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EXPERIENCE WITH ONLINE EXAMINATIONS IN PHYSIOLOGY FOR FIRST-YEAR MBBS STUDENTS

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ABSTRACT

This comparative record-based study was conducted at a medical college in Maharashtra State, India to compare the scores obtained by students in theory and practical formative assessment examinations conducted in physical (traditional) and online formats. The pattern and distribution of marks were identical and the same examiners had conducted these two formats of examinations. Significant differences ($p<0.0001$) were observed in the average marks obtained in physical and online theory examinations, but not in the physical and online practical examinations. The gender difference in scores in the online theory examination were not significant ($p=0.481$) but were significant in case of practical examinations in the physical ($p=0.0005$), as well as in the online ($p=0.012$) formats. For extensive use, teachers and other staff need to be trained for conducting and assessing online examinations. After incorporating adequate safeguards, online examinations can be used for formative assessment of medical students despite the current constraints. Feedback from students can also be obtained online and used to improve teaching-learning techniques.

KEYWORDS: First-year MBBS, Online examinations, Physiology.

INTRODUCTION

Online examinations can be customized and made highly interactive, reliable, secure, and can be accessed in multiple electronic devices and requires fewer resources as compared to the traditional physical examination.[1] The online examination has the following advantages: (i) it is environment-friendly because it saves paper; (ii) if only multiple choice questions are framed, the grading of responses can be completely automated and almost immediately made available to the examinees;[2] (iii) a timer can be added to each question to prevent students from searching for answers; (iv) the transmission of questions to students would be very quick and inexpensive[1,3] because only the e-mail addresses of the students need to be uploaded and e-mails are free-of-cost; (v) saves manpower required for supervision and invigilation in a classroom-based traditional examination;[1] (vi) Since there is no need to travel to the examination centre, students living in remote locations will benefit; (vii) can be tailored to cater to those with various physical disabilities; (viii) enables the addition of multimedia (videos, images, sound clips) that will extend the range of topics examined; (ix) online exams reportedly reduce exam anxiety.[4]

Examinees were more likely to cheat (look up answers in textbooks or Internet; team up with other students) to secure an unfair benefit in online examinations.[5-10] Cheating in the classroom-based physical exams has been categorized as: (a) Planned cheating (this is premeditated and involves developing cheat sheets, plagiarizing a paper, or copying homework) and (b) Panic cheating (during an exam, if the student who does not know the answer tries to copy answer).[11] Planned cheating is more probable in online examinations and includes setting up two computers (one for taking the exam and one for looking up answers from the Internet).[12]

Since the students will take the exam without any supervision, on their own electronic device and mostly as per their convenient time, the questions should be such that their answers are not easily obtainable from books or the Internet. Addition of a timer to each question leaves the student with no time to seek out an answer.[1] It should be noted that answers to short- and long-answer type questions cannot be graded automatically and these answers have to be physically assessed. Another method to thwart cheating is to prepare a huge pre-tested and pre-validated question bank and each examinee gets a random selection of questions from this question bank.[1]

Various built-in low-technology and high-technology options are available to ensure the integrity of online examination, prevent impersonation and thwart cheating.[1,13-15] The low-technology options include: (a) browser lock-down, disables keys like Print Screen, arrow keys and ESC, due to which, the examinees cannot save screenshots or go back to a previous screen and change their answer; (b) use of "dual-proctor login" ensures that the administrator must be logged in first before an examinee can write the test, which prevents examinees from accessing the test questions ahead of time and dishonestly preparing for them; and (c) authentication of identity of the examinee can be augmented by using biometric inputs (for instance, pulse rate, body temperature) from smart watches and fitness monitors.[1, 13-15]

The high-technology options include: (i) Use of "live proctored" exam, a qualified proctor sitting in a remote location monitors the candidates, audio-video and screen share feeds in real time, ensures student authentication and prevents or red flags any form of cheating. But, this is expensive due to human involvement in proctoring and examinees cannot take the examination at their own convenient time; (ii) Use of "recorded proctoring", the audio-video and screen share feeds of the examinees are recorded during the test. After the examination, these recordings are played back to "red flag" suspicious activities. This method is also expensive due to human involvement in reviewing the recordings; (iii) Use of "advanced automated proctoring", the audio-video and screen share feeds of the test candidates are recorded during the test. The system also uses face recognition to authenticate the examinee's identity and monitors the feeds for any suspicious activity using advanced video and audio analytics and ensures that the examinee focuses on the test screen during the test; there is enough light in the room and checks for suspicious objects in video and background voice activity to "red flag" the test. Since the entire process is automated, it is the least expensive among the high-technology options.[1,13-15]

The objective of the study was to compare the scores obtained by students in theory and practical formative assessment examinations conducted in physical (traditional) and online formats.

MATERIAL AND METHODS

This comparative record-based study was conducted at a medical college in Maharashtra State, India. A physical (traditional) theory and practical examination was conducted in the subject of Physiology in March 2020, just before the COVID-19 lockdown. For formative assessment, online theory and practical examinations were conducted in August 2020 during the COVID-19 lockdown. The pattern and distribution of marks were identical and the same examiners had conducted these two formats of examinations. The marks obtained by students during the physical and online examinations were entered in Microsoft Excel Spreadsheet (Microsoft Corporation, Redmond, WA, USA) and presented as mean and standard deviation (SD). 95% Confidence interval (CI) was calculated using the formula: [Mean-(1.96)*Standard Error)] - [Mean+(1.96)*Standard Error)]. EpiInfo Version 7.2.4 (public domain software package from the Centers for Disease Control and Prevention, Atlanta, GA, USA) was used for statistical analyses. The standard error of difference between two means was calculated. Statistical significance was determined at $p<0.05$.

RESULTS AND DISCUSSION

Out of 79 students who had appeared for all the examination, there were 31 (39.24%) females and 48 (60.76%) males.

Table-1: Marks obtained in theory examinations.

Theory Exam (out of 200)	Females (n=31)		Males (n=48)	
	Physical Exam	Online Exam	Physical Exam	Online Exam
Mean	111.40	137.60	95.09	135.86
SD	16.42	9.58	18.83	12.32
95% CI	105.62–117.18	134.22–140.97	89.77–100.42	132.38–139.35
Z value	7.673		13.335	
'p' value	<0.0001 *		<0.0001 *	

*SD = Standard deviation; CI = Confidence interval; *Significant*

Scores obtained in theory exams: Among female students (Table-1), the average marks obtained in physical and online theory exams were 111.40 +/- 16.42 (95% CI: 105.62–117.18) and 137.60 +/- 9.58 (95% CI: 134.22–140.97), respectively, exhibiting significant difference ($Z=7.673$; $p<0.0001$). The average marks obtained by male students in physical theory exams were 95.09 +/- 18.83 (95% CI: 89.77–100.42), while that in the online theory exams was 135.86 +/- 12.32 (95% CI: 132.38–139.35), with significant difference ($Z=13.335$; $p<0.0001$). In the theory examinations, the maximum, third quartile, median, first quartile and minimum scores obtained by both female and male students in the physical format were lower than that in the online format (Fig 1).

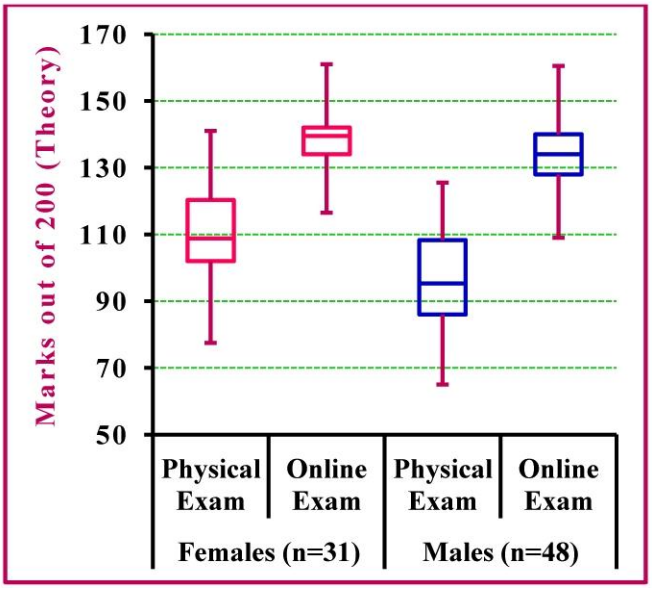

Fig 1: Distribution of marks obtained in theory examinations.

Table-2: Marks obtained in practical examinations.

Practical Exam (out of 100)	Females (n=31)		Males (n=48)	
	Physical Exam	Online Exam	Physical Exam	Online Exam
Mean	67.95	67.65	60.35	64.00
SD	7.78	5.88	11.80	6.97
95% CI	65.21–70.69	65.58–69.71	57.02–63.69	62.03–65.97
Z value	0.171		1.845	
'p' value	0.864		0.065	

*SD = Standard deviation; CI = Confidence interval; *Significant*

Scores obtained in practical exams: Among female students (Table-2), the average marks obtained in physical and online practical exams were 67.95 +/- 7.78 (95% CI: 65.21–70.69) and 67.65 +/- 5.88 (95% CI: 65.58–69.71), respectively, without significant difference (Z=0.171; p=0.864). The average marks obtained by male students in physical practical exams were 60.35 +/- 11.80 (95% CI: 57.02–63.69), while that in the online theory exams was 64.00 +/- 6.97 (95% CI: 62.03–65.97), without significant difference (Z=1.845; p=0.065). In the practical examinations, the median scores of female students were identical in physical and online formats, but the median scores of male students in the physical format were lower than that in the online format (Fig 2).

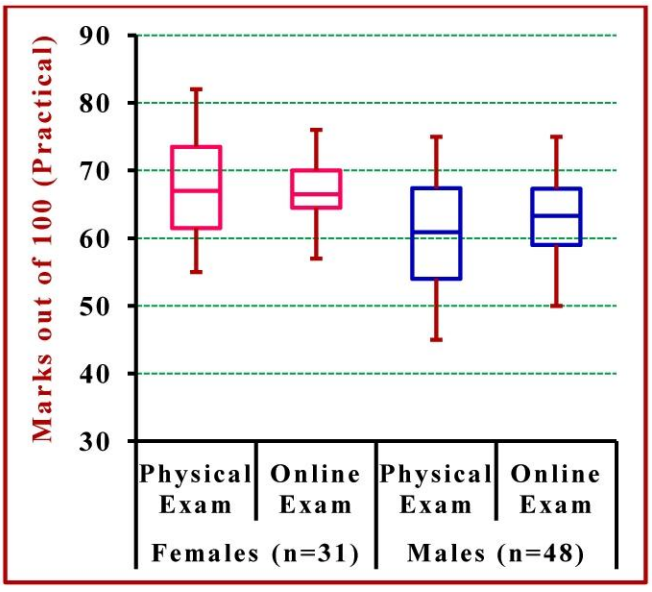

Fig 2: Distribution of marks obtained in practical examinations.

Table-3: Gender differences in marks obtained in theory examinations.

Theory Exam (out of 200)	Physical examination		Online examination	
	Females (n=31)	Males (n=48)	Females (n=31)	Males (n=48)
Mean	111.40	95.09	137.60	135.86
SD	16.42	18.83	9.58	12.32
95% CI	105.62–117.18	89.77–100.42	134.22–140.97	132.38–139.35
Z value	4.116		0.703	
'p' value	0.0003 *		0.481	

*SD = Standard deviation; CI = Confidence interval; *Significant*

Gender differences in theory examination scores: In the physical theory examination (Table-3), the average marks obtained by female and male students were 111.40 +/- 16.42 (95% CI: 105.62–117.18) and 95.09 +/- 18.83 (95% CI: 89.77–100.42), respectively, exhibiting significant gender difference (Z=4.116; p=0.0003). In the online theory examination, the average marks obtained by female students was 137.60 +/- 9.58 (95% CI: 134.22–140.97), while that for their male counterparts was 135.86 +/- 12.32 (95% CI: 132.38–139.35), without significant difference (Z=0.703; p=0.481).

Table-4: Gender differences in marks obtained in Practical examinations.

Practical Exam (out of 100)	Physical examination		Online examination	
	Females (n=31)	Males (n=48)	Females (n=31)	Males (n=48)
Mean	67.95	60.35	67.65	64.00
SD	7.78	11.80	5.88	6.97
95% CI	65.21–70.69	57.02–63.69	65.58–69.71	62.03–65.97
Z value	3.449		2.502	
'p' value	0.0005 *		0.012 *	

*SD = Standard deviation; CI = Confidence interval; *Significant*

Gender differences in practical examination scores: In the physical practical examination (Table-4), the average marks obtained by female and male students were 67.95 +/- 7.78 (95% CI: 65.21–70.69) and 67.65 +/- 5.88 (95% CI: 65.58–69.71), respectively, with significant gender difference (Z=3.449; p=0.0005). In the online practical examination, the average marks obtained by female students was 60.35 +/- 11.80 (95% CI: 57.02–63.69), while that for their male counterparts was 64.00 +/- 6.97 (95% CI: 62.03–65.97), exhibiting significant gender difference (Z=2.502; p=0.012).

In an American study, participants took open- or closed-book exam and they were tested again after two days. In the first exam, participants in the open-book exam obtained higher scores, but after two days, there was no significant difference between the groups. In a follow-up study, participants were told to expect an open- or closed-book exam in the future, but were given a surprise interim exam to assess the difference in their preparations for the exam. The researchers found that those expecting an open-book exam had studied less and they obtained lower scores than those who were expecting a closed-book exam.[16] Contrasting results have been reported on the unfavorable effects on comprehension when students look up the answers to questions during online exams.[17]

Online exam scores may not accurately reflect the level of student knowledge because of higher scores obtained in online exams.[5-7, 10] This can be managed by reducing the weights allocated to online exam scores in overall assessment and including the scores obtained in a traditional in-class final exam that will add up to the final score.[1] Online quizzes and exams can provide valid assessments of student learning since student online scores on mastery quizzes have been found to correlate with in-class exam scores.[18] However, some researchers[2,19] have suggested that unsupervised online exams should be deemed a learning activity and be used in conjunction with other assessments of student learning.

The biggest hurdle for widespread use of online examinations would be the teachers' resistance to adopt new methods and their reluctance to learn new technologies.[20] Internet connectivity would persist as an obstacle for conducting online examinations in resource-limited regions. Even in resource-rich settings, instructors have to configure the online course management system and frequently have to deal with time-consuming technological obstacles faced by students.[21] Computer-related failures may result in few students seeking re-examination, while system-wide failure may call for a complete re-scheduling of the examination.[1] In such circumstances, the time saved in online course management system would surpass the time cost associated with responding to technical problems faced by the examinees.[1]

CONCLUSION

Significant differences were observed in the average marks obtained in physical and online theory examinations, but not in the practical examinations. The gender difference in scores in the online theory examination were not significant but were significant in

case of practical examinations. In the present study, the pattern and distribution of marks were identical and conformed to that recommended by the affiliating University. Questions primarily pertained to the cognitive domain and those relating to case scenarios were not included. For extensive use, teachers and other staff need to be trained for conducting and assessing online examinations. After incorporating adequate safeguards to ensure academic honesty, online examinations, with reduced weights for internal assessment to prevent inflation of marks, can be used for formative assessment of medical students despite the current constraints. Feedback from students can also be obtained online and used to improve teaching-learning techniques.

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