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ORIGINAL ARTICLE

Objective Structured Practical Examination (OSPE) Improves Student Performance: A Quasi-Experimental Study

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Abstract

Background: Medical education aims to develop clinical competency in students at all levels with the aid of appropriate teaching and assessment methods. While the theory examination assesses the student's cognitive domain, the practical examination should be designed in such a way that it assesses the cognitive, psychomotor, and affective domains like knowledge, skill, and attitude. ***Purpose:*** We compared the performance of students between Traditional Practical Examination (TPE) and Objective Structured Practical Examination (OSPE) in two different batches and analyzed their feedback. ***Material and Methods:*** A quasi-experimental type of study design was employed for two batches of the 1st year medical undergraduates who attended both the 1st and 3rd internal assessment (IA). Batch-1 (n=126) had TPE in both IA and Batch-2 (n=164) had TPE in the 1st IA and OSPE in the 3rd IA. The performance of the students was compared using the student '*t*' test and the feedback was collected on a 5-point Likert scale. The content validity index (CVI), content validity rate (CVR), and the coefficient of reliability of the questionnaire were calculated. ***Results****:* The 1st IA marks of both the batches were comparable (p=0.509), however, the 3rd IA marks of batch-2 (p=0.000) were significantly more than that of batch-1. The students and faculty questionnaire had CVR scores >0.96, CVI scores >0.86 and 0.8 with an internal consistency of 0.89 and 1.24 respectively. Both the students and faculty preferred implementing OSPE in biochemistry. ***Conclusion****:* Implementation of OSPE in the medical curriculum was well accepted and appreciated by both students and faculty.

Key Words

Biochemistry, Feedback, Medical education, Questionnaire

Introduction

Medical education aims to develop clinical competency in students at all levels with the aid of appropriate teaching and assessment methods. While the theory examination assesses the student's cognitive domain, the practical examination should be designed in such a way that it assesses the cognitive, psychomotor, and affective domains like knowledge, skill, and attitude (1,2). Assessment should be focused on the student's potential of incorporation, application, and use of knowledge and these components may be considered in the scoring pattern. In the traditional practical examination (TPE) of Biochemistry, the students perform the qualitative and

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quantitative experiment which is then followed by practical *viva voce*. This type of assessment pattern does not provide the examiners with an opportunity to assess the skill of the student and the scoring may be subjected to examiner bias (3,4). The scoring obtained during this type of subjective assessment may only reflect the overall performance rather than the individual competencies (1,5). Hence, an assessment method that tests several objectives must be implemented for conducting the practical assessment.

Objective Structured Practical Examination (OSPE), a modified form of the objective structured clinical examination (OSCE), is one such method that can be followed in both pre and paraclinical subjects (6). OSPE is observed directly to assess competency, based on objective testing. About 5-10 minutes is provided for each station and the students are observed and evaluated for their skills and attitude. A predetermined checklist is prepared for each station taking consensus from all examiners and is used to assess the student's skill with minimal bias (1,7-9). During the regular practical classes, it is generally observed that the students do not perform the exact procedure, are inattentive, and are uncertain about answering when posted with questions. Hence, to improve their skills and reinforce their interest in the subject of biochemistry and make the students more attentive and focused we implemented OSPE during the practical sessions. Since OSPE was newly introduced in our department, we obtained feedback from both students and faculty to evaluate their perception of implementing OSPE in place of TPE. The practical marks of the qualitative experiment (TPE) and OSPE obtained in the 1st and 3rd internal assessment (IA) respectively of two different batches of students were collected and compared within and between the batches.

Material and Methods

The study was conducted in the Department of Biochemistry of a private medical college recognized by the Medical Council of India with 150 admissions in 2016-17 and 200 admissions from 2017 onwards per year for the Bachelor of Medicine and Bachelor of Surgery (MBBS) program. Before compiling the data institutional ethical clearance (IEC) was obtained with IEC number JSSMC/IEC/2509/Aca Study 11/ 2018-19 dated 22-10-2018.

A quasi-experimental type of study design was employed for two batches of the 1st year medical undergraduates (2016-17 and 2017-18) including the students who attended both the 1st and the 3rd IA. Students who had missed either of the IA were excluded from the study. A total of 126 students in batch-1 (2016-17) and 164 students in batch-2 attended both the IA and hence were included in the study. Batch-1 had TPE for both their IA including qualitative and quantitative experiments along with case discussion and spotters. Batch-2 had TPE for their 1st IA and OSPE in place of the qualitative experiment for their 3rd IA.

All the faculty members of the department were oriented towards the conduct of OSPE and were trained to design the OSPE stations and prepare the assessment checklist by qualified faculty of the Medical Education Unit. The topics that were included for the OSPE were discussed with all the faculty members in the department and were finalized with consensus.

Six OSPE stations were designed; among which four were observed stations and two were non-observed stations. All the students were oriented towards these stations during the practical classes and trained in performing the tests by emphasizing the importance of each step. Every student had to go through 2 OSPE stations, one observed and the other non-observed during their internal assessment.

The 1st and 3rd IA of batch-1 and the 1st IA of batch-2 were carried out as TPE consisting of one qualitative experiment. The assessment was carried out in eight batches with 25 students in each batch. Each student was given 5 minutes to complete an OSPE station. The examiners observed each student during the session and allotted the marks according to the checklist provided for each station.

After the 3rd IA of batch-2, feedback comprising various questions related to OSPE and the TPE were collected from the students on a five-point Likert scale. To evaluate the relevancy and clarity of each questionnaire, the content validity index (CVI) and content validity ratio (CVR) were calculated. The content validation of the questions was conducted by organizing an expert panel meeting comprising 10 members through a face-to-face approach. In the meeting, the expert panelists were briefed about the study, and the content validation form was provided with guidelines to review the questionnaire. The questions were given the score based on relevance from highest 4 to lowest 1 and later the rating was recoded as 1 (for the score 3 and 4) and 0 (for the score 1 and 2). CVI was calculated using the formula: CVI = agreed item/number of experts. CVR was calculated using the formula: CVR = [(E - (N / 2)) /

(N / 2)], where E is the number of experts who rated the question as relevant and N is the total number of experts. The coefficient of reliability of questions administered was calculated by Cronbach's alpha using the formula $\alpha = [k/(k - 1)] X [1 - ((\sum s_i^2)/s_t^2)]$ where k = number of items in the questionnaire, s_i = SD of the *i*th item, s_t = SD of the sum score.

Students were informed that their opinion in the feedback would be voluntary and kept anonymous, with no impact on their academic record. The responses were reported in a summative form. The feedback from the faculty was also collected to assess their perception regarding the OSPE session. Later the marks obtained only in qualitative experiments and OSPE from both the batches were collected to assess the improvement of the students in their academic performance.

Statistical Analysis: Data was tabulated in MS excel and responses of the students and the faculty to the feedback questionnaire were represented as percentages. Mean, standard deviation, and the *p*-value was calculated in MS excel. The differences and correlations were interpreted as statistically significant at $p<0.05$. The results were computed with a 95% confidence interval.

Results

Internal assessment marks: The mean practical IA marks of the batch-1 and 2 students in 1st and 3rd internals are tabulated in *Table 1* with their *p*-value.

Table 1: The Marks Obtained in the First and Third Internal Practical Assessment for Qualitative and OSPE

Mean ± Standard Deviation			
Study Variables	**First Internal**	**Third Internal**	***p*-value**
First batch (n=126)	6.71 ± 1.25	7.20 ± 1.13	*p*=0.000
Second batch (n=164)	6.2 ± 1.2	8.16 ± 1.76	*p*=0.000
p-value	*p*=0.509	*p*=0.000	

Table 2: Valid Percent of Student's Responses to the Questionnaire

Structured questionnaire	Strongly agree	Agree	Cannot comment	Disagree	Strongly disagree
The OSPE stations were relevant to the curriculum	67.5	31.3	0	0.6	0.6
The questions written were relevant to the topic	57.8	40.3	1.3	0.6	0
Sufficient time was given	30.5	39	15.6	8.4	6.5
The activity stations (glucometer and dipstick method) that were used to demonstrate skills were relevant	59.7	38.3	1.9	0	0
OSPE can assess a wide range of knowledge compared to the quantitative and qualitative estimation	44.2	39.6	11.7	3.2	1.3
Assessment through OSPE is fair compared with quantitative and qualitative estimation	44.2	37	13	4.5	1.3
OSPE should be followed as a method of assessment in biochemistry	53.2	32.5	11.7	1.3	1.3
Helps to improve the knowledge and skills in biochemistry	51.9	39.6	7.1	1.3	0
Provides chance to score better	54.5	34.4	7.8	1.9	1.3
Application of knowledge in clinical practice	53.9	42.2	3.2	0.6	0
Less stressful	33.8	31.8	20.1	9.7	4.5
Makes students think in more than one way	47.4	31.2	14.3	5.2	1.9
OSPE eliminates bias	46.1	37	13.6	0.6	2.6

Table 3: Faculty Response to the Questionnaire

	Frequency (n=11)	Valid Percentage
OSPE tested objectivity	11	100
Measured practical skills better	11	100
Eliminated examiner bias	11	100
OSPE should be conducted at frequent intervals	09	81.8
Introduction of OSPE for evaluation	11	100

***Student questionnaire*:** The CVR assessment of all the questions scored more than 0.96. CVR varies between 1 and -1. The higher score indicates further agreement of members of the panel on the necessity of an item. The questions whose CVI score is more than 0.83 are considered as appropriate, with six to eight panelists. Our score was more than 0.86, hence the questionnaire was considered appropriate. The Cronbach's alpha values between 0.8-0.9 are considered good and more than 0.9 as excellent internal consistency. Cronbach's alpha of the questions administered demonstrated to have high internal consistency with a score of 0.89.

***Faculty questionnaire*:** The CVR assessment of all the questions scored more than 0.96 and the CVI score was 0.8. Cronbach's alpha of the questions administered exhibited to have high internal consistency with a score of 1.24.

***Student feedback*:** Out of 164 students from batch-2 who attended the 3rd internal assessment, only 154 students took part in the questionnaire survey. Students gave a positive response for OSPE implementation which is shown in *Table 2.*

***Faculty feedback*:** All the faculty accepted that OSPE tested objectivity; measured practical skills better; eliminated examiner bias; and was an ideal tool for assessment, except that about 18.2% of the faculty were skeptical about conducting OSPE at frequent intervals because of the time taken and the number of faculty to be involved for the conduct of the same (*Table 3*).

Discussion

Assessment is strongly interconnected with curriculum and instruction. Assessment must include what and how it has been assessed, and its strength in future learning. It should assess "knows," "knows how," "shows how," and "does" (6). TPE which mainly focuses on subjectivity fails to evaluate the practical skills and its future use in the clinical setup is debatable. Harden *et al.* (10) were the first to describe OSCE to assess the clinical skills in clinical subjects, later it was modified to OSPE for pre- and para-clinical subjects. Recently, OSPE is been used not only as an evaluation method but also as a teaching method (5). In this study, we have made an effort to test the practicability and acceptability of both the students and faculty in implementing OSPE as a form of practical assessment and compared the marks obtained by the students in TPE and OSPE.

The TPE has its own merits and demerits. The merits include that it allows the examiner to assess the knowledge of the students in-depth by having the flexibility to ask questions with no time limit and the demerits include, no uniformity in asking questions by the examiner, the examiner may go out of the topic during the *viva*, no similarity in the time given to each student, etc. (11). Since the TPE focuses on subjectivity rather than objectivity it is believed that the demerits of TPE overweigh merits.

Relwani *et al.* (1) in their study showed that the mean marks scored by the students were significantly higher in OSPE when compared to the TPE and hence it was concluded that OSPE was better than TPE. Similarly, Suganthi *et al.* (4) and Trivedi *et al.* (12) concluded that OSPE helps the students to score better and also helps in conducting the examination in a shorter period. Our results were in concordance with these studies, wherein the students scored better marks in the practical internal assessment which included OSPE rather than TPE (*Table 1*). The marks obtained by the students of two different batches in the 1st and 3rd internal assessments were compared. The 1st practical internal assessment marks of both the batches were comparable with each other (p=0.509). The marks obtained in the 3rd practical internal assessment of both batches were significantly higher when compared to the 1st practical internal assessment. Even though batch-1 was not exposed to OSPE for their 3rd internal assessment their marks were significantly increased, this may be because the students were getting acquainted with the new teaching and learning environment after finishing their schooling. But the marks obtained in the 3rd practical internal assessment of batch-2 who was exposed to OSPE were significantly higher (p=0.000) when compared to batch-1. This clearly indicates that OSPE improves the students' performance when compared to TPE.

We also assessed the perception of students and faculty towards OSPE by collecting feedback from them in a structured questionnaire (*Table 2 & 3*). The OSPE

stations and the checklist to be followed in each station were discussed in the department with all the faculty. The students were oriented to these OSPE stations and the checklist during their practical classes before being assessed in the internal examination. The students opined that OSPE stations and the checklist used to assess the skill in each station were relevant to their curriculum. Nearly seventy percent of the students accepted that the time given to perform and interpret OSPE was sufficient. The activity stations meant to assess the skills and knowledge were well accepted by the students and they opined that they could use this skill in their future clinical practice. Students also agreed that the degree of knowledge is better evaluated in OSPE than in TPE. Our study was in congruence with the others where students agreed that OSPE was fair and easier when compared to TPE (3-5). This may be because the students could score better, carry out OSPE with ease as the steps were well-defined and well-explained during the training sessions and the time allotted for all the students was equal.

Regarding the faculty perception, all agreed that OSPE tested objectivity. Relwani *et al.* (1), and Wadde *et al.* (13) also stated that most of the faculty agreed that OSPE was more comprehensive and covered ample knowledge when compared to TPE. Most of them suggest that OSPE should be followed as a method of assessment that improves the knowledge and skills related to biochemistry and help them to think laterally which may be beneficial in their clinical practice in the future. A study conducted by Relwani *et al.* (1), and Radhika *et al.* (14) showed that the faculty believed that OSPE was a fairer method when compared with the traditional examination.

Relwani *et al.* (1), and Rajkumar *et al.* (3) showed that most of the faculty agreed that examiner bias can be eliminated by OSPE. Similarly, in our study, all the faculty and most of the students agreed that the examiner's bias can be eliminated by the implementation of OSPE. Hence, the students' performance which is generally affected by the examiner's subjectivity and favoritism towards a student can be effectively minimized by OSPE. A study by Rajkumar *et al.* (3) stated that the majority of the students were in favor of implementing OSPE in the pre-clinical subjects for better scoring, improved thinking, and eliminating bias. Similar studies by Menezes *et al.* (15), Rowland *et al.* (16) Rahman *et al.* (17), and Jaswal *et al.* (18) asserted that OSPE is a useful tool for assessing skills in forensic medicine, anatomy, physiology, and biochemistry respectively.

Studies by Relwani *et al.* (1), Rajkumar *et al.* (3), and Wadde *et al.* (13) stated that faculty and students agreed that the degree of stress on students was less while performing OSPE than TPE. These results are in accordance with our study where most of the students agreed that OSPE was less stressful. The less stressful surroundings increase the student's ability to perform the practicals in a relaxed manner and score better in the examination. 20.1% of the students who participated in our study were neutral about the question related to stress which may be due to the fact that they were exposed to the OSPE for the first time and had the fear of being observed.

The limitation in our study was that we did not group the students based on the marks obtained in two different internals, a stress questionnaire to assess the stress was not included and no gender comparison was done.

Conclusion

More and more OSPE stations can be included in the practical syllabus to assess the students extensively. But, in doing so, OSPE may become lengthy and exhaustive and this may be the reason that 18.2% of the faculty disagreed with the conduction of OSPE at frequent intervals. However, despite a few negative feedbacks, by-enlarge both faculty and students appreciated and favored the implementation of OSPE in the medical curriculum for assessing the student's skill.

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Conflicts of Interest

There are no conflicts of interest.

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