between variables. Among the calculated values, and the highest correlation coefficient was .62 between ICTOUT and ICTREG variables. According to Tabachnick and Fidell (2013), if the correlation between two variables is .90 and above, there may be a multicollinearity problem, and care should be taken when using variables with a correlation of .70 and above. Since the highest correlation coefficient calculated between the variables considered in the study was .62, it was accepted that there was no multicollinearity problem. In order to ensure the assumption of multivariate normality, univariate normality must first be confirmed (Çokluk et al., 2012). To examine univariate normality, the skewness and kurtosis coefficients of each variable, z statistics calculated by the ratio of kurtosis coefficients to standard errors of kurtosis, and histograms drawn with the normal distribution curve were examined. Although the histograms of all variables did not indicate large deviations from the normal distribution, the kurtosis coefficients of ICTOUT (1.18), ICTREG (2.15), and ICTINFO (1.55) variables being greater than 1, and the z statistics calculated for all variables ranges between 3.4 and 19.8 and these values were being greater than 1.96 were interpreted as the non-normal distribution of the data (Büyüköztürk, 2023). Failure to meet univariate normality was interpreted as a failure to meet the assumption of multivariate normality. For this reason, the robust maximum likelihood (MLR) method (Satorra & Bentler, 1994), known to provide more consistent results in non-normally

distributed data, was preferred as the estimation method. RMSEA, SRMR, CFI and TLI were examined as fit indices. Howewer $\chi 2/df$ was not examined because of it has weak logical or statistical foundation (Kline, 2023). Also $\chi 2$ heavily affected by the sample size and it is impossible to maintain the null hypothesis in large samples, and the use of alternative indices is recommended (Smith, 2001).

Findings

The Path diagram for the structural equation model was established in the study was presented in Figure 1.

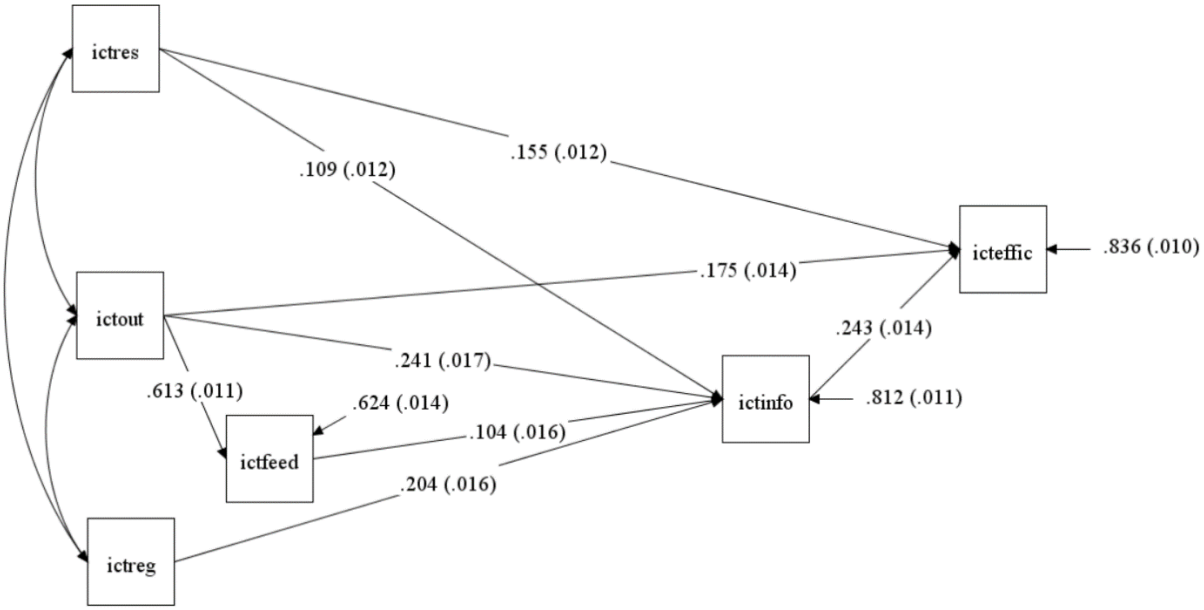

Figure 1. Path diagram

When Figure 1 was analyzed, it was seen that the exogenous variables were ICTRES, ICTOUT, and ICTREG; endogenous variables were ICTFEED, ICTINFO and ICTEFFIC. The explained variance of the ICTFEED variable was .38, the explained variance of the ICTINFO variable was .19 and the explained variance of the ICTEFFIC variable was .16. Path coefficients vary between .104 and .613, and all of them were significant. In examining the effect size between the variables, Kline's (2005) classification of .10, .30 and .50 in absolute value was taken into consideration. When the standardized path coefficients between the variables were examined, the ICTRES variable had a small effect on ICTINFO (.109) and ICTEFFIC (.155) variables. ICTOUT variable had a small effect on ICTEFFIC (.175), a medium effect on ICTINFO (.241) and a large effect on ICTFEED (.613). The ICTREG variable

had a medium effect (.204) on the ICTINFO variable on online information practices. The ICTFEED variable had a small effect (.104) on the ICTINFO variable (.104). Finally, the ICTREG variable had a medium effect (.243) on ICTINFO. The model includes indirect effects as well as direct effects between variables. Table 2 presented the standardized values of direct, indirect and total effects between variables.

Table 2. Values of direct, ındirect and total standardized effects between variables

	Dependent Variables								
Independent	ICTFEED			ICTINFO			ICTEFFIC		
Variables	D. E.	Ind. E.	Total	D. E.	Ind. E.	Total	D. E.	Ind. E.	Total
ICTRES	-	-	-	.109*	-	.109*	.155*	.027*	.181*
ICTOUT	.613*	-	.613*	.241*	.064*	.304*	.175*	.074*	.249*
ICTREG	-	-	-	.204*	-	.204*	-	.050*	.050*
ICTFEED	-	-	-	.104*	-	.104*	-	.025*	.025*
ICTINFO	-	-	-	-	-	-	.243*	-	.243*

** p<.01*

Direct effects in Table 2 refer to the standardized path coefficients in Figure 1. In contrast, indirect effects refer to the standardized coefficient of the effect of the independent variable on the dependent variable through another variable. The magnitude of indirect effects was equal to the product of the path coefficient between the independent variable and the mediator variable and the path coefficient between the mediator variable and the dependent variable. The total effect is the sum of direct and indirect effects.

The fit index values obtained for the model were presented in Table 3.

Table 3. Model Fit Indices

Index	Criterion Value of Perfect Fit	Calculated Value
RMSEA	≤.05	.05 [90% CI .035 - .056]
SRMR	≤.05	.02
CFI	≥.95	.99
TLI	≥.95	.96

Table 3 shows that RMSEA, SRMR, CFI and TLI values were within the required ranges and indicate perfect fit (Kline, 2005).

The variance explained in the model (R^2) is .38 for the ICTFEED variable, .16 for the ICTEFFIC variable and .19 for the ICTINFO variable. Regression equation for ICTEFFIC and ICTINFO variables were presented as Equation 1 and Equation 2 respectively.

ICTEFFIC= (.181)*ICTRES + (.249)*ICTOUT + (.050)*ICTREG + (.025)*ICTFEED + (.243)*ICTINFO Equation_1

ICTINFO= (.109)*ICTRES + (.304)*ICTOUT + (.204)*ICTREG + (.104)*ICTFEED Equation_2

Discussion and Conclusion

In this study, the relationship between ICT self-efficacy perceptions and online information practices behaviors and the related variables were examined with the data obtained from PISA 2022 Türkiye sample. As a result of the analysis, all path coefficients were found significant and the values of the fit indices showed that the model has perfect fit to the data. According to the tested structural equation model, for ICT self-efficacy, ICT resources, out-of-school ICT use related to school tasks and online information-seeking behaviors had a direct effect, while the frequency of receiving support or feedback through ICT and approaches to ICT-related rules in schools had an indirect effect. In addition, ICT resources had a direct effect on the frequency of ICT for school activities outside of the classroom, frequency of receiving support or feedback through ICT, attitudes towards ICT-related rules in schools and online information practices behaviors.

Considering the total effects in the model, it was observed that ICT resources had a small positive effect on online information-seeking behaviors and a moderate positive effect on ICT self-efficacy perceptions; and the use of ICT for school activities outside of the classroom had a moderate positive effect on both online information practices behaviors and ICT self-efficacy perceptions. Frequency of use is one of the most effective ways of learning digital skills (Kuhlemeier & Hemker, 2007). Thus, it can be stated that individuals who are exposed to ICT resources at home and at school may change their skills and usage habits towards ICT tools and differentiation may be observed in both their online information practices behaviors and their self-efficacy perceptions towards ICT tools.

In this respect, it is expected that both ICT resources and the use of ICT activities outside of the classroom will have an effect on online information practices behaviors and ICT self-efficacy perceptions. In addition, the positive relationship between ICT resources and ICT self-efficacy perceptions was also revealed in the structural equation model established by Hori and Fujii (2021). Zhong (2011) also reported that the availability of ICT tools in students' homes and schools had a positive effect on their ICT self-efficacy

perceptions. In the literature, there are also studies (Facer et al., 2003; Livingstone & Helsper, 2007) that reveal the positive effect of home internet access on online information practices behaviors. Considering that the prerequisite for internet access at home is the availability of ICT resources at home, these results seem to support each other. Eynon and Malmberg (2012) included the variable of home internet access in the model explaining online information practices behaviors and stated that there is a positive relationship between the two variables. In the structural equation model established by Livingstone and Helsper (2010), internet access and frequency of internet use were considered as variables explaining ICT self-efficacy and online information practices behaviors, and it was stated that ICT resources had a positive effect on both online information practices behaviors and ICT self-efficacy.

Out-of-classroom ICT use had a significant effect on the frequency of receiving support or feedback through ICT tools. Considering that students receive support or feedback through ICT tools outside of the classroom and that this support or feedback originates from school; in addition, teachers can provide support and feedback through ICT tools to students who have access to ICT tools, it is possible that the use of these tools has a large effect on receiving support or feedback. Although no study that includes children's views on the rules regarding ICT tools in schools (ICTREG), there are studies indicating that restrictions on access to ICT tools at school have an impact on students' online information-seeking behaviors (Dresang 2005; Ito et al. 2008; Lee 2008). It has also been revealed that students' views on these restrictions had a positive and moderate effect on their online information-seeking behaviors. In the structural equation model established within the scope of this research, it was seen that online information-seeking behaviors had a positive and moderate effect on ICT self-efficacy.

Şenyuva (2017) found a positive, weak and significant relationship between internet self-efficacy and online information practices strategies. Tsai and Tsai (2010), who obtained a similar result in their research, also confirmed the positive relationship between online information practices strategies and internet self-efficacy and stated that one way to improve online information strategies is to increase internet self-efficacy.

At the end of the research, since it is seen that feedback through ICT positively affects students' online information seeking behaviors and indirectly ICT self-efficacy, feedback through ICT can be taken into consideration in curriculum development studies in education. Similarly, considering the effect of ICT resources on online information seeking

behaviors and ICT self-efficacy, take action to increase students' access to ICT resources. Research can be planned to explore different variables affecting ICT self-efficacy. This research was conducted with the data obtained from PISA 2022. The research can be repeated with data from different samples and the results can be compared.

Acknowledgement

Due to the scope and method of the study, ethics committee permission was not required.

Author Contribution Statement

Berk DÜNDAR: *Conceptualization, literature review, methodology, data analysis, language editing, and writing.*

Melek Gülşah ŞAHİN: *Conceptualization, methodology, data analysis, language editing, and writing.*

References

Acar, T. (2015). Examination of the PISA 2009 reading skills and information and communication technology (ICT) use skills of Turkish students. *Educational Research and Reviews*, *10*(13), 1825-1831. https://doi.org/10.5897/ERR2015.231

Akbaş, U. & Koğar, H. (2020). *Nicel araştırmalarda kayıp veriler ve uç değerler*. Pegem Akademi.

Bandura, A. (1997). *Self-efficacy: The exercise of control*. W.H. Freeman and Company.

Büyüköztürk, Ş. (2023). *Sosyal bilimler için veri analizi el kitabı.* Pegem Akademi.

Creswell, J. W. & Guetterman T. C. (2018). *Educational research: Planning, conducting, and evaluating quantitative and qualitative research*. Pearson.

Çokluk, Ö., Şekercioğlu, G., & Büyüköztürk, Ş. (2012). *Sosyal bilimler için çok değişkenli istatistik: SPSS ve LISREL uygulamaları*. Pegem Akademi.

Çuhadar, C., & Yücel, M. (2010). Yabancı dil öğretmeni adaylarının bilgi ve iletişim teknolojilerinin öğretim amaçlı kullanımına yönelik özyeterlik algıları. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *27*(27), 199-210.

Dresang, E. T. (2005). Access: The information-seeking behavior of youth in the digital environment. *Library Trends*, *54*(2), 178-196. https://doi.org/10.1353/lib.2006.0015

Drenoyianni, H. (2006). Reconsidering change and ICT: Perspectives of a human and democratic education. *Education and Information Technologies*, 11, 401-413.

Ekici, E., Ekici, F. T., & Kara, İ. (2012). Öğretmenlere yönelik bilişim teknolojileri öz-yeterlik algısı ölçeğinin geçerlik ve güvenirlik çalışması. *Pamukkale Üniversitesi Eğitim Fakültesi Dergisi*, *31*(31), 53-65. https://dergipark.org.tr/en/download/article-file/114558

Erdal, B. M. (2012). Evaluation of human development index and ICT development index, comparative analysis of the OECD and the European members and Türkiye. *International Journal of Business Research*, 2, 126-136. https://doi.org/10.1002/isd2.12060

Eryılmaz, S., & Uluyol, Ç. (2015). 21. yüzyıl becerileri ışığında FATİH projesi değerlendirmesi. *Gazi Üniversitesi Gazi Eğitim Fakültesi Dergisi*, *35*(2), 209-229.

Eynon, R., & Malmberg, L. E. (2012). Understanding the online information-seeking behaviours of young people: the role of networks of support. *Journal of Computer Assisted Learning*, *28*(6), 514-529. https://doi.org/10.1111/j.1365-2729.2011.00460.x

Facer, K., Furlong, J., Furlong, R., & Sutherland, R. (2003). *Screenplay: Children and computing in the home*. Routledge.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage.

Freddano, M., & Diana, P. (2012). The role of ICT to raise students' achievement in Italian technical and professional schools. *Problems of Education in the 21st Century*, 49, 15-26.

Halverson, K. L., Siegel, M. A., & Freyermuth, S. K. (2010). Non-science majors' critical evaluation of websites in a biotechnology course. *Journal of Science Education and Technology*, 19, 612-620. https://doi.org/10.1007/s10956-010-9227-6

Hatziapostolou, T., & Paraskakis, I. (2010). Enhancing the impact of formative feedback on student learning through an online feedback system. *Electronic Journal of E-learning*, *8*(2), 111-122. https://files.eric.ed.gov/fulltext/EJ895699.pdf

Hernandez, R. M. (2017). Impact of ICT on education: Challenges and perspectives. *Journal of Educational Psychology-Propositosy Representaciones*, *5*(1), 337-347.

Hori, R., & Fujii, M. (2021). Impact of using ICT for learning purposes on self-efficacy and persistence: Evidence from Pisa 2018. *Sustainability*, *13*(11), 1-13.

Ito, M., Horst, H. A., Bittanti, M., Herr Stephenson, B., Lange, P. G., Pascoe, C. J., & Robinson, L. (2009). *Living and learning with new media: Summary of findings from the digital youth project*. The MIT Press.

Kline, R. B. (2005). *Principles and practice of structural equation modeling.* Guilford Publications.

Kline, R. B. (2023). *Principles and practice of structural equation modeling* (5th ed.). Guilford Pub.

Kuhlemeier, H., & Hemker, B. (2007). The impact of computer use at home on students' internet skills. *Computers & Education*, *49*(2), 460-480.

Lee, L. (2008). The impact of young people's Internet use on class boundaries and life trajectories. *Sociology*, *42*(1), 137-153. https://doi.org/10.1177/0038038507084829

Lennon, M., Kirsch, I., Von Davier, M., Wagner, M., & Yamamoto, K. (2003). Feasibility study for the PISA ICT literacy assessment: Report to network A. Educational Testing Service.

Livingstone, S. & Helsper, E. (2010). Balancing opportunities and risks in teenagers' use of the internet: The role of online skills and internet self-efficacy. *New media & society*, *12*(2), 309-329. https://doi.org/10.1177/1461444809342697

Livingstone S. & Helsper E. (2007) Gradations in digital inclusion: children, young people and the digital divide. *New Media and Society* 9, 671–696.

Martinez-Argüelles, M. J., Batalla-Busquets, J. M., Noguera-Guerra, P., & Pons-Fanals, E. (2011, October). Personalized e-Feedback and ICT. In Proceedings of the 10th European Conference on E-Learning: ECEL (p. 456). Academic Conferences Limited.

Mikre, F. (2011). The roles of information communication technologies in education: Review article with emphasis to the computer and internet. *Ethiopian Journal of Education and Sciences*, (2), 109-126.

Miller, B., & Atkinson, R. D. (2014). Raising European productivity growth through ICT. ITIF, June. https://doi.org/10.2139/ssrn.3079844

MoNE (2023). PISA 2022 Türkiye Raporu. [PISA 2022 Türkiye Report] https://pisa.meb.gov.tr/meb_iys_dosyalar/2023_12/05125555_pisa2022_rapor_051223 .pdf

OECD. (2023). *PISA 2022 technical report*. OECD Publishing.

Öztuzcu, Ö., & Mısırlı, Z.A. (2023). Secondary school teachers' self-efficacy beliefs regarding information technology. *Journal of Computer and Education Research*, *11* (22), 952- 965. https://doi.org/10.18009/jcer.1344348

Palmer, D. H. (2006). Sources of self-efficacy in a science methods course for primary teacher education students. *Research in Science Education*, *36*(4), 337-353.

Peña-López, I. (2009). *Guide to measuring information and communication technologies (ICT) in education*.

Sakız, G. (2013). Başarıda anahtar kelime: Öz-yeterlik. *Uludağ Üniversitesi Eğitim Fakültesi Dergisi*, *26*(1), 185-210.

Satorra, A., & Bentler, P. M. (1994). *Corrections to test statistics and standard errors in covariance structure analysis*. Sage Publications.

Smith, T. D. & McMillan, B. F. (2001). A primer of model fit indices in structural equation modeling. *Annual Meeting of the Southwest Educational Research Association*. 1-16.

Şenyuva, E. (2017). Hemşirelik öğrencilerinin internet öz-yeterlikleri ile çevrimiçi bilgi arama stratejileri ilişkisi. *Türk Eğitim Bilimleri Dergisi*, 15(2), 102-116.

Tabachnick, B. G., Fidell, L. S., & Ullman, J. B. (2013). *Using multivariate statistics*. Pearson.

Tang, Y., Tseng, H., & Tang, X. (2022). The impact of information-seeking self-efficacy and online learning self-efficacy on students' performance proficiency. *The Journal of Academic Librarianship*, 48(5). https://doi.org/10.1016/j.acalib.2022.102584

Tsai, M. J., & Tsai, C. C. (2010). Information searching strategies in web-based science learning: the role of Internet self-efficacy. *Innovations in education and teaching international*, *40*(1), 43-50. https://doi.org/10.1080/1355800032000038822

Wong, G. K. W., & Yang, M. (2017). Using ICT to facilitate instant and asynchronous feedback for students' learning engagement and improvements. *Emerging Practices in Scholarship of Learning and Teaching in a Digital Era*, 289-309.

Zhong, Z. J. (2011). From access to usage: The divide of self-reported digital skills among adolescents. *Computers & Education*, *56*(3), 736-746. https://doi.org/10.1016/j.compedu.2010.10.016