# Abstact

# Introduction

The COVID-19 epidemic, which started in Wuhan, China and affected the world. Due to the fact that the rate of spread is faster than previous pandemic cases, measures have been taken in various areas to minimize the effect and circulation of the virus. One of the sectors where significant changes and transformations are experienced and measures are taken is education. Digitalization and distance education transformations, which have been going on for years in the field of education, have become a necessity for every stage of education all over the world during the COVID-19 pandemic. Online education has been considered as the easiest and most applicable solution in order to ensure the sustainability of education in higher education institutions, as in other education levels [1].

Technology plays a very important role in distance education. Since the 1980s, the widespread use of computers and then the internet in higher education has led to a series of changes in universities. By the 2020s, computers have become almost the most important element of the academic and administrative organization of universities [2]. Computer-assisted education, internet-assisted education, online education, virtual universities, e-courses, e-books, technology integration in education are some of the innovations that have emerged in the academic structures of universities [3]. Online education refers to the learning style in which learning-teaching activities and services are offered to learners with the support of computers (networks). Online environments where computers and internet are used together can offer continuous, flexible and uninterrupted training in meeting the wishes and needs of individuals [4].

Distance education is seen as the most appropriate model in cases where the students are far from the physical place where the lectures are given or the time of the lectures does not suit the student [5]. By means of online environments, educator-student, student-student can communicate both synchronously and asynchronously [6]. Before the pandemic, Hollands and Tirthali [7] gathered the aims of online education, which has been used in universities for a while, in six groups in the report they published. These;

1) Expanding transportation and use,

2) Creating a brand and ensuring its continuity,

3) Strengthening the economy by reducing expenses or increasing revenues,

4) Increasing educational outcomes,

5) Innovation,

6) To conduct research on teaching and learning [8].

Universities, using the possibilities of distance education during the pandemic process, have strengthened their technological infrastructure and made this issue a competitive element so that education and learning activities can continue without time and place limits. Is online education appropriate for each department taught at universities? While the discussions were continuing, it was stated that with the decision taken by the Higher Education Council (YÖK), at the beginning of the pandemic, all practical and theoretical courses must be given online in each department. Due to the necessity that emerged beyond the purposes mentioned by Hollands and Tirthali [7], the existing course models have been started to be given on the online platform, thanks to the infrastructures established for the continuation of education during the epidemic period. Universities have implemented new software and hardware systems that do not have any or existing limited infrastructure systems, with their rapid investments, through which live connections can be established with students, and where they can upload written, visual and auditory learning materials. Universities with no shortage of resources have created virtual exam environments. Many universities have rapidly mobilized their in-house expertise to provide accelerated training programs for teaching staff on providing online content, managing virtual classrooms, and using technology.

The situation has not changed for the architecture departments, where the theory and practice relationship is very strong and the thought that face-to-face education will be more efficient for applied courses, and all courses have started to be given online. Architecture education has some unique features that should be considered. The objective of this study is to specify CSF of online education in architecture with the acceptance of students. Studies for CSFs of online education for other departments of higher education institutions are common. But for architecture departments with their own characteristics, the case is not same. The study for the critical success factors of online architectural education will be organized as follows. Section 2 discusses the theoretical backgrounds of architectural education, online education, and theory of critical success factors, and CSF implementation to online education. Section 3 describes the research material and methodology that this study employs; the results and discussions of the results are presented in Section 4; the paper concludes in Section 5.

# Literature Review

Architectural education includes teaching/learning modules based on design, technical sciences and narrative, as well as humanities and professional practice.

Juvancic et al.(2012) defined architectural education as a process centrally concerned with individual design creativity among its students and encompasses an important aspect of visual acuity or training in interpretation of visual representation. and is also a communication process with an exchange of mainly visual messages. Architectural learning requires a practical component of ‘learning by doing’, traditionally in a studio environment, through which students acquire experience and knowledge of professional practice in a social context of peers, thus aligning them with the constructivist learning models. The learner will in theory engage a variety of cognitive processes including processing relevant information, organizing that information into coherent representations and integrating these representations with existing knowledge in order to create solutions to the challenges presented.

The architect should receive an education that includes knowledge, skills and abilities in all these areas, without focusing on the search for precise and absolute knowledge.

The Architectural Accreditation Board (MIAK), which aims to improve the architectural education in Turkey through evaluation and accreditation studies, has defined the knowledge, skills and abilities that students who graduate from architectural education should gain in order to improve the welfare of the society by educating better educated and higher quality architects [11] . MİAK has gathered the knowledge and skill areas that students need to gain through the courses in the education curriculum of architectural programs under 5 headings. These;

• Architecture - Design / Creative Thinking,

• Architecture - History / Theory, Culture / Art,

• Architecture - Environment / City / Society,

• Architecture - Technology,

• Architecture - Professional Environment.

MİAK states that it should be aimed for students to gain the ability to interpret, explain, summarize, compare, classify, briefly internalize the information given about the above-mentioned topics and to gain the ability to use the information they have obtained in different representational environments [11].

The developments in computer technologies have also led to great changes in the field of architectural education. In addition to computer technologies, thanks to the development of internet and virtual reality technologies in the last twenty years, many universities can teach in remote interactive environments with these technologies [12]. Before the pandemic, in order to increase the quality of education, project courses in virtual design studios and theoretical courses in virtual classrooms were given remotely in important universities of the world. In addition to these developments, the number of universities that continued their education in face-to-face environments where the instructor and student interacted constituted the vast majority. At this point, due to the pandemic, the distance education model, as a necessity rather than a request, has become the model used by all architecture schools in almost all parts of the world.

Since 1961, organizations have used Critical Success Factors(CSF) to keep things and processes running and achieve their goals. CSFs can be used at all levels of organizations, from the top management to the lower operating unit.(T. Howell, 2010). T. Howell (2010) grouped the reasons for using CSF under four headings. These:

1. CSF is easy to understand.

2. They draw attention to concerns and factors critical to success.

3. They can improve and restructure an ongoing process. In this way, they can be part of the strategic planning process, system and program implementation.

4. It is easy to follow and the benefits are significant.

Implementing CSFs in an organization:

1. It reduces the risk of failure in achieving strategic goals.

2. Develops the understanding of management about what should be done in the implementation of the strategic plan.

3. Increases employee participation in programs, systems or process improvements.

4. By developing program, system and process improvements

achieve operational improvements.

5. Facilitate continuous improvement of operations and process performance (T. Howell, 2010).

There are studies examining critical success factors in online education. Dillon and Gunawardena (1995) and Leidner and Jarvenpaa (1993) as cited by Volery and Lord (2000) stated that the effectiveness of online education depends on three criteria. These are technology, instructor characteristics and student characteristics.

Papp (2000)explored distance learning from a macro perspective and suggest some critical success factors that will aid faculty and institutions in distance learning development. The first factor is the issue of intellectual property rights or ownership.

2) suitability of the course for distance learning environment,

3) advanced preparation that goes into a distance learning class.

4) distance learning course content,

5) distance learning course maintenance,

6) DL platform, and

7) measuring the success of an DL course.

Govindasamy [18] has seven critical achievements for online learning: 1) institutional support, 2) course creation, 3) teaching and learning, 4) course structure, 5) student support, 6) faculty support, 7) assessment and evaluation. determined factor. Selim [19] has gathered the critical success factors for e-learning under four headings. These are 1) characteristics of instructors (teaching style, attitude towards students, technology control, etc.) 2) characteristics of students (motivation, technical competence, perception of content and system, cooperation in interaction, etc.) 3) technology infrastructure (ease of access, internet speed) and screen design), 4) institutional support (technical support, computer usability, teaching material accessibility and printing, etc.).

Benson Soong et al. (2001) states that the e-learning CSFs are, perceived information technology infrastructure, technical competency of both teacher and student, e-learning mindset of both student and instructor, human factors, level of collaboration. Lin et al. (2011) concluded that the CSFs of e-learning are: organisational factors (expertise and experience, leadership, top management support), technological support (platform support, tool support, and technician support), e-learning content related factors (documentation, simplification, creativeness, template auxiliary), and general factors (trust, motivation, communication)

Based on the literature research, it has been seen that the critical success factors of online education can be grouped under four main headings. These can be listed as technology infrastructure and technical support, instructors, students and courses.

# Online education experience at Arel University

Here, information about the elements found in the interfaces of the courses offered on the online platform at Istanbul Arel University and what these elements do are given. The sections on the page of the course given on the online platform;

Course announcement and information section: This interface, located in the middle of the course introduction page, contains the profile of the course, communication methods to be used in the course, and course syllabuses. Students can follow the course calendar and evaluation system through this interface. In addition, the section can be expanded by adding the desired resource and activity to this section.

Weekly course content and files: It consists of separate sections created for each week of the training, continuing under the course announcement and information section on the course landing page interface. It is the section that contains all the information/documents and videos that will be used simultaneously or asynchronously, uploaded by the instructor of the course, under the section opened for each week within the scope of the system created by Istanbul Arel University for online education at UZEM. Each instructor giving online courses at Istanbul Arel University is responsible for providing and uploading data to files and folders opened weekly under at least five headings. These titles are listed below.

Weekly question sets: In the weekly question sets, the instructor of the course aims to make the students think about those subjects before the lesson, by means of at least five questions prepared for that week about the knowledge and skills that the students will gain from the lessons. In addition, it is ensured that he has an idea about what the knowledge and skills he will acquire at the end of the course that week should be.

Case study: In the case study file, sample applications are uploaded in the context of the topic of the week, which are stimulating, enabling the student to establish relations with the sector, and for the student to understand the subject. It is aimed to develop professional practices through these examples. It is aimed to develop the student's ability to predict events in different situations, analyze data and make decisions.

Weekly lecture presentation: In the third topic, information, documents and videos to be used in the simultaneous lecture of that week are shared. In simultaneous lessons, it is aimed that students can understand the lessons more easily through this information, documents and videos interactively and that the student has data in their hands.

Weekly lesson learning output video: These are the 8-10-minute videos that the instructor uploads to the system before the lesson, in which he talks about what he will do in the lesson that week, and what the student should achieve from that lesson for that week. By expressing the goals aurally and visually, it is aimed that the students better understand the goals of that week.

External resource: This is the part where data (books, articles, magazines, videos, etc.) that will increase the knowledge of the students about the subject of the week are uploaded. It aims to enable students who are lost in the internet information pool to access more effective resources and data about the course.

It is possible for the instructor to add different infrastructure resources to the five titles listed above in the Istanbul Arel University UZEM system.(NEREYE KOYMALIYIM BİLEMEDİM)

# Methodology and characteristics of the sample

The core concern of this research study is to investigate the critical success factor for online architecture education. For this purpose, a questionnaire study has been designed. The questionnaire survey was administered via e-mail to the İstanbul Arel University Architecture Department students, who continue 100% online education at Istanbul Arel University in the 2020-21 fall semester. A total of 210 questionnaires were distributed to the sample and 132 responses were received, yielding a response rate of 63%.

The survey instrument used for this study comprised of 3 sections. The first section dealt with general information about the student and information about the internet and device used to attend the online course. The second part is consisted of questions related to the factors affecting success in online architectural education. Based on related literature review, four main factors affecting the success were adopted from Volery (2000) and sub measures under these four headings were adopted from the related literature described below. These are "Technology Infrastructure and Technical Support", "Instructor", "Student" and "Courses". There are five indicators under the technology and technical support category of the survey. T1, T4, T5 indicators are adapted from Selim [19], T2, T3 indicators are adapted from Song et al.[22]. Five indicators were used to measure the instructor category (E1-E5). Indicators under this category are the effectiveness of the instructor in using technology for online education (E1), the motivation of the strategies used in online education to encourage students (E2), the success of encouraging students to participate in the lesson interactively (E4), teaching the use of learning components used in the online system (E2). E5) issues were asked. The E1, E2, E4, E5 indicators were adapted from Volery and Lord [17], and the instructor's active role in education (E3) from Soong et al.[22]. Five indicators (D1-D5) were used in the courses category. Within the scope of the system created by Arel University for online education at UZEM, the effects of weekly information, documents and videos uploaded to the system for simultaneous or asynchronous use on online education were questioned. In the last part, the surveyor was asked to make a general assessment of general online architectural education.

At this part of the study, first of all statistical findings will be summarized and descriptive statistics will be mentioned. The first step in the analysis of these data is to search for some descriptive statistics, so as to identify the general characteristics of the students, device they used to connect to online lectures, status of device and the number of the course taken in the 2020-21 Fall semester. 62.1% of the students who answered the questionnaire were female and 37.9% were male. When the responding students are grouped according to their age, we see that the majority of them are between the ages of 20-24 (80.3%). The rate of students aged 25 and over was 14.4% and the rate of students younger than 20 was 5.3%. When the students were classified according to the class they were in, it was seen that the 1st grades had a rate of 9.1%, the 2nd graders had 16.7%, the 3rd grades had 26.5% and the 4th grades had a rate of 47.7%.

Of the architecture department students who participated in the survey, 9% stated that they attended the classes using a desktop computer, 85.6% using a laptop computer and 5.3% using their smart phones. 83.3% of the students said that the devices they use while attending the classes belong to their own, and 16.7% of them share the devices they use while attending the classes with others. While entering the classes, 89.4% of them used cable internet or fiber internet, and 10.6% of them were connected with the internet of their mobile phones. When the students were asked how many courses they took in the 2020-21 fall semester, when online education was conducted in the survey, it was seen that 17.4% of the students who answered took less than five courses, 66.7% took 5-9 courses, and 15.9% took 10 or more courses.

|  |  |  |  |
| --- | --- | --- | --- |
|  |  | Frequency | % |
| Total sample |  | 132 | 100 |
| Gender | male | 50 | 37,9 |
| Female | 82 | 62,1 |
| Age | Under 20 | 7 | 5,3 |
| 20 to 24 | 106 | 80,3 |
| 25 or over | 19 | 14,4 |
| Grade | 1st grade(freshman) | 12 | 9,1 |
| 2nd grade(sophomore) | 22 | 16,7 |
| 3rd grade(junior) | 35 | 26,5 |
| 4th grade(senior) | 63 | 47,7 |
| Device used by the student to connect to online lectures | desktop | 12 | 9,1 |
| Laptop | 113 | 85,6 |
| smartphone | 7 | 5,3 |
| Status of device | device exclusively used by the student | 110 | 83,3 |
| shared device | 22 | 16,7 |
| Connection to the internet | via landline or fiber | 118 | 89,4 |
| via mobile | 14 | 10,6 |
| How many online courses the student took in the 2020-21 Fall semester | Less than 5 | 23 | 17,4 |
| 5 to 9 | 88 | 66,7 |
| 10 or more | 21 | 15,9 |

# Findings

When students were asked about the problem(s) they encountered most frequently during online classes, students expressed at least one problem. When the mentioned problems are gathered under three headings, technical problems related to the online platform, connectivity, and devices take the first place with a rate of 81%. Problems mentioned under this heading in order of frequency: disruption of student's internet connection, unclear sound, disruption of instructor's internet connection, slow connection speed, problems in file and screen sharing, delay of class due to incidences of disconnect. Secondly, problems related to the students in order of frequency: disrupting stimuli at home or at work, and other factors inhibiting active participation in the lecture) with a percentage of %26.5 were stated. Lastly, problems related to the instructor and interaction with class took place (in order of frequency: ineffective use of visual communication, low interaction with class, less time for example compared to face to face lecture, lack of technical preparation such as pre-class trial meetings for file and screen sharing) with a %16.7 percentage.

|  |  |  |
| --- | --- | --- |
|  | Count | % |
| **technical problems related to the online platform, connectivity, and devices**  (in order of frequency: disruption of student’s internet connection, unclear sound, disruption of instructor’s internet connection, slow 3connection speed, problems in file and screen sharing, delay of class due to incidences of disconnect) | 107 | 81,1 |
| **problems related to the instructor and interaction with class**  (in order of frequency: ineffective use of visual communication, low interaction with class, less time for examples compared to F2F lecture, lack of technical preparation such as pre-class trial meetings for file and screen sharing) | 22 | 16,7 |
| **problems related to the student**  (in order of frequency: disrupting stimuli at home or at work, and other factors inhibiting active participation in the lecture) | 35 | 26,5 |
| N (Multiple Responses) | 132 |  |

## *Student experiences and preferences*

The preferences of the students are not necessarily related personal achievement. While more than 30% have received better grades compared to before, almost none recommended fully online education for architecture students. The rate of those who do not prefer online education is almost the same as the students who say that my average has dropped above. There is principledness in the answers given by the students about choosing online education. The students did not respond only according to the change in their grade point averages, but formed a distinct grouping.

|  |  |  |
| --- | --- | --- |
|  | Frequency | % |
| My GPA increased | 37 | 30,8 |
| My GPA remained about the same | 60 | 50,0 |
| My GPA dropped | 23 | 19,2 |
| Total | 120 | 100 |

Note: (excluding 1st year students)

|  |  |  |
| --- | --- | --- |
|  | Frequency | % |
| Does not prefer online education | 26 | 19,7 |
| Prefers only partial and/or conditional online education (arguments for online lectures in theoretical courses but face to face conduct of practical courses as well as internships) | 104 | 78,8 |
| Prefers online education | 2 | 1,5 |
| Total | 132 | 100 |

A break into components of architecture education gives a hint into what kind of lectures preferred online or not. When asked what kind of courses would facilitate the architectural education to be given online, it is seen that there is a very serious differentiation between the course groups. This differentiation is due to the fact that the courses are theoretical or applied. There is an acceptance that the theoretical courses especially the compulsory common courses are online. We understand this from the fact that the percentage of compulsory common courses is 73.5% and the rate of courses related to history, theory and art is 62.1%.

|  |  |  |
| --- | --- | --- |
|  | Count | % |
| 1. Compulsory common courses (Mathematics, Turkish, Revolution History, English, etc.) | 97 | 73,5 |
| 2. Architectural design courses (Basic Design, Architectural design studios, Presentation Techniques-Technical Drawing, Computerized Expression Techniques, Graduation Project etc. ) | 40 | 30,3 |
| 3. Building Science and Technology (Building Science, Building Material, Construction Project, etc.) | 45 | 34,1 |
| 4. History, Theory and Art (Introduction to Architecture, History of Architecture, etc.) | 82 | 62,1 |
| 5. Environmental design, Urban design (Urban Planning and Design, restoration and conservation of the historic environment, etc.) | 41 | 31,1 |
| 6. Professional Practices (Construction Management and Economics, planning law, etc.) | 38 | 28,8 |
| N | 132 | Multiple responses |

## *Factors of success?*

As we have analyzed not only overall education but each and every component, this paper shall improve our knowledge in improving education in the field of architecture by incorporating proper content and methods for utilization of online lectures. We have done so not only for the overall architecture education, but also separately for the six main components, namely

* Compulsory common courses
* Architectural design courses
* Building Science and Technology
* Environmental design, Urban design
* Professional Practices

As the majority of the students have expressed a preference for partially online education it is of interest to assess the factors that shaped their decision. We made a dimension reduction by doing a factor analysis. 16 sub-factors questioned about the first three main factors ("Technology Infrastructure and Technical Support", "Instructor" and "Student") determined in the study. We reached 4 factors with Eigenvalues higher than 1 represent more than two thirds (68.8%) of the total variance of the 16 variables analyzed.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Factors | Instructor performance coupled with familiarity of the student with technology | Technological infrastructure, IT support and user-friendly interface | Student attitude | Student effort |
| 2.2. Instructor [Instructor followed encouraging strategies for online education.] | .844 |  |  |  |
| 2.2. Instructor [Instructor used online education units and technologies effectively.] | .814 |  |  |  |
| 2.2. Instructor [The instructor took an active role in educating me in online training.] | .806 |  |  |  |
| 2.2. Instructor [The instructor encouraged me to participate in the lesson interactively.] | .758 |  |  |  |
| 2.2. Instructor [Instructor explained how to use online learning components.] | .661 |  |  |  |
| 2.3. Student [Before online education, I was using computer and technology without any problems.] | .526 |  |  |  |
| 2.1. Technology Infrastructure and Technical Support [The systems created had user-friendly interfaces. (It was easily understood and used).] |  | .816 |  |  |
| 2.1. Technology Infrastructure and Technical Support [Asynchronous distance education (transfer of course material, documents, course recordings) could be used without any problems.] |  | .790 |  |  |
| 2.1. Technology Infrastructure and Technical Support [I was able to get written/verbal support for the use of the created system when necessary.] |  | .774 |  |  |
| 2.1. Technology Infrastructure and Technical Support [The system (infrastructure, software, hardware) provided by the university for distance education was good] |  | .635 |  |  |
| 2.3. Student [Online education encouraged me to do more research.] |  |  | .831 |  |
| 2.3. Student [The idea of online tutoring scares me.] |  |  | -.749 |  |
| 2.3. Student [I attended classes interactively in online education, interacted with my teacher and friends.] |  |  | .617 |  |
| 2.3. Student [I learn the lesson better when I attend the lesson only as a listener.] |  |  |  | -.776 |
| 2.3. Student [I learn the lesson better when I participate and contribute to the lesson.] |  |  |  | .702 |

The questions regarding the 6 separate components of architecture education we decided to drop the IT aspect and student characteristics (as they are assumed to be uniform across the courses) and aimed to focus on instructor performance and student reception:

A logistic regression for each component with the 9 assessments scores on instructor performance as dependent covariates of the model.

## *Factors of preferences*

**Odd ratios [Exp(B)] reflecting the probability of preferring online education for the given component over the probability of not preferring online education for that component (only for significant covariates)**

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Dependent variables | | | | | |
| Covariates | 1. Common courses | 2. Architectural design courses | 3. Building science and technology courses | 4. History, theory and art courses | 5. Environmental design, urban design courses | 6. Professional practice courses |
| 2.4.1. Weekly uploaded question sets helped increase my course achievements. |  |  |  |  |  |  |
| 2.4.2. Weekly uploaded case studies helped increase my course achievements |  |  |  |  |  |  |
| 2.4.3. Weekly uploaded lecture presentations helped increase my course achievements |  |  |  | 1.851\*\* |  |  |
| 2.4.4. Weekly uploaded external source documents helped increase my course achievements |  |  |  |  |  | 0.458\*\* |
| 2.4.5. The weekly lesson achievement video uploaded by the instructor increased the efficiency in the lessons |  | 1.879\*\* |  |  |  |  |
| 2.4.6. In the lessons, homework and resources were suitable for the course content and easy to follow. |  |  |  |  |  |  |
| 2.4.7. Assessment methods in lessons were appropriate, reliable and fair. |  |  |  |  |  |  |
| 2.4.8. Lessons were long enough. |  |  | 1.439\*\* |  |  |  |
| 2.4.9. The ability to watch lecture recordings later increased efficiency |  |  |  |  |  |  |

Note:\*\*significant at the 5% level

Approval for common courses is highest, hence, it is not surprising that no particular covariate has any significant effect.

For architectural design courses overall progress video (weekly summarization of all included issues and assignments so no one forgets anything)

For building science and technology courses duration of the lecture (technical issues needs longer lecture)

For history, theory and art courses presentations (visual aspect)

For professional practice courses uploaded outside sources has negative effect. Not sources of information is needed but rather hands-on practice??? Lowest approval for online conduct of courses in this component.

# Discussion

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