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Bibliometric Analysis of Applications Articles on Online Assessment Process

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The study aims to reveal the existing situation, deficiencies, and results of the applications in the online assessment process and to provide suggestions to researchers and practitioners. For this purpose, studies on the applications carried out in the online assessment process were examined and analyzed, and suggestions were made based on the results. The systematic literature review method was used in the study. The results were analyzed by reviewing the research in the literature with the research topic. The studies were collected by examining the full texts of the research included in the analysis, the applications used in the assessment process, and their results. The purpose of the study, the assessment process, and the results of the applications made in this process were examined in detail. These studies were then classified according to focus topics using NVivo 12 software. Additionally, the research findings were presented using descriptive analysis. As a result, studies on online assessmentgenerally focus on the obstacles and experiences encountered in the assessment process. The technical infrastructure problems, accessibility, and technology literacy issues encountered in these studies are imherent elements of online learning environments and must be addressed. By overcoming these issues completely, an in-depth examination of exam security and exam quality can be condycted. Furthermore,the negativities experienced in the assessment processes in applied fields are another area that needs investigation and is open to research .

Keywords: Online assessment applications, online assessment, barriers in the online assessment.

INTRODUCTION

One of the critical issues in learning environments is assessment, which also holds true for online learning environments (Garg & Goel, 2022; Margiene & Ramanauskaite, 2022). The assessment process in face-to-face learning environments has been completely transferred to the digital environment during the COVID-19 period (Garg & Goel, 2022; Montenegro-Rueda et al., 2021), and the existence of problems related to the assessment process carried out in online environments has been observed with the experience of the assessment process in online environments. Online environments offer numerous potentials, alternatives, and advantages for assessment processes. Online assessments provide several advantages such as a faster feedback and grading process, time-saving benefits, environmental friendliness, and ease of access. The examination system is clear and straightforward, allowing students to take exams from any location and at any convenient time (Alsalhi et al., 2022). Assessment processes, implemented to effectively and efficiently measure predetermined learning objectives, hold substantial importance within the online learning environment (Aziz et al., 2022). They play a pivotal role in structuring and integrating the entire teaching and learning process (Montenegro-Rueda et al., 2021; Aziz et al. et al., 2022). Nevertheless, the assessment process, which is crucial in online education, faces challenges in achieving effective implementation (Gürbüz & Ocak, 2022) and unresolved issues persist in online evaluation processes (Yang & Xin, 2022). These encountered problems (St-Onge et al., 2022; Margiene et al., 2022) may have a detrimental impact on perception of online assessments. Online assessment processes are influenced by various factors, including concerns related to plagiarism and the digital literacy levels of both instructors and students (Kılıçkaya, 2023; Lu et al., 2023).

In the literature, the preeminent challenges experienced in the assessment processes are stated as follows: the inadequacy of exam infrastructure at times when the exam is intensive, the complexities of using the exam systems used, the technology literacy level of the instructors is uneven and they do not have a good command of the institutional infrastructure, the instructors are not aware of or cannot use the different potentials of the online environment such as alternative assessment and evaluation tools (Ocak & Karakuş). In addition, Fynn and Mashile (2022) concluded that students' access to devices and the internet is not equitable. Institutional policy is another important dimension. Ayyoub and Jabali (2021) also asserted that

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institutions should consider students' perspectives and expectations regarding online assessment to facilitate its adoption. Duszenko et al. (2022), in his study on assessment within the scope of applied courses, found that students encountered difficulties due to the inability to ask immediate questions and a lack of sufficienttechnical expertise. Cahapay (2021) examined the experiences of university students concerning the online assessment process during the pandemic period, and revealing six problem themes in the study: Browser incompatibility in online exams, anxiety regarding monitoring tools during online exams, unstable internet connection, power outage, distractions in the environment, unknown accessibility problems. On the other hand, educators have a great responsibility in the online assessment process. Assessment in online learning environments entails various dimensions than in face-to-face situations due to the asynchronous nature of the interaction between participants. Therefore, it indicates that educators should question their pedagogical knowledge in order to ensure meaningful student learning and assessment (Vonderwell, 2007). Online assessment can be challenging for both instructors and students due to technical, academic and ethical issues (Lee et al., 2022). Lee et al. (2022) also stated that students had the greatest number oftechnical problems in the assessment process. They also mentioned the importance of receiving detailed and timely feedback about their own performance.

Since assessment processes directly affect learning processes, it is important to verify whether assessments are conducted in an online environment (Maas et al. 2022). Assessment processes should be handled holistically and risks and assumptions should be considered online assessment processes (Schmidt & DeSchryver, 2022). There are many studies on online assessment processes in the literature, but since the online assessment process is comprehensive and has many factors that are affected by it. Thus, it will be valuable for practitioners to reveal the existing situation by examining the assessment process carried out in the online learning environment and to take precautions for this. For this purpose, the research on the applications carried out in the online assessment process was analyzed and suggestions were made according to the results. In this context, answers to the following questions were sought:

In the studies conducted for assessment in the online environment,

1. What is the distribution of the years of the publications?
2. What are the focus areas and what are the results of the assessment process and processes followed?

METHOD

In this study, the research on the applications conducted in the online assessment process is examined to determine the existing situation and to determine how the assessment processes are carried out in the online environment. For this purpose, the systematic literature review method was used in the study. In this context, the results obtained by reviewing the related research topic and the studies in the literature were analyzed.

Study Group

The studies were searched in the Web of Science database without any category limitation, with the words "distance education, e-learning, online learning, measurement, assessment, higher education, evaluation" in the fields of study title, abstract, and keywords for the last five years. As a result of the search carried out in this context, 63 publications were retrieved. Studies without open access were excluded from this study and 50 articles were accessed. The abstracts of the studies were examined and the full text of 37 articles was reviewed by eliminating 13 articles whose focus was not on assessment studies in distance education. By examining the full text of 37 articles, 6 articles that did not focus on online assessment or literature review were excluded. As a result of the detailed analysis of 31 articles and the examination of the assessment applications made in the online assessment process, which is the aim of the study, an additional 6 more articles that did not contain applications were eliminated. Thus, 26 studies were analyzed within the extent of the study, with the addition of 1 article found in the search made according to the same criteria to check whether new studies were carried out. The process is summarized in Figure 1.

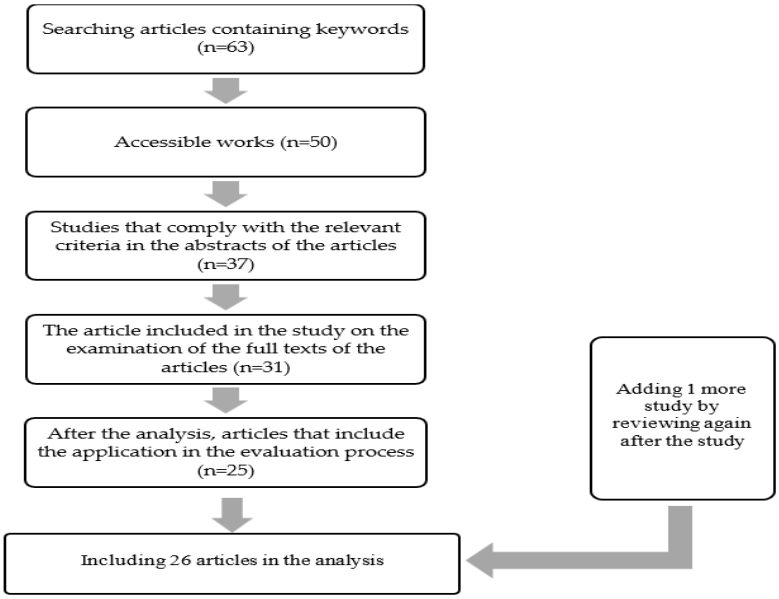

Figure 1. The process of reviewing the studies

Data Collection and Data Analysis

The studies were consolidated by examining the full texts of the article research included in the analysis, the applications used in the assessment process, and their results. The purpose of the research, the assessment process, and the results of the applications made in this process were examined in detail. These studies were then classified according to thematic topics using NVivo 12 software. The classification made was evaluated by another expert another expert who was not involved in the research . Additionally, the research findings were analyzed using descriptive analysis.

FINDINGS

The frequency of publication years of the articles is illustrated in Figure 2. According to the analysis, most studies were published in 2022 (n=10) and 2021 (n=9).

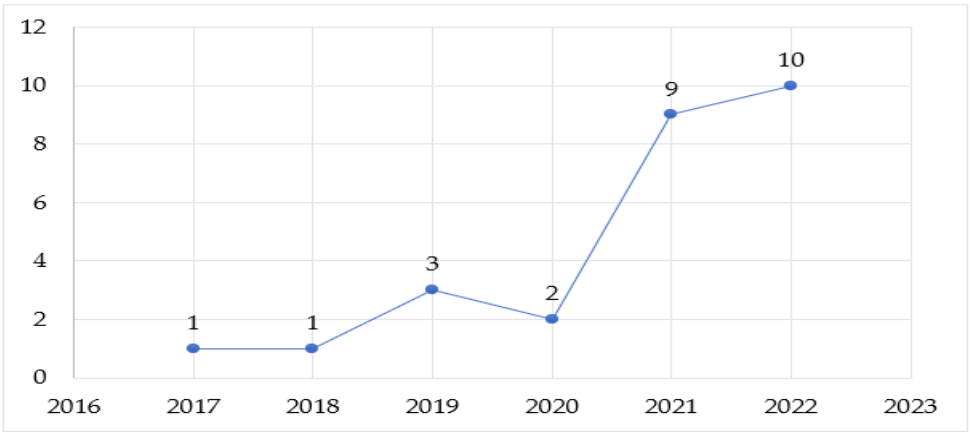

Figure 2. Distribution of articles by year of publication

The studies underwent examination based on their respective focus topics, and the predominant number of studies (n=8) revolved around investigating the obstacles associated with online assessment. . Subsequently, there were studies that focused on exploring feedback in the online assessment process (n=5). Additionally, further research was conducted on topics such as cooperative learning (n=4), formative assessment (n=3), exam security (n=2), exam quality (n=2), and practical lessons (n=2).

Table 1. Topics focused on in online assessment research

Topics	f
Barriers (Difficulties/opinions in the process)	8
Feedback	5
Cooperative learning	4
Formative assessment	3
Exam security	2
Exam quality	2
Applied lessons	2
TOTAL	26

Barriers to Online Exams

In the studies focusing on the obstacles of online assessment, students' researchers sought to gather students' opinions about their experiences in the online assessment process and investigate the difficulties encountered. These studies were primarily conducted in 2022 (n=3) and 2021 (n=4). In the studies, experiences, and problems have been the subject of research due to the realization of the assessment processes in the online environment during the COVID-19 period. The current study primarily aimed to obtain students' opinions and experiences about the online assessment process, and another research objective was to assess the learning outcomes and examine related opinions. The majority of participants expressing negative opinions about the online assessment process cited technical problems and insufficient infrastructure as the main reasons, with even one student encounteringtechnical issues negatively affecting the assessment process. Additionally, suggestions were made regarding the significance of student participation, equal accessibility, well-designed assessment tasks, and the competencies of both instructors and learners in the assessment processes, and that measures were proposed to address these aspects effectively.

In their study, Figaredo et al. (2022) highlighted student views on online exams. The researchers investigated the effect of the difference in the assessment process on students' performance during the transition from the face-to-face exam process to the online exam system. The study examined the participation rates of the students in the assessment tests, their success rates, the number of students who successfully completed the course, and the average course grade during the online assessment process. In addition, a scale consisting of questions about previous experiences with online exams, the conditions in which they participated in the exams, their perception of the exam duration, their preferences for difficulty, anxiety, control/surveillance, and assessment methods, was created and applied to the students. As a result of the research, the academic performance indicators of the students increased, and the majority of the students were more inclined to online assessment methods.

In their study, Fynn and Mashile (2022) investigated student experiences regarding the implementation of online continuous assessment at the Open, Distance, and e-Learning (ODeL) institution. With the launch of online teaching in 2020 due to COVID-19, the activities previously used in face-to-face exams have been transformed into online assessments. The institution's assessment policy includes at least two formative assessments, usually in the form of two assignments, to supplement the summary assessment, which usually consists of one exam. All exam modules have been transferred to the Learning Management System (LMS). Assessment activities, including evaluator feedback, are presented in the LMS. Although the main assessment types include assignments and portfolios, other assessment types are such as tests, presentations, and peer assessments are also used in some modules. A questionnaire consisting of open-ended questions was applied to determine the demographic information of the students and the difficulties they encountered in online assessment. Many students are not ready for the workload required by continuous online assessments. Additionally, online assessment is not suitable for instructors working at home or having managerial duties, making the process disadvantageous. Furthermore, it has been discovered that students' access to devices and the Internet is not uniform, leading to unequal opportunities for online assessment experiences. As a result, students' transition to online assessment is negatively impacted.

Ziehfreund et al. (2022) aimed to examine the perceptions, concerns, and needs of medical students regarding e-assessment. Besides, creating a comprehensive e-exam and assessing the effectiveness of the system is another aim of the study. Before the exam, information about the exam was sent via e-mail to inform the students. During the e-exam, test takers were able to ask for help via chat. Pre-test and assessment tests

were applied to the students before the exam. As a result, most of the participants reported positive opinions about the e-exam. Positive opinions were expressed about the fairness of the platform, its independence from the internet connection, and the consideration of organizational and participant needs,including e-exam preparation. The research has provided conclusive evidence that student engagement in e-exam implementation plays a valuable and supportive role. Additionally, e-exam education, equal accessibility, offline usability, and multi-faceted justice are the factors that should be considered while creating an e-exam format in medical programs.

In their study, Ayyoub and Jabali (2021) sought to investigate the perspectives of their students regarding online assessments by conducting interviews and utilizinga scale for analysis. The students' opinions on assessment processes varied depending on their gender and the academic field they were studying. Notably, medical students and those in other applied fields held a negative view of online assessment. The study emphasized the importance of university administrations considering students' viewpoints and expectations regarding online assessment. Additionally, the study highlighted the need for careful planning, adequate infrastructure, consideration of students' circumstances, and the inclusion of suitable and well-designed assessment tasks to encourage students acceptance of online assessment.

Ilduganova et al. (2021) conducted a study to explore the experiences of university students with online assessments during the pandemic. They employed focus group interviews and a questionnaire to gather data for their research. Several significant issues emerged from the study, including students' self-learning abilities, the assessment tools used by teachers to evaluate knowledge, the importance of timely feedback from teachers, teachers' essential competencies and personal qualities, technical considerations, health-related challenges, and other factors. The selection of appropriate assessment techniques and tools was identified as a crucial aspect of planning e-learning processes. According to the findings, students identified online video calls and traditional self-assessment tests as the most effective assessment techniques. Additionally, they highlighted that project assignments were another reliable means of testing knowledge.

Sánchez-Cabrero (2021) compared the performance of students in the assessment that took place in the classroom environment and the assessment that took place in the online environment. In the research, a questionnaire was applied to the students who participated in the assessment process in a face-to-face environment and the e-assessment process as the experimental group in the groups participating in the e-assessment process to examine the relationship between the stress, difficulty, and satisfaction perception of students about online assessment. Despite online assessments being equally valid and reliable as face-to-face assessments, students achieved 10% higher grades in the online environment compared to the face-to-face assessment, and they expressed confidence in the online assessments.

Şenel and Şenel (2021) explored the common assessment approaches used during the pandemic process and sought to determine how students perceive the quality of assessment and examined the practices implemented. The opinions of the students were collected and analyzed with a comprehensive questionnaire, which aimed to determine the remote tools universities used for assessment, how these tools were utilized, and gathered the opinions of the students regarding the assessment practices . As a result, the observation that even a student experiencing a technical problem may indicate a significant issue that could adversely affectthe validity of the scores. Another significant demand raised by students is related to interaction and feedback. Since distance education does not offer a classroom environment, student-student and student-instructor interaction acquires more importance in the online environment. It is widely held that most assessment scores are overinflated . Participants also expressed negative opinions on "content of tests/homework" and "time constraints". The results indicated that assignments were the most commonly used tools and students were generally satisfied with the quality of their assessment experiences.

Hoffman (2019) investigated the effect of peer assessment on the reflective writing performance of students in an online course. The students were randomly assigned to the experimental or control group (without peer assessment) based on their departments. The course content included learning principles with an emphasis on behavior, cognition, learning, motivation, and data-based assessment. Both groups were presented with a second online module to learn how to evaluate online reading material and reflective writing examples. Furthermore, online compulsory discussions on written teaching material and assessment training were provided for both groups. All participants completed the training within the same period. Finally, upon completion of the assessment modules, all students completed a multiple-choice end-of-unit assessment. As a result, students were more receptive to peer assessment rather than expert assessment, but students expressed

reservations at the beginning of the peer assessment process. Moreover, peer assessment had a positive effect on students' writing performance.

Feedback

In studies that focus on feedback in online assessment, the impact of feedback on student performance has been investigated. These studies were carried out in different years. The importance of feedback in the assessment process was emphasized in the studies. However, in these studies, it was observed that a comprehensive examination of the type and content of the feedback was not carried out.

Maas et al. (2022) developed tools that serve diagnostic assessment to determine the learning outcomes of students with Diagnostic Classification Models (TSM). To support effective learning choices, information was given on how learning boards are used. Afterward, interviews were made with the students and they were asked to evaluate the lesson. In conclusion, cognitive diagnostic assessment can be a valuable tool to obtain timely, diagnostic feedback on cognitive attributes to support student learning in e-learning environments. The value of feedback varies according to how it is interpreted by the receiver and thus influences learning choices.

Mudau (2021) focused on the students' views on the functionality of the e-portfolio as an alternative assessment in the e-learning process. The study was carried out with students who participated in the content related to the e-portfolio. Semi-structured interviews were conducted to explore student experiences regarding the use of e-portfolio. In the case of receiving feedback, student work improved and cooperation between students was enhanced. The findings of the study revealed that the e-portfolio is useful for assessment as it facilitates students to adopt their learning and that the e-portfolio fosters student-centeredness because it provides authentic assessment applicationsand offers constructivist assessments that students are involved in throughout their learning.

González-Gómez and Jeong (2020) investigated the effect of online formative assessment applied for four years on students' motivation toward the Science lesson, their attitudes toward the lesson, and their academic achievement. The online formative assessment tool (OFAT) was implemented for four consecutive academic years between 2014 and 2018. First, students are enrolled in the PlayPosit app and assigned to a specific course offered. Each lesson's achievements are presented in the form of short videos (5-10 minutes) that students had to watch and complete different tasks embedded in the videos. After completing each specific task, students received immediate feedback from the instructors as soon as they completed the assignment. Students were able to comment on this feedback. Instructors tracked students' progress on the dashboard. The dashboard offered three alternatives: an overview (1), an option to track progress (2), and a summary of students' overall results for each lesson (3). According to the system records, formative assessment had positive effects on student engagement, motivation, and academic achievement. In addition, the research reveals that increased use of OFAT by students and faculty members is more effective and functional.

Emmon (2019) explored the effects of feedback provided to students during online assessment on their learning. Students were provided with feedback throughout the online certification process. The importance of student presentations and feedback on the process was emphasized.

Thomas et al. (2018) explored the effect of quizzes on students' performance in their studies. Apart from the quizzes held during the process, the students participated in the exam consisting of 72 multiple-choice questions, including 36 theoretical and 36 practical questions. Students also completed weekly chapter exams with randomly selected questions based solely on the textbook content. Quizzes enhance retention in an online learning environment, exams with feedback contribute to skill development, and taking exams with practice questions improves students' academic performance.

Cooperative Learning

Several studies have focused on cooperative learning within the context of online assessment, examining factors such as individual participation, peer participation, peer feedback, and the effectiveness of cooperative learning environments.

In particular, Allaymoun and Shorman (2022) presented a framework that specifically examined individual participation and emphasized the significance of Computer Assisted Cooperative Learning (CSCL) in online learning environments. They assessed the individual performance based on the feedback provided in a chat environment. Their findings revealed a notable correlation between instructor intervention, feedback, and e-learning systems, which positively impacted students' confidence in their performance. Additionally,

the study highlighted the importance of fostering cooperative environments that enhance student satisfaction with the learning process.

Azevedo et al. (2022) investigated MathE, which is based on cooperative methods, internet resources, resources specially designed by the project team, and communities of practice, and the impact of the platform developed to support mathematics learning in higher education and to encourage learners. In the context of research on online learning, an exploration of strengths, weaknesses, opportunities, and threats is undertaken. A specialized platform called MathE has been developed for engineering faculty students, with a particular focus on mathematics and related subjects. This platform was created through a collaboration among seven institutional partners from five European countries, and it consists of three main components: Student assessment, MathE library, and communities of practice. The student assessment component allows students to self-assess their knowledge, while teachers can create online tests on specific math topics. These tests comprise multiple-choice questions categorized into topics and difficulty levels (basic and advanced) that can be selected by students. The personal needs assessment and final assessment subsections enable students to acquire and evaluate their skills, respectively. The MathE library grants users access to a collection of videos and teaching materials covering various topics featured on the platform. Additionally, communities of practice serve as virtual meeting spaces where users can share their "teaching and learning experiences. Online learning has several strengths, including flexibility, accessibility, cultural pluralism, and the ability to foster learning communities. However, it also has weaknesses, such as reduced classroom control, user resistance, student isolation, time constraints, and limited physical access to a library. On the other hand, online learning presents opportunities such as engaging students, enhancing technical knowledge, skill development, and expanding educational reach. However, there are threats to consider, including internet penetration, financial investment, adoption of new technological habits, and technological limitations. Both instructors and students have expressed the need for additional questions to be added to the MathE platform. Regularly updating and rearranging the available questions, as well as making improvements based on user needs, is crucial, as is the case in any field of study.

Ma and Luo (2022) developed a model that explores the relationship between student participation and learning performance, with a specific focus on argumentative student participation. They analyzed the impact of peer assessment, a crucial component of student participation aimed at enhancing learning performance. The study examined the effects of behavioral, emotional, and cognitive participation, as well as peer assessment, on student performance. A campus sensing environment based on the Internet of Things has been created, resulting in the establishment of a comprehensive smart campus environment has been created that supports ubiquitous learning. In the study, an online questionnaire was used for data collection. The findings reveal that behavioral engagement and cognitive engagement can contribute significantly to learning performance. Peer assessment plays a significant role in learning participation and is effective in learning performance. Continuous monitoring of the cognitive level of the learners in the peer assessment process and the design of extrinsic or intrinsic motivation elements for peer assessment techniques are considered important.

Li et al. (2022) aimed to design and develop a VR-based training and assessment system for bridge inspection with an assistant drone (TASBID). Equipped with biometric sensors, the trainee operates the drone using a remote control in the simulated environment. After completing training, a comprehensive assessment is performed based on the data collected to provide both the information needed to design an individualized training plan and to give post-study feedback to the trainee. At the beginning of the application, an introductory presentation about TASBID is made to the participant. A brief tutorial on simulation training is provided as images and video clips with explanations. Finally, using the remote control provided to the participant, participants are granted access to the drone application. The application is utilized after the participant has sufficient experience. After the training, the participant completes the questionnaire, and the training ends. TASBID can objectively detail the training needs of individuals and can also help them develop the ability and confidence to collaborate with a drone in a simulation environment.

Studies on Formative Assessment

In studies focusing on formative assessment in online assessment, the role of feedback along with various assessment process and exam types, has been investigated. The factors examined in these studies were analyzed with student performances. The significance of feedback, which plays a crucial role in the formative assessment, was emphasized.

Tatira and Kariyana (2022) investigated the formative assessment process of students in mathematics lessons in an online learning environment. The instructor administered four tests to each group of students to facilitate learning through assessment. Before the main tests, a pre-test was designed and administered to familiarize students with e-assessment. Following the application, students' opinions on e-assessment were obtained through a questionnaire. The gathered opinions revealed that e-assessments written and manually graded by the instructor are considered the best assessment method for undergraduate-level mathematics courses. Formative assessment with immediate feedback gave students greater responsibility for their learning. In conclusion, students have positive perceptions of formative assessment during e-learning.

Kühbeck et al. (2019) sought to investigate the relationship between various online assessment methods and summative exam performance in Pharmacology education. Students were registered online. Following a four-week implementation period, students were granted access to the exam comprising 440 multiple-choice questions. Subsequently, a satisfaction survey was administered to the students. It has been found that formative feedback through online assessments has a significant impact on student's academic performance and knowledge levels.

Mbonigaba and Oumar (2017) conducted an investigation into the effectiveness of open-ended and multiple-choice questions for formative assessment in online applied courses. Based on Bloom's taxonomy, the scores attained from multiple choice questions and written questions in the "Introduction to Management" course were evaluated for each of the higher cognitive ability levels, specifically 'application', 'analysis', 'assessment', and 'synthesis'. The course is designed to equip students with the essential skills, and the assessment consists 20 multiple-choice questions and 4 written questions. In determining the exam, questions were selected according to each cognitive ability according to Bloom's taxonomy. Similarly, one written question corresponded to each cognitive ability level. At each cognitive ability level, four multiple-choice question sets were equated with a written question to measure the cognitive abilities of the students according to the same skill level. The study compared the impact of multiple choice and open-ended questions on each level of cognitive ability ('application', 'analysis', 'synthesis', and 'assessment') in a hands-on course. Multiple choice question scores were higher than the open-ended question scores at the 'application' and 'analysis' levels and were the same as the open-ended scores at the 'synthesis' and 'assessment' levels. Moreover, the multiple-choice question ranking of students' scores at the 'assessment' level was inconsistent with their ranking at lower cognitive ability levels. Therefore, it is recommended that multiple-choice questions have sufficiently high, if not the highest, cognitive ability levels to achieve scores similar to open-ended questions.

Exam Security

In studies focusing on exam security in online assessment, examinations on transparency and secure exam methods were carried out.

Alshahrani (2021) investigated the implementation of the blockchain system, which offers a unique encryption technique in an e-learning (EL) environment to ensure transparency in assessment processes. A large amount of e-learning material introduces complexity and data loss to e-learning assessments. The integration of blockchain technology into the e-learning platform has been ensured and the security of the e-learning system has been increased by using a different encryption algorithm by utilizing smart contracts. Evaluation of the behavior of the presented method shows that it will increase confidence in online education systems, assessment processes, educational activities, and credentials.

Meccawy et al. (2021) conducted a study to reveal the situation of online assessments conducted at universities in Saudi Arabia during the Covid-19 pandemic. An online questionnaire was employed to obtain students' opinions about the online assessments they experienced during the pandemic period. There is a need to increase student awareness and education regarding cheating and plagiarism problems and to provide informative training for cheating instructors to to address cheating.

Exam Quality

In studies focusing on exam quality in online assessment, researchers investigated participants' satisfaction with assessment processes. In particular, learning management systems should be used continuously and different assessment types should be used in the online environment to ensure the quality of the exam.

Bello and Abdullah (2021) conducted an investigation on the influence of quality factors on participants' satisfaction in e-assessment. The study, based on the successful model developed by Delone and McLean (2003), for e-assessment, (1) system quality, (2) information quality, (3) usage, (4) user satisfaction, (5)

individual effects and (6) organizational impact, including are discussed. The quality factors of computer-based assessment were examined according to the satisfaction of the students who participated in the e-exam. After the e-exam experiences of the students, their opinions were gathered through open-ended questions aimed at assessing their satisfaction based on their demographic information and quality factors. Some participants expressed negative views about online assessment due to fear or inexperience in assessment and lack of knowledge about e-assessment methods. Despite the increasing adoption of e-assessment in higher education and institutions, it is necessary to examine the attitudes and opinions of the test takers for the system to be applied successfully. In an e-assessment environment, several factors must be taken into account to assess system quality. These factors can be categorized into three dimensions: technical, educational, and economic.

Hamdan et al. (2021) analyzed the views of administrators on e-learning units and the quality of e-assessments. In the study, the quality of electronic assessments was examined to ensure the sustainability of students' quality e-learning.The researchers conducted both online and face-to-face interviews with the managers of the relevant units to gather their insights. The study emphasizes the necessity of incorporating both synchronous and asynchronous assessments in online environments. Instructors are to be attentive and put effort into ensuring the quality of assessments. Furthermore, utilizing various assessment types within the capabilities offered by the online environment has been recommended.

Applied Courses

The comparison of online and face-to-face assessment and assessment processes for applications were investigated in studies examining the assessment process in applied courses that differ from theoretical courses in online assessments. In these studies, it was emphasized that homework was used too much for practical lessons, and at the same time, students should learn at their own learning pace.

In the study of Duszenko et al. (2022), students' learning experiences with a newly designed digital training course in neurophysiology were explored with lessons combined either separately (unsupervised online lectures and e-labs) or concurrently (instructor-supervised online seminars). Demographic information of the students was obtained with a developed scale. The e-learning contents of the determined course were developed. The process was followed in a hybrid way with both simultaneous and part-time content. To prevent the students from getting lost in the process, adaptation training was given to the students. While the common theoretical parts were explained with virtual classes, the applied parts were explained in the e-lab environment. The content explained in the previous lesson was organized to be used in the next lesson. Daily lessons did not require prior knowledge, but prior knowledge of students was required for e-lab lessons. In the process, the sequential accumulation of knowledge and skills is important. The experiments were carried out in the physical environment, and the process was supported. For the evaluation of the students, the most common multiple-choice question type was used on the platform. In the processes consisting of the theoretical part, pre-lab, experiments, and virtual classes, the students were able to get the correct answers immediately after answering the questions. The solution to the pre-lab questions was required to participate in the experiment applications. Additional simulations to support the experiments are presented at http://www.virtual-physiology.com/ and the theoretical and practical parts completed by the students are discussed in the seminars at the end of the course. While online teaching may lack the direct personal communication between lecturers and students, it has been acknowledged that digital education courses hold significant value, particularly for practical lessons. The students adapt quickly to the online course even though they have no previous online course experience. The significance of online teaching lies in its ability to provide higher flexibility, time efficiency, student-centeredness, accommodation of individual learning styles, and the opportunity for students to work at their own pace, including engaging in e-laboratory activities. On the other hand, students stated that they had difficulties in not being able to ask instant questions and lack of sufficient technical expertise.

In their study, Özer and Üstün (2020) aimed to determine the basic dimensions of how assessment should be done in online music education. Students' views on assessments were obtained through interviews and analyzed. In line with the findings obtained from the interviews with the music department students, web-based music education, especially applied courses is not as efficient as face-to-face education, and there are connection and technical problems during the lessons. In addition, it was emphasized that assessments should not be based on homework.

CONCLUSION AND DISCUSSION

In this study, which was conducted to examine the purpose, process, and results of the assessment applications in the online assessment process, most studies were published after 2020 as a result of the analysis made according to the determined search criteria. The reason for this is highly likely to be the impact of COVID-19 on educational processes . The fact that all teaching processes were moved to the online environment during the COVID-19 period, and that assessment practices in the online environment were also experienced, may have laid the groundwork for the research of this subject.

The studies conducted mostly focus on obstacles in online assessment. Unsolved problems in online assessments are open to research. The unequal access of students to devices and the internet adversely affected their online assessment experience. Accordingly, the biggest obstacle in online assessment processes has been the problems related to technical infrastructure and accessibility. In general, students' views on online assessment processes have varied depending on their learning areas, and it can be observed that satisfaction with the process in practice-oriented areas is negative. In online assessment processes, students need to be ready to use online assessment tools to achieve continuous teaching (Lu et al., 2023). Additionally, students' self-learning skills, technology literacy, and interaction gain importance. Moreover, providing sufficient infrastructure, taking into account the conditions of the students, and system designs with a user interface are other important factors.

The role of feedback in the learning process has been extensively studied, as both student-to-student feedback and instructor-provided feedback have been found to support learning. Feedback, in the form of peer feedback, is used as a tool to foster collaboration, leading to increased student participation by creating a collaborative environment. Research on formative assessment has shown that feedback has a significant impact on enhancing student participation in the learning process, thereby improving their knowledge levels. On the other hand, Margiene et al. (2021) stated that continuous assessment has a key role in the success of online assessment processes.

However, single exams at the end of the academic year are risky and often cause anxiety for students (Fynn & Mashile, 2022). Bello and Abdullah (2021) also stated that various assessment methods should be used in the online environment. Project-based assessments or individual assessments are needed in online assessment processes (Schmidt & DeSchryver, 2022). However, the opinions of the participants are also important in these assessment methods. Kılıçkaya (2023) stated that the majority of the participants in his study should contribute to the selection of assessment types. On the other hand, Duszenko et al. (2022) stated that the quality of online environments where assessments are made should be examined. Apart from all these, it should not be ignored that assessment in an online environment requires different skills, such as online assessment literacy, compared to measurement tools prepared in a traditional environment (Schmidt & DeSchryver, 2022).

Creating different versions of the same exam, time-based tests, asking students for documents promising that they will not share their products (St-Onge et al., 2022), are among the various strategies used to reduce the risks of cheating, which threatens exam security as much as possible. These strategies aim to ensure students' confidence in the assessment process and positively affect its quality. Quality in the online environment should be guaranteed as much as possible (Margiene et al., 2022). On the other hand, the features and potentials of blockchain, such as smart contracts, can increase the level of transparency and ensure the security of online assessment (Lam & Dongol, 2022). In assessment processes supported by blockchain, it can make assessments based on predefined rules and targets, especially in question types where marking is done with code, through smart contract programs (Lam & Dongol, 2022).

A hybrid method was followed in the assessments of applied courses. Prior knowledge of the students was required for the applied courses. This preliminary knowledge can be checked with multiple-choice quizzes. In the studies, the results supported the notion that assessment processes are more efficient in the face-to-face environment, especially in the applied courses.

Designing a sustainable process in online assessment processes, taking into account the equality and accessibility of students, is one of the most important issues of online assessments. All these issues to be considered are directly related to learning processes by serving the quality of online assessments. Studies on online assessment generally focus on the obstacles and experiences encountered in the assessment process. The technical infrastructure problems, accessibility, and technology literacy issues encountered in these studies are the inherent elements of online learning environments that need to be resolved.

Suggestions

- Analyze technical problems experienced by students and instructors in the online assessment process, along with their causes. Conduct studies to implement effective measures.
- Enhance exam security by developing evaluation systems that integrate blockchain applications. This approach can increase students' and instructors' confidence in the assessment processes.
- Once technical problems are overcome, conduct an in-depth examinationof exam security and exam quality. Additionally, the negativities experienced in the assessment processes in applied areas is another problem encountered and is a subject open to research.
- Practical courses can be analyzed for assessment processes and suggestions for assessment processes can be developed.
- Focusing on quality in online assessment, the process can be handled holistically by conducting studies examining quality factors.

Limitations of the Study

There were several limitations in this study. The studies analyzed and reviewed are limited to being published in the web of science. The examinations made are limited to the results obtained in the analyzed studies.

Declarations

Conflict of Interest

No potential conflicts of interest were disclosed by the author(s) concerning the research, authorship, or publication of this article.

Ethics Approval

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