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ARTICLES

The effects of online learning self-efficacy and attitude toward online learning in predicting academic performance: The case of online prospective mathematics teachers

Suphi Önder Bütüner and Serdal Baltacı

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The effects of online learning self-efficacy and attitude toward online learning in predicting academic performance: The case of online prospective mathematics teachers

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Abstract: This study aims to discover if Online Learning Self-Efficacy (OLSE) and attitude toward online learning (AOL) significantly predict the academic performance (AP) among Turkish prospective mathematics teachers. Unlike the studies conducted in the literature, online learning self-efficacy and attitude towards online learning as predictor variables were included in the study and both quantitative and qualitative data were collected. The study included 1075 prospective mathematics teachers' responses in the analysis. The Pearson correlation was employed to determine how strongly OLSE, AOL, and AP are related. Results indicated that OLSE and AOL influenced the level of AP. Also, the multiple regression aimed to predict AP based on OLSE and AOL, and this model explained 44.6% of the variance in AP. The beta weights demonstrated that OLSE and AOL (OLSE $\beta = .36$, $t(1072) = 9.705$, $p < .001$, and AOL $\beta = .34$, $t(1072) = 9.176$, $p < .001$) significantly contributed to the model. The results showed that the level of academic performance can be predicted by online learning self-efficacy and attitude toward online learning. In addition, this study revealed the factors that have favorable and adverse effects on the academic performance of prospective mathematics teachers to gain more extensive information. Under the theme of negative factors, there were 7 codes. The results obtained from the study can be a guide for practitioners, policy makers and

* **Suphi Önder Bütüner** (corresponding author, s.onder.butuner@bozok.edu.tr), PhD, is Associate Professor of Math Education at Faculty of Education, Yozgat Bozok University, Turkey. His research focus is on teaching mathematical concepts and teacher training.

Serdal Baltacı (serdalbaltaci@gmail.com), PhD, is Associate Professor of Math Education at the Faculty of Education, Kırşehir Ahi Evran University, Turkey. His research focus is on teaching mathematical concepts and teacher training.

More information about the authors is available at the end of this article.

teachers to take the necessary precautions for the effective execution of the distance education process.

Keywords: Online learning; self-efficacy; attitude; academic performance; online prospective mathematics teachers.

I. Introduction

The 2019–2020 Coronavirus (COVID-19) pandemic, which emerged in the city of Wuhan, the capital of the Hubei province of China, caused vital changes and effects, especially on health at the global level, along with social life, economy, and educational practices. Furthermore, on March 11, 2020, the World Health Organization declared the Coronavirus (COVID-19) pandemic as a global pandemic. The resulting crisis's effects, particularly on health and also the economy, social life, psychology, and education have still continued.[1] As in, all countries of the world, education and training activities were suspended in Türkiye according to the progression of the case numbers. Exams were postponed, distance education started, lessons continued synchronously or asynchronously, and teachers used homework, online exams, and forum discussions for student evaluation.

Distance education is students' web-based access to education by means of developing internet technologies and computers.[2] Thanks to communication technologies, distance education is a bridge between teachers and students.[3] With the synchronous and asynchronous model used in the 21st century owing to computer technologies, students and teachers can carry out education regardless of time and place.[4,5,6,7] Universities took immediate steps to ease crisis caused by the coronavirus pandemic and Universities

[1] World Health Organization, "Advice for the public: Coronavirus disease (COVID-19)," accessed July 3, 2021, https://www.who.int/emergencies/diseases/novel-coronavirus-2019.

[2] Timothy, J Newby, Donald Stepich, James Lehman, James D Russell, and Anne Todd Leftwich, *Educational Technology for Teaching and Learning* (New Jersey: Pearson Merrill Prentice Hall, 2006).

[3] Michael, G Moore and William G. Anderson, *Handbook of Distance Education* (London: Lawrence Erlbaum Associates, 2003).

[4] Margaret Driscoll, *Web-based training: Creating E-learning Experiences* (San Francisco: JosseyBass/Pfeiffer, 2002).

[5] Allan J Henderson, T*he E-learning Question and Answer Book: A Survival Guide for Trainers and Business Managers* (New York: Amacom Press, 2003).

[6] Dongsong Zhang and Jay F. Nunamaker, "Powering E-learning in the New Millennium: An Overview of E-learning and Enabling Technology," *Information Systems Frontiers* 5, no. 2 (2003): 207-218. https://doi.org/10.1023/A:1022609809036.

[7] Anita Rosen, *E-Learning 2.0: Proven Practices and Emerging Technologies to Achieve Real Results* (New York: Amacom, 2009).

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switched from formal to distance education.[8] Like the rest of the world, Türkiye was unprepared for educational activities amid the COVID-19 pandemic and tried to improve the education and training processes by switching to emergency distance education.

There are different forms of application of distance education, and among these, it is seen that mostly online learning types are applied frequently. In this direction, courses can be conducted as synchronous (simultaneous) and asynchronous (asynchronous) courses within the scope of distance education. In simultaneous education, students and teachers meet at a predetermined time (usually online) and live lessons.[9] In this process, it is tried to create a more active environment for teachers and learners such as in-class interaction and discussion, asking questions instantly and expressing parts that are not understood, and an environment close to face-to-face education is tried to be provided. In asynchronous education, on the other hand, it is the type of education in which teachers and students do not have the opportunity to work simultaneously and students can access the course content (presentation, video, audio recording, etc.) over the internet whenever they want or need it. Communication between participants takes place mainly through e-mail and online forums and is usually moderated by trainers.[10]

Universities in Türkiye used software that provides an online environment during the pandemic process. In this direction, some universities have preferred to use online synchronous methods as distance education methods, some have preferred to use offline asynchronous methods and some have chosen to use mixed methods.[11] In many universities, courses in distance education have been processed through methods such as creating presentation files and sharing course content (articles, ppt, Word, pdf, etc.), uploading lessons to the system with live lectures and video recording, asking instant questions and giving feedback, and sharing homework. In addition, it has been observed that universities use different online methods such as

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[8] Virginia Gewin, "Five Tips for Moving Teaching Online as COVID-19 Takes Hold," *Nature* 580, (2020): 295-296. doi: https://doi.org/10.1038/d41586-020-00896-7.

[9] Patricia Fidalgo et al., "Students' Perceptions on Distance Education: A Multinational Study," *International Journal of Educational Technology in Higher Education* 17, (2020): 1-18. https://doi.org/10.1186/s41239-020-00194-2.

[10] Lynette Watts, "Synchronous and Asynchronous Communication in Distance Learning: A Review of the Literature," *Quarterly Review of Distance Education* 17, no 1 (2016): 23-32.

[11] Ersin Kurnaz and Murat Serçemeli, "A Research on Academicans' Perspectives on Distance Education and Distance Accounting Education in the COVID-19 Pandemia Period," *International Journal of Social Sciences Academy* 2, no 3 (2020): 262-288.

homework, projects, online exams and quizzes within the scope of measurement and evaluation regarding the courses offered.[12]

Educators tried to determine student performance in education and training through assessment and evaluation tools such as homework, online exams, and forum discussions. However, due to the rapid transition to distance education, researchers could not evaluate the adaptation processes of students toward distance education.[13] There may be many variables (perceptions and attitude toward online learning, self-efficacy, readiness for online learning, thought processes toward distance education, and individual innovation) that have an impact on students' academic performance in this process. Students' self-efficacy and attitude toward online learning are two of the variables that may affect student performance.

Accordingly, this study investigated to what extent these two variables predict academic performance through multiple regression analysis. In addition, the researcher tried to identify the factors that have favorable and adverse effects on the academic performance of teacher candidates to gain deeper knowledge.

I.1. Self-efficacy toward online learning

Considering that humans are emotional beings, it may not be enough to prepare the physical environment and its factors alone to direct them to the target. Being competent in tasks demands both skills and self-beliefs concerning how well these tasks can be accomplished.[14] Therefore, students' high self-efficacy for online learning is a significant component in the successful execution of this process. Self-efficacy is people's belief in their own competence to learn and develop behaviors.[15,16] Schunk[17]

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[12] Council of Higher Education, "COVID-19 Information Note: 1," accessed April 5, 2020, https://www.yok. gov.tr/Sayfalar/Haberler/2020/.

[13] Parvati Iyer, Kalid Aziz, and David M. Ojcius, "Impact of COVID-19 on Dental Education in the United States," *Journal of Dental Education* 84, no. 6 (2020): 718-22. https://doi.org/10.1002/jdd.12163.

[14] Albert Bandura, "Organizational Application of Social Cognitive Theory," *Australian Journal of Management* 13, no. 2 (1988): 275–302. https://doi.org/10.1177/031289628801300210.

[15] Albert Bandura, "Social Cognitive Theory: An Agentic Perspective," *Asian Journal of Social Psychology* 2, no. 1 (1999): 21-41. http://doi.org/10.1146/annurev.psych.52.1.1.

[16] Jerry L Jinks and Morgan L. Vicky, "Students' sense of academic efficacy and achievement in science: A useful new direction for research regarding scientific literacy?," *The Electronic Journal of Science Education* 1, no. 2 (1996): accessed May 1, 2020. http://unr.edulhomepage/jcannon/jinksmor.htm.

[17] Dale H Schunk, *Learning Theories: An Educational Perspective* (Boston: Pearson, 2009).

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defined self-efficacy as individuals' evaluation of their own skills and capabilities and their ability to transform them into behaviors. Gallagher[18] expressed self-efficacy as evaluating whether people believe that they can carry out their behaviors when necessary. On the other hand, when it comes to the aspects of learning taking place in rather non-traditional environments like online learning, self-efficacy seems to gain more authentic features. In such platforms, self-efficacy consists of five dimensions: These are self-efficacy concerning finishing an online course, using tools in a course management system, establishing interactions with lecturers as well as classmates for social and academic purposes in an online course.[19] Self-efficacy might also be considered as a major factor that determines the readiness of teachers for distance education.[19,20] One of the essential factors affecting prospective teachers' online learning-teaching competencies is their self-efficacy regarding distance education environments.[21,22] When learners believe they have the capacity to do a task, they may be much keener and more determined for fulfilling this task and exhibit behaviors accordingly.[23] Learners having a substantial level of self-efficacy in learning a subject adapt more easily, work harder, and are more successful in coping with difficulties.[24,25] Similarly, Pajares[26] observed that individuals with high self-efficacy have high success and are happier due to this

[18] Matthew W Gallagher, "Self-Efficacy." In *Encyclopedia of Human Behavior*, edited by. Vilayanur S. Ramachandran, 314-320. San Diego: Academic Press, 2012.

[19] Demei Shen et al., "Unpacking Online Learning Experiences: Online Learning Self-efficacy and Learning Satisfaction," *The Internet and Higher Education* 19 (2013): 10-17. https://doi.org/10.1016/j.iheduc.2013.04.001.

[20] Min-Ling Hung, "Teacher Readiness for Online Learning: Scale Development and Teacher Perceptions," *Computers & Education* 94 (2016): 120-133. https://doi.org/10.1016/j.compedu.2015.11.012.

[21] Chia-Lin Tsai et al., "The Self-Efficacy Questionnaire for Online Learning," *Distance Education* 41, no. 4 (2020): 472-489. https://doi.org/10.1080/01587919.2020.1821604.

[22] Stuart Woodcock, Ashley Sisco, and Michelle J Eady, "The Learning Experience: Training Teachers Using Online Synchronous Environments," *Journal of Educational Research and Practice* 5, no. 1 (2015): 21-34. https://doi.org/10.5590/JERAP.2015.05.1.02.

[23] Caroline Sharp, Pocklington Keith, and Weindling Dick, "Study Support and the Development of Self-regulated Learner," *Educational Research* 44, no. 1 (2002): 29- 42.

[24] Journal of Physics: Conference Series. "Mathematics self efficacy and mathematics performance in online learning." accessed May 1, 2021, https://iopscience.iop.org/article/10.1088/1742-6596/1882/1/012050.

[25] Barry J Zimmerman, "Becoming a Self-Regulated Learner: An Overview," *Theory Into Practice*, 41, no. 2 (2002): 64-70. doi: 10.1207/s15430421tip4102_2.

[26] Frank Pajares, "Self-efficacy Beliefs and Mathematical Problem-Solving of Gifted Students," *Contemporary Educational Psychology* 21, no. 4 (1996): 325-344. https://doi.org/10.1006/ceps.1996.0025.

success. Bandura[27] stated that students having weak self-efficacy have less motivation to learn, meaning that they are less willing to learn and make less effort accordingly. Self-efficacy has a mediating role in students' academic success in distance education, and success and self-efficacy are positively related.[28,29,30,31] Besides, Tsai, Cha, Marra, and Shen[32] revealed that whoever has a favorable outlook toward online learning and high self-efficacy expects higher grades.

I.2. Attitude toward online learning

Attitudes are the positive or negative feelings of individuals toward any object, person, or subject.[33] There may be many external factors that affect the forming of attitudes. Learners can change their attitudes and acquire new ones with their experiences as a result of their interaction with their environment. Another predictor that can affect student performance in the distance education process is the attitude toward online learning.[34] because learners' attitude toward new technologies can affect their acceptance of these advancements. In the effective execution of distance education, beyond how advanced its technology is, Liaw, Huang, and Chen[35] highlighted the significance of students having a positive attitude toward online learning. They also stated that students' positive attitude levels toward online learning

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[27] Albert Bandura, Self-efficacy Encyclopedia of Human Behaviour (New York: Academic Press, 1994).

[28] Katrin A Arens, Anne C. Frenzel, and Thomas Goetz, "Self-Concept and Self-Efficacy in Math: Longitudinal Interrelations and Reciprocal Linkages with Achievement," *The Journal of Experimental Education* 90, no. 3 (2020): 1-19. https://doi.org/10.1080/00220973.2020.1786347.

[29] Adeneye A O Awofala, "Correlates of Senior Secondary School Students' Mathematics Achievement," *Educatia* 21, no. 17 (2019): 15-25. https://doi.org/10.24193/ed21.2019.17.02.

[30] Dan Li, "A Review of Self-efficacy of Learners Through Online Learning," *Journal of Humanities and Education Development* 2, no. 6 (2020): 526-533.

[31] Bikkar S Randhawa, James E. Beamer, and Ingvar Lundberg, "Role of Mathematics Self-efficacy in the Structural Model of Mathematics Achievement," *Journal of Educational Psychology*, 85, no. 1 (1993): 41. https://doi.org/10.1037/0022-0663.85.1.41.

[32] Chia-Lin Tsai et al., "The Self-Efficacy," 472-489.

[33] Richard E Petty and John T. Cacioppo, *Attitudes and Persuasion: Classic and Contemporary Approaches* (New York: Westview Press, 1996).

[34] Diana W Sanders and Alison I. Morrison-Shetlar, "Student Attitudes Toward Web-Enhanced Instruction in an Introductory Biology Course," *Journal of Research on Computing in Education* 33, no. 3 (2001): 251–262. https://doi.org/10.1080/08886504.2001.10782313.

[35] Shu-Sheng Liaw, Hsiu-Mei Huang, and Gwo-Dong Chen, "Surveying Instructor and Learner Attitudes Toward E-learning," *Computers & Education* 49, (2007): 1066–1080. https://doi.org/10.1016/j.compedu.2006.01.001.

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affect students' tendencies toward distance education. From this point of view, student attitude toward online learning can directly relate to their academic performance. In studies conducted on attitudes, students' attitudes and academic achievements are strongly related.[36,37,38] In addition, the positive attitudes of students toward online learning will facilitate the teaching process of the teacher, and there will be improvements in the success of the students.[39] In their study, Lijie, Zongzhao, and Ying[40] revealed that mathematics attitude has a positive and direct impact on students' mathematics academic performance. Offir et al.[41] stated that students' attitude toward online learning are effective in students' success. Falowo[42] specified that individuals' negative attitudes toward online learning generally stem from their prejudices. On the other hand, Martinez et al.[43] stated that researchers should conduct more research on attitude toward online learning.

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[36] Brian R Evans, "Student Attitudes, Conceptions and Achievement in Introductory Undergraduate College Statistics," *The Mathematics Educator* 17, no. 2 (2007): 22-24.

[37] Lawsha Mohamed and Hussain Waheed. "Secondary Students' Attitude Towards Mathematics in a Selected School of Maldives," *International Journal of Humanities and Social Science* 1, no. 15 (2011): 277-278.

[38] Solomon O Ogunniyi, "Resource Utilisation, Teaching Methods, Time Allocation and Attitude as Correlates of Undergraduates' Academic Achievement in Cataloguing in Library Schools in Southern Nigeria." PhD diss., University of Ibadan, 2015.

[39] Sanjaya Mishra and Santosh Panda, "Development and Factor Analysis of an Instrument to Measure Faculty Attitude Towards E-learning," *Asian Journal of Distance Education* 5, no. 1 (2007): 27-33.

[40] Zhang Lijie, Mo Zongzhao, Zhou Ying, "The Influence of Mathematics Attitude on Academic Achievement: Intermediary Role of Mathematics Learning Engagement," *Jurnal Cendekia: Jurnal Pendidikan Matematika* 4, no. 2 (2020): 460-467. https://doi.org/10.31004/cendekia.v4i2.253.

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[42] Rasheed Falowo, "Factors Impeding Implementation of Web-based Distance Larning," *AACE Journal* 15, no. 3 (2007): 315-338.

[43] Romero J Sonia Martínez et al., "Attitudes Toward Technology Among Distance Education Students: Validation of an Explanatory Model," *Online Learning*, 24, no. 2 (2020): 59-75.

In the literature, there are studies on the attitudes[44,45,46,47] and self-efficacy[48,49] of university students in distance education environments. However, there was no study that investigated whether these two factors are significant predictors of academic performance. It is critical to reveal the extent to which the attitudes and self-efficacy toward online learning predict academic performance and whether they are meaningful predictors in terms of evaluating the functionality of distance education activities that educators use now and will continue using in the future.

In this respect, the first two questions of this study deal with the level and direction of the relationship between the attitude and self-efficacy toward online learning and academic achievement, and the third question investigates if the attitude and self-efficacy toward online learning are significant predictors of academic success.

Apart from the attitude and self-efficacy toward online learning, there may be different variables that predict academic performance. For example, some studies indicated that technological infrastructure is a significant predictor of students' academic success in the distance

[44] Karen E Brinkley-Etzkorn, "The Effects of Training on Instructor Beliefs About and Attitudes Toward Online Teaching," *American Journal of Distance Education* 34, no. 1 (2019): 1-17. https://doi.org/10.1080/08923647.2020.1692553.

[45] Eleni Koustriava and Konstantinos Papadopoulos, "Attitudes of Individuals with Visual Impairments Towards Distance Education," *Universal Access in the Information Society* 13 (2014): 439–447. https://doi.org/10.1007/s10209-013-0331-2.

[46] Shu-Sheng Liaw, Hsiu-Mei Huang, and Gwo-Dong Chen, "Surveying Instructor," 1066–1080.

[47] David Ojo and Felix Kayode Olakulehin, "Attitudes and Perceptions of Students to Open and Distance Learning in Nigeria," *International Review of Research in Open and Distance Learning*, 7, no. 1 (2006): 1-10. https://doi.org/10.19173/irrodl.v7i1.313.

[48] Demei Shen et al., "Unpacking Online," 10-17.

[49] Stuart Woodcock, Ashley Sisco, and Michelle J Eady, "The Learning," 21-34. https://doi.org/10.5590/JERAP.2015.05.1.02.

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education process.[50,51,52,53,54,55] Also, various studies have demonstrated that solving student problems quickly and paying attention to teacher-student interaction in distance education by using a supportive language have a significant impact on success in distance education.[56,57,58,59] Haber and Mills[60] and Bolliger and Wasilik[61] stated that the lack of social interaction between students and their lecturers, the problems experienced by lecturers in the process of preparing course materials for distance education, and examining the development of the students are effective factors in the academic success of the students. In addition, Chao, Saj,

[50] Pia Ceres, "A Covid Slide' Could Widen the Digital Divide for Students," accessed May 4, 2021, https://www.wired.com/story/schools-digital-divide-remote-learning/.

[51] Rachel Gong, "Coping with MCO: Distance learning and the digital divide," accessed October 15, 2020, https://www.malaymail.com/news/what-you-think/2020/03/27/coping-with-mcodistance-learning-and-the-digital-divide-rachel-gong/1850758.

[52] Brian Hawkins and Diana G. Oblinge, "The Myth About the Digital Divide," *Educause Review* 41, no. 4 (2006): 12–13.

[53] Natalie Helbig, Ramón Gil-García, and Erico Ferro, "Understanding the Complexity of Electronic Government: Implications From the Digital Divide Literature," *Government Information Quarterly* 26, no. 1 (2009): 89–97. https://doi.org/10.1016/j.giq.2008.05.004.

[54] Thelma Obiakor and Adeniran Adedeji P, "COVID-19: Impending Situation Threatens to Deepen Nigeria's Education Crisis," accessed May 1, 2020, https://www.africaportal.org/publications/covid-19-impending-situation-threatens-deepen-nigerias-education-crisis/.

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[56] Jason D Baker, "An Investigation of Relationships Among Instructor Immediacy and Affective and Cognitive learning in the Online Classroom," *The Internet and Higher Education* 7, no. 1 (2004): 1-13. https://doi.org/10.1016/j.iheduc.2003.11.006.

[57] Stefan Hrastinski, "The Potential of Synchronous Communication to Enhance Participation in Online Discussions: A Case Study of Two E-learning Courses," *Information & Management* 45 (2008): 499–506. https://doi.org/10.1016/j.im.2008.07.005.

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[59] Stewe Wheeler, "Student Perceptions of Learning Support in Distance Education," *Quarterly Review of Distance Education* 3, no. 4 (2002): 419-429.

[60] Jennifer Haber and Michael Mills, "Perceptions of Barriers Concerning Effective Online Teaching and Policies: Florida Community College Faculty," *Community College Journal of Research and Practice* 32, no.4-6 (2008): 266-283. https://doi.org/10.1080/10668920701884505.

[61] Bolliger, Doris U and Oksana Wasilik, "Factors Influencing Faculty Satisfaction With Online Teaching and Learning in Higher Education," *Distance Education* 30, no. 1 (2009): 103-16. https://doi.org/10.1080/01587910902845949.

and Tessier[62] stated that another important factor affecting the success of students in the distance education process is the richness and quality of learning-teaching materials, as well as the assessment and evaluation process. Irani et al.[63] and Petracchi[64] revealed in their study that students' perceptions of distance education affect their academic achievement. Also, there are observations that students' motivation levels are a crucial factor on academic performance in distance education environments.[65,66,67] Upon examining these studies, it is seen that there are variables such as teaching methods, technological infrastructure, student-teacher interaction, and assessment and evaluation processes in online learning that can predict academic performance. In this regard, the fourth problem of this study aimed to determine the factors that positively and negatively affect the academic performance of prospective mathematics teachers in the distance education process.

In a study conducted during the SARS epidemic during the pandemic period, it was determined that distance education was effective in reducing people's anxiety levels and increasing and increasing knowledge with the use of distance communication ways.[68] Other advantages of distance education can be listed as allowing students to work at their own pace, providing flexible working opportunities independent of time and space, saving time and therefore less cost. Some of the disadvantageous points of distance education are difficulties in providing motivation, lack

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[62] Tracy Chao, Tami Saj, and Felicity Tessier, "Establishing a Quality Review for Online Courses," *Educause Quarterly* 3 (2006): 32-39.

[63] Tracy Irani et al., "Personality Type and Its Relationship to Distance Education Students' Course Perceptions and Performance," *Quarterly Review of Distance Education* 4, no. 4 (2003): 445-453.

[64] Helen E Petracchi, "Distance Education: What do our Students Tell us?," *Research on Social Work Practice*, 10, no. 3 (2000): 362-376. https://doi.org/10.1177/1049731500010003.

[65] Kuan-Chung Chen and Syh-Jong Jang, "Motivation in Online Learning: Testing a Model of Self-Determination Theory," *Computer in Human Behavior* 26, no. 4 (2010): 741-752. https://doi.org/10.1016/j.chb.2010.01.011.

[66] Reinhard Pekrun et al., "Boredom and Academic Achievement: Testing a Model of Reciprocal Causation," *Journal of Educational Psychology* 106, no. 3 (2014): 696-710. https://doi.org/10.1037/a0036006.

[67] Allen Wigfield et al., "Development of Achievement Motivation and Engagement," In *Handbook of Child Psychology and Developmental Science*, edited by. M. E. Lamb, R. M. Lerner, M. E. Lamb, & R. M. Lerner, 657-700. Hoboken, NJ: Wiley, 2015.

[68] Sophia S-C Chan et al., "Improving Older Adults' Knowledge and Practice of Preventive Measures Through a Telephone Health Education During the SARS Epidemic in Hong Kong: a Pilot Study," *International Journal of Nursing Studies* 244, no. 7 (2007): 1120-1127. https://doi.org/10.1016/j.ijnurstu.2006.04.019.

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of face-to-face interaction and social isolation, difficulty in getting instant feedback, a constant need for technology and situations related to accreditation.[69,70,71] Although there are some advantages brought by distance education, it can be seen that not all students are successful in online classes in distance education and the failure rates in distance education courses are 10 to 20 percent higher than traditional face-to-face courses.[72]

People believe that the use of distance education as a complement to formal education in higher education will increase. In this respect, examining whether students' attitudes and self-efficacy toward online learning are significant predictors of academic performance and determining the factors that have positive and negative effects on academic performance may provide important contributions both for future studies at the institutional level and for studies in the academic field. This can contribute to the more effective planning and execution of the distance education process. Therefore, this study seeks to address the following research questions:

- Question 1: Is there a significant correlation between Online Learning Self-Efficacy (OLSE) and academic performance (AP) among prospective mathematics teachers?
- Question 2: Is there a significant correlation between Attitude toward Online Learning (AOL) and AP among prospective mathematics teachers?
- Question 3: Which of OLSE and AOL is the most effective in predicting AP?
- Question 4: What are the factors that positively and negatively affect the academic performance of prospective mathematics teachers in the distance education process?

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[69] Liesbeth De Paepe, Chang Zhu, and Koen DePryck, "Drop-out, Retention, Satisfaction and Attainment of Online Learners of Dutch in Adult Education," *International Journal on E-Learning* 17, no. 3 (2018): 303-323.

[70] Virginia Gewin, "Five Tips," 295-296.

[71] Agi Horspool and Carsten Lange, "Applying the Scholarship of Teaching and Learning: Student Perceptions, Behaviours and Success Online and Face-to-Face," *Assessment & Evaluation in Higher Education*, 37, no 1 (2012): 73-88. https://doi.org/10.1080/02602938.2010.496532.

[72] Papia Bawa, "Retention in Online Courses: Exploring Issues and Solutions–A Literature Review," *Sage Open* 6, no. 1 (2016): 1-11. https://doi.org/10.1177/2158244015621777.

II. Method

II.1. Research design

This study was non-experimental correlational research and contained quantitative and qualitative data. The Pearson correlation was employed to explore any significant correlations among OLSE, AOL, and AP. A multiple regression was also conducted to analyze the impact of OLSE and AOL on AP. In addition, the researcher obtained qualitative data by asking the question "What are the factors that positively and negatively affect the academic performance of prospective mathematics teachers in the distance education process?"

II.2. Participants

In the selection of the participants of the study, primarily, the researcher determined universities with faculties of education (76 universities in total) in each of the seven regions of Türkiye. Then, two easily accessible faculties of education (14 in total) in each region were selected. For the required sample size for multiple regression, Stevens[73] stated that there should be 15 participants per predictor, and Tabachnick and Fidell[74] expressed that the required number of participants should be higher than 66 when there are two independent variables. These rules are very pervasive but they oversimplify the issue. In fact, the sample size required will depend on the size of effect that we're trying to detect (i.e., how strong the relationship is that we're trying to measure) and how much power we want to detect these effects. The simplest rule of thumb is that the bigger the sample size, the better.[75] The number of participants included in this study is above the benchmark value the literature specifies for each region of Türkiye. A total of 1106 prospective mathematics teachers responded to the web survey questionnaire. Additionally, to gain deeper knowledge within the scope of the study, the researcher obtained the written opinions of 118 volunteer prospective mathematics teachers to identify the factors that have favorable and adverse effects on the academic performance of prospective mathematics teachers in the distance education process. Table 1 contains information about

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[73] Junko Stevens, *Applied Multivariate Statistics for the Social Sciences* (New York: Routledge Taylor Francis Group, 1996).

[74] Barbara G Tabachnick and Linda S. Fidell, *Using Multivariate Statistics* (Boston: Allyn and Bacon, 2013).

[75] Andy Field, *Discovering Statistics Using IBM SPSS Statistics: And Sex and Drugs and Rock "N" Roll* (Los Angeles, London, New Delhi: Sage, 2013).

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prospective mathematics teachers who filled out the scales and provided written opinions.

Table 1

Information on prospective mathematics teachers who filled out the scales and provided written opinions

Variables	Categories	n (number of scales filled out)	n (number of written opinions received)
Region	Marmara	205	26
	Aegean	180	21
	Mediterranean	126	11
	Black Sea	129	12
	Central Anatolia	167	18
	Eastern Anatolia	135	13
	Southeast Anatolia	164	17
Gender	Male	512	53
	Female	590	65
School Level	1.	270	33
	2.	298	29
	3.	278	28
	4.	260	28
Total		1106	118

II.3. Instruments

II.3.1. The online learning self-efficacy scale (OLSES)

This study employed the Turkish adaptation of the self-efficacy scale for online learning (Appendix 1-Original Form, Appendix 2-Turkish Form) developed by Sun and Rogers. Unlike the scales used in previous studies, the fact that all items in the scale used in this study are positive will prevent the respondents from getting confused.[76] Moreover, compared to 4 and 5 Likert

[76] Richard Netemeyer, William O. Bearden, and Subhash Sharma, *Scaling Procedures Issues and Applications* (USA: Sage Publications, 2013).

type scales the 6-point Likert type scale used in the study does not have neutral or uncertainty points, hence providing better measurement properties. Literature review revealed that the scales used in previous studies are insufficient to meet one or more of the four different dimensions.[77] For the stated reasons, the Online Learning Self-Efficacy Scale developed by Sun and Rogers was adapted into Turkish and applied to elementary mathematics teacher candidates to determine their levels of self-efficacy for online learning.

In the first stage of the adaptation process, three academics who are experts in the field translated the scale into Turkish. Then, each academic examined the translations of the others and gave their suggestions on the form. In the second stage, two academicians working in the Computer and Instructional Technologies Department and three academics working in the Turkish language teaching department examined the scale items in terms of content validity and suitability for the Turkish culture and made the necessary corrections. In the third stage, the researcher applied the scale to 23 prospective mathematics teachers and asked them to write the incomprehensible and unclear items in the blank section under the scale form. In the fourth stage, both versions of the scale were applied to 128 prospective teachers studying in the English Language Teaching Department and the correlation coefficient between both forms of the scale was calculated as .92 at a high level. At the last stage, a second level confirmatory factor analysis was performed on the scale. Since the absolute value of the skewness values of the items in the scale was less than 3 and the absolute value of the kurtosis values was less than 10, the scale met the necessary normality conditions for the confirmatory factor analysis.[78] Due to the normal distribution of the data, the study used the maximum likelihood estimation method.[79] Muthén and Muthén[80] stated that a sample size of 150 is sufficient, granted that the data are normally distributed and there are no missing data. In this respect, the sample size (1,078 people) was sufficient for confirmatory

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[77] Yan Sun and Reenay Rogers, "Development and Validation of the Online Learning Self-efficacy Scale (OLSS): A Structural Equation Modeling Approach," *American Journal of Distance Education* 35, no.3 (2021): 184-199. http://doi.org/10.1080/08923647.2020.1831357.

[78] Rex Kline, *Principles and Practice of Structural Equation Modeling* (New York: Guilford Publications, 2005).

[79] Sait Gürbüz and Faruk Şahin, *Research Methods in Social Sciences* (Ankara: Seçkin Publication, 2018).

[80] Linda Muthén and Bengt O. Muthén, "How to Use a Monte Carlo Study to Decide on Sample Size and Determine Power," *Structural Equation Modeling* 9, no. 4 (2002): 599–620. https://doi.org/10.1207/S15328007SEM0904 8.

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factor analysis. The second-order factorial structure of the online learning self-efficacy scale consisting of four sub-dimensions and 31 items was tested using the AMOS 24 program. The results of the second-order confirmatory factor analysis of the scale indicated that the factor load values of the items were between .66 and .89, at the desired level. The goodness of fit values obtained as a result of the second-order confirmatory factor analysis ($\chi 2/df$ = 2.627; RMSEA = .068; SRMR = .063; CFI = .929; TLI = .923; NFI = .890) indicated that the proposed four-factor model is compatible with the data and acceptable.[81] These results signified that the data obtained from the study were compatible with the predicted theoretical structure (four-factor model) of the online learning self-efficacy scale. The final version of the validated OLSES has 31 items, and they load on four factors: Technology use self-efficacy (TU), online learning task self-efficacy (OLT), instructor and peer interaction and communication self-efficacy (IPIC), and self-regulation and motivation efficacy (SRM). The Cronbach's α values for these factors varied from 0.914 to 0.966 revealing high internal consistency reliability for the OLSES. The scale items were graded as "Strongly Agree" (6 points), "Agree" (5 points), "Partly agree" (4 points), "Partly Disagree" (3 points), "Disagree" (2 points), and "Strongly Disagree" (1 point). The lowest score that one could obtain from the scale was 31, and the highest score 186. All items in the scale were positive, in this regard, there was no reverse scoring, and a high score indicated that the self-efficacy level of the individual who completed the scale is more positive toward online learning. Lin[82] also mentioned this scale in his article.

II.3.2. The attitude toward online learning scale (ATOLS)

This study used the attitude toward online learning scale, for which Kışla[83,84] examined the validity and reliability. The exploratory factor analysis was carried out. The eigenvalues of the scale items gathered under 5

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[81] Barbara Byrne, *Structural Equation Modeling with AMOS: Basic Concepts, Applications, and Programming* (New York: Taylor Francis, 2010).

[82] Tzung-Jin Lin, "Exploring the Differences in Taiwanese University Students' Online Learning Task Value, Goal Orientation, and Self-Efficacy Before and After the COVID-19 Outbreak," *Asia-Pacific Education Researcher* 30, no. 3 (2021): 191–203. https://doi.org/10.1007/s40299-021-00553-1.

[83] Kışla Tarık, "University Students' Attitudes Towards Distance Education," Master diss., Ege University, 2005.

[84] Kışla, Tarık, "Development of a Attitude Scale towards Distance Learning," *Ege Journal of Education* 17, no. 1 (2016): 258-271. https://doi.org/10.12984/eed.01675.

factors greater than 1, and these five factors explained 54% of the variance. Upon examining the factor-item loads, the factor-item loads of all items were above .30 and the exploratory factor analysis was repeated by limiting the number of factors to one. The exploratory factor analysis obtained 35 items with factor-item loadings ranging from 0.30 to 0.74. This factor explained 28% of the total variance. A confirmatory factor analysis was performed to confirm this single factor structure and produced the goodness of fit suggested that the single factor model was compatible with the data and feasible ($\chi 2/df = 2.54$; RMSEA = .021; SRMR = .07; CFI = .93; GFI = .90; AGFI = .91). The internal consistency coefficient of the single factor scale consisting of 35 items was 0.89. The scale used a 5-point Likert-type rating in the options for the statements. Accordingly, the scale items number 1, 2, 4, 5, 9, 11, 14, 15, 16, 18, 19, 22, 23, 25, 26, 28, 29, 33, and 34 were scored as "Strongly Agree" (5 points), "Agree" (4 points), "Undecided" (3 points), "Disagree" (2 points), "Strongly Disagree" (1 point), and the remaining items were scored in reverse. While the highest score that one can obtain from the scale is 175, the lowest score is 35. A high score indicates that the individual who completed has a more positive attitude toward online learning. Fidan[85] also used this scale in his study.

II.3.3. Academic performance (AP)

The researcher requested a document (a transcript) showing the courses taken by the participants of this study during the pandemic and their grades received from these courses. The grade point average of the courses each student took during the pandemic period (2019–2020 spring and 2020–2021 fall terms) was included in the analysis as the prospective mathematics teachers' academic performance. Since the grading format in universities in Türkiye is in the 4 and 100 point system, participants were requested to write the 4-point equivalents of their average scores in the 100 system in the data collection form by using the grade conversion table created by the Council of Higher Education and published on its website.[86] The grade point averages of the prospective teachers were recorded in SPSS as a value between [0–4]. Figure 1 presents an example of the transcript requested from the students.

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[85] Mustafa Fidan, "Distance Education Students' Attitudes Towards Distance Education and Their Epistemological Beliefs," *Hacettepe University Journal of Education* 31, no. 3 (2016): 536-550. https://doi.org/10.16986/HUJE.2016016666.

[86] Council of Higher Education, "Correspondence of Grades in the 4-Point System in the 100-Point System," accessed April 26, 2021,https://www.yok.gov.tr/Documents/Kurumsal/personel_dairesi/4_luk_sistem_100.pdf.

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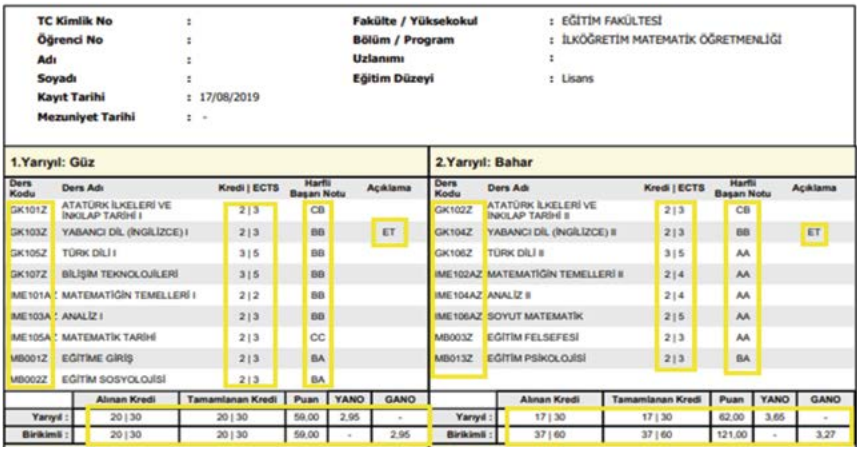

TC Kimlik No	:	**Fakülte / Yüksekokul**	: EĞİTİM FAKÜLTESİ
Öğrenci No	:	**Bölüm / Program**	: İLKÖĞRETİM MATEMATİK ÖĞRETMENLİĞİ
Adı	:	**Uzlanımı**	:
Soyadı	:	**Eğitim Düzeyi**	: Lisans
Kayıt Tarihi	: 17/08/2019		
Mezuniyet Tarihi	: -		

1.Yarıyıl: Güz

Ders Kodu	Ders Adı	Kredi | ECTS	Harfli Başarı Notu	Açıklama
GK101Z	ATATÜRK İLKELERİ VE İNKILAP TARİHİ I	2 | 3	CB	
GK103Z	YABANCI DİL (İNGİLİZCE) I	2 | 3	BB	ET
GK105Z	TÜRK DİLİ I	3 | 5	BB	
GK107Z	BİLİŞİM TEKNOLOJİLERİ	3 | 5	BB	
IME101A	MATEMATİĞİN TEMELLERİ I	2 | 2	BB	
IME103A	ANALİZ I	2 | 3	BB	
IME105A	MATEMATİK TARİHİ	2 | 3	CC	
MB001Z	EĞİTİME GİRİŞ	2 | 3	BA	
MB002Z	EĞİTİM SOSYOLOJİSİ	2 | 3	BA	

	Alınan Kredi	Tamamlanan Kredi	Puan	YANO	GANO
Yarıyıl :	20 | 30	20 | 30	59,00	2,95	-
Birikimli :	20 | 30	20 | 30	59,00	-	2,95

2.Yarıyıl: Bahar

Ders Kodu	Ders Adı	Kredi | ECTS	Harfli Başarı Notu	Açıklama
GK102Z	ATATÜRK İLKELERİ VE İNKILAP TARİHİ II	2 | 3	CB	
GK104Z	YABANCI DİL (İNGİLİZCE) II	2 | 3	BB	ET
GK106Z	TÜRK DİLİ II	3 | 5	AA	
IME102AZ	MATEMATİĞİN TEMELLERİ II	2 | 4	AA	
IME104AZ	ANALİZ II	2 | 4	AA	
IME106AZ	SOYUT MATEMATİK	2 | 5	AA	
MB003Z	EĞİTİM FELSEFESİ	2 | 3	AA	
MB013Z	EĞİTİM PSİKOLOJİSİ	2 | 3	BA	

	Alınan Kredi	Tamamlanan Kredi	Puan	YANO	GANO
Yarıyıl :	17 | 30	17 | 30	62,00	3,65	-
Birikimli :	37 | 60	37 | 60	121,00	-	3,27

Figure 1

A sample document showing the student's grade point average

II.4. Data collection and analysis

This study used a web survey to collect data to measure OLSE and AOL. Both scales contained two control questions ("This is a control question. If you are reading this question, mark the strongly agree option") each. Accordingly, the researcher excluded the data of 28 prospective mathematics teachers who marked the scale items without reading them from the analysis. In addition, the normality test showed that data from 3 participants had extreme values. Consequently, these data were excluded from the analysis, and this study included the data of 1075 prospective mathematics teachers in the analysis. The quantitative data were gathered between April 1st and 25th in 2021.

Basic descriptive statistics, Pearson correlation and multiple regression were used to analyze quantitative data. The level of confidence for all statistical tests in this study was assumed as an alpha level of .05. Descriptive statistics were employed to express the characteristics of the participants. Pearson correlation was conducted to explore if relations among OLSE, AOL and AP were significant. Afterwards, multiple regression analysis was used to discover if there was a significant impact of OLSE and AOL in predicting AP. The study tried to determine the factors that have favorable and adverse effects on the academic performance of prospective mathematics teachers to gain deeper knowledge. For this purpose, the prospective mathematics teachers received the prompt to "Write down the factors that positively or negatively affect your

academic performance in the distance education process." The written answers of 118 prospective mathematics teachers were reviewed through content analysis. Two different researchers conducted the content analysis, and the consistency index between the coding was high, at 0.94. For the coding in which the researchers could not reach a consensus, a third researcher was consulted, and the majority's opinion was accepted.

III. Results

III.1. Results for Question 1 and Question 2

A Pearson correlation was used to analyze the association between OLSE and AP. Table 2 illustrated that there was a significant positive correlation between OLSE and AP ($r(1075) = .634$, $p < .01$). Also, AP had significant correlation with the four subscales of OLSE (TU: $r = .586$ $p < .01$, OLT: $r = .545$ $p < .01$, IPIC: $r = .562$ $p < .01$, SRM: $r = .501$ $p < .01$). A Pearson correlation analysis was conducted between AOL and AP among prospective mathematics teachers, and a significant positive correlation between AOL and AP was found ($r(1075) = .630$, $p < .01$).

Table 2

The correlation between (OLSE, AOL) and AP

	N	AP	p
OLSE	1075	.634	.000**
First factor (Technology use self-efficacy, TU)		.586	.000**
Second factor (Online learning task self-efficacy, OLT)		.545	.000**
Third factor (Instructor and peer interaction and communication self-efficacy, IPIC)		.562	.000**
Fourth factor (Self-regulation and motivation efficacy, SRM)		.501	.000**
AOL		.630	.000**

** Correlation is significant at the 0.01 level (2-tailed).

III.2. Results for Question 3

The study used multiple regression enter method and stepwise method to determine the accuracy of OLSE and AOL on predicting AP. Data were scanned to determine missing data and outliers and to test assumptions. For

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this, Mahalanobis and Cook's distance was taken into account. It is recommended that data above 1 for Cook's distance and data above 13.82, which is the critical value for the Mahalanobis distance, are extreme values and should be excluded from the analysis.[87] There was no Cook distance value greater than 1. However, when the Mahalanobis distances were examined, there were 3 data sets exceeding the critical value of 13.82, these were excluded from the analysis, and the analysis was carried out with 1075 data. Table 3 presents all tolerance levels which were more than .1 and all variance inflation factors (VIF) that were less than 10. Additionally, the Pearson correlation coefficient between the predictor variables $r = .693$ was found to be less than .70. Thus, it revealed that there was no problem of multicollinearity.[88] The Durbin-Watson value being 1.639, which is a value greater than 1 and less than 3, indicates that there is no autocorrelation in the model. Linearity was then analyzed by creating a scatter plot matrix (Figure 2). The scatter plot of the standardized residuals shows that most of the scores are concentrated in the center (along the 0 point). The residual plot was analyzed to evaluate homoscedasticity.[89] Figure 3 indicates that the errors have a near-normal distribution and the residual plots were not extreme. Therefore, linearity and homoscedasticity will be assumed.

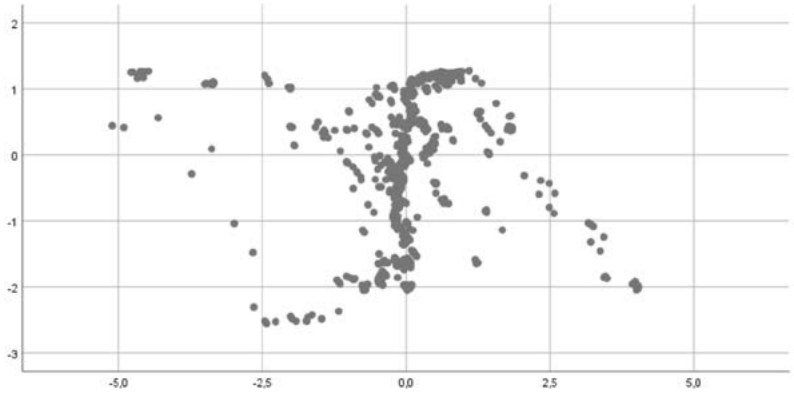

Figure 2

Scatter plot

[87] Barbara Tabachnick and Linda S. Fidell, *Using Multivariate Statistics* (Boston: Allyn and Bacon, 2013).

[88] Julie Pallant, *The SPSS Survival Manual* (London: McGraw-Hill Education, 2013).

[89] Andy Field, *Discovering Statistics Using IBM SPSS Statistics* (London: Sage, 2013).

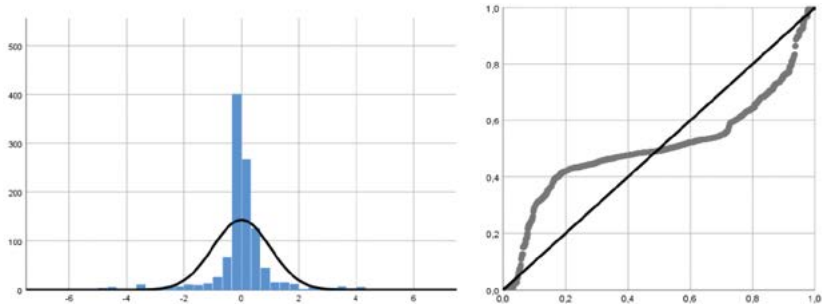

Figure 3

Histogram of regression standardized residual and Normal Probability Plot (PP) of the regression standardized residual

In Table 3, multiple regression demonstrated that the overall model significantly predicted AP (R^2 = .446, R^2 adj = .445, F(2,1072) = 431.246, p < .001). This model explained 44.6% of the variance in AP. The beta weights in Table 3 illustrates that the contribution of OLSE and AOL to the model is significant (OLSE β = .36, t(1072) = 9.705, p < .001; and AOL β = .34, t(1072) = 9.176, p < .001).

Table 3

Multiple regression for predicting AP using the enter method

Model	Variables	B	β	t	Tolerance	VIF	Durbin-Watson	F	R^2	R^2 adj
1	Constant	2.417		63.784			1.639	431.246***	.446	.445
	OLSE	.004	.36	9.705	.371	2.69				
	AOL	.003	.34	9.176	.371	2.69				

*** p < .001.

In Table 4, multiple regression using the stepwise method, represented that the first model with the predictor (OLSE) accounted for 40.2% of the variance in AP and was significantly influential in predicting AP. And as the second model of two predictors added 4.4% of R^2 change, which, in total, accounted for 44.6% and was significantly influential in predicting the criterion (AP). The result of this study revealed that OLSE and AOL can significantly have an effect on predicting AP.

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Table 4

Multiple regression for predicting AP using the stepwise method

Model	Variables	B	β	t	Tolerance	VIF	F	R^2	R^2 change
1	Constant	2,316					722.275***	.402	.402
	OLSE	.007	.634	26.875	1.00	1.00			
2	Constant	2.417					431.246***	.446	.044
	AOL	.004	.362	9.705	.371	2.698			
	OLSE	.003	.343	9.176	.371	2.698			

*** $p < .001$.

III.3. Results for Question 4

This study also tried to determine the factors that have favorable and adverse effects on the academic performance of prospective mathematics teachers in order to gain deeper knowledge. To that end, the prospective teachers were directed to "Write down the factors that positively or negatively affect your academic performance in the distance education process." The researcher conducted content analysis on the written answers of the prospective teachers. Table 5 presents the obtained results.

As a result of the content analysis, 4 codes were obtained under the theme of the factors that positively affect the academic performance of prospective mathematics teachers in the distance education process. These codes are, respectively, "Ease of accessing lecture notes and video recordings of the lecture (f = 77)," "Efficient use of time (f = 84)," "Using different assessment and evaluation techniques (homework, forum, quiz, and performance tasks), (f = 33)," and "Comfort of the working environment (f = 18)." On the other hand, under the theme of negative factors, there were 7 codes. These codes are, respectively, "Technological problems (f = 38)," "The teaching method and teaching tools used (f = 87)," "Instruction time (f = 88)," "Teacher-student interaction (f = 97)," "Assessment and evaluation related problems (f = 91)," "Distractibility (f = 23)," and "Belief in the efficacy of face-to-face education over distance education (f = 32)."

In summary, this study determined that attitude toward online learning and self-efficacy toward online learning are significant predictors of academic performance ($R^2 = .446$; $p < .001$; OLSE $\beta = .36$, $t(1072) = 9.705$, $p < .001$; and AOL $\beta = .34$, $t(1072) = 9.176$, $p < .001$), and found that there are other factors that have positive and negative effects on academic performance.

Table 5

Factors that positively and negatively affect the general academic performance of prospective mathematics teachers in the distance education process

Theme	Codes	Supporting Statement	f
The Positive Factors	Ease of accessing lecture notes and video recordings of the lecture	P3. Since the lessons we took online were recorded, we were able to watch the lessons we missed or could not understand again later, allowing us to understand the points that we were not able to comprehend. P34. Since the lectures are recorded, I can listen to them repeatedly, which contributes to my learning.	77
	Efficient use of time	P95. Since we were always at home, I did not have any problems allocating time for the lessons. P99. Being at home during this process allowed us to make better use of our day and spend our time more productively. P101. Since I was at home during online education, I spent my time more efficiently. This situation contributed to my academic success, and I found time for the aspects I wanted to develop individually.	84
	Using different assessment and evaluation techniques (homework, forum, quiz, and performance tasks)	P55. Since the exams in the form of homework, I learned more about the course. P59. The positive side of the distance education process is the assignments, because when the exams are in the form of homework, I learn the subjects better and do not forget them easily because I have to study the subjects more comprehensively. P88. Taking regular quizzes every week or receiving our exam grades based on homework prevented us from disconnecting from the class. Thus, assessments and evaluations were not only result-oriented, but process-oriented.	33
	Comfort of the working environment	P70. The fact I could study more comfortably at home and spare time for myself had a positive effect. P80. I had the comfort of taking exams at home.	18

Theme	Codes	Supporting Statement	f
The Negative Factors	Technological problems	P41. Due to problems in internet access, my participation in classes was interrupted from time to time. Unfortunately, I felt disconnected when I could not attend a few classes. P66. Since I live in the village, my internet was cut off during some classes and I could not attend the classes. P79. Losing connecting to the internet or the constant freezing of the audio and video while I was listening to the lectures, prevented me from having motivation for some lessons. P85. I had concerns that the electricity would go out or the phone-computer would present errors. P95. In some cases, problems would occur in the exams during the distance education process. In the exams on the system, sometimes the system could remove us from the exam, and sometimes we experienced a loss of time due to the slowness of the internet. Therefore, it was inevitable to be in a constant state of stress during the exam. P102. I had concerns that the electricity would go out or the phone-computer would present errors.	38
	The teaching method and teaching tools used	P29. Some lecturers conducted their lectures using the direct instruction method, which caused the lecture to be monotone. I lost interest in the lesson. P71. The instructor's constant self-explanatory state and the fact that they did not use sufficient and compelling teaching tools reduced my active participation and interest in the lesson. P93. Most lessons were taught through presentations, causing them to be boring after a certain period. P111. Most of our teachers only used power point presentations. I wish they had used other engaging teaching tools. Then I could have been more motivated toward the lesson.	87

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Theme	Codes	Supporting Statement	f
The Negative Factors	Instruction Time	P32. Since the lessons are conducted through technological tools such as the phone and computer, I can get distracted after a certain period of time in front of the screen. Therefore, there is not as much activity in the course as in face-to-face education. P49. Some lessons lasted too long. Thus, we were in front of the screen for a long time and this reduced our interest in the lesson. P61. The long instructing hours and the fact that we lost connection to the course after a certain period of time adversely affected our academic performance.	88
	Teacher-Student Interaction	P13. Interactive learning in lessons decreased to a minimum. This situation had a negative impact on our grades. P25. Since the student-teacher interaction was inadequate compared to the face-to-face classroom environment, this had a negative impact on my academic performance. P45. Both our and our teacher's cameras were closed, so there was no proper teacher-student interaction. This situation made us feel as if we were listening to the radio. P82. Since I am not in the same environment with the lecturer, I have difficulty understanding the lessons, and this is reflected in my exams. P101. Trying to listen to the teachers without even seeing their faces prevented me from being highly motivated for the lesson. P103. I did not have the opportunity to do intensive question-and-answer sessions with our teachers for facts that I was curious about or when I had questions left in my mind.	97

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Theme	Codes	Supporting Statement	f
The Negative Factors	Assessment and evaluation related problems	P23. The limited exam times and the problem of the inability to return to a question when one made a wrong marking caused stress. P56. In distance education, I think there was too much homework in each course at the same time. The fact that it took a lot of time and sometimes the homework being unproductive reduced my motivation. P59. In the simultaneous multiple-choice exams, which are rarely used for certain courses, the students were not allowed to return to the items, and the allocated time was insufficient. P87. Some courses had a very short exam duration (like 20 questions 19 minutes). This situation caused me to be unable to answer all of the questions. P99. We had to be in front of the computer all the time because we were given a lot of homework. This situation caused me to take a dislike to the lesson and reduced my interest. P104. Excessive homework and exams alienated us from the lessons. Even though we reached the finals week, we continued to do our midterm homework and we were doing them reluctantly.	91
	Distractibility	P39. Since I did not have a room of my own at home, my siblings' noise and my parents' conversations distracted me during lessons. P77. The small size and crowded nature of our house negatively affected my focus in lessons.	23
	Belief in the efficacy of face-to-face education over distance education	P22. I think that face-to-face education is more efficient and effective than distance education. Until now, I always had face-to-face training and people cannot easily give up their habits. P44. Distance education definitely cannot replace face-to-face education, because you can clearly feel the authority of the teacher in face-to-face education. P90. In face-to-face education, one can establish teacher-student communication in a healthier manner compared to distance education. Students can participate more actively in the lesson. Therefore, I cannot say that distance education has positively affected my academic performance.	32

IV. Conclusion and discussion

In this study, it was first investigated whether Online Learning Self-Efficacy (OLSE) and attitude towards online learning (AOL) significantly predicted the academic performance (AP) of Turkish pre-service mathematics teachers. In the next stage, 118 volunteer teacher candidates were asked what factors they thought had a positive or negative effect on their academic success during distance education and were asked to explain these factors. In this study, unlike the studies conducted in the literature,[90,91,92,93,94] online learning self-efficacy and attitude towards online learning as predictor variables were included in the study and both quantitative and qualitative data were collected. The results obtained from the study are important because they reveal the positive and negative factors that affect the academic performance of students in the online learning process, as well as showing whether the variables of online self-efficacy and attitude towards online learning are significant predictors of academic performance. The results obtained from the study can be a guide for practitioners, policy makers and teachers to take the necessary precautions for the effective execution of the distance education process.

This study revealed several critical conclusions with the findings from four research questions. A significant positive relationship between prospective mathematics teachers' online learning self-efficacy and level of academic performance was found. Therefore, as the prospective mathematics teachers' self-efficacy toward online learning improves, their academic performance will also improve positively. This result is similar to other

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[90] Judy Drennan, Jessica Kennedy, and Anne Pisarski, "Factors Affecting Student Attitudes Toward Flexible Online Learning in Management Education," *Journal of Educational Research* 98, no. 6 (2005): 331-338. https://doi.org/10.3200/JOER.98.6.331-338.

[91] Maria Puzziferro, "Online Technologies Self-efficacy, Self-regulated Learning, and Experimental Variables as Predictors of Final Grade and Satisfaction in College-Level Online Courses," *American Journal of Distance Education* 22, no 2 (2006): 72-89. https://doi.org/10.1080/08923640802039024.

[92] Mariia Rizun and Artur Strzelecki, "Students' Acceptance of the COVID-19 Impact on Shifting Higher Education to Distance Learning in Poland," *International Journal of Environmental Research and Public Health* 17, no 18 (2020): 1-19. https://doi.org/10.3390/ijerph17186468.

[93] Chia-Lin Tsai et al., "The Self-Efficacy," 472-489.

[94] Shem Unger and William Meiran, "Student Attitudes Towards Online Education During the COVID-19 Viral Outbreak of 2020: Distance Learning in a Time of Social Distance," *International Journal of Technology in Education and Science* 4, no 4 2020: 256-266. https://doi.org/10.46328/ijtes.v4i4.107.

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studies in the literature.[95,96,97,98,99,100,101] It is concluded that students with low self-efficacy are less likely to make an effort and be successful in subjects they have difficulty with than students with high self-efficacy, and drew attention to the relevance of self-efficacy in student success.[102]

This study showed that there was a significantly positive relationship between prospective mathematics teachers' attitude toward online learning and level of academic performance. Therefore, as prospective mathematics teachers' attitudes toward online learning develop positively, their academic performance will also improve. This result is similar to the studies in the literature.[103,104,105] For example, Martinez et al.[106] concluded that student attitude in the distance education process affects academic success. Mohamed and Waheed[107] concluded that if students' attitudes toward lessons are

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[95] Katrin Arens, Anne C. Frenzel, and Thomas Goetz, "Self-Concept and Self-Efficacy in Math: Longitudinal Interrelations and Reciprocal Linkages with Achievement," *The Journal of Experimental Education* 90, no. 3 (2020): 1-19. https://doi.org/10.1080/00220973.2020.1786347.

[96] Adeneye Awofala, "Correlates of Senior," 15-25.

[97] Toni Honicke and Jaclyn Broadbent, "The Influence of Academic Self-efficacy on Academic Performance: A Systematic Review," *Educational Research Review* 17, (2016): 63-84. https://doi.org/10.1016/j.edurev.2015.11.002.

[98] Dan Li, "A Review of Self-efficacy," 526-533.

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[100] Chia-Lin Tsai et al., "The Self-Efficacy," 472-489.

[101] Ya-Ling Wang, Jyh-Chong Liang, and Chin-Chung Tsai, "Cross-Cultural Comparisons of University Students' Science Learning Self-efficacy: Structural Relationships Among Factors within Science Learning Self-efficacy," *International Journal of Science Education* 40, no. 6 (2018): 579-594. https://doi.org/10.1080/09500693.2017.1315780.

[102] Dale H. Schunk, "Self-efficacy and Education and Instruction," In *Self-Efficacy, Adaptation, and Adjustment: Theory, Research, and Application*, edited by James E. Maddux, 281-303. Plenum Press, 1995.

[103] Gwo-Jen Hwang, Po-Han Wu, and Chi-Chang Chen, "An Online Game Approach for Improving Students' Learning Performance in Web-based Problem-Solving Activities," *Computers & Education* 59, no. 4 (2012): 1246-1256. https://doi.org/10.1016/j.compedu.2012.05.009.

[104] Linda Khateeb, Sameer Aowad Kassab Shdaifat, and Nidal A. K. Shdaifa, "Effectiveness of communication techniques in distance education and its impact on learning outcomes at Jordanian Universities (Northern Province)," *International Journal of Higher Education* 10, no. 2 (2021): 74-82. https://doi.org/10.5430/ijhe.v10n2p74.

[105] Mengping Tsuei, "Using Synchronous Peer Tutoring System to Promote Elementary Students' Learning in Mathematics," *Computers & Education* 58, no. 4 (2012): 1171-1182. https://doi.org/10.1016/j.compedu.2011.11.025.

[106] Romero J. Sonia Martínez et al., "Attitudes Toward," 59-75.

[107] Lawsha Mohamed and Hussain Waheed, "Secondary Students' Attitude," 277-278.

positive, there is a significant increase in their performance and academic achievement in the learning process.

This study revealed that prospective mathematics teachers' online learning self-efficacy and attitude toward online learning had a significant influence on their academic performance. The R^2 and R^2 *change* values in Table 4 show that Online Learning Self-Efficacy is more effective in predicting academic performance. The results showed that the level of academic performance can be predicted by online learning self-efficacy and attitude toward online learning. When the studies are examined, it is seen that self-efficacy is one of the most important predictors of academic success.[108,109,110] On the other hand, there were results revealing that another predictor of academic success is attitude.[111,112] However, there were no studies on whether the attitude and self-efficacy toward online learning are significant predictors of academic success. Yet, some studies have revealed the significant effects of motivation and self-efficacy on academic achievement.[113,114]

Therefore, academics should first determine the self-efficacy and attitude levels of prospective mathematics teachers toward online learning. For students who do not have sufficient self-efficacy and attitude, educators can concretize abstract concepts that are difficult to understand. Computer software can assist the concretization process. The distance education

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[108] David B Feldman and Maximilian Kubota, "Hope, Self-efficacy, Optimism, and Academic Achievement: Distinguishing Constructs and Levels of Specificity in Predicting College Grade-point Average," *Learning and Individual Differences* 37 (2015): 210-216. https://doi.org/10.1016/j.lindif.2014.11.022.

[109] Meera Komarraju and Dustin Nadler, "Self-Efficacy and Academic Achievement: Why Do Implicit Beliefs, Goals, and Effort Regulation Matter?," *Learning and Individual Differences* 25, (2013): 67-72. https://doi.org/10.1016/j.lindif.2013.01.005.

[110] Antonio Zuffianò et al., "Academic Achievement: The Unique Contribution of Self-efficacy Beliefs in Self-regulated Learning Beyond Intelligence, Personality Traits, and Self-esteem," *Learning and Individual Differences* 23 (2013): 158-162. https://doi.org/10.1016/j.lindif.2012.07.010.

[111] Peter Kpolovie, Andy Igho Joe, and Tracy Okoto, "Academic Achievement Prediction: Role of Interest in Learning and Attitude Towards School," *International Journal of Humanities Social Sciences and Education* 1, no. 11 (2014): 73-100.

[112] Wisdom Owo and Emmanuel F. Ikwut, "Relationship Between Metacognition, Attitude and Academic Achievement of Secondary School Chemistry Students in Port Harcourt, Rivers State," *IOSR Journal of Research & Method in Education* 5, no. 6 (2015): 6-12. https://doi.org/10.9790/7388-05630612.

[113] Edward L Deci and Richard M. Ryan, "Facilitating Optimal Motivation and Psychological Wellbeing Across Life's Domains," *Canadian Psychology* 49, no. 1 (2008): 14-23. https://doi.org/10.1037/0708-5591.49.1.14.

[114] Meera Komarraju and Dustin Nadler, "Self-Efficacy," 67-72.

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process can utilize learner-interface interaction to make learners active in their own learning processes and to participate in the lesson productively. For this, one can obtain support from software that can help share content created by learners and benefit from cooperation.[115] On the other hand, various discussions can be conducted in relation to social media applications (WhatsApp-Telegram-Facebook-Twitter) to ensure learner-instructor and learner-learner interaction. In addition, online educators can increase the motivation of their students by using communication tools such as email, chat room, social networking services, and bulletin boards for online learning.

The findings of the study determined that there are factors that have favorable and adverse effects on the academic performance of prospective mathematics teachers in the distance education process. As a result of the written opinions received from teacher candidates, the factors that have a positive effect on academic performance were coded as "Ease of accessing lecture notes and video recordings of the lecture," "Efficient use of time," "Use of different assessment and evaluation techniques (homework, forum, quiz, and performance task)," and "Comfort of the working environment." The factors that have a negative impact on academic performance were; "Technological problems," "The teaching method and teaching tools used," "Instruction time," "Teacher-student interaction," "Assessment and evaluation related problems," "Distractibility," and "Belief in the efficacy of face-to-face education over distance education." In addition to these factors, existing studies have highlighted other factors such as technological infrastructure,[116,117,118,119] teacher-student interaction,[120,121] assessment and

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[115] Neelu Sinha, Laila Khreisat, and Kiron Sharma, "Learner-Interface Interaction for Technology-Enhanced Active Learning," *Innovate: Journal of Online Education* 5, no. 3 (2009): 1-9.

[116] Pia Ceres, "A Covid Slide' Could Widen the Digital Divide for Students," accessed May 4, 2021, https://www.wired.com/story/schools-digital-divide-remote-learning/.

[117] Thelma Obiakor and Adeniran Adedeji P, "COVID-19: Impending Situation Threatens to Deepen Nigeria's Education Crisis," accessed May 1, 2020, https://www.africaportal.org/publications/covid-19-impending-situation-threatens-deepen-nigerias-education-crisis/.

[118] Rachel Gong, "Coping with MCO: Distance learning and the digital divide," accessed October 15, 2020, https://www.malaymail.com/news/what-you-think/2020/03/27/coping-with-mco distance-learning-and-the-digital-divide-rachel-gong/1850758.

[119] Yash Sharma, "Massive Open," 1–5.

[120] Doris U Bolliger and Oksana, Wasilik, "Factors Influencing Faculty Satisfaction With Online Teaching and Learning in Higher Education," *Distance Education* 30, no. 1 (2009): 103-116. https://doi.org/10.1080/01587910902845949.

[121] Jennifer Haber and Michael Mills, "Perceptions of Barriers," 266-283.

evaluation processes,[122] and time management and motivation[123,124,125] also affect the academic performance of the students in the distance education process. Reasons such as technical failures in the distance education system, lack of content and material, communication breakdowns, and the emotional reluctance of students negatively affect students' attitudes toward distance education.[126] According to Fidalgo et al.,[127] many students believe that time management and lack of motivation are major concerns about distance education. Especially after the earthquakes that took place in Türkiye on February 6, 2023 and negatively affected 10 provinces, the decision of distance education was taken again in the universities in Türkiye. It should also be emphasized that students living in the earthquake area are likely to have a lack of concentration, loss of motivation and a source of mental depression.

V. Suggestions and implications

According to the results obtained from the study, when prospective mathematics teachers' self-efficacy and attitudes toward online learning are positive and high, their academic performance will be congruent. It can be said that the learning-teaching process in distance education requires interactive, rich content practices and course tools that increase the quality of the time they spend. In distance education, the duration of the lessons is shorter than in normal education, but the intense content plays an important role in the individual participation of the students, their following the lesson, their interaction with each other and with the lecturer. For this reason, it is important to organize the course contents, course design, questions, examples and assignments in the course in a way that attracts students' attention and motivates them. If the learning environments are organized in a student-centered manner in line with the expectations of the teacher candidates, it can be said that the attitudes and self-efficacy of the prospective mathematics teachers towards distance learning can be improved in a positive way.

Additionally, when there are no technological disruptions in the distance education process, when educators use appropriate teaching methods and tools that will make students active in the teaching process and enable them

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[122] Tracy Chao, Tami Saj, and Felicity Tessier, "Establishing a Quality," 32-39.
[123] Patricia Fidalgo et al., "Students' Perceptions," 1-18.
[124] Reinhard Pekrun et al., "Boredom and Academic," 696-710.
[125] Allen Wigfield et al., "Development of achievement," 657-700.
[126] Rasheed Falowo, "Factors Impeding," 315-338.
[127] Patricia Fidalgo et al., "Students' Perceptions," 1-18.

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to access information themselves, when they keep interactions such as educator-student, student-student, student-interface at a high level, and when they use process-based appropriate assessment and evaluation tools, educators can contribute to the improvement of students' academic performance. If the instructors involved in the distance education process take into account the factors that have positive and negative effects on the academic performance of the students and plan their lessons accordingly, this situation can contribute to the effective and efficient execution of the distance education process. In the distance education process, apart from the positive and negative factors revealed in this study, it may be beneficial for the instructors to have regular online meetings with their students and consider the opinions of the students to identify the different factors that may arise and to take the necessary precautions in this direction.

The results obtained from this study are limited to the answers from 1075 and 118 prospective mathematics teachers. In addition, the study reviewed two predictor variables (self-efficacy toward online learning and attitude toward online learning). The research tried to overcome this limitation with the prompt, "Write down the positive and negative factors that affect your academic performance in the distance education process" directed at the prospective mathematics teachers. In the light of the results, it is necessary to reconsider the roles and competencies of distance educators in traditional education according to distance education environments,[128] because educators becoming effective instructors in distance education applications depend on whether they have multidimensional roles and various competencies.[129]

Caution needs to be paid to the generalizability of the results obtained in this study. Students in different countries have different access to technological tools. Self-efficacy levels and attitudes towards online learning of students who do not have their own devices such as computers and tablets at home may differ from those who have these tools. In addition, whether universities in different countries are familiar with the distance education process and their technological infrastructures and the experiences of academicians in this process may differ. Since the participants in this study are prospective mathematics teachers, similar studies can be conducted on prospective teachers from different branches in future research. Future studies can also investigate whether variables other than self-efficacy toward online learning and attitude toward online learning

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[128] Michael Beaudoin, "The Instructor's Changing Role in Distance Education," *The American Journal of Distance Education* 4, no. 2 (1990): https://doi.org/10.1080/08923649009526701.

[129] Nada Dabbagh and Brenda Bannan-Ritland, *Online learning: Concepts, Strategies, and Application* (Prentice Hall, 2005).

(motivation, satisfaction, academic stress, etc.) are significant predictors of academic performance. Additionally, studies can investigate direct and indirect effects between predictor (motivation, satisfaction, academic stress, self-efficacy, and attitude) and predicted (academic performance) variables through path analysis or structural equation modeling.

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About the authors

SUPHI ÖNDER BÜTÜNER (corresponding author, s.onder.butuner@bozok.edu.tr) is Associate Professor of Math Education at Faculty of Education, Yozgat Bozok University (Turkey) where he teaches undergraduate and post-graduate courses. He worked as a mathematics teacher between 2002 and 2014. He received master's degree in 2006 and doctorate degree in 2014. He has been working at the Faculty of Education at Yozgat Bozok University since 2015. His research focus is on teaching mathematical concepts and teacher training.

SERDAL BALTACI (serdalbaltaci@gmail.com) is Associate Professor of Math Education at Faculty of Education, Kırşehir Ahi Evran University (Turkey) where he teaches undergraduate and post-graduate courses. He received doctorate degree in 2014. He has been working at the Faculty of Education at Kırşehir Ahi Evran University since 2007. His research focus is on teaching mathematical concepts and teacher training.

Appendix 1. Factors and items of the Online Learning Self-efficacy Scale (Sun and Rogers, 2020)

Factor	Items
Technology use self- efficacy	1) I feel confident in downloading and installing a software or application from a website.
	2) I feel confident in printing a website.
	3) I feel confident in downloading (saving) an image from a website.
	4) I feel confident in bookmarking a website.
	5) I feel confident in copying a block of text from a web site and pasting it to a document in a word processor.
	6) I feel confident in accessing links to web resources.
	7) I feel confident in conducting an Internet search using one or more keywords

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Factor	Items
Online learning task self-efficacy	8) I feel confident in taking an online quiz/test.
	9) I feel confident in viewing my grades in the grade book of the Learning Management System (e.g., BlackBoard).
	10) I feel confident in viewing my online course materials in the Learning Management System (e.g., BlackBoard).
	11) I feel confident in submitting course assignments through the Learning Management System (e.g., BlackBoard).
Instructor and peer interaction and communication selfefficacy	12) I can develop a sense of community through interactions with other online course participants.
	13) I can feel connected to others in my online courses.
	14) I can develop a sense of community through interactions with my online instructors.
	15) I can share my problems with my online classmates so we know what we are struggling with and how to solve our problems.
	16) I can communicate with my online classmates to find out how I am doing in my online classes.
	17) I can develop a sense of collaboration through team work/projects in my online
	18) I can gain a sense of belonging in my online courses by getting to know other course participants.
Self-regulation and motivation efficacy	19) I can make myself feel the need to do an outstanding job in an online course.
	20) I can encourage myself to understand the most difficult materials presented in an online course
	21) I can motivate myself to persist in my online courses when facing difficulties or setbacks
	22) I can motivate myself to explore content related questions in my online courses
	23) Even in the face of technical difficulties, I can motivate myself to learn the materials presented in an online course.

Factor	Items
Self-regulation and motivation efficacy	24) I can motivate myself to learn online through the belief that my online courses can broaden my knowledge about subjects which appeal to me.
	25) I can motivate myself to perform well in my online courses by seeing how these courses can move me closer to my career goals.
	26) I can motivate myself to learn in my online courses without the presence of instructors to assist me.
	27) I can manage study time for my online courses by setting goals.
	28) I can find where I am able to study most efficiently for my online courses.
	29) I can make myself feel the need to utilize a variety of information sources to explore problems posed in my online courses.
	30) I can work extra problems in my online courses in addition to the assigned ones in order to master the course content.
	31) I can motivate myself to work hard in my online courses through the belief that my online courses can help me get a degree allowing me to get a better salary later

1 point: strongly disagree, 2 point: disagree, 3 point: somewhat disagree, 4 point: somewhat agree, 5 point: agree, 6 point: strongly agree

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Appendix 2. Çevrimiçi öğrenme öz yeterlik ölçeği (Online Learning Self-efficacy Scale-Turkish Form)

Faktör	Madde
Teknoloji Kullanımı öz yeterliği	1) Bir web sitesinden bir yazılım veya uygulama indirip yüklerken kendime güvenirim.
	2) Bir web sitesinden çıktı alırken kendime güvenirim.
	3) Bir web sitesinden bir görsel indirirken (kaydederken) kendime güvenirim.
	4) Bir web sitesini sık kullanılanlara eklerken kendime güvenirim.
	5) Bir web sitesinden bir metni kopyalayıp, bu metni word belgesine yapıştırmada kendime güvenirim.
	6) Web sayfalarının bağlantılarına erişimde kendime güvenirim.
	7) Bir ya da birden fazla anahtar kelime kullanarak internette arama yapmada kendime güvenirim.
Çevrimiçi öğrenme görevi öz-yeterliği	8) Çevrimiçi bir sınava (test, quiz vb.) girmede kendime güvenirim.
	9) Öğrenme Yönetim Sisteminin (örn. Boysis, Moodle, AYDEP, Proliz vb) notlar kısmından notuma bakmada kendime güvenirim.
	10) Öğrenme Yönetim Sisteminde (örn. Boysis, Moodle, AYDEP, Proliz vb.) çevrim içi ders materyallerini görüntülemede kendime güvenirim.
	11) Öğrenme Yönetim Sistemi (örn. Boysis, Moodle, AYDEP, Proliz vb.) aracılığıyla dersin ödevlerini teslim etmede kendime güvenirim.
Eğitici ve akran etkileşimi ve iletişimi öz-yeterliği	12) Çevrim içi derslerimde sınıf arkadaşlarımla etkileşimler yoluyla bir topluluk duygusu geliştirebilirim.
	13) Diğer çevrim içi ders katılımcılarıyla iletişim kurabilirim.
	14) Çevrim içi derslerimde öğretim elemanlarıyla etkileşimler yoluyla bir topluluk duygusu geliştirebilirim.
	15) Çevrim içi derslerimde sınıf arkadaşlarımla eğitim-öğretimle ilgili (öğrenme güçlüğü yaşadığım konular, kavramlar vb) problemlerimi paylaşabilirim.

Faktör	Madde
Eğitici ve akran etkileşimi ve iletişimi öz-yeterliği	16) Çevrim içi derslerimde ekip çalışması/projeler aracılığıyla bir işbirlikli öğrenme ortamı oluşturabilirim.
	17) Çevrim içi derslerimde eğitim öğretim ile ilgili (öğrenme eksiklikleri vb.) ne durumda olduğumu öğrenmek için sınıf arkadaşlarımla iletişim kurabilirim
	18) Çevrim içi derslerimde diğer katılımcıları tanıyarak, çevrimiçi derslerime aidiyet duygusu (bir gruba ait olma, mensup olma) kazanabilirim.
Öz düzenleme ve motivasyon öz-yeterliği	19) Çevrim içi derslerde başarılı olmak için gayretli bir şekilde çalışmam gerektiği hususunda kendimi motive edebilirim.
	20) Çevrim içi bir derste sunulan en zor materyalleri bile anlamak için kendimi cesaretlendirebilirim.
	21) Zorluklar veya aksaklıklarla karşılaştığımda çevrim içi derslerime devam etmede kendimi motive edebilirim.
	22) Çevrim içi derslerimde öğretim elemanları tarafından sorulan soruların cevaplarını bulmak için ilgili kaynaklara ulaşmada kendimi motive edebilirim.
	23) Çevrim içi derslerimde teknik zorluklar ile karşılaşsam bile, derste sunulan ders içeriklerini öğrenmek için kendimi motive edebilirim.
	24) Çevrim içi derslerimin, ilgimi çeken konular hakkında bilgimi arttıracağına inandığım için kendimi çevrim içi öğrenmeye motive edebilirim.
	25) Çevrim içi derslerin beni kariyer hedeflerime nasıl yaklaştırabileceğini görerek, çevrim içi derslerimde iyi performans gösterme konusunda kendimi motive edebilirim.
	26) Çevrim içi derslerde hiçbir destek almadan ilgili konuları öğrenmek için kendimi motive edebilirim.
	27) Çevrim içi derslerim için çalışma süresini, kendime hedefler belirleyerek yönetebilirim.
	28) Çevrim içi derslerime verimli şekilde çalışmam konusunda kendimi motive edebilirim.

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Faktör	Madde
Öz düzenleme ve motivasyon öz-yeterliği	29) Çevrim içi derslerimde ortaya çıkan sorunları (ders ile ilgili veya teknik sorunlar vb.) çözmek için çeşitli bilgi kaynaklarını kullanma konusunda kendimi motive edebilirim.
	30) Ders içeriğine hâkim olmak için verilen ödevlere ek olarak çevrim içi derslerimde ekstra problemler üzerine çalışabilirim.
	31) Çevrim içi derslerimin, daha iyi bir maaş almamı sağlayacak bir kariyere ulaşmamda bana yardımcı olabileceği inancıyla, çevrimiçi derslerimde çok çalışmak için kendimi motive edebilirim.

1 puan: Kesinlikle Katılmıyorum, 2 puan: Katılmıyorum, 3 puan: Kısmen Katılmıyorum, 4 puan: Kısmen Katılıyorum, 5 puan: Katılıyorum, 6 puan: Kesinlikle Katılıyorum