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What the COVID-19 Pandemic Taught Medical Educators in the Caribbean about Online Clinical Teaching

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Abstract: The pandemic forced final year clinical students in six health-profession programs in a Caribbean University to suddenly transition from a clinical learning environment to an exclusively online environment for clinical instruction. The change in curriculum delivery allowed students to compare teaching of clinical skills using clinical and online learning environments. In June 2020, 278 students (78% response rate) completed a survey rating the online teaching experience. Students from each discipline also participated in a focus group discussion. Of the sample, 88% of students felt that the online environment was enthusiastic and stimulating but did not view it as satisfactory for skills transfer; 77% felt connected with their teachers but deprived of the social connectedness, peer support, and vicarious learning afforded by face-to-face instruction. Clinical students perceived the online environment as a convenient and beneficial platform to deliver didactic components of the clinical curriculum, thus providing downtime for students and ensuring equitable exposure of all students to all teachers. In the post-pandemic era, medical teachers should make the effort to maintain and refine online approaches, not just for use in times of emergency, but for integration into curriculum delivery strategies to improve the clinical learning environment and student satisfaction, while maintaining the hands-on method of clinical instruction.

Keywords: COVID-19 pandemic; online clinical teaching; clinical learning environment; medical education; educational equity; Caribbean



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1. Introduction

Globally, the COVID-19 pandemic challenged medical educators in the health professions to complete the curriculum following removal of students from wards and clinics. The acute onset and rapid spread of the coronavirus necessitated a rapid transfer to emergency remote teaching, defined by Hodges et al. [1] as a temporary shift of instructional delivery to an alternate delivery mode due to crisis circumstances. Teachers were forced to use online teaching methods.

This study was conducted at the Trinidad and Tobago campus of The University of the West Indies, a regional university in the Caribbean. It offers programs in Medicine, Dentistry, Veterinary Medicine, Pharmacy, Nursing, and Optometry with annual student intakes of approximately 250, 25, 40, 60, 100, and 25, respectively, and with the exception of Nursing, is the only university in Trinidad and Tobago to offer these programs. The university, through memoranda of understanding with the regional health authorities of the

Ministry of Health of the country, conducts clinical skills training in approved hospitals and community clinics. Students in the final two years of the five-year programs in Medicine and Dentistry, the final year of the four-year program in Pharmacy, and throughout the four years of the Optometry and Nursing programs are assigned to hospital wards, out-patient hospital and community clinics, and approved private facilities. The clinical programs are intensely hands-on under the supervision of full-time and associate clinical faculty.

The onset of COVID-19 led to rapid educational adaptations. Government-mandated public health restrictions resulted in immediate suspension of all face-to-face classes and ward/clinic placements. With oversight and approval from the faculty COVID-19 advisory group, and faculty and university curriculum, and quality assurance committees, teachers quickly utilized available resources to deliver the curriculum exclusively in an online environment, using the BlackBoard Collaborate (BbC) Ultra web conferencing system that was available via the Moodle learning management system. There was an equally intense rush for faculty development aimed at preparing teachers for online delivery of the clinical program. This scenario enabled a natural assessment of comparative approaches to teaching clinical skills using two different learning environments—clinical spaces and online.

The learning environment is an important determinant of effective learning [2–5]. “Learning environment” typically refers to the social, psychological, or conceptual environment but can also include the physical environment where learning takes place.

In medical education, the clinical environment is a necessity for teaching and learning and the acquisition of clinical skills. Hospital wards and clinics are the clinical classrooms. Chan [6] described the clinical learning environment as “the interactive network of forces within the clinical setting that influence students’ learning outcomes”, “a multidimensional entity with a complex social context” that “directly affects the outcomes of students’ clinical placement”. He acknowledged that not all practice settings provide a positive learning environment.

Using a theoretical framework in psychosocial education, Chan [7] later proposed to understand the social climate factors that characterized a clinical learning environment associated with good learning outcomes. From his work with nursing students, he reported that student learning outcomes were strongly associated with their perceptions of the social climate of the clinical learning environment.

Other authors have also concluded that the clinical learning environment affects achievement of learning outcomes [8–10]. Following concept analysis, Flott and Linden [10] concluded that the clinical learning environment had four attribute characteristics that affected learning experiences: (1) the physical space; (2) psychosocial and interaction factors; (3) the organizational culture; and (4) teaching and learning components.

Very little has been written on the usefulness of the online learning environment for clinical instruction and there are no reports of students’ learning experiences in online acquisition of clinical skills in the Caribbean. Using the components of Flott and Linden’s conceptual framework [10], this study explores the usefulness of the online environment for clinical skills instruction in the context of existing resources in a Caribbean university. It aims to investigate the experiences and perceptions of final year students in the six clinical programs who received online clinical skills instruction during the COVID-19 pandemic, and makes recommendations for the context-specific use of the online environment for clinical teaching in a limited resource setting. The findings will be useful in assessing and optimizing the online learning environment for clinical teaching in resource-limited health-profession education programs.

2. Materials and Methods

2.1. Sample and Data Collection

In June 2020, on completion of program learning objectives and before the final examination, all final year students in six clinical disciplines—Medicine, Dentistry, Veterinary Medicine, Pharmacy, Nursing, and Optometry ($n = 355$)—were invited to complete an

online cross-sectional survey disseminated via Google forms as part of the routine internal quality processes of the faculty. Researchers collected data from 278 students (78.3% response rate). Approval was obtained from the UWI Ethics Committee of the University of the West Indies, St. Augustine (Ref CREC-SA.0434/07/2020) to utilize these data in a mixed-methods study.

2.2. Study Instrument

A de novo teaching evaluation questionnaire collected data on student demographics and the online teaching experience. Using a 4-point Likert scale, from strongly disagree (score of 1) to strongly agree (score of 4), students rated their perception of the online learning environment, ease of teaching, challenges experienced, and effectiveness of the online strategies used.

A purposive sample of twelve students from all the health disciplines also participated in a ninety-minute virtual focus group discussion conducted on the Zoom videoconferencing platform. All final-year students received an invitation from the student representative, via their respective student WhatsApp groups, to participate anonymously in a focus group discussion of their experience with the online teaching of clinical skills. Student volunteers indicated interest and the official student representatives of each program selected two volunteers from each program.

Student volunteers received the link to the videoconference focus group session through the student representatives. As instructed, they logged in without names, using only their health profession and gender, and without video.

A semi-structured interview guide covered their subjective experience and associated stress, perceptions of the usefulness of online strategies for clinical instruction, and recommendations for the role of online strategies in clinical instruction.

Two members of the research team conducted the focus group discussion, consistent with published strategies for qualitative research with social distancing [11] and recorded with the verbal consent of the participants, using the Zoom videoconferencing platform. There were no technical difficulties during the discussion. One member of the research team manually transcribed the audio recording, and the team coded and manually analyzed the data for thematic content.

2.3. Data Analysis

The research team designated the survey questions to Flott and Linden's characteristics [10] of the clinical learning environment (Table 1).

Table 1. Designation of survey questions to Flott and Linden's characteristics of the clinical learning environment.

Online Learning Environment	Flott & Linden's Characteristic
The lecturer created an enthusiastic/stimulating learning environment	Physical/online space
I feel the online teaching strategies have enhanced my clinical reasoning skills	Teaching & learning components
I feel the online teaching strategies prepared me for critical thinking in clinical practice	Teaching & learning components
Lecturers were helpful in giving formative feedback	Organizational culture
I felt connected with my teachers	Psychosocial & interaction
Lecturers were effective in communicating during online delivery	Teaching & learning components
I practised clinical skills on persons, pets or dummies at home	Physical/online space
I feel motivated to learn when engaging in online teaching of clinical skills	Organizational culture
Ease of Teaching	
I enjoyed the online teaching strategies	Psychosocial & interaction

Table 1. Cont.

Online Learning Environment	Flott & Linden's Characteristic
I liked that I could engage in learning in my own space	* Not assigned
I enjoyed working a my own pace	* Not assigned
I found it easy to adapt to online teaching	Organizational culture
I felt my teacher was skilled at online teaching	Teaching & learning components
Challenges experienced	
Unavailability of computer/smartphone	Physical/online space
Problems with internet/connectivity	Physical/online space
Distractions during remote classes	Physical/online space
Not enough time to complete learning objectives	Physical/online space
Poor quality of media used by lecturers	Physical/online space
Overall Satisfaction	
I would recommend continued use of online strategies in the teaching of clinical skills.	* Not assigned

* Independent analysis was done.

Descriptive analysis considered students' experience of the online teaching experience using these four attribute characteristics of the clinical learning environment that affected learning experiences. Because of the small class sizes in some programs, we performed no analyses by program.

2.4. Quantitative Analysis

Using the IBM Statistical Package for the Social Sciences (SPSS) version 24.0, we calculated mean age and standard deviation (SD) for students, and used percentages, median, interquartile range, and chi-square tests to determine whether the distribution of frequencies of responses in each item were sufficiently different to reject the null hypothesis that the distribution was due to chance. We calculated Cronbach's Alpha to establish the reliability of the instrument used (0.865). The critical value used to reject the null hypothesis was $p \leq 0.01$.

2.5. Qualitative Analysis

Researchers used a general deductive approach [12] to analyze the qualitative data obtained from the focus group to identify unique experiences, positive and negative perceptions, and recommendations from the final year students. In addition to emergent codes, we pre-specified codes based on Flott and Linden's conceptual framework [10]. Researchers determined content categories which were then combined to determine major themes. To establish inter-rater reliability, a non-medical expert in qualitative analysis reviewed and coded the transcript. Qualitative comparison revealed similar codes.

The themes identified included:

Pre-specified—the online environment, psychosocial and interaction factors, organizational culture, teaching and learning components.

Emergent themes—satisfaction with the online experience, equity in teaching and learning.

3. Results

3.1. The Sample

The sample was predominantly medical students (Table 2) reflecting the typical distribution of students among programs at the Faculty of Medical Sciences, the UWI. The mean age was 25.3 (3.6) years.

Table 2. Distribution of students ($n = 278$) by program, Faculty of Medical Sciences, St. Augustine, 2020.

Programme/ Percentage of Sample	No. of Students in Final Year Class (2020)	No. of Respondents (% of Class)
Medicine (66.5%)	187	185 (99.0%)
Dentistry (12.2%)	35	34 (97.1%)
Veterinary Medicine (1.4%)	25	4 (16.0%)
Pharmacy (11.5%)	44	32 (72.7%)
Optometry (4.7%)	17	13 (76.5%)
Nursing (3.6%)	47	10 (21.3%)
TOTAL	355	278 (78.3%)

3.2. Students' Perception of Online Clinical Teaching

Students in all programs shared their perceptions of the online environment for clinical teaching (Table 3).

Table 3. Student perception of online clinical teaching using Flott and Linden's characteristics of the clinical learning environment ($n = 278$), Faculty of Medical Sciences, St. Augustine, 2020.

No.	Survey Item	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Total	Chi Squared (χ^2)	Median (IQR)
The online space								
1	The lecturer created an enthusiastic/stimulating learning environment	51 (18.4)	192 (69.3)	30 (10.8)	4 (1.4)	277 (100)	306.119 *	3 (0)
2	I practised clinical skills on persons, pets, or dummies at home	34 (12.6)	103 (38.3)	86 (32)	46 (17.1)	269 (100)	47.387 *	2 (1)
3	Unavailability of computer/smartphone	9 (3.3)	42 (15.6)	135 (50.2)	83 (30.9)	269 (100)	131.877 *	2 (1)
3	Problems with internet/connectivity	61 (22.5)	120 (44.3)	66 (22.4)	24 (8.9)	271 (100)	69.266 *	3 (1)
4	Distractions during remote classes	29 (10.6)	113 (41.4)	110 (4.3)	21 (7.7)	273 (100)	110.165 *	3 (1)
5	Not enough time to complete learning objectives	19 (7)	61 (22.3)	164 (60.1)	29 (10.6)	273 (100)	193.212 *	2 (1)
6	Poor quality of media used by lecturers	6 (2.2)	40 (14.7)	191 (70.2)	35 (12.9)	272 (100)	306.559 *	2 (0)
Psychosocial and interaction factors								
7	I felt connected with my teachers	44 (16.1)	167 (60.9)	50 (18.2)	13 (4.7)	274 (100)	200.365 *	3 (0)
8	I enjoyed the online teaching strategies	64 (23.4)	171 (62.4)	30 (10.9)	9 (3.3)	274 (100)	226.993 *	3 (0)
The organizational culture								
9	Lecturers were helpful in giving formative feedback	86 (31)	170 (61.4)	17 (6.1)	4 (1.4)	277 (100)	251.534 *	3 (1)

Table 3. Cont.

No.	Survey Item	Strongly Agree (%)	Agree (%)	Disagree (%)	Strongly Disagree (%)	Total	Chi Squared (χ^2)	Median (IQR)
10	I feel motivated to learn when engaging in online teaching of clinical skills	35 (13)	142 (52.8)	66 (24.5)	26 (9.7)	269 (100)	123.877 *	3 (1)
11	I found it easy to adapt to online teaching	82 (29.9)	138 (50.4)	50 (18.2)	4 (1.5)	274 (100)	138.905 *	3 (1)
Teaching and learning components								
12	I feel the online teaching strategies have enhanced my clinical reasoning skills	34 (12.3)	164 (59.4)	63 (22.8)	15 (5.4)	276 (100)	119.333 *	3 (1)
13	I feel the online teaching strategies prepared me for critical thinking in clinical practice	30 (10.9)	165 (59.8)	69 (25)	12 (4.3)	276 (100)	202.696 *	3 (1)
14	Lecturers were effective in communicating during online delivery	732 (6.4)	171 (61.5)	27 (9.7)	5 (1.8)	276 (100)	235.942 *	3 (1)
15	I felt my teacher was skilled at online teaching	54 (19.9)	166 (61)	40 (14.7)	12 (4.4)	272 (100)	201.765 *	3 (0)
Overall Satisfaction								
16	I liked that I could engage in learning in my own space	133 (48.5)	120 (43.8)	19 (6.9)	2 (.7)	274 (100)	199.781 *	3 (1)
17	I enjoyed working at my own pace	146 (53.5)	113 (41.4)	11 (4)	3 (1.1)	273 (100)	228.319 *	4 (1)
18	I would recommend continued use of online strategies in the teaching of clinical skills.	77 (28.3)	114 (41.9)	62 (22.8)	19 (7)	272 (100)	68.147 *	3 (2)

* Values are statistically significant ($p < 0.01$).

3.2.1. The Online Environment

Most students were equipped for online teaching with just about 20% having no access to an online environment. More than half of all students had challenges with a stable internet connection (67%), and experienced distractions from online learning (52%). The importance of universal online access was reinforced in the focus group:

“One con though was a good few classmates would have experienced connection issues with the classes so they were disadvantaged and we don’t want anyone being disadvantaged.” (Male DDS student)

Notwithstanding, 88% of students agreed that teachers created an enthusiastic and stimulating learning environment. In general, the quality of media used for teaching was considered adequate, but for most students the online experience was not considered an adequate substitute for clinical skills instruction.

“It was just webinars but no direct transference of clinical skill into an online platform” (Male Optometry student)

3.2.2. Psychosocial and Interaction Factors

Most students enjoyed the online teaching strategies (86%) and felt connected with their teachers (77%). Even though online engagement was promoted, students felt deprived

of many advantages of social connectedness including social skills development, peer support, and vicarious learning:

“... whether it is in a classroom like a lecture, all of that is interaction between people and building social skills, no matter how big or small the interaction is...” (Female Optometry student)

“... [online teaching] reduced social interaction with the pharmacists so that you won't be able to hear from them and their experiences, ...” (Male Pharmacy student)

“I did miss the social interactions with lecturers, classmates and patients. Being physically present with classmates during lectures made it easier to understand because you can ask a classmate when you don't understand something in the present but now you have to wait on someone to reply to get answers to your questions.” (Female Nursing student)

Programs where student groups are usually small felt particularly disadvantaged:

“I think that having small groups is a greater advantage, it allows students to feel closer together and have a connection like a family. So having online classes might take away from that.” (Female DVM student)

“...the small community vibe is lost online because you can't see each other. This is a very hands-on interactive field, and we really need to have social interaction down because we do need to interact with people all the time, that is our job.” (Female DDS student)

3.2.3. The Organizational Culture

A majority of students agreed that when using an online platform, teachers were helpful in giving formative feedback (92%); 66% described the teaching as motivating.

Most of the student body reported that it was easy to adapt to online teaching (80%). Students also expressed an ability to and awareness of the need to adapt:

“We all know there is this new norm that we will have to adapt to which will take a while for some of us...” (Female Optometry student)

The sudden termination of face-to-face clinical teaching elicited both uncertainty and a desire for closure among students who were accustomed to structured programs. Together with poor communication, this proved to be a stressful experience:

“It's also something mental for me to know that it was coming to an end and I was prepared for finishing but this was just sudden.” (Female Optometry student)

“First of all, it really did have us in a state where we were a bit anxious and worried because we were kind of left in the dark as to what would be the end result...” (Male MBBS student)

Students expressed confidence in their clinical competence not because of online teaching but because of adequate prior hands-on clinical training.

“...dentistry is one of the degrees where you start your hands on experience quite early so we start seeing our own patients by ourselves from the time we get into year three dentistry so we have a lot of experience under our belt.” (Female DDS student)

“We have reached so far down the road that it's either you're competent or not by now because we would've been doing the practical things. So with regards to confidence in skills and stuff, all of us “rusty” because we haven't done it in a while but it's not like we're incompetent.” (Male Optometry student)

“...most of us would have already had the experience necessary. So, it wasn't too much of a problem, ...” (Male MBBS student)

3.2.4. Teaching and Learning Components

Effectiveness: Students felt that the online teaching strategies enhanced reasoning skills (71%) and prepared them for critical thinking in clinical practice (71%). Teachers

were perceived as effective in communicating during online delivery (88%) and skilled at online teaching (81%). However, students were very clear that the online environment encountered during the period of emergency remote teaching was inadequate to teach clinical skills.

“Dentistry is a pretty hands-on field so it is difficult to replicate that in a clinical setting.”
(Male DDS student)

“Nothing beats back experience, and the more exposure we have, the better we will be as clinicians.” (Female Optometry student)

“Being in an online setting can’t teach you these things. Dealing with animals you never know what to expect and you need to learn how to handle these situations.” (Female DVM student)

Strategies that allowed hands-on activities were seen as the most effective.

“We would’ve had to do patient counselling, we were then asked to do a video presentation of that. That was some of the things that were implemented. I believe it was a very great thing.” (Male Pharmacy student)

“I know other colleagues would have also reported that they would have had to record themselves practising examinations so that would have helped us to stay on our Ps and Qs.” (Male MBBS student)

Perceived challenges: While teaching strategies like clinically focused webinars were seen as relevant, students highlighted disadvantages of using an online forum to teach clinical skills. The overall position was that the online experience did not adequately allow for teaching of clinical skills.

“...when we learn some theory in the classroom, when you go to clinic, it helps to reinforce in your mind because you get the practical with the theory one time like it works together... versus now, we have to refer or rely on past experiences while reading the theory. It’s more difficult...” (Female DDS student)

“I didn’t realize how effective it was until it [clinical face-to-face teaching] was taken away from me and I realize it was very difficult for me to remember things that were otherwise practical.” (Female MBBS student)

“What we did was discussions of clinical cases to try to replicate the clinical experience but we still felt as though that couldn’t fully replace the clinical experience... the lack of clinical hands-on experience because every patient is different so that’s something you don’t really get with the case discussions.” (Male DDS student)

“We had 8–5 classes, and it was very taxing, I know the lecturers were tired, the students were tired and I think actually having the face-to-face will be more interesting.” (Female DVM student)

Advantages of online teaching: There were, however, perceived benefits of the online experience.

“...we actually got more theory done, because before in the hospital settings, classes usually get cancelled or postponed but these classes were more accommodating and flexible.” (Male MBBS student)

“...you get more time for the intake of theory which is good because in the normal world where we are hustling to externships, you can be physically fatigued to even pay attention in a lecture room even though the lecture room engages us nicely so that’s the plus side to being home.” (Male Optometry student)

“With online learning, we can go home after clinic and discuss cases online. Advantage of using sites such as blackboard collaborate is that you can go back and redo what was learnt which is something you don’t have in real life teaching.” (Female DDS student)

"The advantages? Avoiding traffic and being online for class, the whole convenience."
(Female Nursing student)

"...it [online teaching] really gives a little bit of a difference and relieves the anxiety."
(Male MBBS student)

Usefulness of online teaching:

Students suggested the utility of online clinical teaching.

"I know that we have this new norm with the pandemic and we have to take precautions so only if it is necessary for example having a virtual class if persons develop flu like symptoms." (Female Optometry student)

"It gives somewhat of a break, being in the comfort of your own home, ..." (Female MBBS student)

3.2.5. Satisfaction with Online Clinical Teaching

Students were mostly satisfied with the ease of teaching since it was self-paced (95%) and in their own space (92%).

They acknowledged the effort made by clinical teachers in transitioning from face-to-face to online teaching:

"I wouldn't say I felt cheated because I understand the situation was a unique one and everyone tried their best to accommodate us." (Male DDS student)

"I believe that an excellent job was done by my coordinator to ensure that we completed."
(Male Pharmacy student)

"Lecturers were somewhat encouraged to analyze their teaching tools and I guess rise to an occasion." (Female MBBS student)

The majority of students recommended continued use of online teaching strategies for clinical instruction (70%).

3.2.6. Educational Equity in Teaching and Learning

Medical students underscored the advantages of student exposure to a wider range of teachers.

"...there tends to be some competition for which hospital you want to go to, usually based on the experience you had, and a lot of time that experience is based on the lecturers, the tutors or the consultants and so I feel like us having online classes took away some of that rivalry. But with students having access to the same materials and lectures it feels fair." (Female MBBS student)

4. Discussion

Clinical students in the health professions at the Trinidad and Tobago campus of a regional university were able to complete their clinical training in 2020 despite the lockdowns imposed by the COVID-19 pandemic and their withdrawal from the clinical spaces. They did not perceive the sudden transfer to an online clinical environment as a major disadvantage, since most of the clinical learning objectives had been previously fulfilled in wards and clinics. Students lauded the faculty for their effective transitioning, and despite some challenges related to internet availability and connectivity, found the online learning environment enjoyable and stimulating.

Traditionally, the teaching of clinical skills has been through face-to-face interaction, but with increasing use of technology in medical education, the application of online learning has extended to teaching clinical skills. Reviews by McCutcheon et al. [13], Richmond et al. [14], and Pei and Wu [15] as well as other studies [16–18] have all documented online clinical learning as well accepted and enjoyed by students. Even though the effectiveness of e-learning for clinical instruction has been difficult to quantify [13,14], students report online clinical teaching to be as effective as traditional teaching for undergraduate nurses,

medical students, and other health professionals. The satisfaction with use of the online environment for clinical teaching expressed by students in this study is consistent with these prior reports. Working in one's own space and at one's own pace to review didactic aspects of the curriculum through asynchronous modalities was perceived as a very useful complement to face-to-face teaching.

Other studies have considered student perceptions. Pharmacy students generally considered online instruction as complementary to the clinical experience in acquiring clinical skills and expressed preference for a blended approach [19], while student performance in Veterinary Medicine was no different after synchronous face-to-face or asynchronous courses, but lack of instructor interaction was an important perceived barrier in the asynchronous course [20]. Similarly, while medical students rated e-learning highly for acquiring basic clinical skills and consulting skills, they recommended a blended learning environment where e-learning complemented face-to-face teaching [21,22]. Rauch et al. [23] found that medical students' test results in an objective clinical examination of communication skills did not differ between online and on-site learning of Psychiatry and concluded that online courses may be as effective as on-site teaching. However, they noted that online teaching of clinical skills required further improvement to maintain a dependable student-teacher relationship, as they found the connection experience between student and teachers was impaired without on-site contact. They also noted a better subjective learning experience in the clinical environment, leading the authors to recommend face-to-face elements in online courses.

Similarly, students in the health professions in Trinidad and Tobago regarded the online instruction as effective in enhancing critical thinking and clinical reasoning skills, and for didactic components of the curriculum, but emphasized the necessity and importance of their prior face-to-face clinical exposure. In the focus group discussion, they were consistent in their notions that echoed the statement expressed by Nordquist [24]:

"Learning in a clinical context is foundational in the training of health professionals; there is simply no alternative. . . . there is no comparison to the learning that comes from managing patients in a real clinical context."

Students perceived the hospitals and community clinics as providing an effective and supportive clinical learning environment, with the professional socialization needed for effective clinical training. As expressed by students in other studies [22,23], feedback from students in this study valued the psychosocial connectedness of the face-to-face clinical learning environment.

While satisfactory for the emergency situation, students did not regard the online learning environment as adequate for the acquisition of clinical skills, using the resources currently available at the university. A similar perception was expressed by medical students in other countries who did not find online teaching during the COVID-19 pandemic as effective as face-to-face teaching [25,26].

Nonetheless, students in the health professions in this study perceived advantages of the online learning environment in their clinical training, and 70% of students in this study recommended continued use of online strategies in the teaching of clinical skills. Clinical instruction occurs in different hospitals and clinics at different geographic locations away from the main campus. Students saw the continued use of online instruction to deliver didactic components of the clinical curriculum as convenient and useful in reducing physical fatigue and stress related to travelling between clinical teaching sites and the main campus. Medical students in the UK and Iran similarly appreciated the time saved on travelling and the elimination of time and place restrictions on learning [25,26].

Medical students identified a further advantage of the online environment for clinical instruction which is of particular relevance to programs where students are assigned to different institutions to accomplish the same clinical learning objectives. Online, all students had the opportunity to be taught by all teachers at the various hospitals across the country, removing inequities in exposure to gifted teachers. Bellet [27] acknowledged that in the clinical learning environment, little attention is given to the variable effectiveness of the

attending physician on ward rounds, while Lai et al. [28] suggested improvement in the clinical learning environment by encouraging a culture of equity, especially with a diverse medical student body. This aspect of educational equity in the clinical learning environment has not received much attention, but the findings of this study suggest that it is a matter of concern among students and can be addressed by utilizing more online clinical instruction.

The COVID-19 pandemic forced health training programs globally to utilize the online environment, including resource-limited institutions where there is no access to sophisticated virtual teaching software. An exploration of students' perceptions of clinical teaching in the online environment could guide medical educators to the best way to utilize e-learning to improve clinical skills training in resource-limited settings. Going forward, it is important for institutions to determine the most cost-effective and practical use of technology. In an analysis of students' perceptions and attitudes to online learning use in higher education in one Caribbean island, Barclay and Osei-Bryson [29] warned against institutions making significant investments in technology that would not yield full benefits, because of challenges experienced by both learners and instructors. They recommended that adequate research be carried out into the unique contextual settings of the Caribbean before attempts to integrate different modes of e-learning. This caution is relevant to medical education where there is insufficient evidence as to the cost-effectiveness of simulation technology [30,31]. Speaking specifically of e-learning in medical education, Frehywot et al. [32] in their review and Al-Balas et al. [33] similarly cautioned medical educators to ensure institutional readiness before e-learning adoption, especially in resource-constrained countries.

This study took advantage of the scenario set up by the pandemic which afforded an exploration of student perceptions of the online learning environment for teaching clinical skills. Students in the health professions felt that the online environment was stimulating, enjoyable, and effective as a complement to face-to-face clinical teaching but deprived them of the social connectedness, peer support, and vicarious learning experienced in the clinical environment. Students valued the online environment for didactic components of the curriculum, more downtime and stress reduction, and ensuring more educational equity.

This study was conducted during the COVID-19 pandemic, which posed significant limitations on the methodology. It was necessary to utilize an online survey, and while there was an adequate response rate, the sample was not necessarily representative of all students. Though conducted at one university of three in Trinidad and Tobago, all the programs under study, except one, are exclusively offered at this university. However, there was sample bias with regard to the proportions of students from each program that was represented, and participants for the online focus group were self-selected. This would limit the generalizability of the results and did not allow for the exploration of differences across programs. There may also have been a bias towards favourable perceptions of the online learning environment, as the study was conducted just after online teaching resulted in students being able to complete the program following the stress and uncertainty caused by pandemic-driven delays. Despite positive student support for blended learning, there needs to be more research to determine the effectiveness and cost-effectiveness of e-learning to complement face-to-face clinical teaching, and institutional readiness for this transition. In the post-pandemic era, teachers at resource-limited institutions should maintain and refine contextually appropriate online approaches, not just for use in times of emergency, but for integration into curriculum delivery to improve the clinical learning environment and student satisfaction, while maintaining the hands-on method of clinical instruction. Further understanding of student experiences of online clinical teaching will aid faculties in improving the clinical learning environment, and promote student satisfaction.

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