

The Use of OSCE to Predict the Future Work Performance of Singapore Nursing Students

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Abstract— The objective structured clinical examination (OSCE) was first introduced by Dr. Ronald Harden in 1970s to deal with the lack of objectivity and consistencies in clinical competence assessment among examiners due to the varied conditions within the real clinical workplace. OSCE has emerged as an authentic assessment method for evaluating clinical competence in doctors and other health professionals. Although OSCE has been widely researched on within the medical literature in terms of psychometric testing, there is a paucity of studies which report the development of OSCE as a summative examination within nursing education. This study reports the development of the OSCE instrument to measure final-year nursing students' clinical competence at the end of a three-year nursing diploma program, and predict their future work performance, also referred to as readiness for practice, at the end of a six-month post-registration internship at hospitals in Singapore. The findings showed that OSCE can be a valuable assessment method to measure clinical competence and predict future work performance. The OSCE can also be used by nurse educators to determine learning gaps and provide remedial training for 'under-performing' graduating student while nursing administrators can use it to evaluate the clinical competence of foreign trained nurses as part of the interview process for recruitment and selection purposes.

Keywords- OSCE; nursing; work performance; competence; predictive value

I. INTRODUCTION

The OSCE was first introduced by Dr. Ronald Harden in the United Kingdom in 1975 to address the gap in the current assessment methods used for the training of medical students [1]. The main mode of assessment at that time was clinical observation of the medical trainees by the examiners within the actual hospital settings but Harden observed that this process posed much considerable subjectivity, such as risks for assessor bias and inconsistency in the patients' clinical presentation. He therefore designed the OSCE to address these

issues. The original OSCE consisted of 16 five-minute stations, which assess different components of clinical competence required of medical students [2]. Harden also stated that some stations used real patients or standardized actors to test skills such as clinical examination while other stations have written or oral examinations. Under the OSCE framework, the students would normally rotate to the next station at timed interval and each station would be manned by at least one examiner throughout the entire session until every student complete all sixteen stations [1].

Since the introduction of OSCE in medical education in the 1970s, OSCE has been adopted by an increasing number of medical schools across the Western countries such as the United States, Canada, New Zealand and even Asian countries like Philippines and Malaysia [3]. Some countries have even made it a prerequisite as part of the national board examination for registration for professional practice [4], [5]. For example, in Canada, it is compulsory for the medical students to pass the OSCE as part of the pre-registration qualifying examination in order to practice as physicians in the country. The use of the OSCE as an assessment tool is so popular that its use had been increasingly adopted by other healthcare professionals such as the physiotherapists [6] and nurses [2], [7]. The main causes behind the popularity of the OSCE framework are numerous. For example, the OSCE is viewed as more valid than the skills performance checklist and multiple-choice question test as it can provide a comprehensive assessment of a student's knowledge, skills and attitudes (KSA). The KSA domains are viewed by many medical educators as the major underpinnings competency domains required for competent clinical practice [5].

Because of the success of OSCE in medical education, the nursing profession adapted the OSCE framework for their use in nursing examinations in as early as the 1980s [2]. However, Rushforth stated that the OSCE process used for the nursing

examinations was either modified or differed greatly from Harden's original framework or other medical OSCE models [2]. Rushforth observed that the nursing OSCEs had changed over the years to represent an accurate assessment of nursing clinical competence, which was very different from medical ones. For example, the number of stations ranges from 1 to 20 and the duration of the station can range from 4 to 70 minutes in length. While the format of nursing OSCEs varies across different nursing schools, they all share the common principle of seeking to objectively assess a student's proficiency in common clinical and nursing skills such as physical examinations, patient teaching and caring.

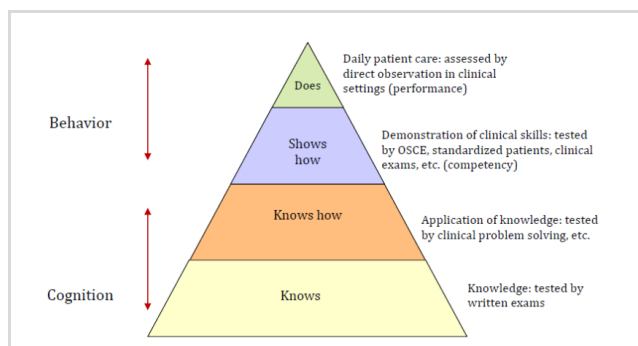


Figure 1. Miller's Model for Clinical Competence [8]

According to Walsh and colleagues, healthcare educators have debated the usefulness of the OSCE as the "gold standard" for judging nursing competency and whether it can replace the existing traditional form of assessment such as the theory examination, professional portfolios and clinical observations [9]. Proponents for OSCE used the Miller's model of competence (Fig.1) to argue that the existing assessment tools, such as written examinations, have failed to evaluate the higher level of nursing competence in a valid and reliable manner and are only able to test the cognition and knowledge of the students [10]. These existing assessment tools also fail to provide formative and summative feedback for the students on how they can improve themselves [11]. The proponents also argued that the unpredictability of the clinical situations and subjectivity of the assessors can pose serious threat to the validity and reliability of the existing tools. In view of the advantages of using OSCE, the proponents recommended to use OSCE as it has the capacity to test all levels of competence based on the Miller's model [2].

Although OSCE has been widely researched in medical and nursing education worldwide, there is a paucity of studies on the use of OSCE as a high-stake exit examination in nursing literature and none reporting the use of nursing OSCE in Singapore. This study aimed to: (1) Phase 1 - report the development of the OSCE to measure clinical competence of final-year nursing students at a nursing school or newly-graduated nurses in Singapore; and (2) Phase 2 – evaluate the predictive validity of using the OSCE scores to predict future

work performance at the end of the six months of internship at the hospital.

II. METHOD

A. Phase 1 – Development of the OSCE

Assessment design was a reiterative process involving multiple consultations with various experts and stakeholders, informed at all times by ongoing analysis of the literature on competence-based assessment tools, and professional resources such as the SNB guidelines [12]. This study adopted the Jones' process of 'blue printing' to develop the Parkway Nursing OSCE (PNOSCE) framework at the nursing school [12]. Jones and colleagues described the development stage as a process whereby the clinical tasks at each OSCE station are mapped to pre-defined learning outcomes of a programme. There are three steps to this stage: (i) review learning outcomes of a programme or module; (ii) define the competencies or tasks to be achieved by the students; and (iii) match the learning outcomes to the competencies to decide which skills will be examined. Each consultation was informed by concurrent review and analysis of the literature and other resources, such as the SNB's Core Competencies for RN [13].

The PNOSCE framework was developed based on the literature review and consultations with a committee of five industry experts, comprising of one nurse educator from Parkway Health, three faculty members from Parkway College and one international nursing expert. These industry experts were selected based on their expertise in clinical nursing and years of experience in nursing education. The practice of inviting expert groups to contribute to the development of assessment tools is a well-established tradition in assessment design [14].

The PNOSCE development process took four weeks for completion. Three face-to-face meetings were held altogether during the PNOSCE development period in the month of December 2011. The experts provided a critical examination of the proposed theoretical framework for assessment, guided the development of assessment content, evaluated how well the assessment content and processes represented the construct of interest, and critically examined scoring rules and criteria [14]. The rigorous process of PNOSCE development over the four-week period helped to confirm the face validity of the PNOSCE examination for this study [14]. These meetings finalized consensus positions regarding the specific issues related to the PNOSCE structure, research and data collection and other issues that required further consideration. The three components of the PNOSCE examination structure would be reported in details in the Results section.

B. Phase 2 – Feasibility testing of the OSCE

A non-experimental, prospective quantitative research design was used for Phase 2. A non-experimental prospective method enabled the author to observe the relationship among the variables of interest, OSCE results, academic grades, and future work performance at the ward [15]. The second phase of this study lasted over seven months from April 2012 to October 2012. The three-day PNOSCE examination was conducted in April 2012 during the transition period from the point of graduation from the diploma in nursing course to just before the new graduate nurses' employment at the participating hospitals. At the end of the PNOSCE examination, the OSCE results were collected and tabulated. In addition, the graduates' academic records were also obtained from the school record databases system as secondary data. The graduates were then given a one-week vacation before they commenced their six months of internship period from April 2012 to October 2012 at one of the four hospitals under Parkway Pantai Healthcare Group. At the end of the internship period, the hospital internship assessment reports, SNB Competency Assessment Report for General Nursing (SCARGN) form which was used to evaluate clinical performance, was collected from Parkway College in November 2012 [13]. The OSCE assessment results, graduates' academic records, hospital internship assessment reports were the primary form of data collection to address research questions. Ethical approval and consent were obtained from the nursing school.

Data were collated using Microsoft Excel spreadsheet and then exported to IBM SPSS 22.0 for data analysis for quantitative data. Descriptive statistics were used to perform univariate analysis and describe the participants' demographic characteristics, and study measures. Inferential statistics were used to perform multivariate analysis and determine if the OSCE results could predict the clinical performance during the first six months of internship, as measured by the SCARGN.

III. RESULTS

A. Phase 1 – Parkway Nursing OSCE (PNOSCE) Framework

The final PNOSCE framework had three main components: (i) Examination structure and layout; (ii) OSCE rating tool; and (iii) inter-rater meeting and training of standardized patients. The PNOSCE framework consists of three components, which describe the entire OSCE process: (i) OSCE examination process; (ii) the inter-rater briefing sheet to standardize the assessment standards prior to conducting the OSCE examination; and (iii) OSCE rating tool.

1) OSCE Examination Structure and Layout

The OSCE examination structure was intended as a summative assessment for the three-year nursing program to

assess graduates' clinical competence and determine whether they were ready to function as beginner registered nurses for the actual clinical workplace and began their first six month of internship at the hospitals. Therefore, the Singapore Nursing Board (SNB) generic skills domains for registered nurses were used as a point of reference for the PNOSCE development [13]. Using simulated situations within the PNOSCE structure, the 12-station OSCE structure was designed to allow the examiners to assess the students' ability to perform the twelve expected nursing competency standards as outlined by the Singapore Nursing Board (SNB) generic skill domains for registered nurse as follows: (a) admission/discharge procedures, (b) health assessment and vital signs, (c) assisting with activities of daily living; (d) administration of enteral feeds, (e) oxygen therapy, (f) administrative of parenteral medications, (g) administration of non-parental medications, (h) wound care, (i) diabetes management, (j) medical emergencies, (k) infection control practices, and (l) patient education.

Under the PNOSCE layout, each clinical station was fifteen minutes in duration and assessed a diverse range of clinical tasks required for a beginner registered nurse. The participants would rotate to the next station at timed interval on the command of a bell and each station would be manned by one examiner throughout the entire session until every participant had completed all twelve stations (Fig. 2). As it was impossible to cover eighty-five participants in one day, the entire examination was estimated to last over three days for a group of eighty to hundred participants.

To standardize the examination process, prevent participant and examiner fatigue, and prevent bias due to leakage of examination information, there would be a maximum of four clinical stations on each day and all 85 participants would undergo the same standardized simulated cases on each examination day. The considerations to this design were based on the OSCE development team's consensus and best practice guidelines from the literature review [12] [16].

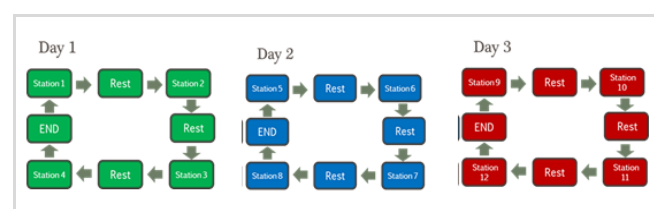


Figure 2. OSCE Examination Layout

2) Inter-rater Briefing and Training of Standardized Patients

The second component of the PNOSCE is the incorporation of inter-rater briefing and training of standardized patients to standardize the assessment standards prior to conducting the PNOSCE examination [12], [17], [18]. The PNOSCE utilized in this study included mannequins or

trained nursing students as standardized patients to act out the role of the patients.

3) PNOSCE Rating Tool

The third component to the PNOSCE development process is to include an objective grading scheme that examiners can use to score the student's performance on the same grading scale [12], [16], [17]. The PNOSCE rating tool consisted of three sections: (a) Part 1: Skill Checklist (Fig. 3); and (b) Part 2: A global rating scale for the three domains of the clinical competence (Fig. 4); and (c) Part 3: Marking guidelines which provide the descriptors for the different levels of clinical competence. Part 2 and 3 of the PNOSCE rating tool for this study was designed to be used as a standardized template for any case scenario developed for all 12 clinical stations. This section was used by the assessors to rate the overall clinical competence of the participants. The evaluation included demonstration of skills, knowledge, and professional attitudes.

A 5-point rating scale was used as follows: Unsatisfactory was measured on a scale of 1-2 while satisfactory was measured on a scale of 3-5. Assessors were asked to circle the number that best reflects the clinical competence of the participant at each station. This scale was chosen due to its common usage in determining clinical competence of nurses by Singapore Nursing Board, Parkway Pantai nursing administration and Parkway College. All stations have an oral examination component, where participants were asked questions and assessed using viva voce format (oral questioning). The test questions were obtained from a pool of examination question bank from Parkway College and two medical-surgical reference textbooks used commonly in nursing education in Singapore. The test questions were reviewed and deemed to have 'face validity' by the panel of five experts.

At each station, participants were graded using a self-designed PNOSCE rating tool, which used a global rating scale of 1 to 5 to assess their clinical competence based on three domains: (i) clinical skills; (ii) knowledge; and (iii) professional attitudes. There are two criteria to pass the OSCE examination: (i) Achieved at least 126 out of 180 for the entire examination; (ii) Attain a grade of at least 3 for all three domains for each station. Any participant who failed to meet the two criteria will be required to re-attempt the OSCE examination at a later date.

PARKWAY NURSING OBJECTIVE STRUCTURE CLINICAL EXAMINATION (PNOSCE) RATING TOOL			
Module Code:	OSCE_2012	Procedure:	Station 11 Managing Resuscitation
Date:		Candidate's ID:	
Starting Time:		Ending Time:	
PART 1: SKILLS CHECKLIST			
Instruction: Please rate each item by ticking in the box (1=performed, 0 = not performed)			
	1	0	Remarks
1. Assess responsiveness			
2. Place patient in supine position (remove pillow)			
3. Perform head tilt and chin lift			
4. Check breathing (look, listen & feel)			
5. Palpate pulse			
6. Activate the Code Blue button			
7. Prepare resuscitation environment swiftly (Pull bed away from wall, elevate bed level & remove headboard)			
8. Perform effective chest compression			
9. Attach the cardiac monitor			
10. Recognize ECG rhythm on monitor			
11. Choose correct size of oropharyngeal airway			
12. Insert oropharyngeal airway			
13. Perform bag-valve-mask ventilation			
14. Prepare IV N/Saline and change to 3-way tap using a septic technique			
15. Prepare and administer IV adrenaline			

Figure 3. PNOSCE Rating Tool – Part 1: Skill Checklist

PART 2: GLOBAL RATING SCALE					
Instruction: Circle the appropriate rating for each of the three core competency domains					
Critical Thinking (Knowledge)					
1	2	3	4	5	
Management of Care (Skills)					
1	2	3	4	5	
Professionalism and Safe Practice (Attitudes)					
1	2	3	4	5	
Overall Global Rating Score					/ 15
Assessor's Name:			Assessor's Signature:		

Figure 4. PNOSCE Rating Tool – Part 2: Global Rating Scale

B. Phase 2 – Predictive Value of PNOSCE

1) Participants' Demographic Characteristics

A total of 85 targeted participants were identified and approached, of which all 85 agreed to participate in both phases of the study. This translated into a response rate of 100%. This study involved the first cohort of final-year nursing students from the diploma in nursing program from Parkway College School of Nursing in Singapore in 2012. These participants were also employed by Parkway Pantai hospitals, which were participating hospitals in this study.

This section would present the descriptive statistics of the demographic characteristics of the participants (Table 1).

2) OSCE, Academic Scores and SCARGN outcome

Based on Table 2, the mean score for OSCE results was 151 with the minimum score at 102 and the maximum at 176. The 95% confidence interval for mean was between 148 and 154. Based on the passing criteria set for the PNOSCE examination, 7 participants failed to either achieve a minimum overall OSCE score of 125 out of 180 for the entire examination or attain a grade of at least 3 for all three domains for each station. The mean academic scores for academic grades were 373 with the minimum score at 270 and the maximum at 484. The 95% confidence interval for mean is between 361 and 384. All participants were deemed to have successfully completed the nursing program, as the minimum academic grade to pass the 50% of the total academic grades, which was set at 262. In terms of SCARGN outcome, seven participants were rated by their hospital supervisors as not yet competent in terms of their work performance at the end of the six months internship. Based on SNB guidelines (Singapore Nursing Board 2012), these participants would be required to undertake remedial training by the hospital and undergo another three to six months of internship, failing which, they would not be confirmed as a registered nurse with SNB Register roll.

3) Predictive Value of OSCE to predict work performance of new graduate nurses at the end of the six months of internship

Binary logistics regression was used to determine if the OSCE results could predict the clinical performance during the first six months of internship, as measured by the SCARGN. In this study, the performance outcome is measured as a dichotomous variable, 'competent' or 'not yet competent'. There were a total of 7 new graduate nurses who were rated by their clinical supervisors as 'under-performing' or 'not yet competent' on the SCARGN. Out of these 7 nurses who did not pass the first attempt of the PNOSCE examination, 6 of them were found to fail the internship at the end of the six months. Based on the Table 4.7, results showed that those who did not performed well during OSCE examination were estimated to be 1.4 times more likely to be rated as 'under-performing' or rated 'not yet competent' by their supervisors and nurse educators (B=0.363, S.E – 0.184, Wald $\chi = 3.879$, CI – 1.002 to 2.062, $p < 0.05$). On the other hand, academic grades were not found to be significantly predictive of future performance at the end of the six-month internship as measured by the SCARGN.

TABLE 1. DEMOGRAPHIC CHARACTERISTICS OF PARTICIPANTS (N=85)

Demographics	Frequency (%)	Mean (SD)
Age (years)		22.6 (SD=4.5)
Gender		
Male	9 (10.6)	
Female	76 (89.4)	
Nationality		
Singaporeans	16 (18.8)	
Malaysians	2 (2.4)	
Mainland Chinese	47 (55.3)	
Myanmar	13 (15.3)	
Others- Vietnamese	5 (5.8)	
Others –Filipino	2 (2.4)	
Prior Highest Educational Qualification		
High School Level	60 (70.6)	
Post-secondary Level	19 (22.4)	
University Level	6 (7.1)	
Previous Working Experience		
Yes	26 (30.6)	
No	59 (69.4%)	

Note. SD = standard deviation.

TABLE 2. OSCE, ACADEMIC GRADES AND SCARGN OUTCOMES FOR THE NURSING STUDENTS (N=85)

Outcome variables (n=85)		
OSCE (Max score of 180)	Statistics	Std. Error
Mean	151.46	1.67
SD	15.392	
95% CI for Lower Bound	148.14	
95% CI for Upper Bound	154.78	
Minimum	102	
Maximum	176	
Academic Grades (Maximum Score of 524)	Statistics	Std. Error
Mean	373.12	5.713
SD	52.673	
95% CI for Lower Bound	361.76	
95% CI for Upper Bound	384.48	
Minimum	270	
Maximum	484	
SCARGN (Competent or Not yet competent)	Frequency	Percentage
Competent	78	91.8 %
Not yet competent	7	8.2 %

Note. SD = standard deviation; CI = confidence interval; OSCE = objective structure clinical examination; SCARGN = Singapore Nursing Board Competency Assessment Report for General Nursing.

IV. DISCUSSION

There is a wide range of existing assessment methods to assess nurses' clinical competence and OSCE is one method which has gained much popularity in nursing education. However, few studies have discussed the issues of validity and reliability on OSCE tool in nursing education [9]. There is a need to develop the OSCE assessment framework using a systematic method which incorporates best practices from literature review, expert consensus and psychometric testing [2]. Utilizing the Singapore Nursing Board nursing competence framework for registered nurses and the systematic approach for tool development by Jones and colleagues, we were able to develop the PNOSCE framework for assessing new graduate nurses' clinical competence in Singapore.

In this study, the predictive value of OSCE was also examined by correlating scores on the OSCE and work performance based on the SCRAGN outcome during the six months of internship. Based on the passing criteria for OSCE, seven participants failed to either achieve a minimum overall OSCE score of 125 out of 180 for the entire examination or attain a grade of at least 3 for all three domains for each station. Out of these seven nurses who did not pass the first attempt of the PNOSCE examination, six of them were later found to fail the internship at the end of the six months. Participants, who did not perform well during OSCE examination were found to be 1.4 times more likely to be rated as 'not yet competent' by their supervisors and nurse educators at the end of the six months of internship probation ($OR=1.4$, CI [1.002 to 2.062], $p<0.05$).

Comparing one measure to a gold standard is a common method employed to determine predictive validity [19]. In the study by Simon, Bui, Day, Berti and Volkan (2007), it was unclear whether the USMLE is considered the gold standard for performance, but it is certainly a standard that must be met in order to practice medicine in the U.S [20]. Similarly, for this study, the SNB's SCRAGN report could be considered a 'gold standard' for measuring competence-related work performance for all new graduate nurses or newly-recruited foreign nurses in Singapore. The PNOSCE proved valuable in predicting future work performance by new graduate nurses. Contrary to some literature, which reported OSCE as a poor predictor for future academic or clinical performance [21]–[23], this study concurred with other medical OSCE studies that reported OSCE as a good predictor. These studies reported that nurses, who performed poorly in the OSCE would be likely to perform poorly later as a beginner practitioner as assessed by licensing examinations or internship program for new graduates [20], [24]–[27]. Based on the author's literature search and knowledge, there was no nursing study which explored the predictive value of OSCE for meaningful comparison. This is the first known study to explore the predictive value of OSCE in nursing education.

The study findings supported the arguments by Matsell et al. (1991), who explained why many studies failed to demonstrate significant correlation between OSCE scores and future performance [25]. Matsell et al. stated that OSCE designs have the potential to develop in a flexible and creative way to examine a wide range of competence. They added that if OSCE developers split OSCE components into four domains to measure, namely knowledge, skills, patient management and problem-solving, these measurements would translate to better predictions of the performance construct within the real workplace. However, many researchers had not taken this logical approach in their OSCE design, choosing to use OSCE to assess only one or two domains of competence (e.g. skills or knowledge). This was evident by the fact that Patrício et al. (2013) stated that they were unable to find sufficient studies within medical literature to conduct a meta-analysis to conclude the value of using OSCE as a predictive tool, despite performing an extensive literature search [28].

This study had several limitations. Firstly, this study took place at one nursing school, Parkway College. Therefore, the nurse graduates from the nursing school in this study might not be representative of those from other nursing schools in Singapore. Although OSCEs are commonly studied within the individual schools, this may limit the study's generalizability [15]. For example, the foreign-to-local student ratio of the study population was higher than those of the other two schools. Secondly, methodological limitation could also relate to the sample size in this study. Although the sample size was found to be adequate using power analysis and was comparable to two similar well-designed nursing studies on OSCE [29], [30], it was relatively smaller when compared with those of well-designed medical studies on using OSCEs as a summative assessment, ranging from 137 to 806 [20], [27], [31], [32]. This could limit the generalizability of the study. A further study could be conducted on future cohorts to strengthen the results of this study.

V. IMPLICATIONS FOR PRACTICE

As the PNOSCE was developed primarily as a summative assessment in alignment with SNB's national competency framework, the tool is useful for evaluating actual clinical competence in real clinical workplace settings for end-of-programme assessment or serves as part of objective criteria for evaluating foreign nurses' clinical competence and their suitability to work in Singapore healthcare context. In terms of implications for nursing practice, our OSCE assessment framework can be useful for future studies that seek to use the selected clinical stations of the OSCE examination structure to evaluate clinical performance of nursing studies for formative assessment of individual nursing modules within a nursing programme. Nurse educators or administrators can use the OSCE assessment to determine learning gaps and provide remedial training for 'under-performing' graduating students. In terms of implications for research, future studies can be conducted to explore students' and faculty's perception on the

feasibility of the OSCE rating tool. In addition, it is also important for future studies to examine the cost-benefits of using this assessment method to justify the OSCE programme.

VI. CONCLUSION

This is the first known local study to report the use of OSCE in nursing education in Singapore. The study's findings supported the use of OSCE as a summative assessment method to evaluate the clinical competence and predict work performance of graduating nursing students and determine their 'readiness for practice' in a local hospital setting.

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