Students' Satisfaction with Electronic Versus Traditional Paper-Based Examinations, AlNeelain University, Sudan

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Abstract

Background:

The rapid integration of technology in higher education has led to increased use of electronic examinations as an assessment tool. This study aimed to compare students' satisfaction with electronic and traditional paper-based examinations at AlNeelain University and to identify factors influencing their preferences.

Methods:

A descriptive cross-sectional study was conducted among 378 students from six faculties at AlNeelain University: Nursing, Physiotherapy, Insurance, Law, Engineering, and Statistics. Data were collected using a researcher-developed questionnaire and analyzed using the Statistical Package for the Social Sciences (SPSS) version 16. Results were presented in tables and figures.

Results:

The majority of participants (97.3%) were aged 22–25 years. Electronic examinations were reported as more stressful by 59.3% of students, while 60% perceived paper-based examinations as more difficult. High satisfaction with electronic examinations as a true reflection of academic performance was reported by 44% of students, whereas 43.1% were satisfied with the time allocated for electronic examinations. Additionally, 59.1% felt that examination formats were not well aligned with their academic specialties, and 48.9% expressed dissatisfaction with the influence of socioeconomic factors on electronic examination experiences. No significant association was found between academic specialty and examination preference (paper pen or electronic) ($p = 0.800$).

Conclusion:

Students showed mixed satisfaction with electronic and paper-based examinations. Enhancing electronic examination systems through appropriate support and training may improve students' confidence and overall satisfaction.

Keywords: Students' satisfaction, electronic examination, paper-based examination.

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Introduction:

An examination (Exam) can be defined as a structured process that is taken to show knowledge and professional competence in a particular subject or to obtain a qualification.(1) The Exam process is considered to be one of the most important means of performance measurement and assessment, and it is an essential part of the educational process to clarify the extent to which educational goals are achieved. In general, assessments vary considerably in their reliability and level of detail, and no single assessment can provide educators with all the information they need to know. (2)

Online learning is gaining popularity in formal educational settings and for personal development. One specific form of information and communication technology for assessment is an electronic Exam or computer-based testing. (2)

An electronic Exam is performed on a computer where questions and answers are presented on screen rather than sheets of paper. (3)

Computer-based testing results are generated more quickly than those from paper-based tests, and they can make admission decisions more quickly. Individuals can take computer-based testing even with minimal or no previous computer experience.(2)

Online Exams are being recognized as one of the more efficient assessment methods. They are effective in both blended and traditional forms of learning, and when used appropriately, bring benefits to both learners and the learning process. (4) There has been a growing interest in improving and utilizing computer-based testing educational systems instead of traditional paper-and-pen Exams. (4) While traditional Exams, using paper and pen, result in a heavy burden on learners and instructors, online Exams provide solutions for such issues. (5) Instructors can save time in grading and mark compilation, resulting in lower administrative costs, while students can receive immediate and detailed feedback, take their Exams at a time and in a place that works best for them, and access self-assessment opportunities. (1) However, online Exams present several challenges, including increased work in the preparation stage, the possibility of technical failures, security issues, and cheating. (1)

In this study, the researcher discussed two types of tests: paper-and-pen tests and electronic tests. The traditional Exam refers to a general group of assessment tools in which candidates read questions and respond in writing. This test can be used to assess subject or course-related knowledge, ability or skills qualifications. Because many candidates are assessed at the same time with a paper-and-pen test, such tests are an efficient method of assessment.(1)

Online education and online assessment were implemented before the COVID-19 pandemic. However, it was conducted in a limited number of lessons and had limited hours. With the COVID pandemic, online education started to be implemented in almost all courses and at all grade levels. Depending on the quarantine, online education is now carried out everywhere. This situation obliged universities to review their previous infrastructure and facilities and to make necessary changes.[6]

Despite the increasing adoption of electronic Exams in higher education institutions due to technological advancements and expanded educational demands, student satisfaction with these digital assessment methods remains uncertain. The transition from traditional paper-based Exams to electronic formats raises concerns about stress levels, perceived difficulty, and alignment with academic needs across various disciplines. Learners' perceptions of online Exams in developing countries have not been widely studied despite the potential of such research for contributing to more effective use of online Exams in these countries. [4]

The current study aims to address the level of student satisfaction with electronic Exams compared to traditional paper-based Exams.

Materials and Methods:

Study design and Study Area:

A descriptive cross-sectional study was conducted in AlNeelain University at six faculties. AlNeelain University is located in Khartoum State, Sudan, and was established following the Sudanization of Cairo University, Khartoum Branch, in 1993. The university includes different faculties in the areas of medical and health sciences, humanitarian studies, and technical sciences.

Sample Design:

The researchers divided the faculties, according to subject areas, into three groups. The first group was the medical and health sciences faculties, which consist of the faculties of Pharmacy, Medicine, Nursing, Physiotherapy, Dentistry, Optometry, Visual Sciences, and medical laboratory sciences. The second group was the humanitarian studies faculties, which consist of the faculties of Arts, Law, Commerce, Economy, Social Studies, Education, and Community Development. The third group was technical sciences, consisting of the Faculty of Petroleum and Mining, Agricultural Technology, Fisheries Science, Math and Statistics, Computer Science, Information Technology and Engineering, and Science and Technology.[18] Since each group was regarded as a cluster, the sample Faculties were selected from each group using the cluster sampling technique.

Within each of these clusters, the researchers purposely selected two faculties based on their use of the electronic Exams. The selected faculties included Nursing Sciences, Physiotherapy, Law, Insurance, Engineering, and Statistics. This approach allowed for a more structured and comprehensive selection of the targeted faculties.

The sample size for the students was calculated using the formula according to Glenn D.

$$n = N/[1+N(e)^2]$$

Where:
n =sample size.
N=total population=6883
e^2=Degree of precision (0.05)
$n=6883/(1+6883*0.05^2) = 378$

The sample size was divided proportionally according to the weight of students in each faculty, as shown in Table 1. The study enrolled students at level four who were exposed to the two types of Exams.

Table 1: Distribution of the Sample Size by Faculties n (378)

Faculty	Number of students	Proportion for each	Size
Nursing	95	95/892*378	40
Physiotherapy	58	58/892*378	25
Insurance	318	318/892*378	135
Law	200	200/892*378	85
Engineering	103	103/892*378	43
Statistics	118	118/892*378	50
Total	**892**		**378**

Data Collection Method and Tools:

Data was collected using a self-administered interview by a questionnaire designed by the researchers after a constructive review of the literature. The questionnaire consisted of two parts: **part one** about students' characteristics (age, faculty, gender, previous courses, socioeconomic status, computer use background), **part two** about satisfaction (environment, control, process of Exam, grading).

To ensure the validity and reliability of the study tool, face and content validity were ensured by an experienced associate professor in nursing, along with a medical education expert, through a pilot test that was conducted in a similar study population that met the criteria of the study. Feedback from the participants was collected to evaluate the tool's effectiveness in measuring the intended constructs. In addition, the reliability of the study tool was evaluated using Cronbach's alpha to determine the internal consistency of the items within the tool. Cronbach's alpha value was found to be 0.80.

Data Analysis:

Data were analyzed using the Statistical Package for the Social Sciences, version 16. Descriptive statistics were applied to summarize the data and calculate frequencies, while bivariate analysis was conducted to examine the significance of associations

between variables. A p-value of ≤ 0.05 was considered the threshold for statistical significance. Results were presented using frequency tables and cross-tabulations.

Ethical Consideration:

The study was approved by the Institutional Review Board of the Postgraduate Faculty at AlNeelain University (Registration NO: **NU-IRB-18-12-12-98)**. Permission was obtained from the deans of the participating faculties. Verbal consent was obtained from all study participants. All participants were ensured anonymity, confidentiality, and their privacy and dignity were protected. Participants had the right to refuse to answer any question.

Results:

The vast majority (97.36%) of respondents were between 20 and 25 years old, and there were more males (55%) than females. Table 2 shows the demographic characteristics of the students.

Table 2: Demographic characteristics of the students (n=378)

Variables		Frequency	Percentage
Age group	20 – 25 years	368	97.36%
	26- 30 years	6	1.59%
	Above 31	4	1.06%
Type of study	Medical studies	65	17.20%
	Human studies	220	58.20%
	Technical studies	93	24.60%
Gender	Male	208	55.03%
	Female	170	44.97%

Analysis of students' satisfaction with electronic Exams revealed generally positive perceptions in key areas, as shown in Table 3. Grading accuracy and fairness received the highest approval, with 84.7% of students expressing satisfaction. A majority were also highly satisfied with the Exam structure (53.2%) and learning opportunities (49.2%), though 20.9% felt electronic Exams lacked sufficient educational value. Time efficiency yielded mixed responses, with 24.6% expressing dissatisfaction, indicating some concern over Exam duration or pacing.

Table 3: level of satisfaction regarding electronic Exam. n=378

Response	Dissatisfied		Satisfied		highly satisfied		Total	
	No	%	No	%	No	%	No	%
1. Provide true grading.	58	15.3%	154	40.7%	166	44%	378	**100%**
2. Do not need more time comparing with traditional Exam.	93	24.6%	163	43.1%	122	32.3%	378	**%100**
3. Exam is well structured.	47	12.4%	130	34.4%	201	53.2%	378	**100%**
4. Provide opportunity to learn.	79	20.9%	113	29.9%	186	49.2%	378	**100%**
5. Suitable for all faculties and materials	258	68.2%	77	20.4%	43	11.4%	378	**100%**

The most notable area of dissatisfaction was the suitability of electronic Exams across different faculties and academic content, with 68.2% reporting discontent.

Table 4 highlights students' satisfaction levels with traditional Exams. A majority (57.7%) were dissatisfied with grading accuracy, raising concerns about fairness and transparency. While 51.3% found the allocated time sufficient, 39.1% were dissatisfied, suggesting time constraints for some students.

The Exam structure received moderate approval, with 54.8% satisfied but 37.3% dissatisfied, indicating areas for improvement. However, traditional Exams were viewed as relatively suitable across faculties and subjects, with 57.4% satisfaction, though 15.9% expressed dissatisfaction

Table 4: level of satisfaction regarding traditional Exam. n=378

Response	Dissatisfied		Satisfied		Highly satisfied		Total	
	No	%	No	%	No	%	No	%
1. Provide true grading.	218	57.7%	127	33.6%	33	8.7%	378	**100%**
2. The time is enough for finishing	148	39.1%	194	51.3%	36	9.6%	378	**100%**
3. Exam well structured.	141	37.3%	207	54.8%	30	7.9%	378	**100%**
4. Suitable for all faculties and materials	60	15.9%	217	57.4%	101	26.7%	378	**100%**

Table 5 presents students' satisfaction levels regarding the organization and environment of electronic and traditional Exams. Overall, electronic Exams received a more positive perception. A majority (48.9%) were satisfied with their structure, with 30.2% highly satisfied, while traditional Exams had a slightly higher satisfaction rate (53.7%) but lower high satisfaction (16.9%). The Exam environment was rated favorably for both formats, with electronic Exams receiving 51.8% satisfaction and 35.8% high satisfaction. In contrast, traditional Exams had slightly lower satisfaction (46.8%) but comparable high satisfaction (31%). A key distinction was in control and minimizing cheating, where 72.8% of students were highly satisfied with electronic Exams, whereas 70.6% were dissatisfied with traditional Exam security, indicating a major concern about cheating in traditional settings.

Overall, students expressed greater satisfaction with the organization, environment, and security of electronic Exams compared to traditional Exams, with notable concerns about minimizing cheating in traditional Exams.

There was a statistically significant difference in satisfaction between electronic and traditional Exams. Students reported higher satisfaction with electronic Exams compared to traditional paper-based Exams.

Table 5: Satisfaction level regarding the organization and environment of the Exam n=378

Response	Dissatisfied		Satisfied		highly satisfied		Total	
	No	%	No	%	No	%	No	%
1. The electronic Exam is well structured.	79	20.9%	185	48.9%	114	30.2%	378	**100%**
2. The traditional Exam is well structured	111	29.4%	203	53.7%	64	16.9%	378	**%100**
3. There was a good environment in the exam room for the electronic Exam.	47	12.4%	196	51.8%	135	35.8%	378	**%100**
4. There was a good environment in the room in the traditional Exam.	84	22.2%	177	46.8%	117	31%	378	**%100**
5. Good control and minimize the chance of cheating in the electronic Exam.	35	9.2%	68	18%	275	72.8%	378	**%100**
6. Good control and minimize the chance of cheating in a traditional Exam.	267	70.6%	85	22.5%	26	6.9%	378	**%100**

Table 6 illustrates the relationship between students' Exam preferences and their field of study. Medical students showed a lower preference for electronic Exams (14.3%) compared to human studies (36.8%) and technical studies (19.84%), though traditional Exams were even less favored across all groups. Human studies students exhibited the highest preference for electronic Exams, while technical students also leaned toward electronic assessments, with only 4.8% favoring traditional Exams. Overall, electronic Exams were the preferred choice across all fields, though traditional Exams retained some support in each academic discipline

Table 6: The association between students' preference of Exam types and their speciality, gender and age n=378

Type of study	Electronic Exam		Traditional Exam		Total		p-value
	No	%	No	%	No	%	
Medical studies	54	14.3%	11	2.91%	65	17.2%	**.8**
Human studies	139	36.8%	81	21.43%	220	58.2%	
Technical studies	75	19.84%	18	4.8%	93	24.6%	
Total	268	70.9%	110	29.1%	378	100%	
Male	130	34.4%	78	20.63%	208	55%	**0.001**
Female	138	36.51%	32	8.5%	170	45%	
Total	268	70.9%	110	29.1%	378	100%	
20 -25 Years	258	68.2%	110	29.10%	368	97.3%	
26 -30 Years	6	1.6%	0	0%	6	1.59%	**.05**
Above 31	4	1.06%	0	0%	4	1.06%	
Total	268	70.9%	110	29.1%	378	100%	

Discussion:

Online assessment research has shown varying focuses. Some studies emphasize online assessment [7.8.9], while others compare online and traditional assessment methods. [10] Additionally, some studies investigate security concerns in online Exams. [11]

A study conducted in Saudi Arabia comparing student performance in online and paper-based Exams concluded that Exam type and question format did not significantly affect performance. Instead, students' preparation and study habits were the major determinants of success. High-achieving students performed well in both Exam formats, while low-achieving students struggled regardless of the format. Students expressed a preference for certain features of online Exams, such as automatic results and immediate feedback, which could enhance learning when incorporated into practice Exams. The authors recommended expanding the study to include larger, more diverse samples across different faculties, majors, and genders to strengthen the generalizability of the findings. [7]

Numerous studies have been conducted on various aspects of online assessment and paper-based assessment methods. While some studies focused on the comparison of learners' academic performance in online or computer-based tests as opposed to paper-based tests. [8]

Others also examined students' attitudes and perceptions toward the same. For instance, Jaap et al. compared the mean scores of students who took an online test on one hand, to the mean scores of their counterparts who took the same test in a traditional paper-based mode on the other hand. Their findings indicated a non-significant difference between the mean scores of the two groups. Similarly, Yu and Iwashita reported that they found comparable scores between students who took a computer-based test and those who took a paper-based test. In contrast, Domínguez-Figaredo et al. reported an increase in academic performance of students when a university in Spain adopted online assessment for its 28 bachelor's degree programs during the COVID-19 pandemic. [8,9]

A study conducted in Egypt aimed to assess the opinions and satisfaction of critical care nursing students and staff regarding electronic Exams and their barriers found that more than half of the students demonstrated a high level of satisfaction with electronic Exams and reported generally positive perceptions and high satisfaction rates among both students and staff. [12]

Regarding stress levels, the study revealed that electronic Exams were perceived as more stressful than traditional Exams by 59% of respondents. This finding aligns with a similar study conducted in Rzeszow, where 63% of participants reported experiencing higher stress

levels during electronic Exams compared to traditional paper-and-pen assessments. [13] The increased stress associated with electronic Exams may be attributed to factors such as technical issues, time constraints, and unfamiliarity with the digital format.

Adanir, investigated and compared students' perceptions of online Exams at state universities in Turkey and Kyrgyzstan via a mixed study research design. Results of the quantitative analysis revealed that Turkish learners found online Exams less stressful and more reliable than the traditional mode of taking Exams while Kyrgyz learners perceived it otherwise [14]

Regarding the perceived difficulty level of Exams, the study found that 60% of respondents considered traditional Exams more challenging than electronic Exams. Similarly, a study conducted in Rzeszow, Pland, reported that only 18% of students found electronic Exams more difficult than traditional ones, while 41% believed both formats had a comparable level of difficulty. [15]. The preference for traditional Exams being more difficult could be attributed to factors such as the need for manual writing, time management challenges, and the absence of digital tools that might aid in answering questions more efficiently. [15]

The present study demonstrated that students expressed mixed satisfaction with electronic Exams. While a considerable proportion valued their accuracy, fairness, and structured organization, as shown by higher satisfaction mean scores compared to traditional Exams (M = 2.09 vs. 1.88, $p < 0.001$), concerns persisted regarding their adaptability across different faculties and subjects. Nearly half of the respondents appreciated the time efficiency and exposure to new technology, yet dissatisfaction remained notable regarding their suitability for diverse academic disciplines.

These findings align with prior research in Saudi Arabia, which concluded that Exam type (online or paper) did not significantly influence students' performance, but that students appreciated unique features of online Exams such as automatic feedback and instant grading. [16] Similarly, our results confirm that electronic Exams are generally perceived as more structured and fairer, but challenges remain in terms of disciplinary adaptability and inclusiveness.

Unlike the Saudi study, which emphasized that student preparation was the main determinant of success, the current study highlights the importance of structural and organizational features of electronic Exams in shaping satisfaction. This indicates that while performance outcomes may not differ substantially, students' perceptions of fairness, efficiency, and usability play a critical role in their acceptance of electronic assessments. [16]

Regarding satisfaction with traditional Exams, the study found that 57.7% of respondents were

dissatisfied with their ability to provide accurate grading. However, 51.3% were satisfied with the time required to complete traditional Exams, while 54.8% found them to be well-structured. Additionally, 57.4% of respondents believed that traditional Exams were more suitable for all faculties and university subjects. A study conducted to assess the Comparative Analysis of Students' Satisfaction Regarding Online vs. Traditional Exam at the Postgraduate Level in the University of Agriculture Faisalabad, Pakistan, concluded that students were more satisfied with the traditional Exam setup, as it was perceived to promote greater learning. In contrast, satisfaction with online Exams was lower. However, since online Exams are also a necessity of the present time, further developments are needed to make this system more familiar and easier for all students to understand and adopt. [13]

In terms of satisfaction with the organization and environment of both electronic and traditional Exams, approximately half of the respondents were satisfied with the structured format of both methods (49% for electronic Exams and 54% for traditional Exams). Compared to the study in Assiut, Egypt, where 53.9% of critical care nursing students reported satisfaction with electronic Exams [12], our result (49% satisfaction with the structure for electronic Exams) is somewhat lower but comparable. Similarly, in Alexandria, the increase in learning satisfaction in virtual classroom settings was more pronounced than our finding, indicating that settings which include broader online learning experiences may support greater satisfaction than isolated Exam-structure alone[17], studies involving mobile-technology tools for evaluation in critical care nursing have shown positive structural satisfaction when tool design is thoughtful (layout, instruction clarity), suggesting that enhancements in the design and delivery of electronic Exams could raise satisfaction in our context to match or surpass those previous studies[18]

Regarding Exam preferences, the study found that a majority (70.9%) of respondents favored electronic Exams. This finding is consistent with a similar study conducted in sub-Saharan Africa. With regard to learner attitudes and preferences between computer-based and paper-based assessment, various studies have similarly reported mixed feelings. Whereas some students express a positive attitude and preference toward online assessment [15,19]

The study revealed that there was no statistically significant relationship between the type of study program and students' Exam preferences, as indicated by a p-value of 0.840. This suggests that students' choices between electronic and traditional Exams were not influenced by their specific field of study. However, the study found a highly significant statistical association between gender and

students' Exam preferences, with a p-value of 0.001. Furthermore, other studies investigated the influence of demographic factors of learners on their scores in computer-based tests. For instance, McClelland and Cuevas analyzed the influence of gender and computer familiarity on students' scores in computer-based tests and concluded that there was no statistically significant relationship between such factors. Their findings were reportedly consistent with some earlier studies.[20,21]

Limitations of the Study

Despite the significance of the findings, several limitations must be acknowledged. First, the study's cross-sectional design provides a snapshot of perceptions at a single point in time, which precludes the ability to establish definitive causal relationships or monitor longitudinal changes in student satisfaction and awareness. Second, the reliance on self-reported data through questionnaires introduces potential subjective biases, such as social desirability or recall bias, which may impact the precision of the results. Furthermore, the study was conducted exclusively at AlNeelain University, and while it included various faculties, the findings may have limited generalizability to other Sudanese or international institutions with differing technological infrastructures and examination protocols. Future research should consider longitudinal approaches and multi-institutional samples to provide a broader understanding of online assessment dynamics.

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