

Facilitators and Barriers of Employing Electronic Exams as Perceived by Nursing Students and The Relation to their Satisfaction

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ABSTRACT

Context: Nowadays, during the COVID-19 pandemic, electronic exams are perceived as a fast-evolving assessment tool because of their accuracy and reliability. It provides relatively more accurate results and immediate feedback for students and instructors.

Aim: To assess facilitators and barriers of employing electronic exams as perceived by nursing students and the relation to their satisfaction.

Methods: A descriptive correlational research design was used to achieve the aim of this study. The study was conducted at the Faculty of Nursing at Benha University on 970 nursing students from the four academic years (2020/2021). They were selected using a stratified random sampling technique. Data was collected using three tools. The student perception of electronic-exams facilitators questionnaire, the student perception of electronic-exams barriers questionnaire, and the nursing students' satisfaction assessment scale.

Results: More than half of nursing students (59.9%) had a high perception level about facilitators of electronic exams, whereas nearly two-thirds of nursing students (60.9%) had a moderate perception level about barriers to electronic exams, and 75.5% had a high satisfaction level regarding electronic exams.

Conclusion: This study concluded that more than three-quarters of students had high satisfaction. There was a positive, statistically significant correlation between total students' satisfaction with facilitators of the electronic exam and a statistically significant negative correlation with barriers to the electronic exam. The study recommends that students must receive regular, periodic in-service computer skills courses and study the factors that influence university students to embrace and use electronic exams with an online test system.

Keywords: Electronic exam, facilitators, barriers, nursing student, satisfaction

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1. Introduction

Computer use has become more widespread and crucial for institutions and students in the higher education sector. Additionally, the use of computers for assessment is expanding rapidly during the coronavirus disease (Covid-19) pandemic. Many colleges have deployed computerized exam proctoring systems to monitor and manage the rising number of student cheating cases. The proctoring systems appear to be an efficient way to judge how well students do in online learning. However, they are based on erroneous presumptions about educational fairness and authoritarian pedagogical methods (Lee & Fanguy, 2022).

The electronic exam is an integral part of the e-learning process. E-exams are defined as all forms of assessment and evaluation that are carried out using digital technologies. It is a method that entails giving tests online. E-exams are computer-based and internet-based tests in which students are given questions, their answers are directly corrected, feedback is given on their answers, scores are reported, and

necessary security measures are used to maintain confidentiality. Moreover, e-exams are timed and controlled. Summative evaluation exams are carried out using each candidate's device through a unified operating system (Amer, 2020; Knowly, 2020).

The tests and evaluations are not only an integral part of the learning process but also an element that completes and closes a circular activity, contributing as a feedback source for the users, instructors, and instructional designers. An electronic exam is one that students take on a computer using specialized exam software. These exams typically come in the form of multiple-choice questions. E-exam is an important step inside the learning process because it gives convenient feedback to all participants, helping to improve the learning and teaching experience (Bergmans et al., 2021).

Also, an electronic exam is useful for evaluating someone's knowledge base, academic status, and problem-solving abilities. Researchers use it as a research tool to gather data or by trainers and educators to evaluate students,

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enabling teachers to save effort. Higher education institutions worldwide use e-exam more frequently since it produces comparatively more accurate results and provides more comprehensive student evaluation (Khan *et al.*, 2021). The e-exams comprising multiple-choice questions (MCQs), true/false, or related questions are conducive to obtaining the essential information about learning in any assigned course. It also allows for essay questions and reliable assessment practices, which are helpful for a more extensive assessment of the student's performance (Eltahir *et al.*, 2022).

E-exams reduce the time needed to mark exams and widen the variety of methods available for assessment compared to traditional pen and paper exams. Students also feel that e-exams improve their learning. E-exams benefit students and the learning processes because the text, photos, video, and interactive virtual worlds could be included. Other benefits of using electronic tests include its simplicity, the possibility to enhance assessment quality, quicker and more accurate scoring, quick data analysis, and quick feedback for students and teachers (Zahedi *et al.*, 2021).

Elsalem *et al.* (2021) stated that digital environments must be used in the future. Wider usage of digital environments pushes the change to digital transformation due to new skills and capabilities needed. However, there is a challenge because most teachers do not have the competencies to use new technological innovations. Plenty of guidelines are available on how to use new technology in education. However, a lack of teachers' time and financial resources decrease the possibility of widening the usage of e-exam (Khan *et al.*, 2021).

When deciding how to proceed with e-exams, the time needed to create e-assessment questions was a barrier. Therefore, providing time and support for those doing such work is essential. Moreover, an e-exam is an important benefit for teachers, as it saves time. Due to this time saving, teachers could devote more effort to improving the contents of the exam questions. Students and university faculty must possess information technology knowledge and experience to successfully complete electronic tests. Adequate training for preparation and implementation processes takes a long time and measuring the higher skills of students is one of the difficulties faced in electronic assessment (Bashitialshaer *et al.*, 2021).

Student satisfaction is a crucial measure of how well students are doing in their classes, leading to different outcomes, also crucial in the assessment of remote learning. Therefore, educational institutions must view student satisfaction as a valuable asset, as students are likelier to talk about their experiences positively. Student satisfaction exists when the individual's subjective evaluation of their experiences and outcomes is favorable. Student satisfaction has been conceptualized in many ways and models from various fields, including marketing, service management, and quality management. Early researchers often considered student satisfaction in evaluating service quality (Qalawa *et al.*, 2021; Kornpitack & Sawmong, 2022).

2. Significance of the study

Electronic exams provided a great service to the education system during the spread of the Covid 19 pandemic. E-exams offer further advantages as well when compared to traditional printed paper tests. These e-exams save faculty members time and effort and make students safer. E-exams are also regarded as one of the most significant e-learning tools for evaluating success in developed nations. Modern, non-traditional evaluation techniques, including computerized, online, remote, and question banks, are now possible because of technology. As the result of the coronavirus disease (Covid-19) pandemic, e-exam has been increasingly used by higher education institutions worldwide. It is a flexible and convenient assessment method (Eltahir *et al.*, 2022). Although the widespread use of the e-exam, few researchers handle the facilitators and benefits of such a way of student evaluation, so the current study will shed light on the facilitator and barriers of electronic exams from the students' perspective and correlate with their satisfaction.

3. Aim of the study

To assess facilitators and barriers of employing electronic exams as perceived by nursing students and the relation to their satisfaction.

3.1. Research questions

- What are the levels of nursing students' perception of facilitators employing the electronic exam?
- What are the levels of nursing students' perception of barriers employing electronic exams?
- What are the levels of satisfaction among nursing students?
- Is there a relationship between facilitators of employing electronic exams and satisfaction among nursing students?
- Is there a relationship between barriers influencing electronic exam use and satisfaction among nursing students?

4. Subjects & Methods

4.1. Research Design

A descriptive correlational research design was used to achieve the aim of this study. It is a study in which the researcher is primarily interested in describing the relations between variables without attempting to establish a causal relationship (Kothari, 2004).

4.2. Study setting

The current study was conducted at the faculty of nursing at Benha University. There are six academic departments: The nursing administration department, psychiatric and mental health nursing department, community health nursing department, pediatric nursing department, obstetrics and gynecological nursing department, and medical-surgical nursing department. Electronic exams were held in the Electronic Test Center at Benha University, where the center consists of 12 computer

laboratories. Each laboratory contained 50 computers connected with internet access and surveillance cameras, and each student had a computer to take the test on. The students were divided into three periods for the center to accommodate the number of students. Two laboratories were allocated for students suspected of having infectious diseases. There were surveillance cameras in all laboratories and a control room connected to surveillance cameras for monitoring the student during the exam.

4.3. Subjects

The nursing students in the present study consisted of 970 students from the four academic grades in the academic year (2020/2021) selected using stratified random sampling. The sample size was taken from each academic year's stratum (according to the following sample size equation (Tejda & Punzalan, 2012).

$$n = \frac{N}{1 + N(e)^2}$$

Where

n: The required sample size

N: Total number of nursing students in each grade

e: Margin error (0.05)

Distribution of nursing students' group

The sample size was 970 students (265 were in the first year, 253 were in the second year, 234 were in the third year, and 218 were in the fourth year) out of 2435 students enrolled in the first to fourth years (753, 684, 540, 458) respectively.

Inclusion criteria

Students are currently enrolled in the 2020-2021 academic year and willing to participate in the study.

Exclusion criteria

Repeaters students where took exams in the faculty of nursing, Benha University.

4.4. Tools of data collection

Three tools were used to collect the necessary data.

4.4.1. Student Perception of Electronic-Exams Facilitators Questionnaire

The researcher developed this tool after reviewing related literature (Dermo (2009); Islam et al. (2015); Alruwais et al. (2018)). It was used to assess the perception of the student regarding facilitators of electronic exams. It consisted of two parts:

The first part included students' characteristics, such as gender and academic year.

The second part was concerned with the facilitators of the e-exam. It included 14-questions divided into three domains, namely: Technical facilitators (six items) such as availability of technology, technical support, and accessibility of necessary adaptive technology; academic facilitators (four items) such as teacher-student interaction, adequacy of time required to have the electronic exam, and accessibility of course notes; financial and organizational facilitators (four

items) such as positive comment about e-exam, adequacy of information and communication technology and e-learning infrastructure, and administrative support for teachers and students.

Scoring system

The statements' responses were measured using three points Likert scale ranging from 1= disagree, 2= uncertain, and 3= agree. The score of items was summed up, and the total was divided by the number of the items, giving the mean score. The total score represents the level of students' perception of the facilitator. It was low if the score was <50%, considered moderate if the score was 50-<75%, and high if it was ≥75% of the total score.

4.4.2. Student Perception of Electronic-Exams Barriers Questionnaire

The researcher developed this tool after reviewing related literature (Dermo (2009); Braun and Clarke, (2013)). It is used to assess the students' perception of barriers to electronic exams among nursing students. It included 19 barriers. Barriers were divided into four domains, namely: Personal barriers (seven items) such as difficulty and poor academic achievement under critical conditions during COVID-19, parents worrying about e-exam, and e-exam will not show the students' real level; pedagogical barriers (three items) such as the answers are very similar among students, teachers do not have sufficient experience to prepare and apply for the exam, and poor exam quality; technical barriers (three items) such as power cuts (lack of electricity), internet unavailability, and lack of physical space; financial and organizational barriers (six items) such as lack of resources and facilitating procedures, lack of administrative support, and students' lack experience with technology.

Scoring system

The statements' responses were measured using three points Likert scale ranging from 1= disagree, 2= uncertain, and 3= agree. The score of items was summed up, and the total was divided by the number of the items, giving the mean score. The total level of student response regarding barriers was classified as low if the score was <50%, moderate if the score was 50-<75%, and high if the score was ≥75% of the total score.

4.4.3. Nursing Students Satisfaction Assessment Scale

It was developed by Tawafak et al. (2019) and modified by the researchers after reviewing related literature through paraphrasing sentences to assess nursing students' satisfaction regarding electronic exams. It included 18 items, such as electronic exams are easier than paper exams, the college adequately provided training on electronic exams, and the exam hall is suitable for holding electronic exams.

Scoring system

The statements' responses were measured using three points Likert scale ranging from 1=Not satisfied, 2=satisfied to some extent, and 3= satisfied. The level of student satisfaction scores was low if the score was <50% and

considered moderate if the score was 50-<75%, and high if the score was $\geq 75\%$ of the total score.

4.5. Procedures

Tools validity and reliability: The three tools' contents were adapted and tested for their content validity by juries of five experts in nursing education, which included (three assistant professors in medical surgical departments and two assistant professors in nursing administration from Benha University). Based on their recommendations, the necessary modifications were made. Also, the reliability of the tools was conducted to determine the internal consistency and homogeneity of the tools used by Cronbach's Alpha test. The internal consistency of the student perception of electronic-exams facilitators questionnaire was $\alpha = 0.91$, the student perception of electronic-exams barriers questionnaire was $\alpha = 0.89$, and nursing students' satisfaction assessment scale was $\alpha = 0.86$.

Ethical considerations: Prior to the conduction of the study, ethical approval was obtained from the Scientific Research and Ethics Committee at the faculty of nursing, Benha University. All participants were interviewed to explain the purposes and procedures of the study, and they had the right to withdraw from the study at any time. Besides, the anonymity and confidentiality of the subjects were considered through the coding of all data. The students gave verbal consent to participate by filling out the questionnaire.

Official permission to conduct the study was obtained from the dean of the faculty of nursing at Benha University after explaining the aim of the study. A pilot study was conducted in June 2021 to ensure the study tools' clarity and applicability; additionally, it was used to determine the time needed for filling the three tools. It was done on 10% of the total subjects (97 nursing students). No modifications were done during the pilot study, so the pilot study was included in the main sample.

Field of work: The investigator prepared the questionnaire electronically via Google form design and took permission from heads of academic departments who explained the study's aim, nature, and method of filling the electronic questionnaires to the students in their departments. Then the links were sent to nursing students through WhatsApp groups via heads of different academic departments.

Students' questionnaire link: student perception of electronic-exams facilitators questionnaire (<https://forms.gle/VbzKkCKnzwownQVi6>). Student perception of electronic-exams barriers questionnaire. (<https://forms.gle/R45mapB7dXvtdfBW8>). Nursing students' satisfaction assessment scale (<https://forms.gle/7ae1mexDMckUQ9bNA>).

Students started to open the links and fill out the questionnaires. Data were collected daily, and the average number of responses per day ranged between 60-70 responses from nursing students and double-checked for accuracy to ensure that no data was missing. Data collection took about two weeks in July 2021.

Electronic exams were conducted on midterm exams (10 nursing courses) and final exams (43 courses) in the first and second semesters for the academic year 2020-2021.

4.6. Data analysis

The collected data were organized, tabulated, and statistically analyzed using the statistical package for social science (SPSS) version 25. Numerical data were expressed as mean and standard deviation (SD). Qualitative data were expressed as frequency and percentage. Correlation between different variables was tested using Pearson product-moment correlation coefficient. A p-value ≤ 0.05 was considered significant, and ≤ 0.001 was considered highly significant.

5. Results

Table 1 shows the personal characteristics of nursing students involving their gender and academic year, which pointed out that 86.0% were females, 27.3% were in the first grade, and 26.1% were in the second grade.

Table 2 reveals students' perceptions regarding facilitators of e-exams. The students perceived the technical facilitators as 54.2% agreed about technical support for students during the exam, 52.7% agreed about the availability of internet access, and 51.2% were uncertain about the technological background from secondary school. Regarding the academic facilitators, the highest percentages (54.3%) agreed that e-exam time was adequate and efficient interaction between students and teaching staff (53.8%).

Also, the highest percentages agreed about financial and organizational facilitators in administrative support for teachers and students (53.4%), (49.9%) were uncertain about adequacy (ICT) information and e-learning infrastructure, and 15.6% disagreed about positive comments about e-exam as facilitators. Moreover, the total technical facilitators had the highest mean percentage (80.0%).

Figure 1 illustrates students' level of perception regarding facilitators of electronic exams, where 59.9% perceive the facilitator of the e-exam as high.

Table 3 reveals students' perceptions of barriers to employing electronic exams. The personal barriers reveal that 46.9% of students disagreed about students prefer traditional exams to electronic exams. Regarding the pedagogical barriers, 31.4% agreed that teachers do not have sufficient experience to prepare and apply for the exams. The technical barriers reveal that 26.9% reported agreement about internet unavailable and poor internet quality. The financial barriers reveal that, 55.3% were uncertain about the lack of resources and facilitating procedures, while 48.1% disagreed about students' lack of experience with technology as a barrier. Moreover, it displayed that the total personal barriers were the highest mean percentage (63.0%).

Figure 2 illustrates students' level of perception regarding barriers to electronic exams, where 60.9% had a moderate level of barrier perception.

Table 4 reveals nursing students' satisfaction regarding electronic exams, where 76.6% of them were satisfied with the exams starting on time, 75.3% of them agreed that exams ended on time, and 74.7% were satisfied that the exam hall is suitable for executing electronic exams. Also, near three-fourths (71.4%) were satisfied with the instructions available for the test, such as time and grading, and 70.7% satisfied with the presence of a technical team to deal efficiently with technical malfunctions during electronic exams, 70.1% satisfied with the results appear faster than they were in the paper test. Also, 45.5% were satisfied to some extent that the college adequately provided training on electronic exams. In comparison, 41.9 % were not satisfied with their

preoccupation with dealing with the computer reduced students' concentration, and 33.4% were not satisfied with technical malfunctions in the software during the tests preventing them from starting on time.

Figure 3 illustrates nursing students' level of satisfaction regarding electronic exams, 75.5% of students had a high level of satisfaction.

Table 5 shows a positive, statistically significant correlation between total students' satisfaction with facilitators of the electronic exam with p-value= 0.013, while a statistically significant negative correlation with barriers of the electronic exam with p-value = 0.009.

Table (1): Frequency and percentage distribution of studied students' characteristics (n= 970).

Student personal characteristics	(No.)	%
Gender		
Male	136	14.0
Female	834	86.0
Academic year		
First academic grade	265	27.3
Second academic grade	253	26.1
Third academic grade	234	24.1
Fourth academic grade	218	22.5

Table (2): Frequency and percentage distribution of students' perception of electronic exam facilitators (n = 970).

Electronic exams facilitators	Agree		Uncertain		Disagree	
	No.	%	No.	%	No.	%
Technical facilitators						
Availability of technology/software required for conducting exam	503	51.9	383	39.5	84	8.7
Presence of technical support for students during exam	526	54.2	347	35.8	97	10.0
Accessibility of necessary adaptive technology such as hearing aids, speech generating, screen readers, braille, refresher braille display, and screen or display	476	49.1	397	40.9	97	10.0
Technological background from secondary school	399	41.1	497	51.2	74	7.6
Institutions provided training courses	479	49.4	356	36.7	135	13.9
Availability of internet access	511	52.7	345	35.6	114	11.8
Total						
			16.79±3.44, mean percentage (80.0%)			
Academic facilitators						
Efficient interaction between students and teaching staff	522	53.8	330	34.0	118	12.2
E-exam time was adequate	527	54.3	348	35.9	95	9.8
Accessibility of course notes/materials	437	45.1	392	40.0	141	14.5
Increase feedback between students and teaching staff during the term about how to apply e-exam	459	47.3	367	37.8	144	14.8
Total						
			9.49±2.17, mean percentage (79.1%)			
Financial and organizational facilitators						
Positive comments about e-exam	476	49.1	343	35.4	151	15.6
Adequacy (ICT) information and e-learning infrastructure	350	36.1	484	49.9	136	14.0
Enhanced resources and facilitating procedures	451	46.5	373	38.5	146	15.1
Administrative support for teachers and students	518	53.4	362	37.3	90	9.3
Total						
			11.62± 2.83, mean percentage (77.5%)			



Fig (1): Percentage distribution of students' total perception level of electronic exam facilitators (n = 970).

Table (3): Frequency and percentage distribution of students’ perception of electronic-exams barriers (n = 970).

Electronic exams barriers	Agree		Uncertain		Disagree	
	No.	%	No.	%	No.	%
Personal barriers						
Difficulty and poor academic achievement under the critical condition during COVID-19	210	21.6	459	47.3	301	31.0
Parents are worried about electronic exams may lead to student fear from e-exam	260	26.8	340	35.1	370	38.1
Electronic exams will not show the students' real level and will not distinguish students from each other	217	22.4	366	37.7	387	39.9
Lack of motivation among students	251	25.9	500	51.5	219	22.6
Lack of feedback from the lecturers	250	25.8	486	50.1	234	24.1
Electronic exams induce students’ anxiety	115	11.9	388	40.0	467	48.1
Students prefer traditional exams to electronic exam	199	20.5	316	32.6	455	46.9
Total	15.13± 3.78, mean percentage (63.0%)					
Pedagogical barriers						
The answer is similar among students	224	23.1	430	44.3	316	32.6
Teachers do not have sufficient experience to prepare and apply for the exam	305	31.4	411	42.4	254	26.2
Poor quality of exams (e.g.one question has two correct answers)	126	13.0	393	40.5	451	46.5
Total	5.62± 1.63, mean percentage (62.4%)					
Technical barriers						
Power cuts (Lack of electricity)	226	23.3	403	41.5	341	35.2
Internet unavailability and poor internet quality	261	26.9	345	35.6	364	37.5
Lack of physical space	170	17.5	371	38.2	429	44.2
Total	5.51± 1.91, mean percentage (61.2%)					
Financial and organizational barriers						
lack of resources and facilitating procedures	218	22.5	536	55.3	216	22.3
lack of administrative support for teachers and students	209	21.5	458	47.2	303	31.2
Students lack experience with technology	115	11.9	388	40.0	467	48.1
Lack of financial and technical capabilities of some students	199	20.5	316	32.6	455	46.9
There was no real observation or widespread cheating	224	23.1	430	44.3	316	32.6
Lack of communication between students and lecturers	305	31.4	411	42.4	254	26.2
Total	11.24± 3.02, mean percentage (62.4 %)					

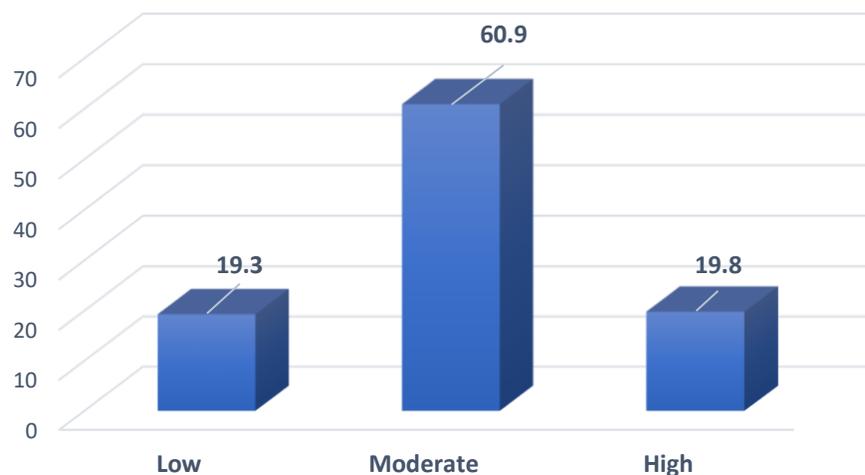


Figure (2): Percentage distribution of students’ total level of perception regarding barriers to electronic exams (n=970).

Table (4): Frequency and percentage distribution of students' satisfaction with electronic exams (n = 970).

Satisfaction with electronic exams	Satisfied		Satisfied to some extent		Not satisfied	
	No.	%	No.	%	No.	%
Electronic exams are easier than paper exams	575	59.3	348	35.9	47	4.8
The college adequately provided training on electronic exams	440	45.4	441	45.5	89	9.2
The exam hall is suitable for executing electronic exams	725	74.7	230	23.7	15	1.5
The time limit for executing electronic exams reduces the phenomenon of cheating among students	510	52.6	347	35.8	113	11.6
Instructions are available for the test, such as time and grading	693	71.4	246	25.4	31	3.2
Preoccupation with dealing with the computer reduced students' concentration	166	17.1	398	41.0	406	41.9
The presence of a technical team to deal efficiently with technical malfunctions during electronic exams	686	70.7	284	29.3	0	0.0
The electronic tests are clear and free from spelling errors	425	43.8	436	44.9	109	11.2
The electronic tests include questions that measure the ability to solve problems	543	56.0	378	39.0	49	5.1
The electronic tests qualify the student for the professional practice tests	469	48.4	426	43.9	75	7.7
Results appear faster than they were in paper tests	680	70.1	290	29.9	0	0.0
Electronic tests provide more self-confidence	524	54.0	402	41.4	44	4.5
Electronic tests allow the student to think critically and conclude	589	60.7	334	34.4	47	4.8
Exams started on time	743	76.6	212	21.9	15	1.5
Exams ended on time	730	75.3	193	19.9	47	4.8
The photos in the tests were clear, e.g., the anatomy of body parts	508	52.4	366	37.7	96	9.9
Some technical malfunctions in the program during the tests prevent the starting on time	218	22.5	428	44.1	324	33.4
It was not easy to deal with the examination software, which hindered starting on time	606	62.5	333	34.3	31	3.2

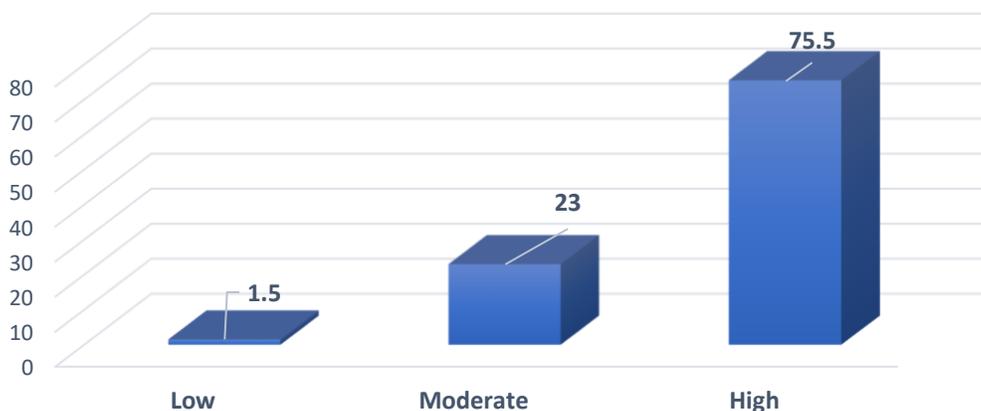


Figure (3): Percentage distribution of nursing students' satisfaction with electronic exams (n = 970).

Table (5): Correlation between nursing students' total perception of facilitators and barriers of the electronic exam with their satisfaction (n=970).

Variables	Total satisfaction with electronic exam	
	r	P value
Facilitators of electronic exam	.079	0.013
Barriers to electronic exam	-0.084	0.009

6. Discussion

The Higher Education Institutions (HEI) and the Academic Accreditation Authorities (AAA) seek to develop and manage education standards. It is to ensure the quality of education within a unified framework, and to be in line with the strategies of governments to ensure educational outcomes that are capable of innovation and development. The AAA used the quality education systems to evaluate the HEI based on a set of indicators. The exam questions' results

could be considered the most important indicators for evaluating the learning outcomes. Therefore, HEI has set self-standards regulations to prepare the exam questions to ensure the quality of the learning process (Khairil & Mokshein, 2018).

An electronic examination can be conducted in various forms, just as it is inserted into varying educational contexts. Earlier research in information and communication technologies (ICTs) has documented their adaptation and impact in higher education over the last decades and

speculated on future trends. However, remote teaching and learning do not have to be ICT-mediated, while on-campus education can use a variety of ICTs. Much of the literature concerns the intersection of these areas, and electronic assessment is therefore understood as an element of ICT-mediated remote teaching and learning (Sitthisak et al., 2018). So, this study aimed to assess facilitators and barriers to employing electronic exams as perceived by nursing students and the relation to their satisfaction.

The present study results point out that more than one-fourth of studied students were in the first grade, and more than one-fourth were in the second. They constitute more than half of faculty students' number. This finding might be due increased admission rate for the student from the high school and technical nursing institutes. Regarding gender, the current study results reveal that most of the studied sample were females. This finding could be because females commonly prefer nursing as a career in Egyptian society more than males. Also, nursing faculties have recently started to receive males. This finding is in line with Aljawarneh's (2020) study about "Exploring innovative, ubiquitous learning tools in higher education" and stated that more than three-quarters of the sample were females. This finding is also similar to Mahalakshmi and Radha's (2020) study about "A massive exposure towards web-based learning," which found that most study subjects were females.

Regarding the facilitators of the e-exam, firstly, regarding the technical facilitators, the present study reveals that more than half of the studied students agreed about the availability of technology/software required for conducting the exam, the presence of technical and administrative support for the student, and the availability of the internet access during an exam. These findings might be due to the well-equipped advanced examination center at Benha University. At the same time, more than half of the studied students were uncertain about their technological background from secondary school. This finding may be due to the faculty students from different secondary schools distributed in a wide geographical region, mostly rural areas. So, many students do not have sufficient experience to deal well with computers because school is usually not equipped well with computers.

Regarding the academic facilitators, more than half of the students agreed about the adequacy of time required to have electronic exams, and efficient interaction between students and teaching staff. This result may be explained by the fact that e-exam increase the interaction between the students and the lecturer by providing instant feedback and usually comes in the form of multiple-choice questions which does not require typing or writing, so they can manage their time well and did not need an extra time to finish the exam. The result is consistent with the result concluded by Al-Khayat (2017), who found that an e-exam increased interaction between the students and the lecturer and also enabled students to answer questions faster. E-exam improves the students' capability to manage time while taking the exam. Also, this result is consistent with what

Ajinaja (2017) suggested in a study titled "The design and implementation of a computer-based testing system using component-based software engineering," which found that the remaining time counter on the e-exam page enables students to manage their time effectively.

The financial and organizational facilitators in the present study reveal that half of students were uncertain about the adequacy of ICT and E-learning infrastructure and. This finding may be due to many students do not have sufficient experience in dealing with computers. Also, some lack sufficient technical knowledge and skills that hinder them from effectively using assessment tools; most importantly, some are unfamiliar with the online assessment process. This finding is also similar to that of Osuji Uchenna (2020), who reported that implementing e-assessment in higher education may be difficult due to students' lack of computer or online assessment experience. A training session is required for students to become accustomed to electronic assessments. Also, this result is similar to the findings of Al-Umari et al. (2016). They noticed that certain students in an Iraqi setting found it difficult to access computers or other such devices. Both university instructors and students struggle with a lack of training in information technology.

The study results show that the total technical facilitators had the highest mean percentage among the other two groups (academic facilitators and financial and organizational facilitators). This finding may be due to the e-exams were conducted in a well-equipped examination center that had recent technology/software required for conducting exams, the presence of or efficiency of technical support for students during exams, accessibility of necessary adaptive technology, and training courses provided by institutions for technicians, staff, and students. Also, adequacy and efficiency of administrative support as evidenced by more than half of the students agreed about the administrative support for teachers and students. Besides, the availability of internet access.

The study results display that about three-fifths of studied students perceived the facilitator of the e-exam as high. This result may be because the students are exposed to it over a long period, so they become well trained and understand and can use e-exam facilitators, besides developing a cumulative experience in dealing with the exam software. This finding agrees with Jamiludin et al. (2017). Their study about students' perception towards national examination: Computer-based test or paper-based test revealed that the majority of the nursing students had positive perceptions ranging from neutral to agree regarding the preference of computer-based test. This result is also similar to Mohamed's (2020) study about the effectiveness of using electronic exams in assessment in Saudi Universities, which reported that nursing students positively perceived e-exam facilitators.

The students' perception regarding barriers to electronic exams reveals personal barriers. The study reveals that nearly half of students disagree with preferring traditional exams to electronic exams. This finding may be because of

the advanced examination center, efforts conducted by the faculty administration and staff to make this experience successful, and the fast exam results. This result is congruent with *Da'asin (2016)*, whose study about "Attitude of Ash-Shobak University college students to e-exam for an intermediate university degree in Jordan" revealed that the majority of students prefer e-exam rather than traditional exams, and the students had positive attitudes towards the e-exam for intermediate university.

Regarding pedagogical barriers, the study reveals that more than one-quarter of them agreed that teachers had no experience preparing and applying for the exams. This result may be because the teachers still need more and more training to be perfect in preparing and applying electronic exams, creating question banks, and applying all design elements. Besides, the presence of some technical barriers related to poor internet quality as reported by more than one quarter of students. This finding is similar to the findings of *Al-Umari et al. (2016)*.

Regarding financial and organizational barriers, the study reveals that more than half of them were uncertain about the lack of resources and facilitating the procedure. Nearly half disagreed about the lack of student experience with the technology. This finding may be due to the budget burden for ICT application in each institution and maintenance of equipment, and the student exposure to the current era of rapid technological advancement. This finding is similar to that of *Bashitialshaaer et al. (2021)*. Their study "Obstacles to applying electronic exams amidst the COVID-19 Pandemic: An exploratory study in the Palestinian Universities in Gaza found that financial and administrative challenges accounted for three of the 13 organizational obstacles. Faculty and students both brought up two of these: The fact that some students lack the resources and technical skills to succeed.

The study reveals that the total personal barriers had the highest mean percentage rather than pedagogical, financial, and organizational barriers, as well as technical barriers. The result may be because the students are the focus of the research and the main beneficiaries. They still suffer from the consequences of the pandemic, worried about the new electronic exam system. This finding is similar to *Garas and Hassan's (2018)* study about "Student performance on computer-based tests versus paper-based tests in introductory financial accounting," which revealed that personal barriers had the highest mean percentage among the other barriers to e-exam.

Regarding the studied students' satisfaction regarding the e-exam, the study reveals that around three-quarters of them were satisfied with the exam start and ended on time; the exam hall is suitable for holding electronic exams, and instructions are available for the test, such as time and grading, presence of a technical team to deal efficiently with technical malfunctions during electronic exams, results appear faster than they were in paper tests. Also, near half of the studied students were satisfied to some extent about training on electronic exams was adequately provided by the college. These findings might be referred to the specialized

examination center, suitable software examination program presence, and adequate training provided by faculty.

Similarly, this result agreed with *Mohamed's (2020)* study about the effectiveness of using electronic exams in assessment in Saudi Universities, which reported that e-exam enables instructors to track the progress achieved by students and enables students to answer questions faster. Also, this results in the same line as *Alruwais et al. (2018)*, whose study is about the advantages and challenges of using e-assessment. They found that e-exam save time and effort for both teachers and students.

The present study reveals that more than two-fifths were not satisfied with the preoccupation with dealing with the computer reduced students' concentration in exams. This finding disagreed with *Al-Khayat (2017)*, who found that an e-exam increases students' concentration. It may be attributed to using text effects, colors, sounds, and multimedia in the e-exam.

The study results show that about three-quarters of students were highly satisfied with electronic-exams employing. This finding may be due to the major benefits of e-exam such easiness of e-exam than a paper exam, adequacy of time, clear and free from spelling errors, exam hall is suitable for holding electronic exams, start on time and end on time, instructions are available for the test such as time and grading, results appear faster than in paper tests. This finding is congruent with that of *Donovan et al. (2019)* in their study entitled "Online vs. traditional course evaluation formats," who stated that the students' opinion about e-exam; more than four-fifth of students preferred e-exam.

Also, this result coincides with *Llamas-Nistal et al. (2020)* study that found that 43 students out of 52 choose online evaluation rather than traditional evaluation. Moreover, a survey at Jorden University (JU) and Zayed University (ZU) conducted that 59% from JU and 50% from ZU preferred online exams. In comparison, 21% of JU and 43% of ZU liked traditional exams (*Tubaishat & Bhatti, 2016*). Similarly, *Sorensen (2013)* reported that students believe that e-assessment enhances higher education learning. In a survey done at the University of New South Wales, most students reported using electronic assessments aided their learning.

The present study results show a statistically significant positive correlation between total students' satisfaction and facilitators of the electronic exam while a statistically significant negative correlation with barriers of the electronic exam. This finding may be because more than half of students perceive the facilitator of the e-exam as high. At the same time, only one-fifth of them had a high level of barrier perception, reflecting an increasing level of satisfaction. This result agrees with *Whitelock et al. (2016)*, who reported a positive and significant correlation between total students' satisfaction with facilitators of e-assessment.

7. Conclusion

The study concluded a high level of facilitator perception among nearly two-thirds of students and a high

level of barrier perception among only two-fifth. More than three-fourths of students were satisfied by the e-exam. A positive, statistically significant correlation between total students' satisfaction with facilitators of the electronic exam and a statistically significant negative correlation with barriers to electronic exam.

8. Recommendations

The following recommendations are suggested in light of the research's findings. Further studies are needed to study the factors influencing university students to optimize the e-assessment process to maximize the institution's benefits from the current resources and improve the educational quality. Increasing the resources needed to conduct the e-exams should be provided by the higher education institutions, including the updated software, the training of teachers and students, and efficient technical support. Barriers to conducting the e-exam should be minimized to facilitate the continued use of this e-learning technology.

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