

## The students' view for teaching numerical analysis in the form of distance education

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### Abstract

With COVID-19 pandemic, which was started in Wuhan, China, and is still affecting the whole world as well as our country, education offered distantly. This research aims to determine the students' opinions and their behaviors towards teaching Numerical Analysis in the form of distance education. The research was carried out with a group of students studying at the Faculty of Engineering in a private university in Northern Cyprus during the 2019-2020 academic year. In the research, an interview form was applied to get students' opinions about distance education and to understand whether it is appropriate to give a numerical analysis course over distance education or not. At the end of the research, students' positive and negative views about distance education emerged. Most of the students argued the idea that distance education platform is not able to provide education as effectively as the traditional classroom environment. It is supported that it is more accurate to give the form of traditional education because of the application of a Numerical Analysis course is challenging.

**Keywords:** Distance Education, Numerical Analysis, Student, Distance Learning, Information and Communication Technologies.

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## 1. INTRODUCTION

In our century, which is called "Information Age", Information and Communication Technologies are developing rapidly; therefore, people need to keep up with this technology. Today, information and communication technologies are frequently required. Additionally, thanks to these technologies, people can quickly meet their needs. One of the areas where Information and Communication Technologies are most needed is education. Also, if individuals working in the field of education do not follow today's technologies carefully, serious problems may arise.

Distance education is rapidly gaining importance in the changing world conditions. Due to different problems, distance education has begun to be used at schools or universities quickly. Hence, an institution providing distance education has to use information and communication technologies properly.

Along with distance education, we started to move away from the system that we call face to face education or traditional education in universities. Thanks to distance education, it has become easier to provide education and training to large lecture groups, and such innovations can be shown among the advantages of distance education. Distance education, with the interruption of face-to-face education as a result of the problems experienced in any country, provides students and lecturers from different countries or cities to meet briefly in the same educational environment and share information. Especially the distance education model used in numerical courses (Mathematics, Physics, etc.) given at universities has a significant impact on students' success. Learners who take such courses remotely can witness a difference in their success in learning-teaching activities compared to traditional learners, and they experience this process on their own. Therefore, distance learners have to be more willing and attentive. At the same time, students are expected to have a level of computer use that can allow them to access the materials used in the course (presentation, lecture notes, etc.) and resolve the small errors that may be encountered during the learning activity and solve the problems (Yildirim, 2008 & Cumhuri and Sarikaya, 2020).

The COVID-19 virus, which emerged in Wuhan, the capital of China's Hubei province on December 1, 2019, has become an epidemic that spread to various parts of the world. After the World Health Organization declared it as a global pandemic on March 11, 2020, education was also heavily influenced. Due to the outbreak of this disease, all universities in Turkey and TRNC took a break from formal education. In line with the decisions taken at the meeting of YÖK on 18 March 2020, all universities decided to continue their services with distance education as of 23 March 2020. Distance education has become even more critical in this period. The distance education process should be prepared, taking into account the needs and requirements of the students. The materials used in the courses given in the form of distance education should meet the needs of the students. Whether students are ready for this environment, and their positive negative opinions are a feature that needs to be investigated.

## 2. METHOD

### 2.1 Research Model

After the transition of education, which started as formal education at the beginning of the 2019-2020 Spring Term, to the distance education system, the education that students received in the form of traditional methods for about a month and the education processes they received in the form of distance education from the numerical analysis course were evaluated. "The effect of giving Numerical Analysis course via distance education system on students and their views on the process" was examined, and the necessary information was obtained with a qualitative mixed pattern research model.

## 2.2 Study Group

The study group of the research consists of all students (Electrical Department, Construction Department, Machinery Department, Automotive Department, Computer Department, etc.) studying at the Faculty of Engineering at a private university in Northern Cyprus in the 2019-2020 academic year Spring term. Our study group consists of 32 (N = 32) volunteer students who took the Numerical Analysis course.

## 2.3 Collection of Data

Interview technique was used in order to reveal student views on distance education applications of a Numerical Analysis course. The data of the students were provided by presenting their opinions about giving numerical analysis courses like distance education by presenting the "interview form for giving numerical analysis courses like distance education".

Considering the features of the Numerical Analysis education given by the distance education method and student behaviors observed in the process, semi-structured interview forms were created. While preparing the interview form, firstly, possible questions were determined as a result of the literature review, starting from the research problem. It has been paid attention that the questions are open in a way that will not cause different interpretations, that they are purposeful to serve the research problem, and that they are not guiding. For the clarity of the interview form, a language specialist was consulted, and the interview form was finalized. In addition, additional questions were directed to the interviewed individuals according to the characteristics of the interviewee and the answers given to the interview questions were evaluated. Thus, due to the possibility of collecting additional information, validity was tried to be obtained by collecting detailed and in-depth information through face-to-face interviews.

In the semi-structured interview technique, the researcher prepares the interview questions in advance but allows partial flexibility to the studied sample during the interview, allowing the reorganization and discussion of the questions. In such an interview, the pupils subject to the research also have control over the research (Ekiz, 2009).

**Table 1. Interview Form Questions**

1) Is the Numerical Analysis course suitable for distance education? Why?
2) Do you think the Numerical Analysis course will be more useful and permanent when it is given in the form of distance education or when it is given in the form of traditional education? Why?
3) Does offering the Numerical Analysis course in the form of distance education increase your interest and motivation in the course? Why?
4) Do you believe that offering Numerical Analysis course in the form of distance education removes students from rote learning? Why?
5) What are the advantages and disadvantages of giving Numerical Analysis course in the form of distance education?
6) How do you evaluate the distance education application when we compare the Numerical Analysis course given in the form of formal education and the Numerical Analysis course given in the form of distance education? Please explain
7) Are the materials (Presentations, videos, etc.) used in numerical courses given in distance education sufficient? Why?

In Table 1, the interview form questions which were directed to the students are displayed, and their answers given to these questions in our study were examined in detail.

## 2.4 Analysis of Data

Content analysis allows researchers to indirectly examine human behavior. It is very important in analyzing observation and interview data (Fraenkel, Wallen, 2003). The main purpose of content analysis is to reach concepts and relationships that can explain the collected data. For this purpose, the collected data must first be conceptualized, then organized logically according to the emerging concepts, and accordingly, the themes that explain the data must be determined. The process performed in content analysis is to gather similar data within the framework of certain concepts and themes and interpret them in a way that the reader can understand (Yıldırım, 2008). After the content analysis, a framework is created according to the themes, the data are processed according to this framework, and the findings are defined and interpreted. Thus, descriptive analysis is created. In the descriptive analysis, the aim is to present the findings in an organized and interpreted way to the reader. The data can be arranged according to the themes revealed by the research questions, or they can be presented by considering the questions or dimensions used in the interview and observation process. In the descriptive analysis, direct quotations are frequently used to reflect the views of the individuals interviewed or observed.

The steps of creating a descriptive analysis are as follows (Yıldırım, 2008).

- **Creating a framework for descriptive analysis:** Based on research questions, a framework for data analysis is created to allow for the conceptual framework of the research or the dimensions involved in the interview and / or observation. Under this framework, it is determined under which themes the data will be organized and presented.
- **Processing of data according to the thematic framework:** At this stage, the data obtained according to the framework previously created is read and edited. At this stage, the data are selected for identification purposes and combined in a meaningful and logical way. Direct citations to be used at this stage are also selected.
- **Identification of findings:** At the last stage, the edited data are defined and supported with direct quotations where necessary. At this stage, care should be taken to describe the data in an easily understandable and readable language and to avoid unnecessary duplication.
- **Interpretation of the findings:** Explanation, association and interpretation of the identified findings are carried out at this stage. Explaining the cause and effect relationships between the findings and making comparisons between different cases, if necessary, helps the interpretation made by the researcher to be more qualified.

Observation data were analyzed according to the dimensions determined when creating the observation form. The data obtained in the interviews with students were likewise subjected to content analysis and then descriptive analysis. Since the semi-structured interview form was used in the interviews, the themes of the interview were rearranged after the data is collected.

## 3. RESULTS

In this section, the findings obtained from the interview forms, including the opinions of students who took the Numerical Analysis course in the form of distance education, are presented. The coding and tabulation process of the content analysis performed on the data obtained as a result of the interview forms was created by the researchers at the end of the study. The created tables are given below with details regarding the interview forms.

**Table.2: Student opinions regarding the question “Is the Numerical Analysis course suitable for distance education? Why?”**

Opinions	Frequency (f)
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It is suitable because it is a theoretical expression.	5
It is more appropriate to give face-to-face training in the classroom.	14
Not suitable.	5
Since the efficiency of the course increases by solving questions, it does not have a negative effect.	2
Numerical courses become more difficult when given in the form of distance education.	2
It may be healthy in terms of watching and listening to the lecture given on the internet and in terms of recording and watching again.	1
I am not in favor of giving digital courses taken by the engineering department as a distance education.	1
It is necessary because of the health problems we are experiencing.	1
Since it is a numerical course, it is not efficient enough due to being distracted in online education.	1
<b>Total</b>	<b>32</b>

As seen in Table 2, 31.25% of the students think that it is appropriate to give the Numerical Analysis course in the form of distance education. In comparison, the remaining 68.75% of the students argue that this course should not be in the form of distance education. 22 students emphasized that it is not suitable and that numerical lessons are basically tricky and that this difficulty in the way of distance education has increased further. In contrast, the remaining 10 students emphasize that distance education does not create a problem, and it is appropriate due to the health problems we are in and does not have a negative effect.

**Table.3: Student opinions regarding the question “Do you think the Numerical Analysis course will be more useful and permanent when it is given in the form of distance education or when it is given in the form of traditional education? Why?”**

<b>Opinions</b>	<b>Frequency (f)</b>
It can be applied in either way.	5
Traditional education would be more beneficial because we can ask questions and get answers whenever we want.	16
I am not in favor of giving numerical courses taken by the engineering department in the form of distance education.	2
Numerical Analysis course, which is carried out in the form of traditional education, has higher retention.	4
It allows each student to ask questions without being embarrassed and bored when given online.	1
When given over the internet, we can open and repeat courses infinitely.	2
Traditional education is more efficient because the video courses on the internet are taught uniformly in a certain pattern.	1

Conducting courses over the internet may impair some of the technical problems (internet outage, sound problems, etc.).	1
<b>Total</b>	32

In Table 3, the question of which of the two education methods (traditional and online) experienced by the students in the numerical analysis course is more useful and permanent is asked, and 71.875% of the students (23 people) defend traditional education. In contrast, 9.375% of the students (3 people) supports the view that it is more beneficial, and the remaining 18.75% are unstable and have equal success in both methods.

**Table.4: Student opinions regarding the question “Does offering the Numerical Analysis course in the form of distance education increase your interest and motivation in the course? Why?”**

Opinions	Frequency (f)
No change is observed.	10
I prefer face to face education in the classroom.	6
It does not increase.	6
It can be increased with a suitable program for the course.	1
At the computer, the student is bored and does not listen to the class after a while.	1
Fear of falling behind in the classroom but not in the internet environment.	1
When I think I will not understand, I can watch the videos over and over again in a short time.	2
During distance education, if there is any situation at home, I leave the course and take care of it. But it's not like that in the classroom environment. I listen to the course and act accordingly.	4
As the distance learning platform has not been used for this course, my interest has increased.	1
<b>Total</b>	32

In Table 4, a question is asked to the students about how the teaching of the Numerical Analysis course in the form of distance education affects their motivation. According to the findings, we see that 13 people, that is, the students do not increase the part of 40.625%, and six people who support this view, and support the traditional education system. While nine people, i.e. 28.125% of the students, defend the view that online education increases motivation, the knowledge learned is reinforced due to the ability to watch the videos repeatedly. Still, we see that ten people, that is, 31.25% of the students, are undecided about the answer they gave to this question.

**Table.5: Student opinions regarding the question “Do you believe that offering Numerical Analysis course in the form of distance education removes students from rote learning? Why?”**

Opinions	Frequency (f)
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It can make a difference.	3
It causes more rote learning and distraction.	10
Neither traditional nor distance education does move away from rote learning.	6
Numerical Analysis course is not a course that can be offered in the form of rote learning.	2
I don't think it has any connection with rote learning.	1
While in the classroom, it may be tempting to memorize everything because it is necessary to write everything instantly and keep that moment in mind, but thanks to distance education, you can repeat the course taught at any time without stress, and any incomprehensible part can be asked online to the lecturer in the next class.	4
Rote learning is a studying method that varies from person to person.	2
I understand very little from the distance learning classes, and because I have to study more than my normal classes, I tend to memorize.	2
It makes students memorize. Since the lectures can be taught via video or slide, sometimes the student just listens and does not try to understand.	2
<b>Total</b>	<b>32</b>

In Table 5, the question of whether students should be given the numerical analysis course in the form of distance education is examined and 14 students, 43.75% of the class, argued that online education does not exclude students from memorization, on the contrary, 11 students are 34.375%. They argued that you do not make an impact. The remaining seven people, that is, 21.875% of the students, defended the view that online education dissuaded them and argued that focusing on the lesson instead of taking notes leads to more permanent knowledge and removes from memorization.

**Table.6: Student opinions regarding the question “What are the advantages and disadvantages of giving Numerical Analysis course in the form of distance education?”**

<b>Opinions</b>	<b>Frequency (f)</b>
I have no opinion.	1
To follow past issues easily	1
Limited information sharing	1
Failure will increase in applied courses.	4
It has no advantage.	4
By taking more time to the notes shared by the lecturer, I can solve the issues I couldn't solve by myself.	2
It provides easy access to resources.	2
Since the courses are covered by recording, I can turn on the records and watch them again later.	

	11
Decreased motivation	3
Lack of possibility to ask and solve questions in the class unlike face to face education	1
Internet-related problems during the live course	2
<b>Total</b>	32

In Table 6, the advantages and disadvantages of providing students with the numerical analysis course in the form of distance education are mentioned and 16 of the students, 50% of the students, list the advantages of listening to the lesson and the ease of access to the resources. In contrast, 11 students, 34.375% of the students, see distance education as disadvantageous that it reduces the motivation of the lesson and internet problems, the inability to communicate with the instructor as in the classroom. The remaining five students, i.e. 15.625% of the class, emphasized neither an advantage nor a disadvantage.

**Table.7: Student opinions regarding the question “How do you evaluate the distance education application when we compare the Numerical Analysis course given in the form of formal education and the Numerical Analysis course given in the form of distance education? Please explain.”**

Opinions	Frequency (f)
Distance education is not suitable for digital courses.	6
Formal education is more effective and productive.	4
Both are the same.	5
I think that distance education has lost its effect and is incomplete.	5
We do not make any effort to solve the questions asked during the course in distance education.	2
It is not a suitable environment for taking exams.	2
I believe that this course will be better understood in the comfort of home.	3
There is nothing that can be done because it is mandatory due to health conditions.	2
As it is a new environment, we are slowly trying to get used to it.	4
<b>Total</b>	32

In Table 7, students were asked to compare traditional education and distance education methods and 18 students, in other words, 56.25% of the students, emphasized that they would be more successful in numerical lessons by traditional education. 9 students that are 28.128% of the students emphasized the necessity of distance education in health conditions. The remaining 15.625% of 5 people noted that there was no difference between the two ways.

**Table.8: Student opinions regarding the question “Are the materials (Presentations, videos, etc.) used in numerical courses given in distance education sufficient? Why?”**



Opinions	Frequency (f)
Satisfactory. Because the information about the course progresses programmatically.	1
It is not satisfactory because the class is difficult to understand.	7
All required materials are shared.	12
If more examples are solved, its competence will increase.	4
Availability of resources available whenever required	2
It may vary from student to student.	1
No matter how many materials are shared for numerical courses, it will not be enough.	4
Course content is sufficient in line with the possibilities in distance education, but it is not sufficient for full comprehension or for the student to listen and understand the lecture more carefully.	1
<b>Total</b>	<b>32</b>

In Table 8, the adequacy of the materials used in the digital courses given in the form of distance education has been investigated, and 19 students, that is, the 59.375% slice see it as sufficient. In contrast, the remaining 13 students, that is the 40.625% slice, see it as insufficient and think that it is not appropriate to give quantitative lessons online as they are difficult lessons; thus, the materials were inadequate because they were not understandable.

#### 4. DISCUSSION, CONCLUSION and RECOMMENDATIONS

##### 4.1. DISCUSSION and CONCLUSION

Positive and negative opinions were put forward by the students in the study aimed at providing the numerical analysis course as distance education. Most students do not find it appropriate to use distance education in numerical courses. In a numerical or other course conducted by distance education, it was stated as a negative factor that the communication between the lecturer and the student was not sufficient and which caused the students' interest in the course to decrease and their motivation to deteriorate. This result is similar to the findings and results of the study conducted by Birişçi (2013). Another comment emerging from the students' opinions is that the technical problems experienced during the live classes and the failure to open the uploaded lecture notes create difficulties in following the course. This situation makes it more difficult for students to understand the numerical problems solved during the course. This result is similar to the results of the study conducted by Chan and Ismail (2012).

The results regarding the advantages/disadvantages of giving Numerical Analysis course in the form of distance education are as follows: Among the advantages of providing the numerical analysis course in the form of distance education, a positive conclusion has been reached that students can access the lectures whenever they want and that the lectures can be recorded and watched again and again, which makes it easier for them to study the subjects. Similarly, according to Çandarlı and Yüksel (2012), after the activities carried out through video conferencing, students acquired the learning environment they did not have in normal conditions through the video conference system and benefited from the experiences of different experts in their fields; these are stated as the benefits of the system. Since numerical analysis course is a difficult one, the student must be actively participated

in order to understand the problems during the course. The students, who argued that it is not appropriate to provide this with distance education, found it appropriate to give the lecturing part of the numerical analysis course in the form of distance education using videos. However, comments have been made that success will increase at a high rate when the application part is given with face-to-face education. Another conclusion is that any problems during the videos or live lectures cause the classes to be interrupted, which leads to a decrease in students' motivation towards the lecture. This result is similar to the results of the studies conducted by Wilson and Whitelock (1998) and Kışla et al. (2010).

The results regarding whether the numerical analysis course is given in the form of distance education make any difference compared to face-to-face education can be summarized as follows. It was concluded that giving Numerical Analysis courses in the form of distance education is not suitable for some students, but it does not make any difference for some students. It was pointed out that discontinuing the education due to any internet problems in distance education negatively affected learning and that the students had difficulties while asking questions when the topics were being covered. However, students argued that this was easier in formal education. It has been concluded that distance education may be suitable for the lecturing parts of the courses, but face-to-face training will be more useful for practicing in courses such as Numerical Analysis where lengthy problems are solved. This result is similar to the results reached in the study by Balıkçioğlu et al. (2019). In this study, a positive opinion was put forward in terms of possibilities such as the system being independent of time and place, having the opportunity to repeat, and not being obliged to attend. However, they stated that they were not satisfied with the reasons such as not being able to reach the lecture notes, their individual impossibilities (personal computer, internet, etc.), not being able to interact with the instructors, being unsuccessful in the course due to not being able to use the virtual classroom application, having technical problems, and insufficient announcement and information.

It has been shown by the students that distance education is more beneficial in terms of uploading live courses or shared videos to the system during the training given during distance education and allowing students to access the loaded courses whenever they want. This is the most important difference shown by students regarding formal education. In Sumer's (2015) study, it was emphasized that even if learners have different learning styles, web-assisted collaborative learning makes the learner feel comfortable, provides ease and flexibility to the learner, and the interaction is higher than face-to-face teaching.

It was concluded that the communication of students and teachers and giving feedback on time would ensure that both types of education are similar. Similarly, in the studies of Moore and Thompson (1990) and Verdiun and Clark (1991), it has been shown that distance education can be at least as effective as face-to-face education when the method and technology suitable for the learning topic is used, an interactive environment between students is created, and the students are given feedback.

The results of the opinions and deficiencies indicated by students in distance education practices can be summarized as follows: (i) In general, communication barriers between students and teachers in distance education practices, (ii) students do not have the opportunity to ask questions whenever they want, (iii) If a student who does not know how to use a computer and fails to connect to the courses, he/she may have difficulties in understanding the subjects, (iv) interruptions in education due to the internet or any other source during the course, (v) the interaction between students and teachers is not as efficient as in formal education, which causes students to lose their interest and motivation in the course. These issues have been shown in the research as deficiencies in distance education applications experienced by the students. Similarly, the research results revealed that enabling students in online distance education programs to feel belonging to the group and to interact with various components such as chatting, private messaging or face-to-face interaction is an important element. Students who interact will be more willing to participate in education and will not tend to leave the program as a result of the feeling of loneliness developing over time. This situation

will positively reflect on the success and satisfaction of the student, and the deficiencies will disappear (Ilgaz & Aşkar, 2009). One of the shortcomings that students show about distance education in the studies is that students behave comfortably because they do not have to attend classes. Similarly, in the study of Çakmak-Karapınar, Güler, Kurşun and Karaman (2018), students mostly mentioned the problem of not ensuring active participation. The vast majority of students think that the underlying reason is that attendance is not compulsory and does not cause absenteeism. Students found that distance education offered a comfortable and flexible learning environment and the flexible learning hours offered within this framework were a positive aspect. However, the fact that they thought that the problem of active participation stated in negative opinions was caused by the lack of attendance emerged as a remarkable phenomenon.

The reasons for students' negative approach to distance learning can be summarized as follows: In order to conduct a course successfully or efficiently, there should be no communication problems between the student and the teacher. However, healthy communication is not established between the student and the teacher in the distance education process. Adequacy of the materials used in the course ensures the good progress of the course. However, when there are problems with the materials (videos, presentations, etc.), the course will be difficult to understand. This is also true in formal education, but it leads to complete loss of courses in distance education. During the course, problems such as interruption of the course due to hardware problems and the decrease in students' interest and motivation, inadequate understanding of the courses not taught face to face, ineffectiveness, distractions outside the classroom environment and loss of time were pointed out. In the research conducted by Turgut (2011) and Bayrak, Aydemir and Karaman (2017), students' negative opinions about technical problems and interaction were revealed.

#### **4.2. RECOMMENDATIONS**

The following recommendations have been developed based on the findings of this study, in which the opinions of the students within the scope of the study about the teaching of numerical analysis course in the form of distance education were examined:

- a) It was concluded that the students experienced mostly time management problems. In accordance with the results obtained, the students should be informed about time management and the need for the teachers to inform the students about the planned learning,
- b) The necessity of creating a suitable environment where students can interact face-to-face as in formal education and provide student-student, student-teacher interaction,
- c) The necessity of establishing new structures that can eliminate the communication barriers that students may experience during distance education,
- d) In the distance education platform, reinforcing incentives such as class participation grades can be used to ensure active participation of students in classes,
- e) The computer usage skills of the students should be measured in advance and the necessity of empowering studies,
- f) Students should be informed beforehand about the problems that may occur during distance education by instructors or different educators,
- g) The necessity of providing in-service courses related to the applications to be used for teaching staff before the application of distance education,
- h) It should also be taken into consideration that students enrolled in distance education programs may not have a personal computer and internet access, and measures such as the central laboratory should be taken for these students.

#### **5. REFERENCES**

Balıkçioğlu ve diğerleri (2019). Üniversite Öğrencilerinin Uzaktan Eğitim Dersindeki Memnuniyet Araştırması:

Aşık Veysel Meslek Yüksek Okul Örneği. Cumhuriyet Üniversitesi İktisadi ve İdari Bilimler

Dergisi,20(1),462-473. <https://dergipark.org.tr/tr/pub/cumuiibf/issue/45599/544303>

- Bayrak, M , Aydemir, M , Karaman, S . (2017). An Investigation of the Learning Styles and the Satisfaction Levels of the Distance Education Students . *Cukurova University Faculty of Education Journal* , 46 (1) , 231-263 . DOI: 10.14812/cuefd.310022
- Birişçi, S., (2013). Video konferans tabanlı uzaktan eğitime ilişkin öğrenci tutumları ve görüşleri. *Journal of Instructional Technologies and Teacher Education*, (2), 24-40. <https://dergipark.org.tr/tr/download/article-file/231299>
- Chan, S.W. and Ismail, Z., (2012). The role of information technology in developing students' statistical reasoning. *Procedia - Social and Behavioral Sciences*, (46), 3660 – 3664 DOI:10.1016/j.sbspro.2012.06.123
- Çakmak Karapınar, D , Güler, M , Kurşun, E , Karaman, S . (2018). Atatürk Üniversitesi kampüs tabanlı dersler modeli bileşenlerine yönelik öğrenci görüşleri . *Açıköğretim Uygulamaları ve Araştırmaları Dergisi* , 4 (2), 90-111 . Retrieved from <https://dergipark.org.tr/tr/pub/auad/issue/36759/419604>
- Çandarlı, D. & Yüksel, H. G., (2012). Students' perceptions of video-conferencing in the classrooms in higher education. *Procedia - Social and Behavioral Sciences*, (47), 357-361. DOI:10.1016/j.sbspro.2012.06.663
- Ekiz, D., (2009). *Bilimsel Araştırma Yöntemleri*. Ankara:Anı Yayınları.
- Fraenkel, J.R. & Wallen, N.E., (2003). *How to Design and Evaluate research in Education*. *Mc Graw Pub*, New York.
- İlgaz, H., & Aşkar, P., (2009). Çevrimiçi Uzaktan Eğitim Ortamında Topluluk Hissi Ölçeği Geliştirme Çalışması. *Turkish Journal of Computer and Mathematics Education*, (1), 27-35 <https://toad.halileksi.net/olcek/cevrimici-uzaktan-egitim-ortaminda-topluluk-hissi-olcegi>
- Kışla, T., Sarsar, F., Arıkan, Y.D., Meşhur, E, Şahin, M. & Kokoç, M., (2010). Web tabanlı uzaktan eğitim sistemlerinde karşılaşılan sorunlar. *E-Journal of New World Science Academy*, 5(1), 1-18. <https://www.researchgate.net/publication/230689119>
- Cumhur, M. G. & Sarıkaya, H., (2020). Evaluation of numerical analysis course problem-solving processes of engineering students based on different dimensions. *Cypriot Journal of Educational Sciences*, 15(1), 21-32. <https://doi.org/10.18844/cjes.v15i1.4429>
- Moore, M.G. & Thompson, M. M., Quigley, A.B., Clark, G.C. & Goff, G. G., (1990). The effects of distance learning: A summary of literature, American Center for the Study of Distance Education. Research Monograph University Park, PA: The Pennsylvania State University. <https://eric.ed.gov/?id=ED330321>
- Sümer, A . (2015). Farklı öğrenme biçimlerine sahip öğrenenlerin web destekli işbirlikçi öğrenme araçlarından wikiye ilişkin görüşleri . *Açıköğretim Uygulamaları ve Araştırmaları Dergisi* , 1 (2) , 49-64 . <https://dergipark.org.tr/tr/pub/auad/issue/3029/42081>

Turgut, Y. E., (2011). Video Konferans Yoluyla Verilen Derslerde Verimliliğe Etki Eden Faktörler. *Yüksek Lisans Tezi*, Karadeniz Teknik Üniversitesi, Fen Bilimleri Enstitüsü, Trabzon. <https://dergipark.org.tr/tr/pub/jitte/issue/25080/264691>

Wilson, T. & Whitelock, D., (1998). Monitoring the On-Line Behavior of Distance Learning Students. *Journal of Computer Assisted Learning*, 14(2), 91-99. Wiley. Retrieved October 24, 2020 from <https://www.learntechlib.org/p/86678/>.

Verduin, J. R & Clark, T. A., (1991). *Distance Education: The Foundations of Effective Practice*, California: Jossey - Bass Publisher.

Yıldırım, A. & Şimşek, H., (2008). *Sosyal Bilimlerde Nitel Araştırma Yöntemleri*. Ankara: Seçkin Yayıncılık.