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Experiences of radiography students regarding the objective structured clinical examination (OSCE): a case of the University of Namibia (UNAM)

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Abstract

Background. An objective structured clinical examination (OSCE) is a comprehensive assessment tool that is used to quantify the clinical competence of health professionals including student radiographers. Students raised concerns about the objectivity of the OSCE in view of a high failure rate at the University of Namibia (UNAM) over the past three years. In accordance with UNAM guidelines, a reassessment is prescribed when > 50% of students fail an assessment. This prompted the researchers to explore the experiences of student radiographers regarding an OSCE.

Objective. To explore and describe the experiences of UNAM radiography students regarding an OSCE as a clinical assessment tool.

Methods. A qualitative, exploratory, descriptive, retrospective and contextual research design with an ethnographic approach was utilised. A purposively selected sample of second, third and fourth year radiography students (n=20) participated in the study. Four focused group discussions were conducted during data collection.

Findings. Four themes emerged from the data: management and administration of an OSCE, psychological factors, validity and reliability of an OSCE, and teaching and learning. These were considered important elements shaping students' experiences regarding their OSCE.

Conclusion. Student experienced poor management and administration of an OSCE and psychological factors such as stress and anxiety affected their performance. The findings also indicated low validity and reliability of an OSCE, and positive teaching and learning as student experiences. The recommendations are: effective orientation with clear aims and objectives of an OSCE must be provided to students; OSCE stations should be well aligned to objectives and real life practice with clear instructions and questions; time per each station should be aligned to the content at that particular station rather than having a standard time for all stations and the integration of simulation within an OSCE to enhance and maximise the validity and reliability of the assessment.

Keywords clinical competence, radiography, assessment, OSCE

INTRODUCTION

The objective structured clinical examination (OSCE) was introduced by Harden in 1975.^[1] It was initially used to assess final year medical students' clinical skills.^[2] It is now a common practice in the training of many health professionals.^[3,4] An OSCE is an assessment method whereby aspects of clinical competence are evaluated in a comprehensive, consistent and structured manner.^[1] These competencies include communication and problem solving skills, teamwork as well as critical thinking abilities.^[4] An OSCE for radiography students may consist of various stations to assess different clinical competencies, such as history taking, interpretation of clinical data, and labelling of radiographic anatomy.^[5] Students are presented with scenarios with questions that have to be completed within a limited time frame: at the University of Namibia (UNAM) this is usually five minutes. These

scenarios test student knowledge within a specific domain. They are a simulation of problems that students would normally encounter in a clinical setting.^[6] An OSCE, unlike traditional assessments (e.g. multiple choice questions), demonstrates individual competencies thus it became the preferred method of assessment.^[7] It is evident from the literature that an OSCE enhances practical skills and encourages learning from real life scenarios rather than acquiring knowledge from theoretical sources such as books. It enables assessment of a large cohort of students simultaneously and also provides effective feedback as students can identify areas where they lack a specific clinical competency and therefore strive to improve their skills.^[8] It eliminates subjectivity, reduces variations and subjectivity in marking standards from examiner to examiner and accurately reflects real life tasks.^[9] Despite the positive attributes of an OSCE,

it has been reported to inflict high levels of stress and anxiety compared to other methods of assessment.^[10,11]

Similar to other health professions, the OSCE is used as an assessment method for radiography students at UNAM. In 2016 the use of an electronic OSCE was introduced. It allowed students to view projected radiographic images instead of traditional viewing box stations. This method was reported to be beneficial to both students and assessors; it is user-friendly and saves on resources.^[8] It is essential that an OSCE objectively measures students' competencies at undergraduate level.^[12] It is important that assessors structure OSCEs in such a manner that students can value their training programme. An OSCE may have an impact on students' behaviour and studying patterns.^[12]

Literature highlights that students may perform unsatisfactorily during OSCEs due to lack of recovery from a previous station;

students felt that they may have performed unsatisfactory due to time constraints. This may result in overall poor performance of students^[13] and therefore they may question their competencies in order to practice as professional practitioners. Previous studies regarding OSCEs were conducted in developed countries and mainly focused on other health professionals, such as nurses, physiotherapists, and doctors; with limited focus on radiography students.^[3,4] These studies were mainly quantitative in design and lacked the depth and detail afforded by a qualitative design. OSCEs are context, competency and discipline specific. Findings from other professions and contexts cannot be interpolated to radiography students. During the 2017 academic year, a number of concerns, such as inadequate time per station, long questions per station, stress, unrealism and punitive marking, were raised by first year radiography students regarding OSCEs at UNAM. In addition there was an increase in the failure rate during OSCEs from 37% in 2017 to 66% in 2019 for the second year students. The experiences of UNAM radiography students regarding an OSCE have never been assessed since its introduction. Students' experiences can influence their future performance and can potentially affect the reliability and validity of an OSCE as a method to assess practical competencies. The aim of the study was therefore to explore and describe radiography students' experiences regarding an OSCE as a clinical assessment tool at UNAM.

ETHICAL CONSIDERATIONS

Permission to conduct the study was sought and granted by UNAM's Faculty of Health Sciences, School of Nursing Ethics Committee; the permanent secretary of the Ministry of Health and Social Services (MoHSS); and the chief radiographers at the MoHSS. The ethics principles of respect of persons, beneficence, justice, and non-maleficence, were adhered to in this study.^[14] The objectives of the research were explained to participants prior to commencement of data collection. Participants had the right to withdraw at any time without any reprisal. Only those who consented to partake in the study were included in the focus group discussions (FGDs). Confidentiality and anonymity were assured by assigning a study code to each participant. To minimise bias due to power relations, the FGDs were led by a fellow student trained

in research methodology. This allowed the FGDs' students to speak openly and freely among their peers.

A pilot study was conducted to refine the interview questions, where necessary. The responses from the pilot study were excluded from the final data analysis.

MATERIALS AND METHODS

A qualitative, exploratory, descriptive, retrospective and contextual research design, with an ethnographic approach, was utilised to explore radiography students' experiences concerning an OSCE as a clinical assessment tool at UNAM. A qualitative approach allows researchers to gain deep insight into experiences of radiography students in their own environment.^[14,15] An explorative design enables the investigation of a phenomenon where little information is known. The study was retrospective in nature as it sought the past experiences of the student regarding their OSCE. The study was conducted at the main campus of UNAM in Windhoek. All second, third and fourth year radiography students were included as they did have prior exposure to an OSCE. First year students were excluded as they had not been exposed to an OSCE at the time of data collection. Four FGDs were held until data were saturated enabling group consensus to be reached. The study included twenty (n=20) participants in four focus groups: group one (n=6), group two (n=7), group 3 (n=7), and group 4 (n=10). They were grouped according to their year of study. The second year students however were divided into two groups as they were the largest cohort of the three year groups.

DATA COLLECTION

All FGDs were held in a lecture venue at the Katutura Intermediate Hospital. Prior to commencement of the FGDs, permission was sought and granted by participants to interview and record them. Each FGD lasted approximately one hour. The facilitator (researcher) paid close attention to the participants' facial expressions and body language during the FGDs. A semi-structured interview guide, with minor modifications, was adopted from a previous study,^[15] was used to obtain insight from radiography students. The central question used to guide the FGDs was: Tell me your experiences regarding the OSCE?

The following are some of the probing questions asked during the FGDs.

- What are your experiences as a

radiography student?

- Tell me your opinion of the set-up of an OSCE?
- What are your feelings regarding time allocation for an OSCE?
- How long do you think an OSCE should be?
- Do you believe OSCE questions cover the study guide/content of the syllabus?
- What do you like about the OSCE?
- In your opinion, in what ways can the OSCE be improved?

The question on students' experiences in the programme was an ice-breaker to stimulate FGD and to put the participants at ease.

DATA ANALYSIS

Upon completion of each FGD a debriefing session was held with participants and debriefing notes were compiled. The data were transcribed verbatim, after listening to the audio recorded FGDs. The transcribed data were read and reread several times until the researcher gained a general sense of the data and their meaning. Phrases with similar meanings were coded. Comments that had similar meanings were grouped together. The researcher then compared the various codes based on differences and similarities and sorted them into categories. The different categories were formulated into themes and sub-themes.^[16] The themes and sub-themes identified from the transcriptions were reviewed by two reviewers. Areas of disagreement were discussed until consensus was reached.

Lincoln and Guba's model, as described by Babbie,^[17] was used to ensure trustworthiness of the data. Their model was implemented by using the following criteria. To ensure credibility required: prolonged engagement and varied in-depth FGDs, member checking by two experienced research supervisors, reflective field notes, and triangulation of the data.^[16] Extensive field notes were made by the researcher before and after the in-depth FGDs. Triangulation of the data was achieved by merging the data collected from the FGDs from the researcher's reflective field notes throughout the research process using criticality.^[16]

Transferability of the study was ensured by providing sufficient descriptive data

that could be compared to another population or setting. For example, a similar study could be undertaken amongst radiography students registered at the National Health Training Centre using the same research design. To ensure dependability, a well trailed audit trail and supporting documents of various codes was provided to ensure that the study can be replicated in the same or similar context and yield similar results.^[16]

Confirmability was ensured by detailed field notes before and after the FGDs. This was achieved through reflexivity as it is a critical component of the qualitative paradigm.^[16] This was done to avoid any bias. Reflexivity is a process where one accounts for one's experience in order to be mindful of how this may impact the data.

RESULTS

Table 1 presents the four main themes and ten sub-themes from data analysis regarding student radiographers' perceptions and experiences of OSCE as their clinical assessment tool.

Theme 1: management and administration of the OSCE

A well administered OSCE is a powerful and valuable tool to assess competency in the area tested.^[12] This entails that OSCE stations must be well planned and designed in advance; those in charge of the planning need to be well versed with the examination. Time allocated per station, and the environment where an OSCE is held, need to be factored in during its planning. A poorly administered OSCE may fail to attain the assessment objectives and compromise students' learning.

Sub-theme 1: improper planning and orientation of the OSCE

Bashir et al.^[18] note that possible flaws in the construction of OSCE stations may be due to untrained lecturers, lack of motivation or time to design proper stations. Lecturers should be properly trained and oriented on how to plan and design an effective OSCE. It is worth mentioning that content clarity, effective processes and communication during an OSCE is beneficial for successful experiences.^[19] Students, especially for their first OSCE, need to be oriented on the structure and composition of the examination to aid in preparation. In this study the students felt that the vocabulary at the OSCE stations

Table 1. Themes and sub-themes

THEMES	SUB-THEMES
Management and administration of the OSCE	<ul style="list-style-type: none"> • Improper planning and orientation towards the OSCE • Insufficient time during stations • Unconducive environment
Psychological factors	<ul style="list-style-type: none"> • Increased levels of stress • Feeling of confusion
Validity and reliability of the OSCE (fair)	<ul style="list-style-type: none"> • Lack of alignment of the OSCE content with clinical practice • Unfair mark allocation
Teaching and learning	<ul style="list-style-type: none"> • Provide feedback to students regarding clinical deficiencies • Evaluate different skills regarding clinical practice • Excitement and enhancement of critical thinking

was ambiguous and contained too much content and questions. They also felt that lack of orientation or unawareness of the nature of examination led to their poor performances. The following, in italics, are some of the quotes from the students.

"and also sometimes the labelling of the images for the OSCEs it's not clear what anatomy is labelled when they don't use arrows...a suggestion is that they put arrows". (FG 4, year 2)

"The instrument they also use I think was it last year the projector switched off they also need to test their things before we start writing to avoid interruptions." (FG 1, year 4)

These findings are similar to those of Alghamdi et al.^[20] who reported that the majority of respondents felt that the OSCE stations were unclear and ambiguous. This reiterates the importance of well-planned and designed OSCE stations. However, other studies,^[1,5,15,21,22] reported that OSCE stations were clear, fair, understandable, well-structured and organised. These studies also revealed that students were aware of the nature of the assessment. This shows that when orientation is carried out it enables proper preparation and increases the objectivity of the assessment. It is thus recommended that students be briefed about the aims and objectives of OSCE sessions beforehand so that they can properly plan their preparation. Mitchell et al.^[19] emphasised the importance of good student orientation and alignment of the aims and objectives of an OSCE with students' level of study. Similarly, clear and simple vocabulary, instructions and adequate time should be allocated to complete tasks at different stations.^[3,8,23-25]

Sub-theme 2: insufficient time during stations

The number of stations and the length of time per station must be carefully planned as this plays an important role in the overall structure of an OSCE. Time allocated per station can have a positive or negative effect on students' performance and it should be determined by carefully considering the objectives of an OSCE. An OSCE's time may vary from 5 to 15 minutes per station depending on the complexity of the station and the objectives to be assessed. Students in this study expressed that the time allocated was insufficient to complete long questions, especially those requiring them to describe patient positioning. All OSCE stations at UNAM are allocated 5 minutes. A comment of a student illustrates the need for more time.

"I feel time is too little cos not everybody write fast and not everybody can think fast under pressure so I feel the time is very too little." (FG 3, year 2)

Previous studies report limited time per OSCE station as one of the negative experiences of students.^[4,15,25] Time should not be a factor of how fast students perform a task; but rather how well they can perform it.^[21,26] Station objectives should be matched to the time allocated for that station to enable an objective assessment. Exposure to more formative assessment opportunities in the form of OSCEs is one of the ways recommended to increase students' familiarity with the examination as it encourages deep learning and builds confidence.^[12,23,27-29]

Sub-theme 3: unconducive environment

OSCE sessions must be conducted in an

appropriate environment to facilitate students' learning. The environment should resemble real clinical scenarios to improve the authenticity of the examination.^[20] The physical context, equipment and accessories used during an OSCE should facilitate the assessment not serve as a distraction. In this study students were dissatisfied with the physical environment in which the OSCE was administered. They felt the room was distracting. It was small and too bright as evident in the below comments.

"There is too much lighting. You have to use the projector so you can't really see what you are supposed to see. You cannot interpret it enough" (FG 1, year 4)

"uuuhhh I think we need to...to use the viewing box like how we did in the first year and not view from the laptops and stuffs then we can see everything clearly" (FG 2, year 3)

Beckett et al.^[15] reported that students recommended some modifications to the environment in order to improve an OSCE. Although the UNAM students are exposed to digital images in clinical practice, it was surprising that they felt that the use of the standard viewing would be better than use of digital images during an OSCE. However, this could have been as a result of the bright lighting in the OSCE venue, which reduces visibility of a projected image compared to focused lighting on a viewing box with low ambient lighting. It is important to note that effective learning cannot take place when external factors, such as the environment, are uncondusive.

Theme 2: psychological factors

Psychological factors, which can be mental or spiritual, can affect students' acquisition of knowledge.^[30] There are many psychological factors that hinder learning including stress, anxiety and motivation among others. They affect the cognitive ability of students to assimilate or recall knowledge thereby compromising their learning.

Sub-theme 1: elevated levels of stress and anxiety

According to Brand and Schoonheim-Klein^[10] and Bagheri^[11] OSCEs induce higher levels of stress and anxiety than other forms of assessment. Increased stress and anxiety compromise perfor-

mance because intellectual functions are temporarily impaired, hence an anxious individual cannot exercise their full intellectual potential and in the process cannot master assessment material.^[31] In this study stress and anxiety were induced because students did not get adequate opportunities to practice and familiarise with the OSCE. Lack of orientation of an OSCE resulted in unfamiliar expectations about the assessment hence added to their stress and anxiety. They expressed the following sentiments.

"They say neh that its suppose to help us think on your feet right approach to the situation or something but I really don't know how its helping this is just stress...pure stress! Furiously" (FG 3, year 2)

"So if you want me to think fast theoretically how's that beneficial for the patient critical thinking how does the OSCE allow me to do that because all it does is just making me anxious and stressing me out here to write all of these things" (FG 4, year 2)

These findings are in keeping with other studies^[1,3,4,10,11,24,25,32] that reported OSCEs with time restrictions induce high levels of stress and anxiety. Less stress was also reported where an OSCE stations were well planned and very objective.^[9] This indicates that students should likely exhibit less stress and anxiety when the examination is well planned and administered. Likewise, studies conducted in Iraq, India and Egypt^[1,4,5] reported that an OSCE is less stressful than other types of assessments, but is exhausting and lengthy. Other stressors in the literature relate to students having to wait for a long time before entering an examination room.^[9,18]

Sub-theme 2: feeling of confusion

In this study the students experienced a feeling of confusion regarding an OSCE. Confusion brings a feeling of uncertainty of what one is required to do or the process that is underway. Confusion has been identified as a positive element during the learning process, but it may result in cognitive retraction that may hinder performance in an examination setting such as an OSCE. The following are some of the comments from the students.

"I also don't think it's a good clinical assessment because at the end of the day, we are supposed to learn some-

thing to master it. But now with the OSCE you have to learn so much you get confused you don't even actually catch anything like most of us are just guessing in this OSCEs it's not even a matter of learning anymore you are out so it doesn't make sense anymore" (FG 3, year 2)

"I don't like OSCEs I don't like the way they ask the questions I don't know what to study in OSCE and when it comes to technique theory okay...my colleague said its suppose to test my clinical knowledge but how can you test clinical knowledge by asking positioning in OSCE" (FG 2, year 3)

Confusion during learning or an examination can be minimised by proper orientation of the examination process as well as clarifying the objectives of an examination. When this is not adequately done, students end up confused and this can affect their performance.

Theme 3: validity and reliability of the OSCE

Reliability of an OSCE is achieved through rotation of stations, assessing the same competencies and simulated patients. Validity can be achieved when an assessment's content correlates with the learning outcomes as well as the purpose of an examination.^[12,33] Reliability and validity are important when considering the objectivity of the OSCE thus careful considerations must be given during planning.

Sub-theme 1: lack of alignment of OSCE content with clinical practice

An OSCE enables students to put evidence-based medicine, which combines knowledge and communication skills, into practice.^[23] OSCE scenarios test student knowledge within a specific domain. These scenarios are a simulation of problems that students would encounter in clinical practice.^[6] In this study the student felt that OSCE stations do not cover clinical procedures available in practice.

"And they should give us something we do in the department something we can relate to and think in a practical way as some of these we never come across with" (FG 3, year 2)

The absence of quality radiographic images at the stations, and the use of internet images, were raised as a major concern.

“Just to add on it. It would be more realistic if we also start to use the images that we experience in the hospitals unlike tracing images from the internet that we don’t normally get to see in the departments” (FG 2, year 3)

An OSCE may lack scenarios where clinical and practical competencies are tested if they are not aligned to a curriculum.^[25,34] Furthermore, a previous study^[20] showed that OSCEs did not assess the skills that students had acquired. In this study there was malalignment between what is practiced and what is examined. In contrast however, students in two other studies^[15,35] agreed that OSCEs assess a wide range of clinical skills and the content covered what they were taught during clinical rotations at various sites. A recent study^[36] carried out on radiography students’ experience during rural placement, suggested that one way to combat a theory-practice gap was to implement simulation. In the context of this study, simulated OSCEs can address poor comprehension of the assessment by students. Simulated patients are people who are trained to act as real patients; this enhances the reliability of an OSCE.^[23,12] The benefits of this include a safe environment for students, reduced medical errors and maximised clinical experience.^[21,37]

Sub-theme 2: unfair mark allocation

The purpose of an assessment is to make a judgement and provide feedback on how the students mastered the required competencies. A fair and consistent mark allocation, and a consistent examination format for both examiners and students, enhance an OSCE’s reliability and thus eliminates prejudice.^[38] Students in this study expressed concern with punitive marking as highlighted below.

“Okay theres a thing where the instructions say 20% is deducted for central ray and centring point I just think it’s a lot. I know we suppose to know it but why 20 % your whole positioning is right that one thing is wrong the whole what you call it the slide is deducted...so I don’t know I don’t like that part” (FG 3, year 2)

Students reported that a 20% penalty as a punitive measure is too stringent and as a result they may lose confidence in the assessment method. This may have a detrimental effect; it may decrease their motivation and performance in future

OSCEs. Almohiy and Davidson^[39] therefore recommend moderation of OSCEs to increase their reliability and objectivity.

Theme 4: teaching and learning

Teaching is the ability to provide students with learning opportunities to acquire knowledge and skills.^[23] Learning, on the other hand, is defined as the process of acquiring knowledge with meaning of growth, change in thinking abilities, emotions and practice.^[27] Teaching and learning are essential components which informs an assessment. Lindal et al.^[26] noted that feedback is beneficial to a student and an assessor as it also identifies and rectifies errors in a curriculum.

Sub theme 1: provide effective feedback to students regarding clinical deficiencies

Feedback is essential as it allows students to reflect on and improve their abilities as well as identify areas where their performances were sub-optimal.^[8,40] Clear constructive and timely feedback enables students to think critically, reflect on their progress and decide what they need to do to improve. This is evident in the following comment.

“The fact that after an OSCE you can say to yourself maybe I didn’t study that section so it is also a self-evaluation for you that I didn’t study this specific situation but I know so in some degree I can say my training was sufficient and then I can assess myself based on that because sometimes the content is so much and you don’t know what will come in so it’s just a type of self-assessment as well” (FG 1, year 4)

Small et al.^[3] noted that more than half the students in their study did not receive any feedback. They suggest prompt feedback from educators to students in order to guide and support them towards their learning. A similar finding was reported in the literature^[18] as students commented that through enhancement of clinical scenarios at OSCE stations, students should be able to improve their communication, problem solving and practical skills and thus build better relationships with patients.

Sub-theme 2: evaluate different clinical skills regarding clinical practice

Jabbari et al.^[41] state that assessing dif-

ferent skills in radiology minimises the chances of repeated exposures. OSCE stations are usually diversified and this helps students improve their different skills and enhance their confidence.^[23] This is underscored in the below comment.

“For me the set-up is fine especially the questions the way they ask their questions because then you find that there are labelling anatomy and evaluate the image maybe the procedures” (FG 2, year 3)

These findings echo those of students in Bashir et al’s study:^[18] through enhancement of clinical scenarios at OSCE stations, students should improve their communication, problem-solving and practical skills building better relationships with patients. This in turn aids students to become competent and confident to practice as professional practitioners.

Sub-theme 3: excitement and enhancement of critical thinking

Excitement can be defined as a positive and pleasant experience that improves an individual’s performance.^[42] An excited individual is more focused on positive outcomes than an unexcited individual. Positive experiences are fun, enjoyable and satisfying feelings.^[43] Students perform exceptionally well when they enjoy or are satisfied with an assessment. There was a sense of excitement among students regarding the OSCE as expressed in the following:

“(Laughing and happy) I like the rush...I just like the adrenaline you know having to answer the questions so quickly I think it exercises your brain” (FG 1, year 4)

“OSCEs tests my clinical competency it stimulates me to think quickly there and then...” (FG 2, year 3)

These findings are in keeping with literature that reported the OSCE as a worthwhile, valuable and an exciting experience.^[3,24,43] The respective studies by Patil^[44] and Dhinakaran^[4] found the OSCE to be highly satisfying and a good assessment tool. According to Jindal and Khurana^[26] OSCEs induced enthusiasm among students due to their uniformity, objectivity, and reliability. Acquisition of critical thinking skills enables students to become competent practitioners. Positive feelings were experienced mostly by senior students in this study who had prior exposure to this assessment method.

CONCLUSION

The student participants in the FGDs experienced the following. Poor management and administration of the OSCE; psychological factors, such as stress and anxiety that affected their performance; low validity and reliability of the OSCE; and positive teaching and learning. It is recommended that an effective orientation with clear aims and objectives of an OSCE must be provided to students. OSCE stations should be well aligned to the objectives of the assessment and real life practice with clear instructions and questions. The time per each station should be aligned to the content at that particular

station rather than having a standard time for all stations. There needs to be integration of simulation within an OSCE to enhance and maximise the validity and reliability of the assessment.

LIMITATIONS

The study was retrospective in nature and relied upon students' recall of previous experiences and this may have increased the chances of recall bias. Data collection was limited to one training institution.

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AUTHORS' CONTRIBUTIONS

WH conceptualised the study, did literature review, collected and analysed data. ED supervised the study, did literature review, analysed data, prepare the manuscript. AK did literature review, analysed data, and prepared the manuscript. AK and ED finalised the manuscript and guarantee the integrity of the study.

CONFLICT OF INTEREST

None

REFERENCES

- Al-Saegh RM, Scherpbier AJ, Al-hibaly HA, Hmood AR, Almkhtar MA. Perception of OSCE examination in Iraqi undergraduate medical students. *Kerbala Journal of Medicine*, 2015; 8(1):2056-69 [cited 2019 June 10]. Available from <https://www.iasj.net/iasj?func=fulltext&ald=102550>
- Naumann F, Moore K. Developing an objective structured clinical examination to assess clinical competency. Deekan University: Geelong, 2012.
- Small LF, Pretorius L, Walters A, Ackerman M, Tshifugula P. Students' perceptions regarding the objective, structured, clinical evaluation as an assessment approach. *Health SA Gesondheid*, 2013;18(1).
- Dhinakaran M, Chattwal J, Dheeraj KV. Faculty and student perceptions on the introduction of objective structured clinical examination in an undergraduate physiotherapy course: a pilot study. *Int J Physiother Res*, 2015; 3(6):1307-1311.
- El-Nemer A, Kandeel N. Using OSCE as an assessment tool for clinical skills: nursing students' feedback. *Australian Journal of basic and Applied Sciences*. 2009; 3(3):2465-72 .
- Hsieh MC, Cheng WC, Chen TY. Objective structured clinical examination (OSCE) including critical simulation: evaluation of medical student competence. *Tzu Chi Medical Journal*, 2014; 1;26(1):40-3.
- Manjula A, Shashikala B, Nagaraj P. Student's perception on objective structured practical examination in pathology. *Journal of Medical Education & Research*, 2013; (1): 12-14.
- Agarwal A, Batra B, Sood AK, Ramakantan R, Bhargava SK, Chidambarathan N, Indrajit IK. Objective structured clinical examination in radiology. *The Indian Journal of Radiology & Imaging*, 2010; 20(2):83 [cited 2019 June 12] Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC2890931/>
- Elfaki OA, Al-Humayed S. Medical students' perception of OSCE at the Department of Internal Medicine, College of Medicine, King Khalid University, Abha, KSA. *Journal of the College of Physicians and Surgeons Pakistan*, 2016; 1;26(2):158-9.
- Brand HS, Schoonheim-Klein M. Is the OSCE more stressful? Examination anxiety and its consequences in different assessment methods in dental education. *European Journal of Dental Education*, 2009; 13 (3):147-53.
- Bagheri M, Forotgheh MS, Fallah MS. The comparison of stressors in the assessment of basic clinical skills with traditional method and OSCE in nursing students. *Life Science Journal*, 2012; 9(4):174852 [cited 2019 June 20] Available from http://www.lifesciencejournal.com/life0904/266_11799life0904_1748_1752.pdf
- Harden RM, Lilley P, Patricio M. The definitive guide to the OSCE: the objective Structured clinical examination as a performance assessment. London: Churchill Livingstone, 2015
- Kirton SB, Kravitz L. Objective structured clinical examinations (OSCEs) compared with traditional assessment methods. *American Journal of Pharmaceutical Education*, 2011; 10;75(6):111. [cited 2019 June 20] Available from <https://www.ajpe.org/doi/pdf/10.5688/ajpe756111>
- Brink H, van der Walt C, van Rensburg, G. Fundamentals of research methodology for healthcare professionals. (3rd ed.). Cape Town: Juta, 2012.
- Beckett N, Hellenberg DA, Namane M. A qualitative evaluation of University of Cape Town medical students' feedback of the objective. *MEFANET Journal*, 2014; Jun 26;2(1):20-5. <http://mj.mefanet.cz/mj-03140310>
- Creswell JW. Qualitative inquiry & research design choosing among five approaches (3rd ed). Thousand Oaks: CA SAGE, 2013.
- Babbie E. The practice of social research. (12th Ed): Wadsworth: Belmont, 2010.
- Bashir A, Tahir S, Nasima A, Khan J. OSPE – as an assessment tool! Teachers and students perspectives. *Medical Education*, 2016; 32: 288-295.
- Mitchell ML, Jeffrey CA, Henderson A, Glover P, Nulty DD, Kelly MA, Groves M, Knight S. Using an objective structured clinical examination for bachelor of mid-wifery students' preparation for practice. *Women and Birth*, 2014; 27(2):108-13. [cited 2019 June 20]. Available from <https://reader.elsevier.com/reader/sd/pii/S187151921300437X?token=7C2195BB0F85E9C710D31F7CE7AFE52A8BE7916627E98C6132FB181A743D68CDCB731CBE501BC00DCC4DA3041D8BDD>
- Alghamdi KS, Katib BH, Alhoqail AA, Alkhatib TA. Perception and acceptance of senior medical students at King Abdulaziz University of the use of objective structured clinical examination as a tool of assessment. *Med Ed Publish*, 2016; Sep 1:5.
- Awad, LA, Ahmed S, Alshamandy AA, & Abolwafa N F. Perception of undergraduate nursing students towards objective structured clinical examination (OSCE). *Journal of Nursing and Health Science*, 2017; 6:52-60.
- Khan A, Ayub M, Shah Z. An audit of the medical students' perceptions regarding objective structured clinical examination. *Education Research International*, 2016; article ID 4806398, 4 pages [cited 2019 June 20] Available from <http://dx.doi.org/10.1155/2016/4806398>
- Alinier G. Nursing students' and lecturers' perspectives of objective structured clinical examination incorporating simulation. *Nurse Education Today*, 2003; Aug 1; 23(6):419-26
- Fidment S. The objective structured clinical exam (OSCE): a qualitative study

- exploring the healthcare student's experience. *Student Engagement and Experience Journal*, 2012; 1(1):1-8.
25. Shahzad A, Saeed MH, Paiker S. Dental students' concerns regarding OSPE and OSCE: a qualitative feedback for process improvement. *BDJ open*, 2017; Jun 9;3:17009. [cited 2019 June 2019] Available from <https://www.nature.com/articles/bdjopen20179>
 26. Jindal P, Khurana G. The opinion of post graduate students on objective structured clinical examination in anaesthesiology: a preliminary report. *Indian Journal of Anaesthesia*, 2016; Mar; 60(3):168. [cited 2019 June 20] Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4800932/>
 27. Msosa A. Evaluation of undergraduate nursing students' clinical learning in a developing country: a formative assessment framework (unpublished doctoral thesis). University of the Witwatersrand, Johannesburg, South Africa, 2017.
 28. Omu A, Al-Azemi M, Omu F, Al-Harmi J, Diejomaoh M. Attitudes of academic staff and students towards objective structured clinical examination (OSCE) in obstetrics and gynaecology. *Creative Education*, 2016; 7: 886-897.
 29. Al Kadri HM, Al-Moamary MS, Magzoub ME, Roberts C, van der Vleuten C. Students' perceptions of the impact of assessment on approaches to learning: a comparison between two medical schools with similar curricula. *International Journal of Medical Education*, 2011; 2:44.
 30. Budianto L. Students' psychological factors in SLA: a dilemma for teachers of English. *Journal Ilmu Bahasa dan Sastra*, 2011; 5:62-68.
 31. Kalantari M, Zadeh NL, Agahi RH, Navabi N, Hashemipour MA, Nassab AH. Measurement of the levels anxiety, self-perception of preparation and expectations for success using an objective structured clinical examination, a written examination, and a preclinical preparation test in Kerman dental students. *Journal of Education and Health Promotion*, 2017;6. [cited 2019 June 20] Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5441202/>
 32. Al Nazzawi AA. Dental students' perception of the objective structured clinical examination (OSCE): the Taibah University experience, Almadinah Almunawwarah, KSA. *Journal of Taibah University Medical Sciences*, 2018; Feb 1; 13(1):64-9.
 33. Katowa-Mukwato P, Mwape L, Kabinga-Makukula M, Mweemba P, Maimbolwa MC. Implementation of objective structured clinical examination for assessing nursing students' clinical competencies: lessons and implications. *Creative Education*, 2013; 4(10):48. [cited 2019 June 20] Available from http://file.scirp.org/pdf/CE_2013101511531218.pdf
 34. Mokkaapati A, Pavani G, Dass M, Rao M. Objective structured physical examination as a formative assessment tool for IIInd MBBS microbiology students. *International Journal of Research in Medical Sciences*, 2016; 10, 4535-4540.
 35. Jawaid M, Masood Z, Jaleel F. Students' perception of surgical objective clinical examination (OSCE) at DOW University of Health Sciences. *Journal of Postgraduate Medical Institute (Peshawar-Pakistan)*, 2014; Jan 14; 28(1). [cited 2019 June 20]. Available from <https://www.jpmi.org/pk/index.php/jpmi/article/viewFile/1523/1452>
 36. Daniels ER, Nabasenja C, Mbukusa N. Exploration of reflective practice among final year radiography students during rural placement in Northern Namibia. *South African Radiographer*, 2018; 56(2):7-10.
 37. Abuzaid M, Elshami W. Integrating of scenario-based simulation into radiology education to improve critical thinking skills. *Rep Med Imaging*, 2016; 9:17-22.
 38. Alsaïd AH, Al-Sheikh M. Student and faculty perception of objective structured clinical examination: A teaching hospital experience. *Saudi Journal of Medicine & Medical Sciences*, 2017; Jan; 5(1):49. [cited 2019 June 20] Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC6298287/>
 39. Almohiy HM, Davidson R. Evaluating the clinical teaching of medical imaging students at Curtin University of Technology, Australia. *Biomedical Imaging and Intervention Journal*, 2011; Jul-Sep; 7(3). e20 [cited 2019 June 20] Available from <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3265192/>
 40. Bhowate R, Panchbhai A, Vagha S, Tankhiwale S. Introduction of objective structured clinical examination (OSCE) in dental education in India in the subject of oral medicine and radiology. *Journal of Education and Ethics in Dentistry*, 2014; Jan 1; 4(1):23 [cited 2019 June 20] Available from <http://www.jeed.in/article.asp?issn=0974-7761;year=2014;volume=4;issue=1;spage=23;epage=27;aulast=Bhowate>
 41. Jabbari N, Zeinali A, Ageshteh S. Assessment of radiology technology students' internship with objective structured clinical examination. *Future of Medical Education Journal*, 2012; 2(3):19-23.
 42. Brooks AW. Get excited: Reappraising pre-performance anxiety as excitement. *Journal of Experimental Psychology: General*, 2014; 143(3):1144 [cited 2019 June 20] Available from <http://citeseerx.ist.psu.edu/viewdoc/download?doi=10.1.1.721.4773&rep=rep1&type=pdf>
 43. Furmedge DS, Smith LJ, Sturrock A. Developing doctors: what are the attitudes and perceptions of year 1 and 2 medical students towards a new integrated formative objective structured clinical examination? *BMC Medical Education*, 2016; Dec; 16(1):32. [cited 2019 June 20] Available from <https://bmcmededuc.biomedcentral.com/articles/10.1186/s12909-016-0542-3>
 44. Patil, VC. Perceptions by feedback analysis of objective structured clinical examination (OSCE) as an assessment tool for competency based medical education for postgraduate students for teaching institute. *National Journal of Integrated Research in Medicine*, 2017; 8(6): 46-54