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Research Article

Artificial Intelligence-Based Proctored Online Exams: A Study on the Experiences of Distance Education Students

Yapay Zekâ Temelli Gözetimli Çevrimiçi Sınavlar: Uzaktan Eğitim Öğrencilerinin Deneyimlerine Yönelik Bir Çalışma

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ABSTRACT

The purpose of this study is to ascertain distance education students' views on their experiences with Artificial intelligence-based (AI-based) proctored online exams. The study was conducted using the case study approach, one of the qualitative research designs. Data were collected from 34 students enrolled in a distance education associate degree program at a university in Turkey. A researcher-developed question form was utilized to gather insights into students' perceptions of proctored online exams. The content analysis method was employed to analyze the data collected through the question form. Themes determined from the analysis are grouped under six categories: Flexibility and Accessibility, Affective Factors, Support Services, Exam Conditions, Exam Access Issues, and Personal Factors. These categories comprehensively review various aspects of students' online exam experiences, providing in-depth insights into the opportunities and challenges encountered. Additionally, the study includes important information regarding students' emotional states during online exams and the support services they receive. The study revealed positive student perceptions, equating the reliability of online exams with face-to-face exams. Results suggest that with the right infrastructure, software, and team, proctored online exams can provide an environment as reliable as traditional settings.

Keywords: Distance education, artificial intelligence-based online proctored exam, student experiences, online exam.

ÖZ

Bu çalışmanın amacı, yapay zekâ temelli gözetimli çevrimiçi sınavlara ilişkin uzaktan eğitim öğrencilerinin görüşlerini belirlemektir. Araştırma, nitel araştırma desenlerinden durum çalışması yaklaşımıyla yürütülmüştür. Veriler, Türkiye'de bir üniversitenin uzaktan eğitim önlisans programına kayıtlı 34 öğrenciden toplanmıştır. Öğrencilerin gözetimli çevrimiçi sınavlara ilişkin görüşlerini belirlemek için araştırmacı tarafından geliştirilen bir soru formu kullanılmıştır. Soru formu aracılığıyla elde edilen veriler, içerik analizi yöntemiyle incelenmiştir. Analiz sonucunda belirlenen temalar altı kategori altında gruplanmıştır: Esneklik ve Erişilebilirlik, Duygusal Faktörler, Destek Hizmetleri, Sınav Koşulları, Sınav Erişim Sorunları ve Kişisel Faktörler. Bu kategoriler, öğrencilerin çevrimiçi sınav deneyimlerinin çeşitli yönlerini kapsamlı bir şekilde ele almakta ve karşılaşılan fırsatlar ile zorluklar hakkında derinlemesine bilgiler sunmaktadır. Ayrıca, çalışma, öğrencilerin çevrimiçi sınavlar sırasında yaşadıkları duygusal durumlar ve aldıkları destek hizmetleri hakkında önemli bilgiler içermektedir. Çalışma, öğrencilerin çevrimiçi sınavların güvenilirliğini yüz yüze sınavlarla eşdeğer gördüklerini ortaya koymuştur. Sonuçlar, doğru altyapı, yazılım ve ekip ile gözetimli çevrimiçi sınavların geleneksel ortamlara eşdeğer güvenilir bir ortam sağlayabileceğini önermektedir.

Anahtar Kelimeler: Uzaktan Eğitim, yapay zeka temelli çevrimiçi gözetimli sınav, öğrenci deneyimleri, çevrimiçi sınav.

INTRODUCTION

Distance education is mostly delivered through communication technologies (Gunawardena & McIsaac, 2003). These technologies can be used to carry out a variety of educational activities such as teaching classes, exchanging materials, providing interaction and communication, and measuring and evaluating. As higher education institutions expand their capacity to teach online, online assessment is becoming a major topic (Vazquez et al., 2021). This practice is projected to continue after the pandemic, especially given the mandated online exam experience during the pandemic (Reedy et al., 2021).

It is widely known that assessing students' success and performance in distant education is difficult (Howard, 2020). Summative evaluations assess student performance at the end of the instructional process. For distance education students, these may include face-to-face exams, which can be costly and challenging due to travel, accommodation, and personal responsibilities (Çivril & Aruğaslan, 2023). This contradicts the flexibility of distance education, which offers time and space independence. The integration of information and communication technology in distance education supports the adoption of online exams, addressing these issues. Online exams eliminate the need for students to physically take exams in testing centers or classrooms.

Today's technology has enabled online exams to be supervised. Online proctored exams can be defined as the systems that have the characteristics of a real exam hall online environment (Raman et al., 2021), in which artificial intelligence systems are used (Coghlan et al., 2021), digital via microphone and webcam with the internet connection (Wiberg et al., 2021), and enable monitor live video streams and attempt to detect inappropriate behavior (such as cheating) (Han et al., 2021). The system for artificial intelligence detects suspicious movements by recording sounds and images and these undesirable behaviors can be analyzed afterwards (Wiberg et al., 2021). This AI-based online proctored exam software may be readily linked into learning management systems, and students can take exams by downloading or installing online proctored exam programs as web browser extensions (Coghlan et al., 2021). In addition, it is possible to administer online proctored exams in which no artificial intelligence algorithms are utilized and a real person monitors students via webcam (Wuthisatian, 2020).

Due to the pandemic that began in 2020, higher education institutions around the world had to switch to distant education and required students to take examinations online to minimize the spread of the Covid-19 virus. However, as an alternative to face-to-face exams, various online proctored exam software programs have been developed by software companies and implemented by institutions, both as a result of the pandemic and with the expectation that technology will play a greater role in our lives and that it will create a safer exam environment (Kharbat & Abu Daabes, 2021; Raman, et al., 2021). Online proctoring systems employed in online examinations can give rise to a range of negative implications. Chief among these are privacy concerns; the accumulation of personal data and facial recognition details of students may pose substantial ethical and privacy issues (Kuleva & Miladinov, 2024). Additionally, technological challenges constitute a significant barrier; unreliable internet connectivity, limited technical expertise, and hardware malfunctions can adversely affect the examination process. Furthermore, the persistent sensation of surveillance may heighten student anxiety (Chan & Ahn, 2023; Kuleva & Miladinov, 2024).

1.1. Academic Integrity in Online Proctored Exams

People in the information age may quickly obtain the knowledge they seek from both the internet and printed sources. While this condition has numerous benefits for learning, it might

disclose unfavorable situations in online exams. Students can discover answers to exam questions from external sources such as the textbook, websites, or other students when taking the online exam. Furthermore, the student thought to have taken the exam may not be "that" student. Therefore, ensuring academic integrity in online exams is difficult (McGee, 2013). Exam cheating violates both ethical and academic integrity requirements (Daffin Jr & Jones, 2018; Lee, 2020). According to Gudio Paredes et al. (2021), online proctored exams have become an important tool for ensuring academic honesty in distant education.

Cheating is the first disadvantage that comes to mind when thinking about online exams (Han et al., 2021; Wiberg et al., 2021). Varble (2014) contends that greater attention should be taken to reduce cheating in online exams and to assure academic honesty. Students may also have various technological or motivational disadvantages when taking online proctored exams. Students may lack the necessary physical infrastructure, internet access, or personal space to take the exam (Kuleva & Miladinov, 2024; Wiberg et al., 2021). Furthermore, variables such as software expenses, a shortage of manpower, and an insufficient question pool are examples of adverse scenarios for institutions.

Table 1 summarizes the advantages and disadvantages of online proctored exams for institutions and distance education students.

Table 1

Summary of Advantages and Disadvantages of Online Proctored Exams Based on Literature

Advantages		**Disadvantages**	
Institutional	Cost savings for printing	Institutional	Difficulty maintaining academic integrity
	Allows for the creation of tests with a variety of question formats		High software costs
	Elimination of the requirement to set up a physical location for the exam		Lack of specialized personnel
			Insufficient question pool
Student	Elimination of accommodation-travel expenses	Student	Lack of equipment and poor digital literacy
	Having the opportunity to take the exam anywhere		Insufficient personal space
	Uninterrupted commitments to one's family and job		Concerns resulting from the recording of personal data
Institutional and Student	Instant announcement of exam results	Institutional and Student	Technical problems

1.2. Literature Review

Recent advances in information and communication technologies, coupled with the challenges posed by the Covid-19 pandemic, have facilitated the delivery of courses and the

transition of face-to-face exams to online platforms in distance education. These developments have also increased the number of studies on online proctored exam evaluations.

The literature on online proctored exams can be classified into three categories. These include (1) studies on user behavior, academic integrity, ethical principles, and test transformation (Coghlan et al., 2021; Gudiño Paredes et al., 2021; Han et al., 2021; Kharbat & Abu Daabes, 2021; Milone et al., 2017; Raman et al., 2021; Wiberg et al., 2021), (2) studies on cheating in online proctored exams and how to prevent such activity (Brothen & Peterson, 2012; Varble, 2014), and (3) studies comparing face-to-face and proctored/unproctored online exam performance (Andreou et al., 2021; Daffin Jr & Jones, 2018; Goedl & Malla, 2020; Gulati et al., 2024; Hollister & Berenson, 2009; Hope et al., 2021; Howard, 2020; Ilgaz & Afacan Adanır, 2020; Lee, 2020; Stack, 2015; Varble, 2014; Weiner & Hurtz, 2017; Wiberg et al., 2021; Wuthisatian, 2020).

Milone et al. (2017) investigated the impact of online proctored exams on the learning experience. The majority of students were pleased with the online proctored exam experience, according to the evaluations. In the study, students stated problems such as long installation time for the exam software and technological challenges. Coghlan et al. (2021) carried out a theoretical investigation on the ethics of online proctored exam technologies. This research examines the long-term moral philosophy of these technologies via the lens of ethical notions such as academic integrity, fairness, non-harming, transparency, privacy, autonomy, freedom, and trust.

Gudiño Paredes et al. (2021) conducted a study to investigate how online proctored tests affect students' learning and academic integrity (ethics). When the study's findings were evaluated, it was shown that online proctored exams had a substantial effect on academic honesty since they reduced the potential of cheating in the exams. Han et al. (2021) researched distance proctored exam designs and techniques. The study's findings indicate that distance proctored exam designs require the addition of new technical elements such as authentication, widening the scope of the camera, and making changes to minimize the stress levels of exam takers. Using an e-surveillance technology in their final exams during the Covid-19 pandemic, Kharbat and Abu Daabes (2021) evaluated students' attitudes, worries, satisfaction, and exam averages. They discovered that, while students expressed substantial worries (e.g., privacy, environmental, and psychological problems) about their experiences with e-surveillance tools, the majority of them performed above average on online exams.

Raman et al. (2021) investigated student adoption of online proctored exams during Covid-19. According to the study's findings, innovation characteristics such as benefit, compatibility, convenience of use, trialability, and observability are positively connected with the acceptability of online proctored exams. Wiberg et al. (2021) aim to explain, analyze, and discuss how tests changed throughout the Covid-19 epidemic. Many studies conducted before and after the Covid-19 outbreak revealed that students adapt quite well to the online exam environment, yet many instructors are concerned about the potential of cheating in these exams (Raman et al., 2021; Wiberg et al., 2021).

Studies comparing students' academic achievement based on the type of exam proctored face-to-face, unproctored online, or proctored online are frequently encountered in the literature. Some research found no significant difference in student performance between face-to-face exams and unproctored online exams (Hollister & Berenson, 2009; Stack, 2015). In other research, students performed better on unproctored online exams than on face-to-face exams (Daffin Jr & Jones, 2018; Varble, 2014). In some studies, that compared the outcomes of face-to-face exams versus online exams administered with live supervisors via web conferencing software, it was discovered that there was no difference in student performance (Hope et al., 2021; Weiner & Hurtz, 2017). Wuthisatian (2020) concluded in his study that students' exam

averages in face-to-face exams are greater than those in online exams with live supervisors. Goedl and Malla (2020) compared the grade distributions of unproctored online and video conferencing software, as well as online proctored exams, as well as the time required for students to complete the exams. The study's findings revealed that unproctored and proctored exams are not similar. Howard (2020) concluded in his study comparing the scores and exams times of proctored face-to-face, proctored online, and unproctored online exams that the unproctored online exam averages were equivalent to the exam averages of the other two groups. In their study, Andreou et al. (2021) compared the exam results of the online proctored exam group to the results of the face-to-face supervised exam group. The study's findings revealed that the type of supervision had no effect on exam scores. Similarly, Gulati et al. (2024) compared student performance across three different methods (computer-based, in-class, and Zoom proctored exams) and found no significant differences. However, their final assessment indicated that students achieved higher scores.

The use of AI-based online proctored exams is becoming increasingly common in distance education. However, a deeper understanding is needed regarding how students experience these exams particularly in terms of opportunities, challenges, emotional responses, and the support they receive. Developing such an understanding can make a valuable contribution to the design of effective and student-centered assessment processes. This study qualitatively explores students' experiences with AI-based online proctored exams and aims to contribute to the existing literature in this context. While prior research has often focused on aspects such as technical infrastructure and system design, this study emphasizes the human dimension by examining students' perceptions, emotional states, and support needs within a specific context. In this regard, the study may offer useful insights for institutions planning to implement similar systems and contribute to the ongoing discourse on digital assessment practices. Based on this aim, the study seeks to answer the following research questions:

1. What opportunities have online proctored exams afforded students?
2. What challenges have students encountered during online proctored exams?
3. How have students' emotional states been affected during online proctored exams?
4. What forms of support have students received during online proctored exams?

METHOD

2.1. Research Model

This study was designed as a qualitative case study to explore student views on AI-based online proctored exams within a specific context. A case study is an approach that enables a specific phenomenon to be examined in depth and detail within its real-life context (Yıldırım & Şimşek, 2011).

2.2. Context of the Research

This study was conducted at a vocational college within a state university in Türkiye, which has adopted distance learning methodologies. The majority of the students are not residents of the province where the college is located but come from various other cities. Before the COVID-19 pandemic (pre-2020), the institution conducted face-to-face exams on campus. However, similar to trends worldwide, these were shifted to online formats to minimize interpersonal interactions. In the spring semester of 2021-2022, the college implemented AI-based proctored online exam software instead of unproctored exams, aiming to foster a more controlled online assessment environment. This form of exam, which is an artificial intelligence-based online proctored exam, will be referred to as online proctored exam in the following sections of the study.

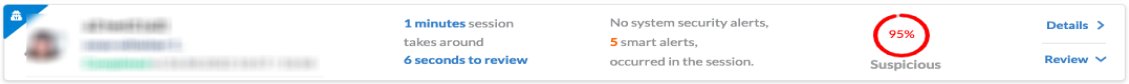
The AI-based proctored online exam software tracks students without the need for a live proctor, detects and reports their suspicious movements during the exam, and provides a detailed analysis. Institutions or faculty members can use this software to determine various security measures. Some of these security measures include the following:

- Camera and microphone to be active during the exam
- Termination of the exam if the camera and microphone are turned off during the exam
- Detection of ambient sounds during the exam
- Detection of the person not being in front of the screen
- Detection of different people in the camera image
- Obligation to take the exam in full screen
- Preventing new tabs from opening
- Students are not allowed to open any windows other than the exam window.
- Detection of abnormal head movements of students
- Preventing the use of a second monitor
- Detection of very fast answers to questions
- Determination of the rapid completion of the exam

Students must install a plug-in in their web browser to take exams. After the exam, all students' audio and video recordings during the exam, exam movements and suspicion rates are reported by the software. Figure 1 shows an example of a student's suspicion rate.

Figure 1

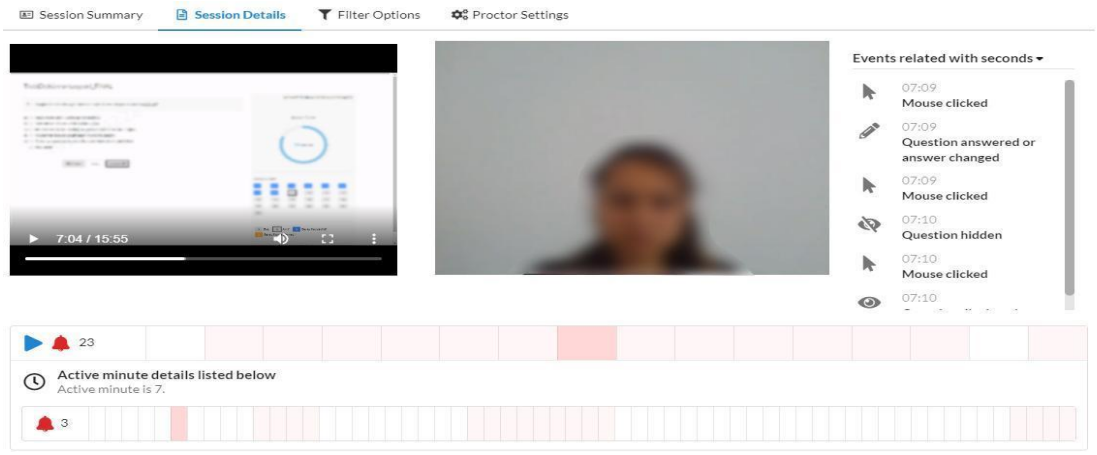
Example of Suspicion Rate Representation



The "Details" button allows access to the student's records and detailed exam report. There is an access to the student’s exam window in the computer environment and the video/audio recordings of certain moments from this screen, as shown in Figure 2.

Figure 2

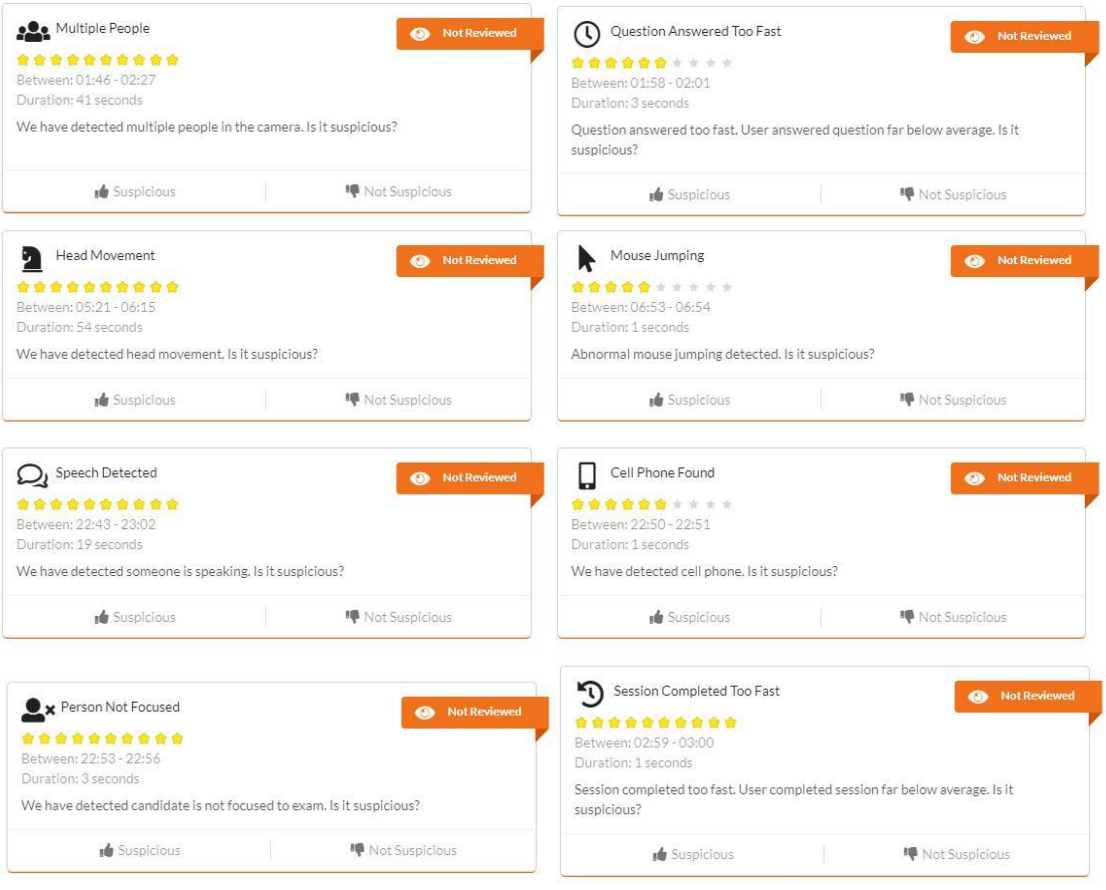
Screenshot Of Student Exam Record



Simultaneously, there is a report on this screen that contains the students' information on which rule infraction occurred at which minutes. Figure 3 shows an example of a rule violation in one of these reports. When in doubt, the course advisor can refer to the minutes and thoroughly analyze the student's video and audio recordings, according to this report.

Figure 3

Detailed Display of Sample Rule Violations



The required synchronizations have been accomplished in order for this program to work in tandem with our school's Learning Management System. The software presentation, test norms, and activation information were explained to the students in live sessions. Students were given help manuals and sample videos on how to use the system. In addition, a practice exam was held so that students would not encounter any problems during the exams and may prepare their computers in hardware and software before the real exams. Almost all of the students took the demo exam. During this period, any technical issues they encountered were resolved with the support of the unit's technical staff. Since the video and audio recordings will be taken during the exam, the consent of the students was obtained. Students who do not want their video and audio recordings to be captured have the option of taking the exam in person in the school facility. The online proctored exams were done in four days, over two weekends. The online proctored tests consisted of 25 multiple-choice questions. A 30-minute time frame has been defined in the exam calendar for each exam, and the exam period has begun to be 30 minutes from the moment the student takes the exam within this time frame. During the exams, the technical support team maintained regular contact with the students and resolved any issues that arose. Students were repeatedly reminded prior to the exams that they needed to use a computer, camera, and microphone for the exam entry process.

2.3. Participants

The participants of this study were selected using purposive sampling, a method commonly used in qualitative research to identify information-rich cases. During the spring term of the 2021–2022 academic year, a total of 419 students were enrolled in the associate degree distance education program at a public university in Turkey. Of these, 395 students participated in the AI-based proctored online exams administered during the term. Following the exams, a call for voluntary participation was sent to all 395 students. In line with the principles of qualitative research, the goal was not statistical generalization, but rather in-depth exploration of experiences. A total of 34 students, who consented to participate and submitted complete responses to the open-ended questions, were included in the study.

In this study, demographic information such as age, gender, and working status was collected to provide a contextual profile of the participants. While these variables were not directly examined in relation to the research questions, they offer descriptive insight into the composition of the sample. The demographic characteristics of the students are presented in Table 2.

Table 2

Demographic Information of Students

Demographic features		**f**	**%**
Age	20-24 age	20	58.82
	25-29 age	9	26.47
	30-36 age	5	14.71
Gender	Female	24	70.59
	Male	10	29.41
Working Status	Yes. I am working	22	64.71
	No. I am not working	12	35.29

2.4. Data Collection

Data for this study were gathered from students who participated in proctored online exams during the spring term of the 2021–2022 academic year. Ethical approval for this research was obtained from the University's Ethics Committee. To ascertain students' views regarding proctored online exams, a researcher-developed question form was employed. The

question form was developed by the researcher based on a comprehensive review of the relevant literature and in alignment with the research questions formulated in the introductory section. The aim was to ensure theoretical coherence and content relevance. The development process involved several stages, including item generation, expert review, and revision. The form consisted of questions categorized into three segments: closed-ended questions aimed at identifying demographic characteristics (e.g., age), closed-ended questions to assess experiences related to the exams (e.g., In what setting did you take the proctored online exams?), and open-ended questions designed to explore various aspects of students' experiences, including encountered problems, emotional responses, and perceived support during the proctored online exams.

The open-ended questions were constructed to elicit rich, narrative responses regarding students' perceptions and experiences. While data were collected in written form, this method was deemed appropriate considering the asynchronous and geographically distributed nature of the target population in a distance education setting. Written responses enabled participants to reflect on their experiences more thoughtfully and at their own pace. Prior to deployment, the question form was reviewed by two faculty members specializing in distance education, whose feedback led to minor revisions that improved clarity and relevance. Data collection was conducted using Google Forms immediately following the spring term exams.

2.5. Data Analysis

Content analysis was employed to evaluate the data derived from the question form designed to address the research questions. In this method, similar data are aggregated, organized, and interpreted according to concepts and themes identified by researchers (Yıldırım & Şimşek, 2011). To ensure the validity and reliability of the findings, the responses to the open-ended questions were independently coded by the researcher and a domain expert during the thematic analysis process. Intercoder reliability was calculated using the formula suggested by Miles and Huberman (1994) (Reliability = Number of Agreements / (Number of Agreements + Number of Disagreements)), and the resulting agreement rate was found to be 87%. Based on their feedback, the researcher formulated themes and codes. When students' views corresponded to multiple codes, they were categorized under several codes. To cite students' views, a prefix 'S' followed by a sequential number was used.

FINDINGS

Within the scope of this study, four research questions were formulated, and the data collected from students were analyzed in detail to address these questions. The obtained data were classified into various themes and codes, which elucidate students' perceptions of their proctored online exam experiences, the challenges encountered, and their overall satisfaction with the exam system. These themes and codes comprehensively encapsulate the varied experiences and perspectives of students throughout the examination process. Table 3 presents the frequency and percentage distributions of students' responses to the closed-ended questions included in the online question form.

In addition to the qualitative data, responses to three closed-ended questions were also included in the online question form to gather background information regarding the students' technical readiness, exam-taking environment, and perceptions of reliability in online proctored exams. While these items were not directly aligned with the main research questions, they were designed to support a contextual understanding of students' overall exam experiences. Presenting this data provides descriptive insight into the practical conditions under which students took the exams and helps frame their open-ended responses more meaningfully. Therefore, the results of these closed-ended questions are presented in Table 3.

Table 3

Students' Responses to Closed-Ended Questions

Questions	Answers	f	%
Did you have the necessary equipment to take the online proctored exams?	Yes. I did.	24	70.59
	No. I did not.	10	29.41
In what setting did you complete the online proctored exams?	At home.	29	70.73
	At work	7	17.07
	At my friend's/ neighbor's house	5	12.20
Did you find the online proctored exams as reliable as the face-to-face exams?	Yes. I did.	29	85.30
	No. I did not.	5	14.70
	Total	34	100.00

Table 3 reveals that 70.59% of students have the requisite equipment to take the online proctored exams. Students provided multiple responses to the issue of where they took the online proctored tests, with the majority stating that they took the exams from their home environment. The online proctored tests were found reliable by 85.30% of the students.

Table 4 shows the themes and codes based on students' views to the online proctored exam.

Table 4

Themes and Codes Based on Students' Views on Online Proctored Exam

Themes	Codes	f	%
Flexibility and Accessibility (37 Views-%25.17)	Cost Effectiveness	15	40.54
	Spatial Flexibility	13	35.14
	Time Efficiency	9	24.32
Affective Factors (29 Views-%19.73)	Satisfaction	11	37.93
	Anxiety	7	24.14
	Stress	6	20.69
	Excitement	5	17.24
Support Services (27 Views-%18.37)	Technical Support	15	55.56
	Institutional Support	10	37.04
	Academic Support	2	7.41
Exam Conditions (22 Views-%14.97)	Comfort (Positive/Negative)	10	45.45
	Exam Hours/Duration	7	31.82
	Exam Security	5	22.73
Exam Access Issues (21 Views-%14.29)	Malfunctions and Technical Problems	17	80.95
	Lack of Equipment	4	19.05
Personal Factors (11 Views-%7.48)	Work and Home Responsibilities	8	72.73
	Environmental Factors	3	27.27

In this study, the perspectives of distance education students who experienced in the AI-based online exam system were analyzed. Upon examining Table 4, it is evident that there are 6 themes, 17 codes, and 147 views. Students' views have been organized under the themes: 'Flexibility and Accessibility', 'Affective Factors', 'Support Services', 'Exam Conditions', 'Exam Access Issues' and 'P ersonal Factors'. These themes provide a comprehensive examination of various aspects of students' online exam experiences, delivering detailed insights into both the opportunities presented and the challenges faced.

3.1. Flexibility and Accessibility

Table 4 shows that the theme “Flexibility and Accessibility” was the most frequently commented upon, accounting for 37 responses or 25.17% of the total. This theme primarily focuses on the advantageous situations and significant opportunities that distance education students perceive to be associated with online exams. This theme illustrates that proctored online exams offer flexibility by enabling students to participate in exams from their own living spaces, devoid of geographic limitations. Additionally, it highlights how these exams help to mitigate challenges such as additional costs and time loss that might be encountered during the exam process.

The 'Cost Effectiveness' code underscores the financial advantages of participating in exams remotely, eliminating the need for travel to and from the campus where the university is located. Students have continued to access education even during economically difficult times by avoiding direct financial burdens such as travel costs, accommodation, and meals. Some student statements related to this code are provided below:

> *I took the exams from home, so I didn’t have to travel to Isparta or stay overnight there. It saved me travel costs and spared me extra expenses during a financially tough time. This way, I could focus solely on the exams. (S12, Code1: ‘Cost Effectiveness’)*

> *Thanks to online exams, we didn't have face-to-face exams and avoided additional costs like accommodation and meals. This was a huge advantage for my friends who were financially struggling. (S26, Code1: ‘Cost Effectiveness’)*

The codes of 'Spatial Flexibility' and 'Time Efficiency' highlight further advantages that distance education students experience through online exams. 'Spatial Flexibility' code encompasses views on enabling students to access the exam from any desired location, irrespective of their geographical location. Spatial Flexibility has been particularly beneficial for students residing outside the city or those with limited transportation options, as it eliminates the need to commute to campus and reduces exam-related stress.

> *I took the exams from wherever I wanted. This not only provided comfort but also reduced my exam stress. (S2, Code2: ‘Spatial Flexibility’)*

> *For face-to-face exams, I would have had to travel. Maybe I wouldn't have been able to make it to the exam. The online exam saved me from a lot of trouble. (S18, Code2: ‘Spatial Flexibility’)*

Conversely, the 'Time Efficiency' code encompasses views regarding students' more effective use of time during exam processes. Online exams have minimized travel time and other time-related losses associated with exams, allowing students to prepare more effectively and continue their daily activities without interruption. Both codes have significantly improved educational processes by making exam participation more flexible and efficient for distance education students. The student statements related to this code are presented below:

> *I was able to focus directly on my exam without spending any extra time outside of the exam period. This allowed me to continue my education without disrupting my daily routine. (S2, Code3: ‘Time Efficiency’)*

> *Online exams allowed me to use the time before and after the exam more efficiently by eliminating the time spent traveling. This way, I could dedicate time to my other important tasks. (S28, Code3: ‘Time Efficiency’)*

3.2. Affective Factors

The 'Affective Factors' theme reveals in detail the psychological effects and emotional reactions of proctored online exams on students. Table 4 presents the codes within this theme, including the emotional states experienced by students during the exam processes, such as satisfaction, anxiety, stress, and excitement. Following the online exams, many students expressed satisfaction with their exam experience. Students expressed high satisfaction with the comfort and experience provided by this exam format, as long as they did not encounter technical problems and were adequately prepared for the lessons. Student expressions related to this code are presented below:

> *I didn't encounter any problems in the online exams; this made the exam process very comfortable and hassle-free for me. Thanks to my mastery of the material, I was able to complete the exam easily. (S34, Code4: 'Satisfaction')*

> *I did not encounter any problems in the exams, I completed my exams very quickly. (S30, Code4: 'Satisfaction')*

Online exams have induced stress, anxiety, and excitement among students, primarily due to technical issues and unfamiliarity with the exam format. The possibility of technical disruptions, such as internet connection interruptions or system errors, during the exam process has raised concerns among students about their ability to complete the exams. Additionally, isolation from peers in the exam environment and the feeling of being monitored have led to increased tension and anxiety among students before and during the exam.

> *Being at home with the camera and microphone on seriously stressed me out from the beginning to the end of the exam. (S10, Code6: 'Stress')*

> *The excitement and nervousness of taking online exams for the first time caused some initial difficulties. But after a while, it felt like I was in a normal exam environment, and I got used to it. (T12, Code7: 'Excitement')*

> *I didn't experience any problems, but I was always worried about potential issues. While taking the exams, thoughts like 'What if my internet connection goes down? What if I can't run the software?' were constantly on my mind. (S24, Code5: 'Anxiety')*

3.3. Support Services

The 'Support Services' theme highlights students' views on the technical solutions provided, institutional assistance, and academic support offered for preparing for online exams and addressing issues encountered during the exam process. Students encountered various technical issues during the exams, such as system errors and connectivity problems. In their statements, they noted that they relied on the support services provided by the institutions to overcome these challenges.

> *The system logged me out of the exam several times, and I couldn't get back in. I emailed the school, and they responded immediately during the exam, helped me, and we finally resolved the issue. (S21, Code8: 'Technical Support')*

> *Our school was very helpful before the online exam. They held meetings and explained how the exams would be conducted through videos. They also gave us the opportunity to take a sample exam to prepare us for the proctored exam. (S18, Code9: 'Institutional Support')*

The information and motivational talks given by our professors before the exam prepared us for potential problems, which significantly reduced my exam stress. (S5, Code10: 'Academic Support').

3.4. Exam Conditions

The 'Exam Conditions' theme includes views on the physical and psychological comfort of the exam environment, the duration of the exams, and their security. Students also discussed the negative effects that the exam environment had on them. The student statements related to the codes in this theme are as follows:

I felt comfortable because I was at home, but if I had taken the exam in a university environment, I might have felt stressed due to simultaneous panic and excitement. I took my exam very comfortably at home. (S15, Code11: 'Comfort (Positive)').

I felt very uncomfortable because the camera and microphone were constantly on, making it feel like an intrusion into my personal space. (S29, Code11: 'Comfort (Negative)')

Since the exam times conflicted with my work hours, I had to leave work, quickly take the exam at home, and then return to work. This made it very difficult for me to concentrate on the exam questions. Holding the exams in the evening would be better for everyone. (S33, Code12: 'Exam Hours/Duration')

Since the exam duration was very short, I couldn't spend enough time on the questions and felt stressed. (S10, Code12: 'Exam Hours/Duration')

Exams conducted with cameras gave me the confidence as if I were taking a normal exam. Therefore, I would like to thank our school for providing such a secure exam environment. (S26, Code13: 'Exam Security')

3.5. Exam Access Issues

The 'Exam Access Issues' theme addresses the technical issues encountered during online exam processes, such as connection errors in the exam software, system malfunctions, internet outages, and the difficulties students face in accessing the necessary technological tools for the exams. Student statements regarding the two codes in this theme are as follows:

My internet connection frequently dropped, and the program ran slowly. As a result, I spent most of my time troubleshooting the internet and camera. When the connection was weak, my screen went blank, which made it hard for me to focus on the exam. I constantly faced technical issues while trying to take the exam at work. (S33, Code14: 'Malfunctions and Technical Problems')

I couldn't take the exams because I didn't have a computer and had to spend days looking for one. Some of my friends couldn't find reliable internet access. (T13, Code15: 'Lack of Equipment')

3.6. Personal Factors

The 'Personal Factors' theme addresses individual and environmental factors that affect students during the online exam processes. This theme comprises two main codes: 'Work and Home Responsibilities' and 'Environmental Factors'. The 'Work and Home Responsibilities' code examines how students' professional lives and domestic responsibilities impact their exam preparation and participation processes. The 'Environmental Factors' code addresses the environmental conditions students encounter during exams, such as noise at home or the lack of a suitable study area. Student statements related to these codes are as follows:

It was very difficult for me to attend face-to-face exams because of my job. With the exam method used by our school, I didn't need to take time off work. Thanks to the online exams, I was able to take my tests without disrupting my work schedule. (S3, Code16: 'Work and Home Responsibilities')

People were coming and going in the room at home, and I was worried that the system might crash during some exams. The school had warned us that if the program detected more than one person during the exams, it would be considered an attempt to cheat. (S22, Code17: 'Environmental Factors')

DISCUSSION AND CONCLUSION

In this study, the views of distance education students regarding the AI-based online exam system were examined in detail. The research comprehensively addressed students' exam experiences, highlighting both positive and negative aspects, and covered their views on the opportunities provided by such exams, the challenges encountered, their affective states, and the support services available. This study provides valuable insights into the impact of online exams on student experiences and offers guidance for improving future practices. In addition to the qualitative findings, the results of the closed-ended questions provided further descriptive insight into students' exam conditions and perceptions. For instance, a significant majority reported having the necessary equipment and considered the online proctored exams to be as reliable as face-to-face exams. These findings complement the qualitative themes and reinforce the overall conclusions of the study.

The opportunities provided to students by proctored online exams have been examined under the themes of flexibility and accessibility, personal factors, and exam conditions. These types of exams have eliminated the necessity for students to physically attend campus, thereby granting them independence in terms of time and location. Particularly for students residing in geographically remote areas, this flexibility has offered a significant advantage, enabling them to engage in the exam process within a more reliable and comfortable environment. Additionally, online exams have provided significant advantages by eliminating additional costs, such as travel expenses, accommodation, and meals. These findings align with other studies in the literature, demonstrating that proctored online exams provide significant opportunities for accessibility and flexibility in education. Ilgaz and Afacan Adanır (2020) argue that online exams provide advantages including reduced time requirements, enhanced test security, secure data storage, rapid result delivery, cost-effectiveness, paper savings, and automated records for item analysis and learning analytics. Frankl et al. (2019) suggest that online exams can enhance various aspects of education, including information transmission and learning process organization, significantly reduce workload and costs, minimize the influence of instructors' subjective assessments, alleviate stress, enable disabled students to take exams under conditions similar to their peers, and conserve paper. Coghlan et al. (2021) have noted that online exams provide accessibility benefits not only for distance education students but also for those enrolled in campus-based programs who prefer to take exams from home. In their study, Pettit et al. (2021) reported that online exams result in significant cost reductions by eliminating the need to rent exam halls, employ proctors and exam staff, incur travel expenses, print exam papers, and handle the digitization and marking of exam papers. Pandey et al. (2020) stated in their study that online exams allow students to participate from any location, and the examiner can monitor the students at any time during the exam or even after its completion. Additionally, the study indicated that students' ability to balance personal and household responsibilities, along with their professional lives, positively impacted their exam preparation processes and performance. In terms of exam conditions, being able to take exams in their own comfortable environments has reduced students' exam stress and provided a more focused exam

experience. Aristeidou et al. (2024), in their study examining students' views about online exams, emphasized that students feel quite comfortable taking exams in their own homes and that taking face-to-face exams in unfamiliar locations can create additional concerns. Ilgaz and Afacan Adanır (2020) emphasized the satisfaction of physically disabled students who could take their exams from home instead of having to travel to an exam location.

The challenges faced by students in proctored online exams have been categorized into exam access issues, exam conditions, and personal factors. It has been determined that students predominantly encountered issues such as internet connection interruptions, technical glitches, and hardware deficiencies. These types of technical problems can distract students during the exam process and negatively impact their performance. Pettit et al. (2021) indicate that students may be disadvantaged by unreliable bandwidth during online exams and suggest offering exams offline or providing an option to seamlessly switch to offline mode in case of connection loss to mitigate this issue. Similarly, Frankl et al. (2019) argue that exam data should be stored on system servers even in an internet disconnection. In the 'Exam Conditions' category, criticisms regarding the duration of exams have come to the forefront. In this study, the same time durations previously allocated for face-to-face exams at the institution were applied to online exams. However, despite the identity verification procedures at the beginning of online exams not being included in the exam duration, it is believed that this process gave students the impression that the exam time was insufficient. In the study conducted by Ilgaz and Afacan Adanır (2020), students also expressed difficulties due to the short exam duration. Regarding personal factors, the negative impacts of environmental conditions on students' exam participation have been highlighted. Distractions caused by children or other family members at home can lead to decreased performance during the exam. Fuller et al. (2020) stated that the possibility of interruptions from shared spaces with other family members and children during online exams would disadvantage students. Similarly, Aristeidou et al. (2024) indicated that the existing home environment and workspace might not be ideal for students with children to take exams, suggesting that face-to-face exams should be arranged for such situations. In parallel with these findings, Bayazit and Aşkar (2012) also reported that students have expressed complaints regarding external noises, fatigue, and concentration issues associated with online exam environments.

The effects of proctored online exams on students' emotional states have been addressed under the 'Affective Factors' category. This category examines students' emotional responses, such as satisfaction, anxiety, stress, and excitement, in detail. Satisfaction was generally reported in situations where there were no technical glitches, where students experienced the comfort of taking the exam at home, and where they were well-prepared for the exam. In contrast, the negative aspects in this category were typically attributed to technical problems, unfamiliarity with the exam format, and feelings of isolation. Additionally, the feeling of being under surveillance increased students' stress and pressure during the exam. The results of this study align with the findings of other research in the literature. Woldeab et al. (2017) concluded that students experiencing web-camera proctored online exams for the first time might suffer from exam anxiety. Coghlan et al. (2021) noted that proctored online exam systems might cause students to worry about making mistakes, as these systems can incorrectly flag behaviors such as looking away from the screen or talking to themselves as cheating attempts. Woldeab and Brothen (2019) found that students with higher levels of anxiety had lower exam performance. Wuthisatian (2020) and Lee (2020) observed that students' unfamiliarity with the procedures required by the exam environment negatively affected their performance. Additionally, studies examining students' views support these findings, revealing that students share similar concerns regarding online exams (Aristeidou et al., 2024; Ilgaz & Afacan Adanır, 2020; Kharbat & Abu Daabes, 2021; Milone et al., 2017). Conijn et al. (2022) indicated that factors such as being monitored, low internet literacy, and environmental distractions could lead to online exam

anxiety among students. To make proctored online exams more effective and student-friendly, it is important to consider these affective factors.

Students' views on the support they received during proctored online exams are detailed in the 'Support Services' category. The analysis reveals that students had positive experiences with technical support, institutional support, and academic support. Many students stated that the support provided was sufficient to quickly and effectively resolve the technical problems encountered during the exam process. However, some students reported experiencing delays in addressing issues that arose during the exam. In terms of institutional support, universities' information and guidance services have played a significant role in reducing students' exam anxieties. Informational meetings organized before the exams and the resources provided have particularly helped students to be better prepared for the exam process. Demo exams were conducted one month prior to the actual exams, allowing students to familiarize themselves with all stages of the proctored exam system, including identification at the entrance, starting the exam, and completing the exam. Other studies have also indicated that such services and supports provided before the actual exam help reduce exam stress for students (Arora et al., 2021; Lee, 2020). Academic support has played a crucial role in answering students' questions about the exams and offering guidance. Frankl et al. (2019) suggest that support staff need to adopt a kind and understanding approach to help reduce students' exam stress. The results of this study demonstrate that technical, institutional, and academic support services are critically important for enhancing the success of proctored online exams.

RECOMMENDATIONS

The results of this study indicate that conducting proctored online exams is a sound decision for distance education students. Creating an environment as reliable as face-to-face exams appears feasible with proctored online exams, provided that the appropriate infrastructure, secure software, and qualified personnel are in place. The most important consideration is to ensure that students are adequately informed about the exam system and trained in advance to prevent any disadvantages during the exam process. Therefore, institutions should organize orientation programs, demo exams, and clear communication procedures prior to implementation. Furthermore, the design of proctored online exams should prioritize validity, reliability, flexibility, and security (Shraim, 2019). Exam interfaces must be user-friendly, and technical support should be readily available to address any unexpected issues during the exam. AI-based proctoring software equipped with necessary monitoring features provides a practical and scalable alternative to traditional assessment environments. In fact, such systems may offer advantages beyond human observation, such as continuous monitoring and automated flagging of suspicious behaviors.

It is also recommended that institutions collect regular feedback from students and instructors to continuously improve the exam experience. Particular attention should be paid to students with special needs, ensuring that accommodations are integrated into the system to promote equity. Finally, future research can explore students' long-term adaptation to proctored online exams, comparative studies between AI-based and human-proctored systems, and the effectiveness of different instructional and technical support strategies across disciplines and learning levels. This study may serve as a valuable guide for institutions and educators who plan to implement or improve AI-based proctored online exam systems.

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GENİŞLETİLMİŞ ÖZ

Giriş

Uzaktan eğitim, genellikle iletişim teknolojileri aracılığıyla yürütülmektedir (Gunawardena & McIsaac, 2003). Bu teknolojiler, derslerin işlenmesi, materyal kullanımı, etkileşim ve iletişimin sağlanması gibi birçok eğitim faaliyetinin gerçekleştirilmesine olanak tanımaktadır. Ayrıca, ölçme ve değerlendirme süreçlerinde de kullanılabilmektedir. Özellikle Covid-19 pandemisi süresince çevrimiçi sınav deneyimi zorunlu hale gelmiş olup (Reedy vd., 2021), yükseköğretim kurumlarının çevrimiçi eğitim kapasitelerini artırmalarıyla birlikte, çevrimiçi sınav uygulamaları dünya genelinde önemli bir konu haline gelmiştir (Vazquez vd., 2021).

Uzaktan eğitim öğrencilerinin başarılarının değerlendirilmesi zorluklar taşımaktadır (Howard, 2020). Özellikle, bu değerlendirmeler arasında yer alan yüz yüze sınavlar, seyahat, konaklama ve kişisel sorumluluklar gibi zorluklar nedeniyle maliyetli ve zaman açısından zorlayıcı olabilmektedir. Bu durum, uzaktan eğitimin sunduğu esnek yapıyla çelişmektedir. Bilgi ve iletişim teknolojilerinin entegrasyonu, çevrimiçi sınavların benimsenmesine destek vermekte, böylece bu zorluklar aşılmaya çalışılmaktadır. Çevrimiçi sınavlar, öğrencilerin sınav merkezlerine veya sınıflara fiziksel olarak gitmelerini konusunda kolaylık getirmekte, bu da önemli bir avantaj sağlamaktadır.

Günümüz teknolojisi ile çevrimiçi sınavlar, gözetimli bir şekilde yapılabilmektedir. Çevrimiçi gözetimli sınavlar, yapay zekâ tabanlı sistemler ile mikrofon ve kamera gibi dijital araçlarla internet üzerinden canlı video akışını izleyerek uygunsuz davranışları tespit etmeye çalışmaktadır (Han vd., 2021). Bu sistemler, ses ve görüntüleri kaydederek şüpheli hareketleri algılamakta ve bu davranışlar sonradan analiz edilebilmektedir (Wiberg vd., 2021). Yapay zekâ tabanlı bu çevrimiçi gözetimli sınav yazılımları, öğrenme yönetim sistemlerine kolaylıkla entegre edilebilmekte ve öğrenciler, tarayıcı eklentileri aracılığıyla sınavları gerçekleştirebilmektedir (Coghlan vd., 2021).

Yöntem

Bu çalışma, yapay zeka tabanlı çevrimiçi gözetmenli sınavlara ilişkin öğrenci görüşlerini belirli bir bağlamda incelemek üzere nitel bir durum çalışması olarak tasarlanmıştır. Durum çalışması, belirli bir olgunun gerçek yaşam bağlamında derinlemesine ve ayrıntılı olarak incelenmesini sağlayan bir yaklaşımdır (Yıldırım & Şimşek, 2011). Araştırma, Türkiye'deki bir devlet üniversitesinin meslek yüksekokulunda gerçekleştirilmiştir. Bu bağlamda, 2021-2022 bahar döneminde uzaktan eğitim programına kayıtlı 34 öğrenciden veriler toplanmıştır. Söz konusu dönemde, yüz yüze sınavlar yerine yapay zekâ tabanlı çevrimiçi gözetimli sınavlar kullanılmıştır.

Veriler, öğrencilerin çevrimiçi gözetimli sınavlara ilişkin deneyimlerini belirlemek amacıyla araştırmacı tarafından geliştirilen bir anket formu aracılığıyla toplanmıştır. Anket formu, demografik soruların yanı sıra kapalı uçlu ve açık uçlu sorular içermektedir. Kapalı uçlu sorular öğrencilerin sınavlarla ilgili genel deneyimlerini değerlendirmek için kullanılmış, açık uçlu sorular ise karşılaştıkları zorlukları ve bu zorlukları nasıl çözdüklerini daha derinlemesine

anlamak amacıyla sorulmuştur. Ankette yer alan sorular, alanında uzman iki öğretim üyesinin görüşleri doğrultusunda son haline getirilmiştir. Veriler, içerik analizi yöntemi kullanılarak analiz edilmiştir. Bu yöntemde, araştırmacı tarafından belirlenen temalar ve kavramlar çerçevesinde benzer veriler bir araya getirilmiş, organize edilmiş ve yorumlanmıştır (Yıldırım & Şimşek, 2011).

Çalışmanın bulguları, öğrencilerin çevrimiçi gözetimli sınavlara ilişkin görüşlerinin altı ana kategori altında toplandığını göstermektedir: Esneklik ve Erişilebilirlik, Duygusal Faktörler, Destek Hizmetleri, Sınav Koşulları, Sınav Erişim Sorunları ve Kişisel Faktörler. Her bir kategori altında öğrencilerin görüşlerine dayalı temalar oluşturulmuştur ve bu temalar, öğrencilerin sınav deneyimlerine ilişkin derinlemesine analizler sunmaktadır.

Sonuç ve Tartışma

Bu çalışma, yapay zekâ tabanlı çevrimiçi gözetimli sınavlara katılan uzaktan eğitim öğrencilerinin deneyimlerini kapsamlı bir şekilde incelemektedir. Elde edilen bulgular, çevrimiçi gözetimli sınavların öğrencilere önemli esneklik ve erişilebilirlik fırsatları sunduğunu ortaya koymaktadır. Özellikle, öğrencilerin sınavlara kendi yaşam alanlarından katılabilmeleri, sınavlar sırasında seyahat ve konaklama gibi ek maliyetlerden kaçınmalarına olanak tanımaktadır. Bu bulgular, çevrimiçi sınavların, öğrencilere zaman ve mekân bağımsızlığı sunarak eğitim süreçlerinde daha fazla esneklik sağladığını göstermektedir.

Öğrencilerin karşılaştığı zorluklar ise, teknik sorunlar ve donanım eksiklikleri ile ilişkilidir. İnternet bağlantısının kesilmesi, yazılım hataları ve yeterli donanıma sahip olmama gibi teknik sorunlar, öğrencilerin sınav deneyimlerini olumsuz etkilemiştir. Öğrenciler ayrıca, sınav sırasında izlenme hissi nedeniyle stres ve kaygı yaşadıklarını belirtmiştir. Bu bulgular, literatürdeki diğer çalışmalarla da paralellik göstermektedir. Woldeab ve Brothen (2019), çevrimiçi gözetimli sınavların, öğrencilerin sınav kaygılarını artırabileceğini ifade etmiştir.

Çalışmanın önemli bir bulgusu, yapay zeka tabanlı çevrimiçi gözetimli sınavların yüz yüze sınavlar kadar güvenilir olarak algılandığıdır. Öğrenciler, bu sınavların doğru altyapı ve teknik destekle güvenilir bir sınav ortamı sunabileceğini ifade etmişlerdir. Ayrıca, öğrencilerin sınav öncesinde aldıkları teknik destek ve bilgilendirme hizmetlerinin, sınav kaygılarını azalttığı ve sınav sürecine daha iyi hazırlanmalarına olanak tanıdığı sonucuna ulaşılmıştır. Bu bulgular, çevrimiçi sınav sistemlerinin öğrenci başarısını ve memnuniyetini artırma potansiyeline sahip olduğunu göstermektedir.

Sonuç olarak, bu çalışma, yapay zeka tabanlı çevrimiçi gözetimli sınavların uzaktan eğitim öğrencileri için etkili bir değerlendirme aracı olabileceğini ortaya koymaktadır. Çevrimiçi sınavların başarılı bir şekilde uygulanabilmesi için, sınavların geçerlilik, güvenilirlik, güvenlik ve esneklik ilkelerine uygun olarak tasarlanması gerekmektedir. Bu çalışma, bu tür sınavları uygulamayı düşünen kurumlar ve akademisyenler için önemli bir rehber niteliği taşımaktadır.