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Basic Science Medical Students' Perception of a Formative Peer Assessment Model for Reinforcing the Learning of Physical Examination Skills During the COVID-19 Pandemic Online Learning Period

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***Abstract*—**The COVID-19 pandemic challenged the education system and forced medical schools to transition to online learning. With this transition, one of the major concerns for students and educators was to ensure that Physical Examination (PE) skills were still being mastered. Thus, the formative peer assessment model was designed to enhance the learning of PE skills during the COVID-19 pandemic in the online learning landscape. Year 1 and year 2 students enrolled in clinical skills courses at the University of Medicine and Health Sciences, St. Kitts were asked to record themselves demonstrating PE skills with a healthy patient volunteer after every skills class. Each student was assigned to exchange feedback with one peer in the course. At the end of the first two semesters of this learning activity, a cross-sectional survey was conducted for the two cohorts of year-1 and year-2 students. The year-1 cohorts most frequently rated the peer assessment exercise as 4 on a 5-point *Likert* scale, with a mean score of 3.317 [2.759, 3.875]. The year-2 cohorts most frequently rated the peer assessment exercise as 4 on a 5-point *Likert* scale, with a mean score of 3.597 [2.978, 4.180]. Students indicated that guidance from faculty, flexible deadlines, and detailed and timely feedback from peers were areas for improvement in this process.

***Keywords*—**COVID-19 pandemic, distant learning, online medical education, peer assessment, physical examination.

I. Introduction

THE introduction to a clinical medicine course is an essential component of clinical training during the basic sciences program of medical school. It prepares medical students for clinical rotations by teaching PE skills, history-taking and communication skills, basic clinical knowledge, and clinical reasoning skills which are necessary for aiding diagnostic decision-making and developing rapport with patients [1], [2]. The transition to online learning due to the COVID-19 pandemic has posed various challenges to teaching clinical and PE skills with the e-learning platform.

One of the major concerns for pre-clinical medical students during this COVID-19 pandemic online learning environment was ensuring that PE skills were still being learned and mastered in preparation for clinical rotations [3]. With in-person classes suspended, it became difficult for students to learn these skills from the direct supervision of their teachers and to have the opportunity to collaborate with their peers within the school and hospital setting [4]. Although current advances in technology have made the online learning platform a beneficial method at all levels of education, clinical skills training has been the most challenging aspect of medical education to move to an online forum [5]. Institutions have been utilizing surgical video libraries, and social media tools such as podcasts and Twitter, and initiating student involvement in virtual consults and telemedicine. These are beneficial methods to ensure medical students continue to learn clinically relevant material while lacking the hands-on aspect of their education [3]. Another helpful tool that has been incorporated into medical students' online education platforms is the use of virtual group viewings of clinical encounter videos as it incorporates peer interaction to promote the learning of proper PE techniques and good bedside manners [3]. However, despite all these new online learning measures, a major pitfall is the lack of the student's ability to demonstrate mastery of PE skills.

As we transitioned to online learning, our school retained the same format to teach PE skills by using live virtual faculty demonstrations with Standardized Patients (SPs). However, though the live virtual demonstration with SPs continued, many of our students did not have the opportunity to practice their skills during a live session. The professors of the pre-clinical skills department have attempted to address these concerns by supporting the asynchronous practicing of PE skills while allowing students to develop a sense of independence, self-regulation, and collaboration, as these traits play a pivotal role in online learning, adult learning, and physicians' education [5]-[8]. Thus, we developed and piloted a formative peer assessment model to support the online learning of PE skills to promote collaboration and hands-on PE skills demonstration to help our students in practicing and mastering their PE skills.

Formative peer assessment is defined as the method of peers assessing or being assessed by each other to provide quality and constructive feedback [9]. Medical schools have long used the peer assessment tool as an intervention to lead to more effective learning [10]. A study conducted on higher education students revealed that implementation of peer assessment led to a 10-30% increase in students' grades over one year [10]. As an added benefit, the students who participated in this study

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became more confident in themselves as learners while noting an increased ability to criticize and reflect upon their work by identifying the gaps between their current performance and their desired goal [10]. It was also determined that peer assessment reduced anxiety when later being evaluated by an authority figure as the process increased their familiarity with the PE skills and the evaluation criteria [8], [11]. Furthermore, exposure to the skill of peer assessment is crucial to a medical student's development as physicians are expected to effectively provide feedback to their colleagues [12]. Peer assessment can be hindered by several factors including not wanting to destroy friendship dynamics, perceived lack of fairness due to inflation of peer skills among some peers, and perceived inferiority to faculty feedback [12], [13]. Additionally, individual influences, including students' perceived level of preparedness and self-efficacy, can affect acceptance and adaptability to this program [13]-[15]. Thus, students should be adequately trained to effectively assess and receive feedback [16].

A. Aim

This study aims to determine the students' perception of the formative peer assessment model used for reinforcing the learning of PE skills during the COVID-19 pandemic distant learning experience.

II. Methods

A. Participants and Procedure

We developed the formative peer assessment exercise to enhance the learning of PE skills for first and second-year medical students. Two cohorts of year-1 (1-Y1 and 2-Y1) and year-2 (1-Y2 and 2-Y2) medical students enrolled in pre-clinical courses have participated in this activity as part of the mandatory course activities. During live virtual skill sessions, the faculty first demonstrated the PE skills of an organ system using SPs. Appropriate additional learning materials, e.g., institution-made and commercial PE videos and PE checklists, were provided to assist students in meeting their learning outcomes. Each week, the year 2 cohorts were required to practice, record, and submit a video recording of themselves demonstrating mastery of specific PE skills learned that week. Additionally, each student was assigned to assess a peer's video submission and provide feedback using the provided peer assessment checklist. The Google Drive platform was the tool used to exchange PE videos and feedback submissions. In the interest of privacy, only the assigned faculty and peer were given access to a student's Peer assessment folder. The year-1 cohorts had the same design of this exercise, except the frequency of classes and volume of submissions were approximately half of that described for the year-2 cohorts. Students were briefed on the goals of the exercise, their role as peer evaluators, and how to give feedback to a peer effectively. Each faculty member teaching the course was assigned to monitor a fraction of the students to ensure that students stayed up to date with submissions. This allowed faculty to engage with students who needed additional support. Faculty did occasional spot checks of the peer feedback provided and provided additional feedback on the depth and accuracy of the feedback given by peers.

B. COVID-19 and Safety

Careful consideration was given to ensure that students and their volunteer patients would be safe during the COVID-19 pandemic. Firstly, students were asked to find a volunteer within their social circle (e.g., someone they will naturally socialize with during this period). Protocols for wearing masks and sanitization of hands were enforced. All other COVID-19 protocols were to be followed according to their local cities. Throughout the semester, the faculty remained flexible and accommodating to individual students' needs and safety concerns.

C. Study Design

As part of our ongoing commitment to addressing our students' needs during the COVID-19 distance learning period, we conducted an end-of-course survey to evaluate the effectiveness of the formative peer assessment exercise. As such, we petitioned the school's Institutional Review Board [IRB] board to use data gathered from this process for this study and were granted IRB-exempt status.

D. Measures

We analyzed data from the course surveys to gather feedback about students' experiences during this peer assessment activity. Quantitative data were collected by surveying students' attitudes to various aspects of their experience using a 5-point ordinal *Likert* scale (5-Excellent, 4-Good, 3-Average, 2-Fair, and 1-Poor). Qualitative data were gathered using an open-ended question to determine how students felt the department could improve the experience and support their learning goals.

E. Analysis

Data from the *Likert* scale rankings were processed and charted using Microsoft Excel. Data were analyzed as ordinal data to determine the overall attitude on each item. The mean was calculated as the measure of central tendency for the ordinal data. Thematic analysis was applied to the qualitative data. Data were mapped according to the key themes and tallied for further interpretation.

III. Results

Course enrollment for each cohort included 1-Y1 (133), 2-Y1 (101), 1-Y2 (72), and 2-Y2 (86). The survey response rate was as follows: 1-Y1 48 (36%), 2-Y1 53 (52%), 1-Y2 51 (70%), and 2-Y2 60 (70%).

A. Attitude to Formative Peer Assessment Exercise

Overall, year-1 and 2 cohorts more often rated the peer assessment exercise as good (4/5) for affording them the flexibility to practice their PE skills, confidence in giving feedback to peers, receiving quality or accurate feedback from peers, affording quality amount of time and effort spent learning PE skills, and in the mastery of PE skills. However, the 1-Y1 cohort most frequently rated this activity as fair (2/5) for

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affording them the flexibility to practice their PE skills and the quality or accuracy of feedback received from their peers. The Mean score was 3.317 [2.759, 3.875] and 3.597 [2.978, 4.180] for the year-1 cohorts and year-2 cohorts, respectively. Table I shows a summary of the student experience with the peer assessment exercise, and Figs. 1-6 show students' attitudes toward the peer assessment exercise by cohort.

B. Preparedness for Subsequent Clinical Courses

Students' perception of preparedness for subsequent clinical courses was only surveyed in the year-2 cohorts as these students are progressing on to the final pre-clinical semester, where they can further fine-tune their clinical skills and clinical reasoning. Overall, the year-2 cohorts most frequently rated the peer assessment exercise as good (4/5) for preparing them for their next level pre-clinical experience with a mean score of 3.549 [2.958, 4.140].

C. Improving the Peer Assessment Activity

The response rate for this item was as follows: 1-Y1 29 (60%), 2-Y1 27 (53%), 1-Y2 58 (31%), and 2-Y2 53 (32%). The year-2 students asked for increased time between class and the submission deadline, flexible deadlines near exam periods, and decreasing the volume of required video submissions. One 2-Y2 student wrote, "In terms of the pandemic, the faculty and staff went above and beyond and provided a quality course given the circumstances." Another -Y2 student wrote, "I think the peer assessment videos really helped me to master the week's material and the techniques… I didn't realize how much I remembered for the Final until I started practicing… I was able to perform most of the movements and motions without cues. It shows how helpful the practice was from a remote setting." Both year-1 and 2 students asked for setting time limits for PE videos and timely feedback from peers, guidance from faculty (e.g., feedback on video submission, video resources from faculty or recording of the live lab sessions), exemplar video from students, and more feedback or detailed feedback from peers. One 1-Y2 student wrote, "It is difficult to deliver a program as such via ZOOM … videos were time-consuming but forced me to practice my clinical skills". One 2-Y1 student wrote, "…My partner was great, and we did our best to provide feedback to each other but for both students' feedback from professors prior to the final would have been nice." Table II shows a summary of the areas in which students identified for improvement in the formative peer assessment exercise.

IV. Discussion

The COVID-19 pandemic has created a catalyst for change in higher education. Even though face-to-face learning in medical education has clear advantages for learning PE skills and student collaboration, the necessary online education, if executed properly, may be an effective temporary contingency [3], [17]. The formative peer assessment model presented in this study appears acceptable, practical and affords students the protected time to practice and demonstrate their PE skills during this period. The 1-Y1 cohort expressed the most significant dissatisfaction regarding flexibility to practice their PE skills and the quality of feedback from their peers. As this dissatisfaction was not consistent across both cohorts of year-1 students nor was it consistent across other variables surveyed, it is difficult to ascertain if the novice students felt uncomfortable with this activity or if their mindset toward the value of this activity led to some resistance to acceptance of the concept. We have found that the model worked better with student buy-in as the semester(s) progressed.

To ensure that peer assessment fulfills its goal of enhancing learning PE skills, it is essential to understand the potential downfalls of the model. Firstly, we found that though students self-reported a reasonable level of confidence in giving and receiving feedback, many still requested input from faculty. At the same time, [18] states that a novice peer assessor with adequate time to focus on the task can produce an assessment of equal quality to that of an expert, and early guidance can build a sense of proficiency and independence with this task. Thus, for peer assessment to be considered an efficient tool, it must be deemed a professional skill that requires proper training on being an appropriate assessor [16]. This activity may ultimately enhance the student's ability, confidence, and independence to self-reflect and criticize their work while strengthening their ability to cooperate and create discussions with peers [11], [19].

Secondly, another potential barrier can be the educators' or students' inability to merge technology with this learning strategy [20]. Although peer assessment could be implemented in the online platform, there are likely differences in technical skills, e.g., recording skills and sharing and accessing videos and checklists, which could reduce the effectiveness of peer assessment as a useful learning tool [11]. Thus, institutional support is essential to ensure educators and students can properly incorporate peer assessment into the online setting.

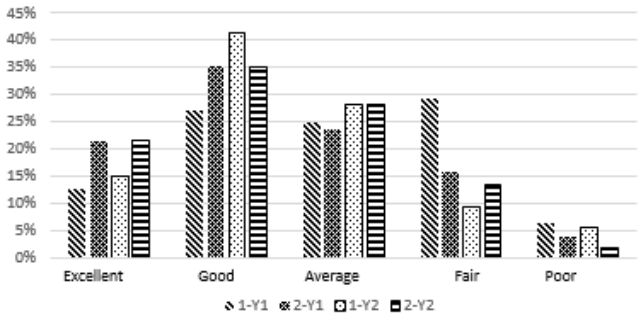

Fig. 1 Students' attitudes (%) to the peer assessment model by cohort- flexibility to practice your PE skills

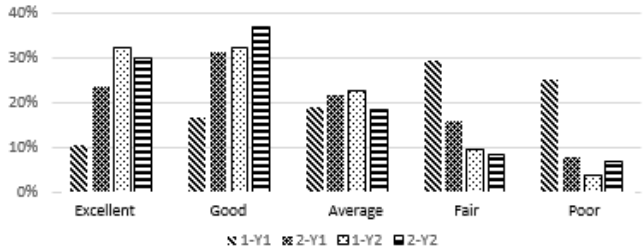

Fig. 2 Students' attitudes (%) to the peer assessment model by cohort- quality/accuracy of feedback

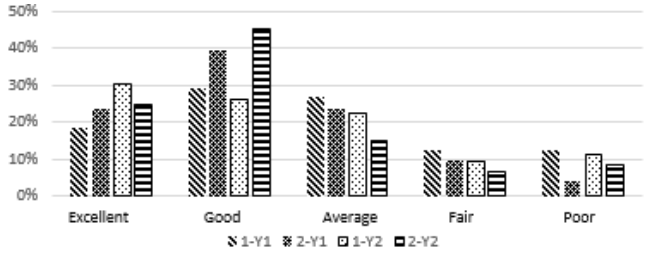

Fig. 3 Students' attitudes (%) to the peer assessment model by cohort- quality time and effort for learning PE skills

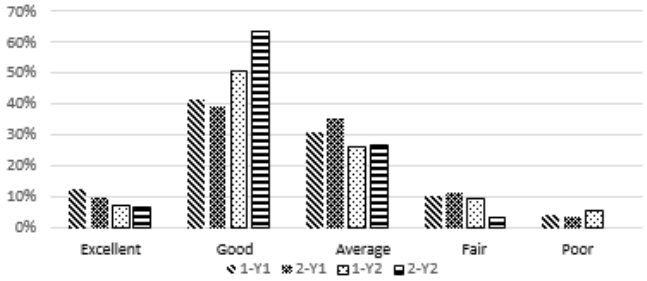

Fig. 4 Students' attitudes (%) to the peer assessment model by cohort- mastery of PE skills

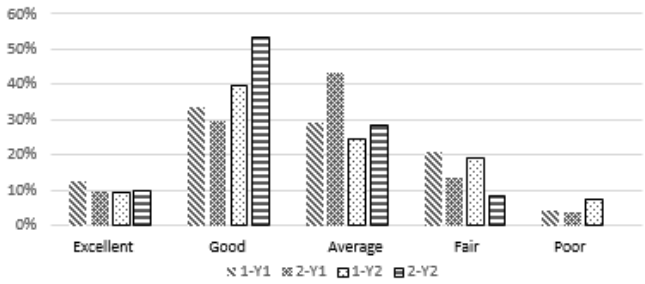

Fig. 5 Students' attitudes (%) to the peer assessment model by cohort- confidence in providing feedback on PE skills

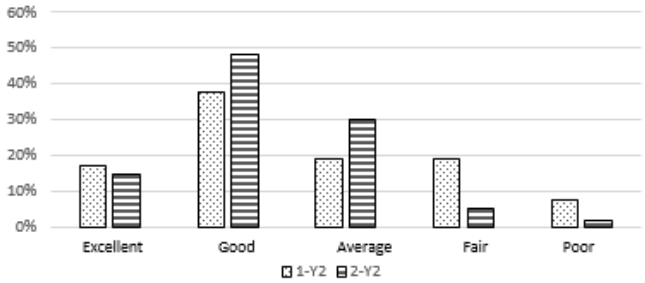

Fig. 6 Students' attitudes (%) to the peer assessment model by cohort- preparedness for the next clinical course

TABLE I
STUDENT RESPONSES TO EXPERIENCE WITH LEARNING PE SKILLS USING THE PEER ASSESSMENT EXERCISE

Experience	Cohort	Excellent (5)	Good (4)	Average (3)	Fair (2)	Poor (1)	Mean (95% CI)
Flexibility to practice PE skills	1-Y1	6	13	12	14	3	3.104 [2.312, 3.896]
	2-Y1	11	18	12	8	2	3.549 [2.686, 4.412]
	1-Y2	8	22	15	5	3	3.509 [2.646, 4.372]
	2-Y2	13	21	17	8	1	3.617 [2.797, 4.437]
	All	**38**	**74**	**56**	**35**	**9**	**3.458 [3.039, 3.877]**
Quality/accuracy of feedback received	1-Y1	5	8	9	14	12	2.583 [1.902, 3.264]
	2-Y1	12	16	11	8	4	3.471 2.6.6, 4.326]
	1-Y2	17	17	12	5	2	3.792 [2.849, 4.735]
	2-Y2	18	22	11	5	4	3.750 [2.886, 4.614]
	All	**52**	**63**	**43**	**32**	**22**	**3.429 [3.003, 3.855]**
Quality amount of time and effort into learning PE sills	1-Y1	9	14	13	6	6	3.292 [2.437, 4.147]
	2-Y1	12	20	12	5	2	3.686 [2.792, 4.580]
	1-Y2	16	14	12	5	6	3.547 [2.647, 4.447]
	2-Y2	15	27	9	4	5	3.717 [2.862, 4.572]
	All	**52**	**75**	**46**	**20**	**19**	**3.571 [3.132, 4.010]**
Mastery of PE skills	1-Y1	6	20	15	5	2	3.479 [2.603, 4.355]
	2-Y1	5	20	18	6	2	3.392 [2.584-4.200]
	1-Y2	4	27	14	5	3	3.453 [2.612-4.294]
	2-Y2	4	38	16	2	0	3.733 [2.909, 4.557]
	All	**19**	**105**	**63**	**18**	**7**	**3.524 [3.105, 3.943]**
Confidence in demonstrating PE skills	1-Y1	6	16	14	10	2	3.292 [2.459, 4.125]
	2-Y1	5	15	22	7	2	3.275 [2.497. 4.053]
	1-Y2	5	21	13	10	4	3.245 [2.445, 4.045]
	2-Y2	6	32	17	5	0	3.650 [2.839, 4.461]
	All	**22**	**84**	**66**	**32**	**8**	**3.377 [2.973,3.7781]**
Preparedness for your next clinical course	1-Y2	9	20	10	10	4	3.377 [2.534, 4.220]
	2-Y2	9	29	18	3	1	3.700 [2.872, 4.528]
	All	**18**	**49**	**28**	**13**	**5**	**3.549 [2.958, 4.140]**
Combined responses-all variables	(1-Y1 & 2-Y2)	77	160	138	83	37	3.317 [2.759,3.875]
Combined responses-all variables	(1-Y1 & 2-Y2)	124	290	164	67	33	3.597 [2.978, 4.180]

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Finally, it is essential to realize that although the formative peer assessment model seemed adequate to our students for enhancing the learning of PE skills in a distance model of education, the long-term implications of such adjustments to medical education are not yet understood. There are other vital elements to consider when trying to ascertain its benefit for reinforcing the learning of PE skills during the pre-clinical years of medical school. For example, medical students who take hands-on PE skills courses in the pre-clinical curriculum have been found to perform statistically superior on Objective Structured Clinical Examinations (OSCE) [21]. Thus, the next step is to investigate the benefits of this peer assessment model on students' performance on OSCE compared to the pre-COVID-19 cohorts. Perhaps, another study in the future may help to provide insight as to whether this peer assessment model had a significant effect in reducing the impact of the COVID-19 pandemic online learning period on the student's ability to perform PE skills as they progress further in their training.

TABLE II
STUDENT-IDENTIFIED IMPROVEMENT AREAS FOR THE PEER ASSESSMENT EXERCISE

Themes	1-Y1 n (%)	2-Y1 n (%)	1-Y2 n (%)	2-Y2 n (%)	Total n (%)
Increasing time between class and the submission deadline	0 (0)	0 (0)	9 (29)	2 (6)	11 (9)
Flexible deadlines as exams approach	0 (0)	3 (11)	4 (13)	3 (9)	10 (8)
Decreasing the volume of videos to be submitted	0 (0)	0 (0)	2 (6)	0 (0)	2 (2)
Setting time limits for PE videos	0 (0)	0 (0)	0 (0)	1 (3)	1 (1)
Timely feedback from peers	2 (7)	1 (4)	1 (6)	0 (0)	5 (4)
Guidance from faculty	25 (86)	12 (144)	11 (35)	16 (50)	64 (54)
Exemplar video from a student	1 (3)	0 (0)	0 (0)	1 (3)	2 (2)
More feedback or detailed feedback from peers	2 (7)	2 (7)	1 (3)	0 (0)	5 (4)

V. CONCLUSION

The abrupt onset of online distance learning during the COVID-19 pandemic has called for highly innovative ideas and adaptable qualities from educators and medical students. The University of Medicine and Health Sciences, St. Kitts took advantage of these qualities by creating a collaborative learning environment to support online learning and allow for hands-on demonstrations of PE skills through a formative peer assessment model. The peer assessment exercise required proper training of students and technical support for both faculty and students to ensure its success. Students felt the formative peer assessment exercise was overall at least average for enhancing student learning of PE skills during the COVID-19 pandemic distance education period. Considerations for further development of this activity include student workload, time constraints, and reliability of peer feedback.

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