



## **Evaluation of OSPE in Medical Laboratory Sciences Department: Post- Examinations Quality Metrics**

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### **Authors' contributions**

*This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.*

### **Article Information**

DOI: 10.9734/JESBS/2021/v34i930354

*Editor(s):*

(1) Dr. Alina Georgeta Mag, "Lucian Blaga" University of Sibiu, Romania.

*Reviewers:*

(1) Fauzie Rahman, Universitas Lambung Mangkurat, Indonesia.

(2) Ibrahim Halil Yurdakal, Pamukkale University, Turkey.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/73272>

**Original Research Article**

**Received 28 June 2021**

**Accepted 08 September 2021**

**Published 17 September 2021**

### **ABSTRACT**

**Introduction:** Assessment plays a major role in improving the learning and teaching process. The practical examination has a key role in the assessment of students' competences. In conventional method, the judgment of students' performances is mainly subjective because the same performance of students is graded differently by different examiners. Successful implementation of OSPE deals with this major deficit of the conventional methods

Assessing the assessment is very important because the implementation of OSPEs are very complex and resource intensive, as it needs large numbers of examiners, candidates and physical resources and equipment as well as time.

Assurance of sufficient quality of OSPEs by a range of metrics that gives us critical view about the assessment process as a whole, rather than focusing on candidate outcomes only.

**Objectives of the study:** The objectives of this study were

- 1- To evaluate OSPEs conducted by Medical laboratory sciences department in Fakeeh College for Medical Sciences(FCMS) with regards to their quality metrics as an assessment tool.

**Results:** A cross-sectional analytic study was conducted in Medical Laboratory Sciences Department Practical Examinations at FCMS

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Before OSPE conduction, the different stations were revised for criteria of content coverage, skills assessed, clarity of language, dominant domain assessed, and time allocated for each station. Post examinations quality metrics results showed that the reliability of the different examination in Medical Laboratory Sciences department ranged from 0.75 to 0.93 that mean good to excellent reliability. One OSPE showed that one or two stations didn't contribute to the overall all reliability of the whole exam. All OSPEs showed that there are good positive correlation between the theoretical and practical part of the course, and this come with the concurrent evidence of validity.

*Keywords: OSPE; assessment; quality metrics.*

## 1. INTRODUCTION

The Objective Structured Practical Examination (OSPE) plays an important part in the assessment of performance in simulated environment in a number of stations [1]. In each station, students are requested to perform one practical skill, usually in 2-5 minutes, related to procedural skill, Identification of data and data interpretation [2].

OSPE is a complex task that requires complete understanding of the underlying educational principles [3]. The institutions that implement OSPE is as an assessment tool should ensure quality assurance and continuous improvement to maintain standards and psychometric rigor [4].

(OSPE) uses criterion-based assessment principles within a robust process that begins with 'blueprinting' course content against pre-defined competences [5]. Moreover, at the station level, Performance is assessed using an item checklist with detailing sequences of behaviors. and ended with a global rating that relies on overall assessment by examiners [6]. To ensure the quality of OSPE delivery, a range of metrics that allow thoughtful consideration of the performance of the assessment as a whole, rather than just a narrow focus on candidate outcomes [7]. 'Assessing the assessment' is vital, as the delivery of OSCEs are complex and resource intensive, usually involving large numbers of examiners, candidates and often taking place across parallel sites [8].

## 2. CONCEPTUAL FRAMEWORK FOR EVALUATING OSPE

The aim of the current study is to evaluate OSPEs conducted by Medical laboratory sciences department in FCMS with regards to their quality metrics as an assessment tool.

Before conducting OSPEs, the individual stations were standardized by establishing the blueprint, checklists for procedural skill stations and

revising of OSPE stations instructions to the candidates and the examiners. Face and content validity were established through reviewing by subject experts and assessment center representative, respectively. Internal construct reliability was assessed using Cronbach's alpha. Also, the reliability of each station and if the stations contributed to the overall reliability. The R2 coefficient was used to assess the proportional change in the dependent variable (checklist score) due to change in the independent variable (global grade). This determined the degree of (linear) correlation between the checklist score and the overall global rating at each station and helped to determine inappropriate checklist and station design. In addition to that, correlation with scores from another instrument assessing the same construct was assessed using the Pearson's coefficient of correlation between OSPE and Written exam for the same course.

## 3. METHODS

This is a cross sectional study, where Medical Laboratory Sciences OSPEs were evaluated for validity and reliability evidence.

This study was conducted in Medical Laboratory Sciences Department at FCMS in First Semester of the Academic Year 2019-2020 where ten OSPEs were conducted in different courses. Each of them comprised of a total of 10-15 OSPE stations which included one or two observed station (Procedural skill) and the other stations are non-observed stations. According to OSPE blueprint domain of Competencies addressed in OSPEs are Identification of data, Interpretation of data, Procedural skills and safety measures and communication.

### 3.1 Data Collection

OSPEs in Medical Laboratory Sciences Department at FCMS went through three phases.

**First: Planning phase of OSPE** in this phase the following points will be covered

1. Preparation of OSPE blueprint using the blueprint template according to the following points:

- Review the course learning outcomes
- Decide on domains of skills to be tested (Identification of data, Interpretation of data, Procedural skills and safety measures and communication)
- Map the domains against the learning objectives
- Sampling: decide on the proportion of stations in each section

2. Calculate your total testing time; ensure appropriate time is allowed for the task at each station

3. Writing stations according to station writing template.

4. Revising the checklists for each procedural examination station by assessment center members.

5. Training for the students for exam process (mock exam) by course coordinator in each course

6. Training for stations raters for calibrations and standardization for procedural skill station.

### **Second: Implementation stage of OSPE:**

1. Assigning roles and responsibilities (exam coordinator, examiners, support staff)

2. Orientation and debriefing of the students and examiners.

3. Each OSPE should include 10-15 stations at least (static and dynamic) each station lasts from 5-10 minutes.

4. The following materials are available for every station:

- Station writing template including (candidate instructions, Examiner instructions and equipment list)
- Marking Guidance including (station checklist and scoring rubric)

### **Third: Evaluation phase of OSPE:**

1. Marking of stations by the examiners

2. Doing evaluation metrics (psychometric analysis) after station marking which includes the followings:

#### **A. Content evidence of Validity**

- a. Establishment of OSPE blueprint: to ensure that the skills being assessed are accurately and completely represented on OSPE. In addition to that to allow

mapping of these skills to specific learning outcomes

**Metrics 1:** Identified assessed Domain in each OSPE.

#### **B. Internal structure validity evidence:**

The internal structure validity evidence correlates to the psychometric measures of the test encompassing inter-item correlations and exam reliability. Reliability was evaluated using the following metrics:

#### **Metrics 2**

Cronbach's alpha measures the internal consistency whereby in an effective test, better students should perform similarly well in all stations. Acceptable alpha value in OSPEs is 0.7 or above. In addition to the number of stations didn't contribute to overall reliability.

#### **C. Response process evidence of validity**

Ensures the correctness and the integrity of the data collected through OSPE reduce any possible bias

a. Review and revision of existing OSPE stations: All the stations were revised and assessed by content and non-content expert for content clarity, clear instruction to students and avoidance of duplicity across various stations

b. Development of checklist: All the individual stations were reviewed in detail and a uniform checklist for scoring individual stations was ensured.

c. The validity of the final scores relates directly to the accuracy of the grades provided by the assessors. The assessors were provided with the appropriate orientation and instructions in order to get familiar with the checklists' items, the marking process, and the expected students' behaviour. Checklists included 10–15 items for each station Each item was scored using a 3-point scale correlated to the task completion. The global rating score consisted of a 3-point scale (clear pass, Borderline and Clear fail) associated with the overall performance of the student and based on the Assessors' global impression and not on the items' scores.

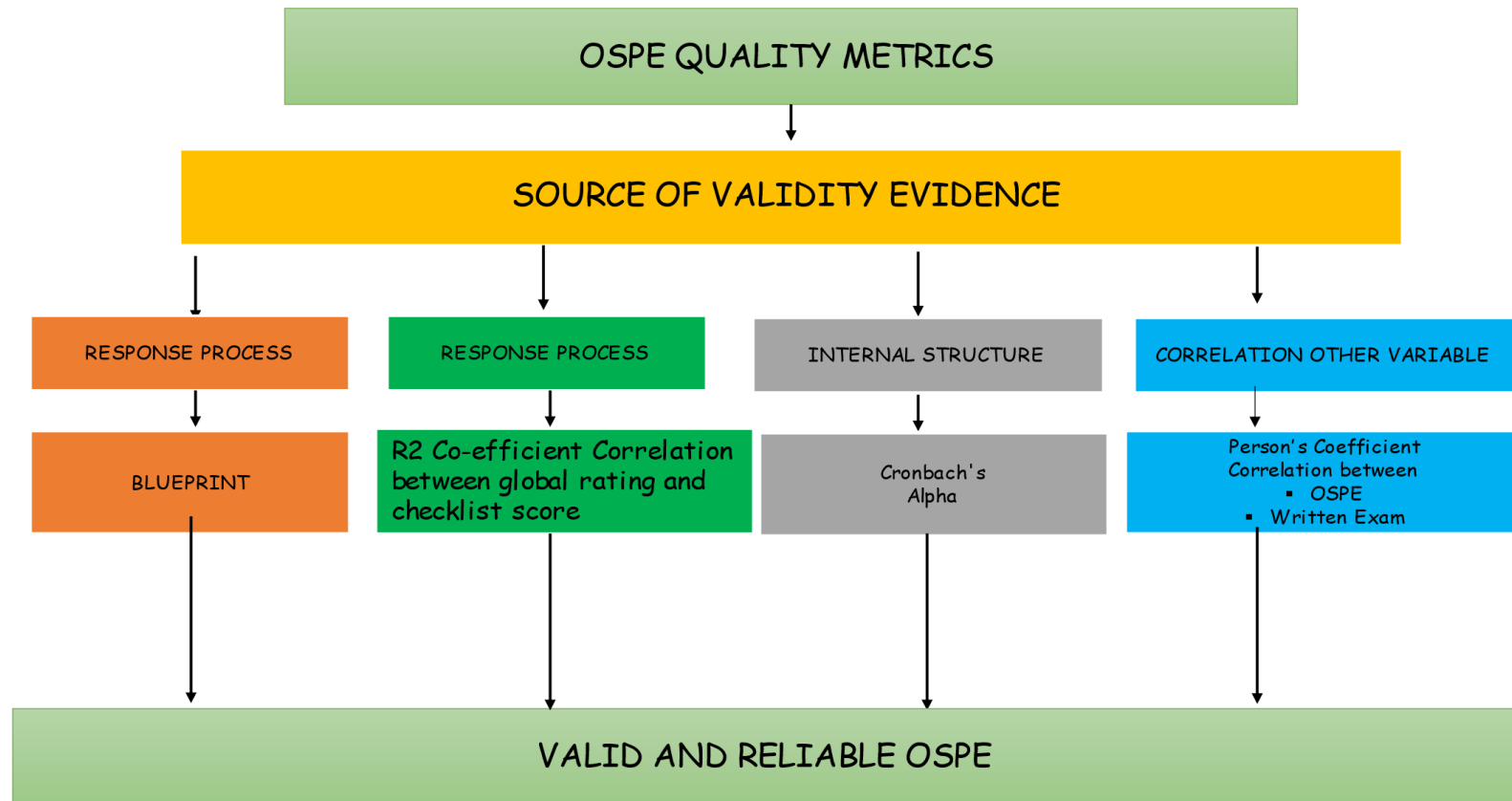


Fig. 1. Conceptual Framework for Evaluating OSPE

### Metrics 3

R2 coefficient is the squared linear correlation between the global rating score and the checklist score. It is expected that the two scores be positively correlated. An R2 = 0.5 is considered reasonable.

### D. Relations to other variables

correlation with scores from another instrument assessing the same construct

### Metrics 4

The Pearson's coefficient of correlation between OSPE and Written exam for the same course

### E. Students' satisfaction about OSPE

Self-administered questionnaire to assess students' Satisfaction about OSPE. The questionnaire consists of 4 constructs with 23 items. The questionnaire was designed using a 5-point Likert response scale ranging from 1 (strongly disagree) to 5 (strongly agree).

### Metric 5

Feedback from students: The satisfaction of the students were assessed using questionnaire. The used questionnaire consists of four core factors and 23 items

- I. Organization of the examination
  - II. Preparation for the examination
  - III. Quality of the examination
  - IV. Stations quality and design
3. Reporting the findings and identifying the area of strengths and areas of improvement using Report of internal verification of assessment (RIVA) template for OSPE.
  4. Developing recommendations and action plan for upcoming OSPEs through Post examination metrics report.

## 3.2 Statistical Analysis

The data were analyzed using SPSS software Version 25. The scores obtained were analyzed to calculate Cronbach's alpha. Correlation analysis was conducted also. A *P*-value of <0.05 was statistically significant. Internal consistency

reliability for each scale was analyzed using Cronbach's  $\alpha$  statistic.

For student satisfaction questionnaire Data were presented as mean  $\pm$  standard deviation (SD) of each parameter.

## 4. RESULTS

The Table 1 showed the Medical Laboratory Sciences department OSPE stations ranged from 10 to 15 station Moreover most of OSPE stations in MLS program assessed data interpretation and procedure skills.

The Table 2 showed that the overall OSPE reliability ranged from 0.75 to 0.93 which indicates good to excellent reliability.

In addition to that some OSPEs had one or two stations that didn't contribute to overall reliability.

The Table 3 showed that all procedural skill stations had positive good to excellent correlation between checklist score and the global rating which indicate good checklist construction.

All OSPEs in Medical Laboratory Sciences Department had good to excellent correlation between their theoretical and practical part of the course

The Table 4 showed that almost the students were satisfied about OSPE.

## 5. DISCUSSION

OSPE was firstly introduced in MLS program at FCMS in the academic year 2018/2019. It was introduced as a substitute to the traditional practical exam which was adopted for years from the beginning of MLS program in FCMS. Assessment centre took the role to ensure validity and reliability of OSPE through a rigorous process and different measures. The aim of this study is to establish validity and reliability of (OSPEs) as a tool of assessment in Medical Laboratory Sciences department in FCMS. This was done through evaluation of OSPEs conducted by Medical laboratory sciences department, FCMS with regards to their quality metrics as assessment tools and measuring the satisfaction of the students regarding OSPE.

Since it is more objective, OSPE has been claimed to be a successful alternative for the traditional practical exam methods [9]. This

assessment method is focused on competencies assessment for practical and procedural skills with the goal of delivering high-quality products, as it allegedly provides detailed evaluation and prompt recognition of deficiencies [10]. Many educationists assume that the OSPE method can be an effective tool for evaluating basic science skills, at each station, a student performs a different task or mission [11]. OSPE is said to be a reliable method that can discriminate between various groups of students [12]. At the time of the exam, in different stations, it also measures the student's mental attendance and attitude toward learning [13]. In the current study a variety of domains of competencies were assessed including procedural skills, identification of abnormal findings, data interpretation and communication and safety measures. In addition, a blueprint was established for each OSPE exam to ensure that the skills being assessed are accurately and completely represented on OSPE, as well as, to allow mapping of these skills to specific learning outcomes

Cronbach's alpha was used to measure the internal consistency, overall OSPE reliability

ranged from 0.75 to 0.93, in addition to that some OSPEs had one or two stations that didn't contribute to overall reliability. Cronbach's alpha was also used to determine the reliability's coefficient of OSPE and OSCE in many medical and health colleges in both high and low stake exams [14,15]. Based in comparing the results of the current study and other similar studies in using Cronbach's alpha for measuring OSPE's exam internal consistency, the current results indicate good to excellent reliability of MLS OSPE examinations.

R2 coefficient correlation between the global rating score and the checklist score, revealed that all procedural skill stations had positive good to excellent correlation between checklist score and the global rating which indicate good checklist construction. In the study conducted by Rajiah et al 2014, they confirmed that, the global rating scale is acceptable for assessing students' abilities within the context of an OSCE. The strong correlation between the global rating scale and task-based checklists showed that the global rating scale could reliably measure students' skills [16].

**Table 1. Metric 1: Identified assessed Domain in each OSPE**

| <b>Courses</b>                                 | <b>Number of stations</b> | <b>Domain of competences</b> |  |                            |  |
|--|---------------------------|------------------------------|--|----------------------------|--|
|  |                           | <b>Procedural Skills</b>     | <b>Identification of abnormal findings</b> | <b>Data Interpretation</b> | <b>Communication and safety measures</b> |
| <b>Biochemical Instrumentation and methods</b> | 13                        | 1                            | 3  | 9                          |  |
| <b>Clinical Biochemistry II</b>                | 10                        | 2                            |  | 8                          |  |
| <b>Clinical Bacteriology I</b>                 | 15                        | 2                            | 3  | 10                         |  |
| <b>Clinical Bacteriology II</b>                | 13                        | 2                            | 1  | 10                         |  |
| <b>Biochemistry for health sciences II</b>     | 10                        | 1                            |  | 7                          | 1  |
| <b>Clinical Virology</b>                       | 18                        | 2                            | 1  | 15                         | 1  |
| <b>Electron Microscopy</b>                     | 20                        |                              | 10   | 10                         |  |
| <b>Histopathology and cytopathology</b>        | 15                        |                              | 4  | 10                         | 1  |
| <b>Introduction to Microbiology</b>            | 15                        | 1                            | 3  | 10                         | 1  |
| <b>Clinical Parasitology</b>                   | 15                        | 1                            | 4  | 10                         |  |

**Table 2. Metric 2: Metrics 2- Cronbach's alpha measures the internal consistency**

| <b>Courses</b>                          | <b>Number of stations</b> | <b>Exam Reliability of OSPE (Cronbach Alpha)</b> | <b>Number of stations didn't contribute to overall reliability</b> |
|---|---------------------------|--|--|
| Biochemical Instrumentation and methods | 13                        | 0.90   | 0  |
| Clinical Biochemistry II                | 10                        | 0.87   | 1  |
| Clinical Bacteriology I                 | 15                        | 0.77   | 1  |
| Clinical Bacteriology II                | 13                        | 0.83   | 1  |
| Biochemistry for health sciences II     | 10                        | 0.93   | 2  |
| Clinical Virology                       | 18                        | 0.80   | 0  |
| Electron Microscopy                     | 20                        | 0.75   | 2  |
| Histopathology and cytopathology        | 15                        | 0.78   | 2  |
| Introduction to Microbiology            | 15                        | 0.76   | 1  |
| Clinical Parasitology                   | 15                        | 0.88   | 0  |

**Table 3. Metrics 3: R2 coefficient correlation between the global rating score and the checklist score**

| <b>Courses</b>                          | <b>Number of Procedural stations</b> | <b>R2 coefficient correlation between the Global rating score and the checklist score</b> | <b>P- value</b> |
|---|--------------------------------------|---|-----------------|
| Biochemical Instrumentation and methods | 1                                    | 0.494   | .000            |
| Clinical Biochemistry II                | 2                                    | 0.724<br>0.947  | .000<br>.000    |
| Clinical Bacteriology I                 | 2                                    | 0.485<br>0.885  | .000<br>.000    |
| Clinical Bacteriology II                | 2                                    | 0.702<br>0.485  | .000<br>.000    |
| Biochemistry for health sciences II     | 1                                    | 0.885   | .000            |
| Clinical Virology                       | 2                                    | 0.80<br>0.75  | .000<br>.000    |
| Introduction to Microbiology            | 1                                    | 0.914   | .000            |
| Clinical Parasitology                   | 1                                    | 0.810   | .000            |

**Table 4. Metrics 4: The Pearson's coefficient of correlation between OSPE and Written exam**

| <b>Courses</b>                          | <b>The Pearson's coefficient of correlation between OSPE and Written exam for the same course</b> | <b>P- value</b> |
|---|---|-----------------|
| Biochemical Instrumentation and methods | 0.673   | .000            |
| Clinical Biochemistry II                | 0.662   | .000            |
| Clinical Bacteriology I                 | 0.485   | .000            |
| Clinical Bacteriology II                | 0.822   | .000            |
| Biochemistry for health sciences II     | 0.743   | .000            |
| Clinical Virology                       | 0.665   | .000            |
| Introduction to Microbiology            | 0.892   | .000            |
| Clinical Parasitology                   | 0.821   | .000            |

**Table 5. Metrics 5: Means and Standard deviation of the four factors of students' OSPE satisfaction Questionnaire (n=337)**

| Factors                              | Number of Items | Means | Standard deviation | Percentages % |
|--------------------------------------|-----------------|-------|--------------------|---------------|
| (F1) Organization of the examination | 5               | 4.4   | 0.76               | 88            |
| (F2) Preparation for the examination | 4               | 4.5   | 0.78               | 90            |
| (F3) Quality of the examination      | 6               | 4.7   | 0.83               | 94            |
| (F4) Stations quality and design     | 8               | 4.4   | 0.75               | 88            |

*N.B. scales were rated out of 5*

Regarding the correlation between OSPE and Written exam, the Pearson's coefficient showed that all OSPEs in Medical Laboratory Sciences Department had good to excellent correlation between their theoretical and practical part of the course. In the study conducted by Al-Osail et al 2015, the validity of OSCE in internal medicine exam was measured using Pearson's correlation, the validity of the OSCE was 0.63, which is near to great extent to that of the current study which has the average of 0.71 [17].

The result of the students' questionnaire analysis showed high satisfaction rate and this results was consistent with study conducted at Rak Medical and Health Sciences University (Rakmhsu), UAE where students were satisfied about the OSPE and this reflects good planning and implementation of OSPEs at FCMS [18].

## 6. CONCLUSIONS

Based on the findings of the current study on using OSPEs for assessing practical skills in MLS program at FCMS, in addition to comparing its results with similar studies on both OSCE and OSPE, it is of great importance to establish a complete quality system to ensure the validity and reliability of OSPE. This quality system should depend on more than one parameter to ensure exam validity, internal consistency, and its correlation with other assessment tools like written examination, which ensure concurrent validity. It is also recommended to expand the use of OSPE and OSCE in other programs in FCMS as substitute to the traditional practical and clinical exam respectively.

## CONSENT

As per international standard or university standard, Participants' written consent has been collected and preserved by the authors.

## ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the authors.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES

1. Anupama K. Objective Structured Practical Examination (OSPE) in Nursing. Journals Pub ; 2019.
2. Harden RM, Cairncross RG. Assessment of practical skills: the objective structured practical examination (OSPE). *Studies in Higher Education*. 1980;5(2):187-196.
3. Khan KZ, Ramachandran S, Gaunt K, Pushkar P. The objective structured clinical examination (OSCE): AMEE guide no. 81. Part I: an historical and theoretical perspective. *Medical Teacher*. 2013;35(9): e1437-e1446.
4. Ranga Rao D, Parameswari Babu U, Kalyan Chakravarthy CV, Ramya N. Objective structured practical examination (OSPE) as a tool in formative assessment of II MBBS students, in pathology *International Journal of Researches in Medical Sciences*. 2018; 6(1):221-224.
5. Pell G, Fuller R, Homer M, Roberts T. How to measure the quality of the OSCE: a review of metrics—AMEE guide no. 49. *Medical Teacher*. 2010;32(10):802-811.
6. Ranjan R, Jain A, Rashmi Bhujade R. OSPE in anatomy: New dimensions in assessment. *Int J Anat Res*. 2016;4(1): 1789-1794.
7. Shadap MA. Tool for competency-OSCE/OSPE: A Short review. Ranjan, R., Jain A, Rashmi Bhujade R. OSPE in anatomy: New dimensions in assessment *Int J Anat Res*. 2016;4(1): 1789-1794
8. Dutta, AK, Goswami K, Murugayan SB, Sahoo S, Pal A, Paul C, Biswas S. Evaluation of e- OSPE as compared to traditional OSPE: A pilot study.



- Biochemistry and Molecular Biology Education. 2021;49(3):457-463.
9. Malik S, Hasan S, Hamad A, Khan H, Bilal M. Conventional/ traditional practical examination (CPE/TDPE) versus objective structured practical evaluation (OSPE)/ semi objective structured practical evaluation (SOSPE). Pakistan Journal of Physiology. 2009;5(1).
  10. Gitanjali B. The other side of OSPE. Indian journal of pharmacology. 2004;36(6):388.
  11. Kam B, Oh YR, Lee SH, Roh HR, Hahm JR, Im SJ. Experience of clinical skills assessment in the Busan-Gyeongnam Consortium. Korean journal of medical education. 2013;25(4).
  12. Kemelova GS, Tuleutaeva ST, Aimbetova DB, Garifullina RR. An objective structured clinical examination in dentistry: strengths and weaknesses. Dentistry. 2019;98 (4), 8-11.
  13. Kundu D, Das HN, Sen G, Osta M, Mandal T, Gautam D. Objective structured practical examination in biochemistry: An experience in Medical College, Kolkata. Journal of Natural Science, Biology, and Medicine. 2013;4(1):103.
  14. Lawson DM. Applying generalizability theory to high-stakes objective structured clinical examinations in a naturalistic environment. Journal of manipulative and physiological therapeutics. 2016;29(6):463-467.
  15. Nurumal MS, Aung KT, Ismail S. Reliability and Validity of the Objective Structured Clinical Assessment (OSCA) in Undergraduate Nursing Program. Journal of Advanced Research in Social and Behavioural Sciences. 2016; 4:146-151.
  16. Rajiah K, Veettil SK, Kumar S. Standard setting in OSCEs: a borderline approach The Clinical Teacher. 2014; 11(7):551-556.
  17. Al-Osail AM, Al-Sheikh MH, Al-Osail EM, Al-Ghamdi MA, Al-Hawas AM, Al-Bahussain AS, Al-Dajani AA. Is Cronbach's alpha sufficient for assessing the reliability of the OSCE for an internal medicine course?. BMC Research Notes. 2015;8(1):1-6.
  18. Goud BKM, Begam S, Zaki B, Haridas S. Perceptions and performance of undergraduate medical students in objective structured practical examinations (OSPE) in biochemistry at RAK Medical and Health Sciences University (RAKMHSU), UAE. Journal of Universal College of Medical Sciences. 2014; 2(4): 54-61.

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