



Doi: 10.21608/jhpei.2024.320784.1035

RESEARCH ARTICLE

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Developing, Validating, and Implementing a Tool for Evaluating Electronic Assessment at the Faculty of Medicine, Suez Canal University from the Student's Point of View

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Abstract

Background:

Electronic assessment offers several benefits for teachers and students, including flexibility in time and place, quick results, immediate feedback, and automated grading. Due to these benefits, the Faculty of Medicine at Suez Canal University implemented an e-MCQ assessment. Accordingly, this study aims to develop, validate, and implement a tool to evaluate electronic assessment at the Faculty of Medicine, Suez Canal University, from the student's point of view.

Methods:

The study was conducted using an analytical cross-sectional design at the Faculty of Medicine, Suez Canal University (FOM-SCU) in Ismailia during the academic year 2022-2023. It aimed to evaluate the electronic MCQ assessment from the 1st and 2nd year students' point of view at the Faculty of Medicine, Suez Canal University.

Results:

Construct validity evidence for the Students' Satisfaction towards Electronic MCQ Assessment (SSE-MCQA) questionnaire was obtained through exploratory factor analysis (EFA), and reliability analysis was performed, which revealed high reliability (internal consistency); Cronbach's alpha coefficient value for the

total scale was 0.85. Regarding the satisfaction of the students toward the e-MCQ assessment, they were highly satisfied, with the highest mean score (31.56) of students' satisfaction with the teaching and learning construct and the lowest mean score (3.4) of students' satisfaction with the efficacy of the e-MCQ assessment construct.

Conclusion:

This study concluded that the SSE-MCQA questionnaire had good reliability and construct validity after measuring construct validity evidence through EFA and reliability analysis. The students generally favored the new implementation of electronic MCQ assessment, finding it effective due to its flexibility and convenience.

Keywords:

E-Assessment, Undergraduate Medical Students, Well-Constructed Multiple Choice Questions, Validity, Reliability

Received: 14-09-2024 Accepted: 6-11-2024

Published Online: Dec. 2024

How to cite this article

Fayez E, Hassan N, Wasfy N & Fouad S. "Developing, Validating, and Implementing a Tool for Evaluating Electronic Assessment at the Faculty of Medicine, Suez Canal University from the Student's Point of View." J Health Prof Edu Innov, Vol. 1, No. 4, Dec. 2024, pp 01-16.
Doi: 10.21608/jhpei.2024.320784.1035

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Introduction:

The assessment of medical students has evolved from traditional paper-based exams to electronic testing systems. This shift is driven by advantages such as time efficiency, improved feedback, and scalability for large cohorts. Digital platforms streamline administrative tasks and enable faster grading, supporting continuous learning and improving educational quality at both undergraduate and postgraduate levels in medical education [1].

Electronic assessment, accelerated by the COVID-19 pandemic, has reshaped higher education by facilitating remote learning and assessment worldwide. Various techniques—face-to-face, electronic, or blended—affect the learning cycle of students [2].

Multiple-choice questions (MCQs) are favored in electronic assessment for their efficiency and perceived fairness, providing quick feedback and straightforward evaluation of applied knowledge. However, some issues exist, such as the potential for guessing factor [3]. This can promote rote memorization over deeper learning processes [4]. Moreover, MCQs may not adequately assess practical skills or soft competencies essential in medical practice, highlighting the need for a balanced assessment approach that integrates various methods to evaluate diverse aspects of student competence [3].

Since 2018, electronic assessment has been implemented at the Faculty of Medicine, Suez Canal University, alongside electronic multiple-choice question banks introduced in 2020. The faculty provided workshops and training sessions to educate medical staff on creating question banks and administering tests using Assessment Gourmet software, which provides detailed analytical reports. Electronic assessment was first applied to preclinical year students, and it was formative first, then summative for all 12 modules in the preclinical years, and then applied to all years in the faculty.

Due to COVID-19, the Faculty of Medicine at Suez Canal University shifted from paper-based assessments to electronic MCQ assessments. However, evaluating these electronic assessments poses challenges due to the lack of validated tools for assessing their advantages and limitations from the students' perspective. Therefore, this study aims to develop, validate, and implement a tool to evaluate the electronic MCQ assessment from the student's point of view at the Faculty of Medicine, Suez Canal University.

Methods:

This study is a cross-sectional analytic design conducted to develop, validate, and implement a tool evaluating electronic MCQ assessment from the (1st and 2nd) year students' point of view at the Faculty of Medicine, Suez Canal University.

A comprehensive sample of undergraduate pre-clinical (1st and 2nd) year medical students (n = 400) was taken at FOMSCU.

Sample Size

The sample size was calculated according to the following equation:

$$n = \left[\frac{Z_{\alpha/2}}{E} \right]^2 * P(1 - P) \quad [5]$$

Where:

n = sample size

$Z_{\alpha/2} = 1.64$ (the critical value that divides the central 95% of the Z distribution from the 5% in the tail)

p = 76.9% of the students preferred e-assessment [6].

E = 10%, the margin of error.

Accordingly, a total of 273 students were required.

Quantitative method data collection tools were used through an online form sent to the 1st and 2nd-year students to assess their satisfaction with the electronic MCQ assessment. The developed questionnaire, which was applied in the Faculty of Medicine, Suez Canal University (FOMSCU), consists of six core themes and 36 items on a 5-point Likert scale ranging from strongly agree to disagree (Annex 1).

Approval from the Research Ethics Committee was obtained. Then, the approval of the Vice Dean for students' affairs at the FOM-SCU was obtained.

Regarding the study maneuver, as shown in Figure 1, the questionnaire was developed by conducting previous literature reviews, and then content validation of the questionnaire was assessed through a Google evaluation form link (Annex 2). The form utilized both quantitative and qualitative techniques to gather the opinions of the medical education experts (n = 10).

A pilot study was conducted through a focus group with 30 students from (1st and 2nd) years filling out the printed form of the developed questionnaire before the data collection, and then construct validity through

exploratory factor analysis (EFA) and reliability were performed to identify and interpret the number of factors that could explain most of the common variance till reaching the final validated version of the questionnaire (Annex 3).

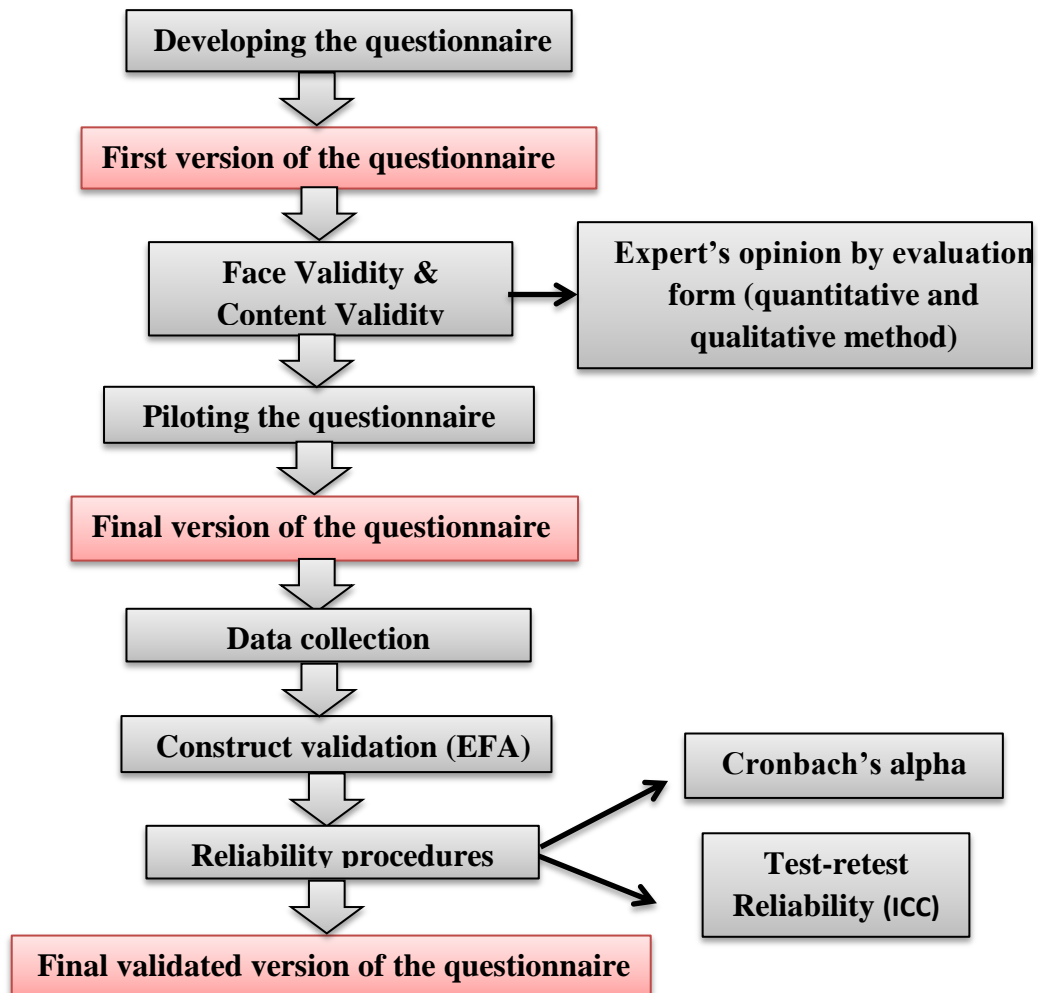


Fig. 1: The Steps of Study Maneuver

Results:

The results are divided into three parts:

Part I: Demographic data related to study participants (participants background)

400 of the 1st and 2nd-year medical students completed the questionnaire, with the predominance of females (52.6%).

Part II: Validity and reliability of the newly developed questionnaire to assess students' satisfaction towards Electronic MCQ Assessment

1. Content validation through experts' opinions towards the developed questionnaire

According to the review done by medical education experts (n=10) at the Faculty of Medicine, Suez Canal University, the experts' opinion results were generally positive, modifications to some items were made, and the survey was edited and made ready for administration to the study participants. Examples of modifications were adding an item related to student performance in the efficacy of the Electronic MCQ assessment construct, using the term platform rather than website system in the construct.



2. Construct validity and reliability of the developed questionnaire

1. First: Exploratory Factor Analysis

2.1.1 Checking the suitability of data for factor analysis:

- **Sample size:**

The sample size is 400 participants, which is adequate for factor analysis.

- **Factorability of the correlation matrix**

The correlation matrix reveals statistically significant, moderate correlations among the observed variables used in the analysis. None of the correlation coefficients are large; therefore, there is no need to eliminate any variables at this stage.

- **Kaiser-Meyer-Olkin Measure of Sampling Adequacy (KMO) and Bartlett's Test of Sphericity**

This test revealed the KMO Measure of Sampling Adequacy was 0.906 (superb). This value indicates that each factor predicted sufficient items. Furthermore, Bartlett's test of sphericity was statistically significant ($P < 0.001$), which indicates that the variables were significantly correlated.

2.1.2 Extraction of factors:

Principal component analysis with varimax rotation was performed to identify and interpret the number of factors that could explain most of the common variance and to remove non-reflective or redundant items. The results revealed that the 36 items of the students' satisfaction with the Electronic MCQ Assessment (SSE-MCQA) questionnaire resulted in eight factors with an eigenvalue > 1.00 . The eight factors that emerged from the factor analysis accounted for 57.208% of the total variance. The number of factors was also confirmed with the visual inspection of the scree plot that indicated a sudden drop in the scree beginning with the eighth factor.

2.1.3 Rotation of factors:

From the initial 36 items, we should remove 8 items from the questionnaire. The rules used for deleting items are:

- Number of items/ factors: A factor with fewer than three items is generally weak and unstable; four or more items are desirable and indicate a solid factor.
- Cross-loading items: items that load at 0.3 or higher on two or more factors.
- Factor loading < 0.30 : lower factor loadings demonstrate a lower degree of association between the factor and the item.

The deleted items were as follows:

- Items with cross-loading ≥ 0.30 on the other factors: Items 2, 5, 9, 13, 18, 19, 20, 28

Finally, the questionnaire contained 6 factors and 28 items, as shown in (Table 1). Factor 1 included 6 items, factor 2 included 3 items, factor 3 included 4 items, factor 4 included 3 items, factor 5 included 8 items, and factor 6 included 4 items. All the previously mentioned interpretability criteria were achieved.

The six factors were labeled as follows:

- **Factor 1:** This factor has been renamed "Efficacy." This factor addresses the accuracy, validity, and reliability of electronic MCQ assessment.
- **Factor 2:** This factor has been renamed "Emotions Related Exams." This factor addresses the feelings of students toward exams.
- **Factor 3:** This factor has been renamed "Practicality." This factor addresses the application of MCQ electronic exams.
- **Factor 4:** This factor has been renamed "Security." This factor addresses the safety of using MCQ electronic exams.
- **Factor 5:** This factor has been renamed "Teaching and Learning". This factor addresses the comfort and confidence in using learning management systems in course development and management.
- **Factor 6:** This factor has been renamed "MCQ Assessment Platform". This factor addresses the assessment of the platform.

Furthermore, the communalities of the 28 items are presented in Table 1. It reveals that the communalities ranged between 0.426 and 0.715, which means that extracted factors explained most of the variance in the variables being analyzed. Only 5 items (8, 6, 7, 4, and 14) had low communalities (< 0.50).



N.B. Communalities are defined to measure how many percentage variances among the indicators can be explained by the common factors. This is to estimate the communality of each item.

Communalities are ranged between 0 and 1.

High communalities (> 0.5) show that the factors extracted explain most of the variance in the variables being analyzed.

Low communalities (<0.5) mean there is considerable variance unexplained by the factors extracted.

Table (1): Factor structure of (SSE-MCQA) Questionnaire, using principal components analysis

Item	Component						Communalities	Factor labelling
	1	2	3	4	5	6		
1	0.851						0.715	F1
3	0.707						0.607	
7	0.633						0.473	
6	0.617						0.435	
4	0.599						0.480	
8	0.548						0.426	
11		0.709					0.634	F2
10		0.542					0.595	
12		0.497					0.553	
15			0.79				0.677	F3
16			0.711				0.612	
14			0.606				0.487	
17			0.568				0.537	
22				0.638			0.504	F4
23				0.637			0.515	
21				0.439			0.516	
24					0.339		0.509	F5
31					0.718		0.579	
26					0.667		0.526	
30					0.623		0.622	
27					0.612		0.619	
29					0.59		0.595	
25					0.468		0.545	
32					0.398		0.568	
34						0.785	0.658	F6
33						0.731	0.633	
35						0.726	0.708	
36						0.711	0.614	



2. Second: Reliability analysis:

The Cronbach’s alpha coefficients of the six factors of (SSE-MCQA) questionnaire ranged between 0.839 and 0.857. The overall Cronbach’s alpha for the total (SSE-MCQA) questionnaire items was 0.851. This result indicates high internal consistency (reliability). Alpha levels did not increase if any items were deleted.

Part III: Descriptive Statistics of (SSE-MCQA)

Efficacy of Electronic MCQ Assessment construct

One-third (34.3%) of students find electronic MCQ assessment more accurate than paper-based ones for

complex questions, while over half (65%, 63.7%, and 63.8%, respectively) agree it's easier to guess correct answers, results reflect actual performance, and it's sufficient for undergraduates. Nearly half (44.8% and 48.3%, respectively) think technical issues can affect performance and believe it helps in applying information.

• **Emotion Related to Electronic Assessment**

As shown in Figure 2, nearly half (48%) of students feel that electronic MCQ assessment reduces exam stress, and 70.1% prefer computer-based exams. A small percentage (11.3%) struggle to concentrate on the questions.

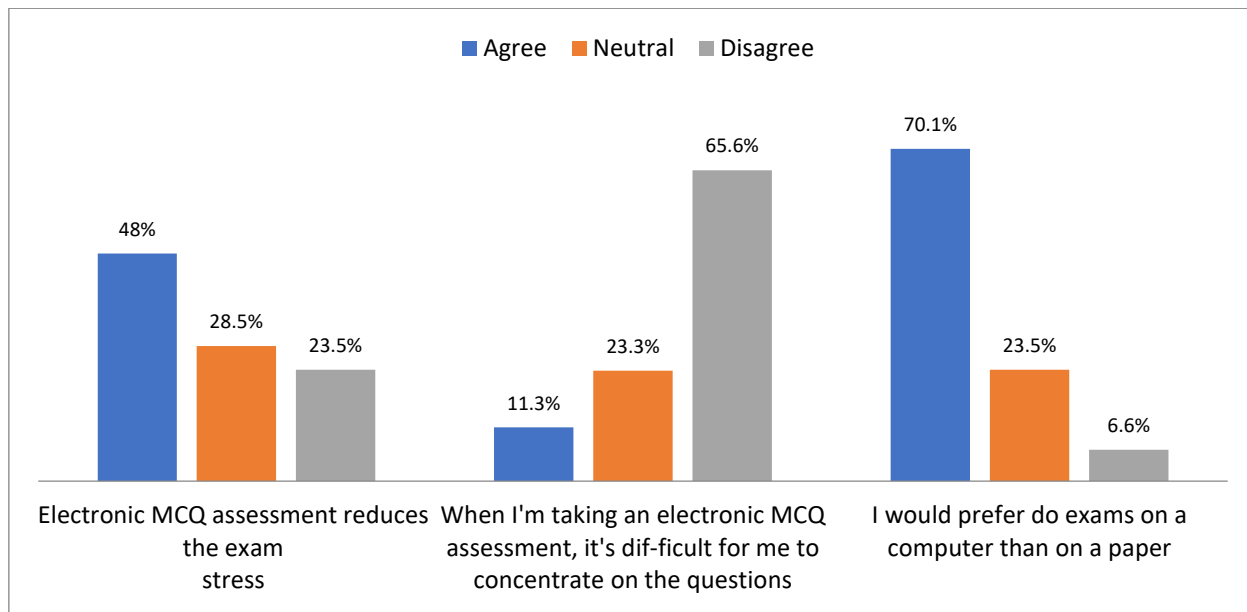


Fig. (2): Emotion Related to Electronic Assessment



Practicality of Electronic MCQ Assessment

About half (54.3% and 57.5%, respectively) believe electronic assessment saves time and effort and is more physically exhausting, while fewer (31.8% and 37.5%, respectively) agree that it requires computer skills and is liable to technical issues.

Security Issues of Electronic MCQ Assessment

As shown in Figure 3, around half (53.5% and 52.3%, respectively) of students believe login security is adequate, and cheating is easier than paper-based assessment, but only 27.3% think it's vulnerable to hacking.

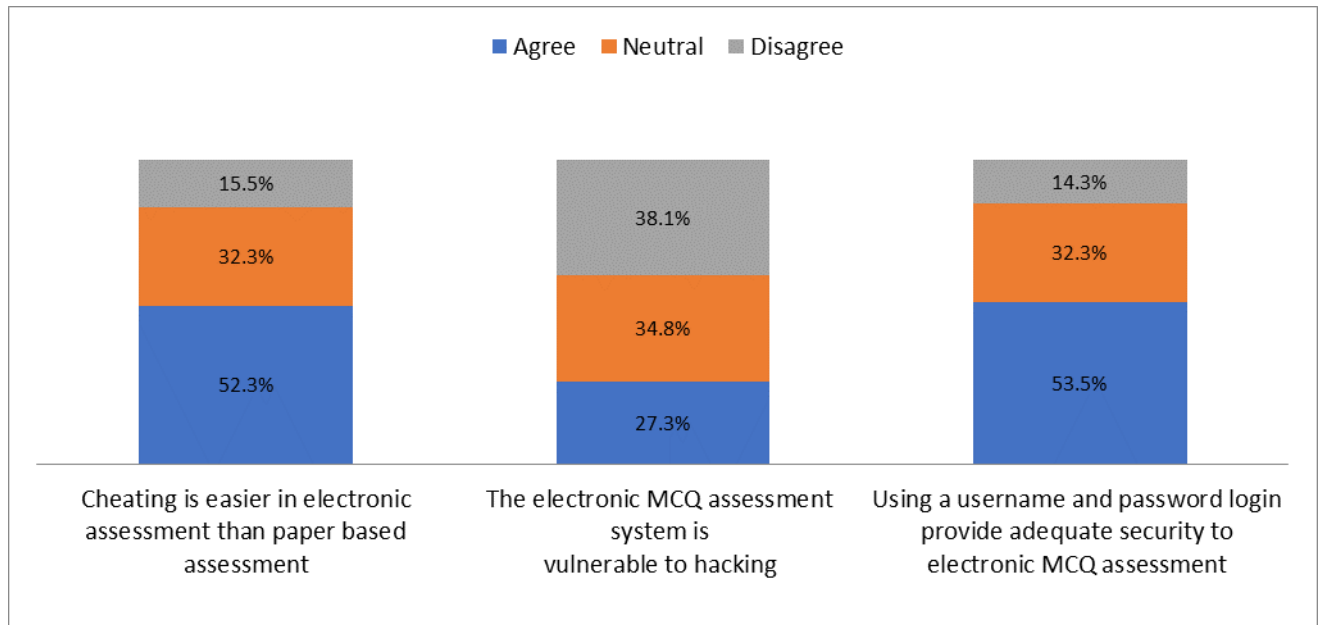


Fig. (3) Security Issues of Electronic MCQ Assessment



• **Teaching and Learning in Electronic MCQ Assessment**

The majority (67.3%, 57.5%, 65.3%, and 59.3%, respectively) believe electronic MCQ assessment aligns with teaching methods, changes learning styles, is suitable for all student levels, and is complementary to e-learning. About half (52.5%, 52.8%, and 55.3%, respectively) agree that it adds value to their learning, improves their computer skills, and aligns with learning

outcomes. A minority (10.3%) of students believe that those with better computer skills can complete electronic assessment more easily and quickly.

Electronic MCQ Assessment Platform

As shown in Figure 4, a large percentage (65%, 68.6%, 77.1%, and 71.1%, respectively) agree that the platform is user-friendly, easy to navigate, correct answers, and monitor time.

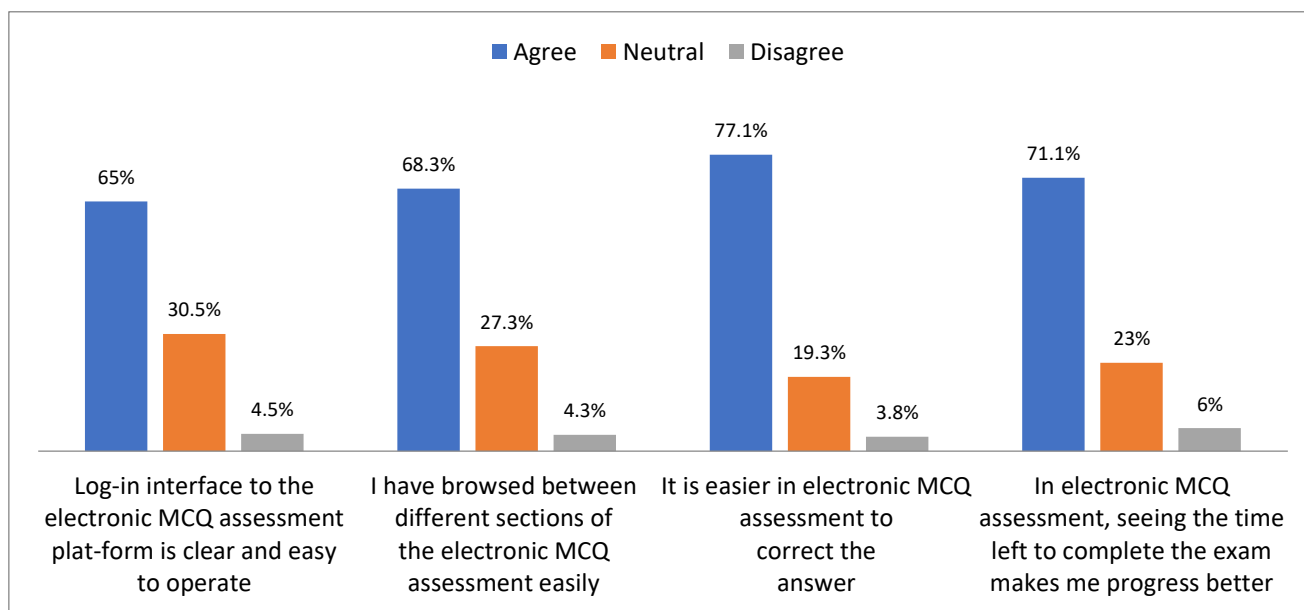


Figure (4) Electronic MCQ Assessment Platform

Discussion:

The Current study findings of the six factors of the SSE-MCQA questionnaire are consistent with those of Ranganath et al. [1], who originally developed the students’ perception towards electronic MCQ assessment questionnaire and emphasized that this questionnaire developed from four factors that emerged in his study. Despite the similarities, there are some differences in terms, and the data of the current study is more valid. The reason for that may be that in the current study, an EFA was conducted, which indicates evidence for the construct validity of the SSE-MCQA questionnaire and fits the measurement model with the theoretical model. Additionally, the “electronic MCQ assessment platform” has been added, which is one of the important factors that did not emerge in the Ranganath et al. [1] study.

The Cronbach’s alpha coefficient value for the total scale in the current study was 0.85. Based on the scale instrument quality criteria rating table by William P Fisher Jr. [7] [8], the reliability of the respondents in the

current study is classified as excellent. This indicates the high internal consistency (reliability) of the SSE-MCQA questionnaire. Therefore, an instrument with excellent psychometric internal consistency is considered a very reliable instrument. In addition, internal consistency and reliability are, by themselves, another piece of evidence of the construct validity of the questionnaire Fenn et al. [9].

Taken together, the findings in the current study indicate that the SSE-MCQA questionnaire in the FOMSCU setting has high reliability and acceptable evidence of construct validity.

Most of the current study students prefer to do exams on computers rather than on paper due to shorter completion times; students could proceed at their own pace and fairer marking practices. This preference aligns with findings from Jawaid et al. [10], where initial experiences with e-assessment similarly increased student satisfaction and preference for electronic exams.



Considering the practical issues, most students agreed that electronic MCQ assessment gives sufficient time to complete exams and saves effort in distributing and collecting exam papers, which aligns with Ranganath et al. [1]. This is because questions and answers are stored electronically, and scoring is automated, reducing the time and effort needed for paper-based exams. A different result was obtained from the Brink et al. [11] study, which reported that electronic assessments needed more time, possibly due to system slowness and performance issues affecting all users, leading to delays and difficulty completing exams. This contrasts with the present study using Gourmet, a reliable electronic MCQ platform with minimal technical issues.

Regarding the FOM- SCU electronic MCQ assessment platform, most of the students agreed that the log-in interface is clear and easy to operate and navigating between sections and correcting answers is straightforward. They believed that seeing the time left to complete the exam makes them progress better Alameri et al. [12] similarly, positive student experiences with web-based platforms were found.

Regarding the efficacy of electronic MCQ assessment, most of the students in the current study believed electronic MCQ assessment was more accurate in assessing complex question content (through the addition of media like images or videos); besides, they believed that it was sufficient as an assessment tool, appreciating features such as color diagrams with zoom capabilities and a question completion checkpoint. Khan S, and Khan RA. [13] also reported similar positive perceptions, while Tomljanovic J, and Polic T. [14] highlighted the suitability of e-assessment in higher education subjects.

In the present study and Tomljanovic J, and Polic T. [14], most students reported that although electronic assessment is more liable to technical problems, it didn't affect their performance in the exam. Unlike Ranganath et al. [1], who noted that technical issues could make online exams impractical, necessitating extended exam times. At FOMSCU, the rarity of technical problems is attributed to robust internet connectivity and an active IT committee dedicated to promptly addressing issues during electronic assessments.

Most of the students in the present study asserted that the e-assessment reduces exam stress by promoting sustainability through less paper usage, facilitating easier answer corrections, and providing clear time management by seeing the left time during the exam. These results are supported by the Ranganath et al. [1]

study, as their students reported that electronic MCQ assessment does not add to the stress of the exam due to exam flexibility and immediate feedback.

The majority of students in this study reported no difficulty maintaining concentration during electronic MCQ assessments, attributing it to the controlled environment and clear instructions. These findings align with Tomljanovic J, and Polic T. [14] study, where participants found exams in computer clusters practical and concentration unaffected. However, they differ from Hew et al. [15] study that suggested electronic assessments could negatively impact stress and concentration.

According to Harmon et al. [16], electronic assessment examinations are more vulnerable to academic dishonesty and authentication attacks due to a lack of physical interaction. However, in the current study, most students reported that electronic assessment is more secure than paper-based assessment in terms of leakage of exam questions and using a username and password login protects electronic assessment from hacking, aligning with findings from Tomljanovic J, and Polic T. [14] study, as their students reported that e-assessments are considered secure.

In the current study, the students believed that cheating was easier in electronic assessment than in paper-based assessment. These findings are consistent with the study by Chirumamilla et al. [17], in which students perceived cheating as easier with e-exams. This may be due to the students thinking it is easy to peek at the answers of other candidates. But they are at odds with the Rubab I, and Imran A. [18] study, in which more than half of the students agree that electronic assessments reduce the risk of cheating among students, and also with the study by Ranganath et al. [1], in which students did not think that it is easier to cheat in online exams than with paper-based exams.

At FOMSCU, electronic MCQ assessments employ countermeasures like randomizing question and answer order and presenting different sets of questions to minimize cheating behaviors such as peeking and texting. This approach is supported by Yates et al. [19], who noted that multiple-choice formats facilitate automated detection of potential cheating through answer analysis.

Electronic MCQ assessment is considered complementary to e-learning, as most of this study students believed due to its ability to consistently create standardized assessments for measuring students'



progress. The Tomljanovic J, and Polic T. [14] study supported this. Students believe that e-assessment is not just a gimmick, going hand in hand with e-learning, and the immediate feedback they get from e-assessment also helps learning.

Most students agreed that electronic assessment is consistent with the learning outcomes and teaching methods at FOMSCU. They felt it motivated and added value to their learning. This is because E-assessments effectively assess a range of objectives, from knowledge to higher-order thinking skills. Huda et al. [20] study supports previous findings that e-assessments enhance learning by offering immediate feedback and increasing motivation.

Conclusion:

The study confirmed the SSE-MCQA questionnaire's good reliability and construct validity of SSE-MCQA questionnaire, supporting its effectiveness in capturing intended constructs and its potential for meaningful research.

The study concluded that students generally favored the new electronic MCQ assessment, finding it effective due to its flexibility and convenience. The method could enhance learning outcomes and align with FOMSCU's teaching methods. However, improvements are needed to reduce cheating and address technical issues.

Suggestions for further research:

The study focuses on only one institution (FOM-SCU) and its 1st and 2nd-year students, which restricts the generalizability of the findings. It also did not analyze correlations between demographic data and satisfaction or evaluate faculty satisfaction, limiting the assessment to student perspectives. Based on these findings, it is recommended in further research to share the results with all stakeholders, conduct future research with Confirmatory Factor Analysis (CFA) for theory validation, and organize orientation sessions and hands-on workshops on e-assessment for faculty and students. Furthermore, user activity monitoring for security, improving platform maintenance, and qualitative evaluations of the electronic MCQ assessment are advised for future improvements.

Ethical approval:

Ethical approval was obtained from the Faculty of Medicine Suez Canal University Research and Ethics Committee (REF No: 4621#).

Availability of data and material:

Data supporting the current study are available from the corresponding author upon a reasonable request.

Conflict of interests:

The authors have declared that no conflict of interest exists.

Funding:

There has been no funding or financial support involved in this study.

Acknowledgements:

The authors want to express their gratitude to all students at the Faculty of Medicine, Suez Canal University, who participated in this study. The authors also wish to thank the school administration for easing the work of this research. Finally, they gratefully thank members of the medical education department for their continuous help.

Authors' contributions:

EF has made substantial contributions to data acquisition, analysis, and interpretation. She has drafted the work and substantively revised it. NF and SF had made substantial contributions to the acquisition, analysis, and interpretation of data. NH managed the analyses of the study. All authors contributed to revisions of the manuscript, and all authors read and approved the final manuscript.



Annex 1

Students` Satisfaction towards Electronic MCQ Assessment (SSE-MCQA) Questionnaire

(The final version of the developed tool before construct validation)

Student name (Optional):

Year:

Group:

Gender:

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1	Electronic MCQ assessment is more accurate than paper based MCQ in assessing complex questions content (through adding media like images or videos).					
2	Electronic assessment will help me in preparing myself for the online Egyptian Medical Licensing Exam (EMLE) which conducted electronically after graduation.					
3	It is easier in electronic MCQ assessment to guess the correct answer.					
4	Results of electronic MCQ assessment represent my actual performance on the exam.					
5	Electronic MCQ assessment can only assess recall of knowledge.					
6	Electronic MCQ assessment allows me to apply information.					
7	Electronic MCQ assessment is sufficient as an assessment tool for undergraduate medical students.					
8	Electronic technical problems can affect my performance in the exam.					
9	Electronic MCQ assessment is fairer than paper based assessment.					
10	Electronic MCQ assessment reduces the exam stress.					
11	When I'm taking an electronic MCQ assessment, it's difficult for me to concentrate on the questions.					
12	I would prefer do exams on a computer than on a paper.					
13	Electronic MCQ assessment gives sufficient time to answer and finish the exam.					
14	In electronic MCQ assessment, time & effort related to distributing & collecting exam papers are saved.					
15	Taking electronic MCQ assessment requires having computer skills.					



16	Electronic MCQ assessment is more liable to technical problems.					
17	Sitting for exams in front of computer screens is more physically exhausting than paper based assessment.					
18	Assessing a large group of students with electronic MCQ assessment in the same time and place affects the concentration.					
19	Electronic assessment is more practical than paper based assessment in terms of easy accessibility at any time and place.					
20	Electronic assessment is more secure than paper based assessment in terms of leakage of exam questions.					
21	Cheating is easier in electronic assessment than paper based assessment.					
22	The electronic MCQ assessment system is vulnerable to hacking.					
23	Using a username and password login provide adequate security to electronic MCQ assessment.					
24	Electronic MCQ assessment is consistent with the teaching methods which used in my faculty.					
25	Electronic assessment changes my learning style and the way I prepare for the exam.					
26	Electronic MCQ assessment adds value to my learning.					
27	I believe that e-assessment is complementary to e-learning.					
28	Electronic MCQ assessment motivates me to learn the subject matter better.					
29	Electronic assessment improves my computer Skills.					
30	Students with better computer skills can do the electronic assessment easier & faster than other students.					
31	Electronic MCQ assessment is considered consistent with intended learning outcomes.					
32	Electronic MCQ assessment is suitable for all levels of students.					
33	Log-in interface to the electronic MCQ assessment platform is clear and easy to operate.					
34	I have browsed among different sections of the electronic MCQ assessment easily.					
35	It is easier in electronic MCQ assessment to correct the answer.					
36	In electronic MCQ assessment, seeing the time left to complete the exam makes me progress better.					



Annex 2

Expert Opinions Evaluation Form for SSE-MCQA Questionnaire

		Yes	To some extent	No
1	Is the questionnaire written in a clear language?			
2	Does the questionnaire include ambiguous questions (please indicate their numbers in the comments section)			
3	Does the questionnaire include embarrassing questions to respondents? (if any, please indicate their numbers in the comments section below)			
4	Does the questionnaire include terminology/jargon that is difficult for respondents to understand? (if any, please indicate their numbers in the comments section below)			
5	Do you suggest adding definitions of terms or glossary in any part of the questionnaire? (if yes, kindly indicate the terms in need of clarification in the comments section below)			
6	Is the Likert scale included in the questionnaire suitable for ALL questions? (if not, kindly indicate the number of questions in the comment section below)			
7	How do you rate the number of items in the whole questionnaire (36 items)?			
8	Can the 6 constructs included in the questionnaire (Validity indicators, affective domain indicators, practicality indicators, reliability indicators, security indicators, teaching and learning indicators) measure the Students` satisfaction towards electronic MCQ assessment ?			
9	Would you suggest adding or omitting constructs? (kindly elaborate or write none if no suggestion is to be made)			
10	How would you rate the number of items measuring each construct 4-8 items)			
11	Are the items included in the construct "validity " truely measuring the Students` satisfaction towards electronic MCQ assessment in terms of validity issues? (kindly include any comments in the section below)			
12	Are the items included in the construct "affective domain" truely measuring the the Students` satisfaction towards electronic MCQ assessment in terms of affective domain issues? (kindly include comments in the section below)			
13	Are the items included in the construct "Practicality" truely measuring the Students` satisfaction towards electronic MCQ assessment in terms of practicality issues? (kindly include comments in the section below)			
14	Are the items included in the construct "Reliability" truely measuring the Students` satisfaction towards electronic MCQ assessment in terms of Reliability issues ? (kindly include comments in the section below)			
15	Are the items included in the construct "security " truely measuring the Students` satisfaction towards electronic MCQ assessment in terms of security issues ? (kindly include comments in the section below)			
16	Are the items included in the construct "Teaching and Learning " truely measuring the Students` satisfaction towards electronic MCQ assessment in terms of teaching and learning issues? (kindly include comments in the section below)			
17	Are the items included in the construct "electronic MCQ assessment website system" truely measuring the Students` satisfaction towards electronic MCQ assessment in terms of website system? (kindly include any comments in the section below)			
18	Do you have further comments on the questionnaire?			



Annex 3

Students` Satisfaction towards Electronic MCQ Assessment (SSE-MCQA) Questionnaire (The final validated version of the developed tool)"

Student name (Optional):

Year:

Group:

Gender:

		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
Efficacy						
1	Electronic MCQ assessment is more accurate than paper based MCQ in assessing complex questions content (through adding media like images or videos).					
3	It is easier in electronic MCQ assessment to guess the correct answer.					
4	Results of electronic MCQ assessment represent my actual performance on the exam.					
6	Electronic MCQ assessment allows me to apply information.					
7	Electronic MCQ assessment is sufficient as an assessment tool for undergraduate medical students.					
8	Electronic technical problems can affect my performance in the exam.					
Emotions Related Exams						
10	Electronic MCQ assessment reduces the exam stress.					
11	When I'm taking an electronic MCQ assessment, it's difficult for me to concentrate on the questions.					
12	I would prefer do exams on a computer than on a paper.					
Practicality						
14	In electronic MCQ assessment, time & effort related to distributing & collecting exam papers are saved.					
15	Taking electronic MCQ assessment requires having computer skills.					
16	Electronic MCQ assessment is more liable to technical problems.					
17	Sitting for exams in front of computer screens is more physically exhausting than paper based assessment.					
Security						
21	Cheating is easier in electronic assessment than paper based assessment.					



22	The electronic MCQ assessment system is vulnerable to hacking.					
23	Using a username and password login provide adequate security to electronic MCQ assessment.					
Teaching and Learning						
24	Electronic MCQ assessment is consistent with the teaching methods which used in my faculty.					
25	Electronic assessment changes my learning style and the way I prepare for the exam.					
26	Electronic MCQ assessment adds value to my learning.					
27	I believe that e-assessment is complementary to e-learning.					
29	Electronic assessment improves my computer Skills.					
30	Students with better computer skills can do the electronic assessment easier & faster than other students.					
31	Electronic MCQ assessment is considered consistent with intended learning outcomes.					
32	Electronic MCQ assessment is suitable for all levels of students.					
Electronic MCQ Assessment Platform						
33	Log-in interface to the electronic MCQ assessment platform is clear and easy to operate.					
34	I have browsed among different sections of the electronic MCQ assessment easily.					
35	It is easier in electronic MCQ assessment to correct the answer.					
36	In electronic MCQ assessment, seeing the time left to complete the exam makes me progress better.					



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