BRIEF

Pharmacy Students' Perceptions and Performance on the Use of an Online Virtual Experience Tool for Practicing Objective Structured Clinical Examinations

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Objective. To examine pharmacy students' performance on and perceptions regarding the use of an interactive online tool for practicing to take objective structured clinical examinations (OSCEs).

Methods. The Monash OSCE Virtual Experience (MOVE), an online module consisting of 20 pharmacy case scenarios with virtual patients, was piloted with final-year pharmacy students at Monash University campuses in Australia and Malaysia. A mixed methods approach that included reviewing user attempts and comparing grades, collecting student-administered questionnaires, and holding focus groups was used to examine students' perception and performance.

Results. More than 99% of all students attempted at least one online case scenario in preparation for their final in-person OSCE, and 81% attempted all 20 scenarios two or more times. Ninety percent of students at the Malaysia campus and 70% of students at the Australia campus reported that MOVE was a helpful study tool for their OSCE preparation. However, a raw comparison of user attempts and OSCE grades did not find a direct correlation between online module attempts and assessment grades. Self-administered questionnaire and focus group results indicated that MOVE prepared students for targeted and time-restricted history-taking and problem-solving skills. Overall, students perceived MOVE to be a useful learning tool and a less overwhelming learning experience than were face-to-face sessions. Nevertheless, students still preferred face-to-face OSCE practice with simulated patients over online practice with virtual patients.

Conclusion. The Monash OSCE Virtual Experience was perceived by our students as a flexible and useful online learning aid in preparing for their final-year OSCE. However, there was no direct correlation between online practice attempts and students' exam grades.

Keywords: pharmacy, objective structured clinical examination OSCE, virtual patients, simulation, online learning

INTRODUCTION

Objective structured clinical examinations (OSCEs) have been the gold standard for evaluating clinical skills in health care worldwide.^{1,2} Objective structured clinical examinations allow educators to assess students' clinical knowledge, communication, and problem-solving skills in a time sensitive, simulated environment, making the examination more rigorous than written examinations. In pharmacy education, OSCEs are an increasingly popular method to assess the knowledge and skills of pharmacy

students for registration, licensing, and certification.²⁻⁷ Objective structured clinical examinations can be summative or formative. Formative OSCEs can help orient students to the OSCE process and allow them to practice their skills in a low-stakes environment prior to completing a summative version of the real assessment.⁸

The balance between managing resourcing for OSCEs and allowing students enough opportunity for practice has been a constant struggle. Use of online learning resources has been shown to assist student learning, enhance performance, and reduce staff workload and cost.^{9,10} Virtual patients in online case scenarios have been used successfully in recent years in medical,¹¹ nursing,¹² occupational therapy,¹³ and pharmacy training to help prepare students for working with simulated patients in a real OSCE.^{7,10,14-18}

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In particular, OSCEs are helpful in upskilling pharmacy students in conducting clinic visits,¹⁹ history taking, developing pharmaceutical care plans, and clinical problem solving.²⁰ Simulated patients are individuals (commonly professional actors) who are trained to portray a patient with a specific condition in a standardized, realistic way so that students can be tested in a controlled environment such as an OSCE.²¹ Substituting well-designed virtual patients in place of live simulated patients in order to prepare students for OSCEs has the advantage of providing students with the opportunity for access, flexibility, and repeated practice, an approach that would be costly and difficult to implement in face-to-face sessions. Repeated exposure to online case scenarios using virtual patients can increase students' confidence in their performance.¹⁹ Using virtual patients also ensures that all situations are standardized,²² giving each student the same consistent practice experience and responses, which is challenging to achieve in face-to-face practice.

At our institution, we have two pharmacy campuses, one in Melbourne, Australia, and one in Sunway, Malaysia, which deliver the same curriculum simultaneously. We use OSCEs as formative and summative measures throughout the four-year Bachelor of Pharmacy degree program on both campuses. Summative OSCEs are conducted at the end of every year and are embedded in a unit and serve as a hurdle assessment for that particular unit. A graduated approach is used in terms of how many stations the OSCE has and the overall level of difficulty of the OSCE (moving from one OSCE station on a fixed particular content area to four OSCE stations on any content area). In years 1 and 2 of the pharmacy program, formative OSCEs (practice attempts with feedback) are conducted as small-group face-to-face tutorials with a 1:4 staff member to student ratio, allowing for personalized feedback. However, this approach has proven to be very resource demanding. Because of this, the formative OSCEs conducted in years 3 and 4 are held in large classes, and only the small number of students who volunteer to participate in the role-play with the facilitator receive feedback from the lecturer and peers in the class.

With the advantages of online training and virtual patients in mind, we sought a more sustainable approach to OSCE preparation, particularly for final year (year 4) students who have already had several opportunities to participate in formative and summative OSCEs. While these students are already familiar with the structure and process of an OSCE, they may still benefit from more learning and practice opportunities involving a variety of topics covered across the four-year program. Our objective was to assess student use and acceptance of the online

learning module, Monash OSCE Virtual Experience (MOVE), which includes virtual patients with scenarios similar to those used in actual OSCE scenarios as a means of providing students with a consistent and readily accessible learning tool to use in preparation for their final OSCE.

METHODS

In 2017, Monash University developed the Monash OSCE Virtual Experience (MOVE) using Articulate Storyline software (Micro Way Pty Ltd, New York, NY). The online learning module, which included virtual patients in scenarios similar to those in actual OSCE scenarios, was created to provide pharmacy students with a consistent and accessible learning tool to use in preparation for their final OSCE. The software program consisted of 20 pharmacy-based scenarios role-played by virtual patients. Each scenario involved medication-related problems involving classes of medicines featured in chapters of the *Australian Medicines Handbook, 2017*.²³ Students navigated through MOVE cases by clicking on a standard set of history-taking questions to communicate with the virtual patient or doctor who responded to their questions via pre-recorded video clips. For each scenario, students were given a set time limit (seven minutes as in a real OSCE) to elicit patient information, identify medication-related problems, and recommend management options and counselling points by entering text in a text-box. Once the time lapsed, a checklist of model answers was automatically released for student feedback.

In this study, a mixed methods approach was used to assess student perception of MOVE and its impact on students' OSCE performance. Three types of data were collected and analyzed: number of user practice attempts compared with students' OSCE assessment grades, student responses on a paper-based user evaluation questionnaire, and content of focus group interviews (n=20 volunteers, 10 from the Australia campus and 10 from the Malaysia campus). Participation in the survey and focus groups was voluntary and anonymous. The survey and semi-structured focus group questions were related to students' preparation process for taking the in-person OSCE and students' perceptions of and experience with using MOVE for OSCE preparation. The interview conversations were audio-recorded and transcribed verbatim. Coding of the transcripts into themes was performed using NVivo (QSR International, Cambridge, MA). The data analysis of the interviews was broken down into rounds with the first round being to establish nodes based on questions posed to students in the focus groups. In the second round, a thematic analysis following the principles of Braun and Clarke²⁴ was used to identify themes that

Figure 1a and 1b. Figure 1a. Comparison of total number of online practice attempts vs. students' grades in OSCE

Figure 1b. Comparison of number of online OSCE scenarios attempted vs. students' grades in OSCE

emerged with each node. Finally, a peer review process was conducted by an independent reviewer to add rigor to the data analysis process.²⁵ This project was approved by the Monash University Human Research and Ethics Committee.

RESULTS

More than 99% of all students (193/195 [99%] in Australia and 40/40 [100%] in Malaysia) completed at least one of the online case scenarios, and 81% of students attempted all 20 scenarios. More than 7000 attempts were documented across both campuses with usage data increasing substantially during the last two weeks preceding the in-person OSCE. Raw comparison of individual user attempts and final OSCE grades of the whole cohort showed there was no direct correlation between students' online practice attempts and final assessment performance (Figure 1a and 1b).

One hundred twenty students (response rate=50.8%) completed the student perception questionnaire. Students' perceptions about the usefulness of MOVE for OSCE preparation are presented in Table 1. The MOVE was ranked the most-used method of OSCE preparation by students on the Australia campus and the second most-used method of preparation by students on the Malaysia campus. Approximately 90% of students in Malaysia and 70% of students in Australia reported MOVE to be helpful for their OSCE preparation. Those who did not access MOVE cited lack of time and being unsure about how an online module could help with OSCE preparation as the main reasons for not using the software. The OSCE topic that students felt most prepared to manage correlated well with Moodle analytics of student attempts of the topic in the final two weeks before the examination.

Ten students on each campus were recruited by convenience sampling to participate in a focus group. Six themes emerged from the two focus groups. Key quotes and findings are presented in Appendix 1.

DISCUSSION

The design and delivery of MOVE was well received by Monash University pharmacy students on both campuses, and the majority of students found it useful for OSCE preparation. Having a standard set of history taking questions and a set time limit in which to interact with virtual patients to identify and manage their medication-related problems, students learnt the importance of patient-centered questioning technique and time management using this online learning tool. Students also found the MOVE feedback tool useful for reflection and identifying gaps in their clinical and product knowledge that they needed to address prior to completing the real OSCE. Allowance for repeated practice with virtual patients increased students' confidence in tackling complex case problems, which is consistent with other studies where pharmacists showed they were more likely to use a medication therapy management program after completing virtual cases.¹⁰

In this study, students indicated that a virtual simulation tool such as MOVE could serve as an additional resource to prepare them for engaging in face-to-face OSCE practice sessions, which they preferred. Similar to our findings, Al-Dahir and colleagues¹⁸ reported that pharmacy students in their study rated the traditional face-to-face facilitator-led environment favorably compared to a self-directed virtual learning environment. The limitations that the students identified about MOVE included the software program's inability to give them personalized

Table 1. Pharmacy Students' Responses to a Self-administered Questionnaire Assessing Their Perceptions of the Monash OSCE Virtual Experience to Prepare Them for Objective Structured Clinical Examinations

	Students on Malaysia Campus, %	Students on Australia Campus, %
"I felt prepared for OSCE"		
Strongly Disagree	0 (0.0)	4 (4.8)
Disagree	5 (13.9)	21 (25.0)
Neutral	20 (55.6)	31 (36.9)
Agree	10 (27.8)	22 (26.2)
Strongly Agree	1 (2.8)	2 (2.4)
Method of preparation for OSCE		
Familiarized yourself with pharmacy textbooks and online resources	35 (97.2)	63 (69.2)
MOVE	30 (76.9)	67 (73.6)
Revised lecture notes	27 (69.2)	39 (42.9)
Practiced with friends	35 (89.7)	49 (53.8)
Spoke to previous final year students	10 (25.6)	32 (35.2)
Revised with library staff	0 (0.0)	1 (1.1)
Did not prepare	0 (0.0)	2 (2.2)
"I found MOVE helpful" for those who completed MOVE		
Very Helpful	13/28 (46.4)	22/73 (30.1)
Somewhat Helpful	13/28 (46.4)	28/73 (38.3)
Slightly Helpful	2/28 (7.1)	19/73 (26.0)
Made no difference to my learning	0 (0.0)	4/73 (5.5)

Abbreviations: OSCE=objective structured clinical examination, MOVE=Monash OSCE Virtual Experience

feedback on their oral and non-oral communication skills (eg, empathy), and the lack of interaction with a real-life person in completing the OSCE.

Another limitation of MOVE was the bulk release (ie, making all of the case scenarios available to students at the same time), which may have influenced the limited number of cases that students accessed prior to the examination. Maier and colleagues found that releasing cases periodically through the year led to more balanced use compared to releasing all of the cases at the same time.²⁶ Recommendations to other institutions who plan to use an online learning tool like MOVE for OSCE preparation would be to release small blocks of exercises over several weeks after relevant content has been taught to allow students more time to access them.

Students in our study also felt that the short amount of time allocated for online scenarios and face-to-face sessions²⁷ could not effectively assess their abilities and skills.²⁸ Another limitation of using virtual patients is the potential for less empathetic learners.²⁹ The majority of respondents in our study were female, which was consistent with enrollment statistics for gender. In another study, female students found training using virtual patients to be more beneficial than did male students.³⁰ Although the two campuses, one in Malaysia and the other in Australia, are culturally different, we did not find students' perceptions of MOVE to differ significantly.

Raw comparison of students' online practice attempts with OSCE assessment scores for the whole cohort demonstrated no significant correlation, indicating virtual learning engagement alone could not sufficiently impact students' OSCE performance in real life. In this regard, the user survey results and focus group interview results showed that students used a variety of OSCE preparation methods in addition to completing the online modules in MOVE, including recruiting peers to role play MOVE cases in person. Nevertheless, students from both the Australia campus and the Malaysia campus felt that online practice attempts helped them prepare for the OSCE, in particular, their history-taking, problem-solving, and time management skills. Similar to our finding, Tarileri and colleagues¹⁹ reported that pharmacy students access to virtual patient activities prior to mock clinical visits improved student performance in real life. Practice with virtual patients provided additional learning opportunities and positive outcomes for pharmacy students.

While virtual patients and online simulation cannot completely duplicate the experience of real-life human interactions, MOVE provided a controllable, secure, and safe learning environment with an opportunity for unlimited access and learning attempts without the restrictions on time and space normally incurred with face-to-face practice sessions.²² Lack of easy access to technology has been suggested as one of the barriers to student use of virtual

patient technology as well as the ability to engage with online learning materials which may also be challenging for some students.⁶

Finally, we listed the online cases in alphabetical order and we found that the most accessed cases were the ones starting with “a” such as “allergy” and some of the last cases were missed (data not shown). We suggest that educators use a portal that randomly allocates a case (eg, hospital, community, prescription, drug chart, product request) to the student for each practice session. Then, once the student has attempted all cases, they will have the ability to repeat any case. It may be beneficial to go over several example cases with students in a face-to-face session to enhance student engagement, learning experience, and outcomes.

In summary, the use of virtual patients and simulated scenarios can be a feasible and effective way of providing student-centered learning.³¹ However, it is still a supplementary tool and does not replace the spontaneity of human interaction achieved when live simulated patients are used. Future directions include looking into incorporating verbal and non-verbal communication practice.

CONCLUSION

The Monash OSCE Virtual Experience was well received by pharmacy students on two campuses as an online learning tool to aid them in preparation for OSCEs. This online learning tool, which uses simulated patients and physicians, is intended to supplement rather than replace the real human interaction that takes place in an actual OSCE. Additional work is required to integrate verbal and non-verbal communication practice more comparable to authentic face-to-face live practice.

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Appendix 1. Combined Results of Focus Groups Held With Pharmacy Students on Two Campuses Regarding Their Perceptions of a Virtual Experience to Prepare Them for Objective Structured Clinical Examinations

Theme	Key Results	Exemplar Quotes
1. MOVE compliments the general OSCE preparation process	Students value MOVE as an OSCE practice tool but felt could not rely on it solely for the exam preparation. Students indicated they recruited MOVE scenarios for face to face practice with peers.	<p>“I used MOVE, I went through each one and I tested the answers on a Word document, just to see what the right responses were, like what you actually wanted to hear, then I practiced with my friends.” <i>Parkville Campus, Australia, student</i></p> <p>“for the hospital cases, I think it prepares us to familiarize ourselves with the resources we would have to reply on. . .” <i>Parkville Campus, Australia, student</i></p> <p>“(recommending study techniques for the OSCEs) Use the MOVE module, practice with your friends, if you don’t have a job already, get one as soon as possible, and then obviously you should revise all your integrated stuff, like revise on everything, but that’s not really realistic, especially when we’re trying to learn new things to pass this semester. That’s why you need to keep up to date with the study across the 4 years.” <i>Parkville Campus, Australia, student</i></p> <p>“we actually found it very useful, and split them to ten questions each and familiarized ourselves with those MOVE cases before we practiced with other people. . .so you can then provide more solid feedback to your friends” <i>Sunway, Malaysia, student</i></p>
2. MOVE prepares students for the real OSCE	Students questioned whether virtual patients authentically prepared them for the real OSCE with simulated patients. MOVE, unlike in a face-to-face session, used standardized answers provided by a virtual patient in a video clip which students felt was not mimicking a real-life exam situation. Nevertheless, students also indicated a practice opportunity with a virtual patient was a less daunting situation compared with the challenge of face-to-face interaction with a simulated patient. On the other hand, some students found virtual interaction challenging as they couldn’t express their non-verbal and empathy skills.	<p>“It’s less daunting looking at someone on the screen, knowing that they can’t see you as well. And like it’s not scary at all, but if that same person was right next to me and I know they’re marking me, I think just for myself I’d get scared.” <i>Parkville student</i></p> <p>“it doesn’t help much with communication, just questioning...right management. . .and time management, it’s really important to have friends to practice with. . .because everyone speaks to the patient differently” <i>Parkville student</i></p> <p>““after going through MOVE, we will also practice on each other with the same cases” <i>Sunway student</i></p>

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Theme	Key Results	Exemplar Quotes
3. Other methods for OSCE preparation	Students reported other OSCE preparation strategies such as revising lecture notes, familiarizing themselves with reference books and practicing with friends, which aligned with the responses from the questionnaires. Students also stated that working part-time in a pharmacy as a significant advantage over other preparation methods for the OSCE.	“Familiarize yourself with the AMH (Australian Medicines Handbook). . . I usually just look up drugs but in front of each drug there’s a section and it tells you how the treatments work, the sorts of things you learn at university, it’s all condensed there. . . I didn’t know it existed in the AMH.” <i>Parkville student</i> “it makes a very big difference if you’re working in the community pharmacy. . . you get to see more when you’re working rather than just practising with friends” <i>Parkville student</i> “if you’re not working in a community pharmacy, it’s really hard to even practice with your own friends” <i>Parkville student</i>
4. MOVE helps students with targeted questioning in patient history taking	Students conveyed that they found it helpful that each case scenario in MOVE had a logical and consistent set of patient interview questions in combination with the fixed timing for history taking, which helped guide their questioning technique and avoid asking unnecessary questions.	“I think MOVE actually helps you to know what kind of questions to ask, because sometimes when you just think it off the top of your head then it’s kind of difficult and you forget some questions, but then because they have a list there, so then if you keep practicing that then in the real scenario you can sort of just remember that there’s an extra question like are you pregnant or something like that and then you can ask that. So, I think that’s what helped the most” <i>Parkville student</i> “it makes you think about what you’re actually going to say rather than like press every single question and asking a male are you pregnant just in case” <i>Parkville student</i> “it taught me not to forget those little questions like are you pregnant or breastfeeding because sometimes I do forget to ask that” <i>Parkville student</i> “from the online teaching OSCE...I made a list of you know what kind of questions I could ask if I was struggling with the case” <i>Parkville student</i>
5. Difficulty level of MOVE	Students felt MOVE had a higher difficulty level for the hospital pharmacy-based scenarios than the community pharmacy scenarios. Students indicated that this could be because most had limited exposure and work experience in hospitals.	“MOVE cases were harder than the actual OSCE” <i>Parkville student</i> “. . . after completing the MOVE cases, I felt quite well prepared for community cases” <i>Parkville student</i> “the hospital cases were a lot harder. . .” <i>Sunway student</i>

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Theme	Key Results	Exemplar Quotes
6. The comparison between MOVE and a face to face practice session	Students still preferred live face-to-face practice as they could get individualized feedback from the facilitator acting as the simulated patient compared with the generic feedback of item checklist received from the online module.	<p>“MOVE responses is in a perfect world. . .it’s not reflective of what would happen really in real life.” <i>Parkville student</i></p> <p>“you can also like not do it properly because. . .I would waste like 6 minutes looking at stuff, and then the last one minute you can just write whatever and then click submit and then all the answers will come up” <i>Parkville student</i></p> <p>“by the time you finish asking all the questions and checking everything, all your time’s up already, and then you have type out everything you want to say as well, that takes even longer” <i>Parkville student</i></p> <p>“Like questions you want to ask you can’t ask” <i>Parkville Student</i></p> <p>“the MOVE module is difficult because there is a time limit, so even when you have not finished asking all the questions the time is up. It’s difficult. . .but it was good practice to ask just the specific questions.” <i>Sunway student</i></p>

Abbreviations: OSCE=Objective Structured Clinical Examination, MOVE=Monash OSCE Virtual Experience