AUTHOR:
Dr Reina Abraham[1]

AFFILIATION:
[1]University of KwaZulu-Natal

DOI: http://dx.doi.org/10.18820/2519593X/pie.v39.i2.7

e-ISSN 2519-593X

Perspectives in Education

2021 39(2): 82-94

PUBLISHED:
11 June 2021

RECEIVED:
15 June 2020

ACCEPTED:
03 August 2020

THE NEED OF THE HOUR: ADAPTING THE DELIVERY OF CLINICAL SKILLS TEACHING REMOTELY

ABSTRACT

As the World Health Organization (WHO) announced the prevailing COVID-19 pandemic, the South African government enforced a nationwide lockdown in March 2020. The resulting closure of medical schools necessitated the provision of clinical skills teaching on remote platforms. This presented numerous challenges especially for skills that require face-to-face interaction and hands-on instruction. The Nelson R Mandela School of Medicine, University of KwaZulu-Natal modified George's (2001) five stage process and devised a framework for online small group skills teaching with the help of videos. The adapted method retained as close as possible the significant concepts and frameworks of conventional face-to-face programmes allowing for continuation of teaching under the current constraints.

Keywords: *Clinical skills; medical education; remote teaching; online/electronic learning*

1. INTRODUCTION

Acquisition of clinical skills is important during medical school (Abraham & Singaram, 2019). Early simulation and deliberate practise of clinical skills in a simulated setting such as the clinical skills laboratory enhances competency-based skills development and transference of skills to the clinical setting (Krackov & Pohl, 2011). As the Coronavirus (COVID-19) pandemic spreads, its societal effects are becoming increasingly widespread and the conventional methods of medical education are now under pressure. To reduce the spread of COVID-19, the South African government announced a national lockdown in March 2020 (RSA, 2020). Several medical schools postponed all clinical placements in the expectation that viral transmission would be mitigated. Given the profound implications of postponing student learning due to the inability to carry out teaching and clinical placements, particularly in the context of clinical skills involving close interaction between the examiner and the patient, there is a need to consider alternative teaching methods that can be provided during this period. In recent years, some medical schools have moved from

traditional in-person teaching to other approaches, including online, distance or interactive e-learning (Moran *et al.,* 2018). Though not ideal, delivery of online education can prove to be an appropriate solution for the current postponements (Mian & Khan, 2020). Authors have identified the use of multimedia video-based material as an effective method of teaching cognitive and psychomotor skills to medical students (Waseh & Dicker, 2019; Muñoz, 2010; Salyers, 2007; Schwan & Riempp, 2004; Lewis 2003). These literature reports also suggest that students' performance in assessments after multimedia instruction is often better and identified as positive adjuncts for medical students learning.

With students sent home and all forms of face-to-face clinical skills interactions not feasible, the University of KwaZulu-Natal (UKZN) put in place a contingency plan to transition to remote clinical skills teaching using online platforms. This has required retaining the key principles and structure of clinical skills teaching to as close as possible despite the obvious challenges. The objectives of this study were to adapt and develop a plan for clinical skills training remotely, identify an online platform, pilot an online skills session using the identified platform and evaluate the effectiveness of the process. The aim was to identify advantages and difficulties with this new approach as a necessary replacement for traditional face-to-face small group clinical demonstrations during the COVID-19 pandemic.

2. METHODS

This study was carried out at the Nelson R Mandela School of Medicine (NRMSM), UKZN clinical skills laboratory. Undergraduate pre-clinical medical students at NRMSM, UKZN are taught clinical skills in the first three years in the clinical skills laboratory, prior to their clinical placement in the last three years of training. Clinical skills are taught in an integrated fashion within the theme-based hybrid problem-based learning curriculum. The clinical skills course within each theme covers the history-taking, physical examination and procedural skills related to a specific body system that extends over a period of six weeks. The skills teaching sessions are delivered by a group of clinical tutors in large and small group sessions on a weekly basis. The tutors are medical doctors from a wide range of specialist backgrounds and have had at least five years of clinical skills teaching experience. The clinical skill teaching sessions are conducted following the five teaching stages described by George (2001). His suggested steps/stages are:

Stage 1: The tutor provides an overview of the need for the skill and how it is applied in patient care. The students are also introduced to the clinical manifestations and the pathophysiological bases of common clinical signs as well as the measurement of vital signs.

Stage 2: The tutor demonstrates the skill with little or no explanation, while the student observes the execution of the skill/procedure.

Stage 3: The tutor then repeats the skill while discussing/providing students with a detailed, step-by-step explanation of the skill/procedure and encourages the students to ask questions.

Stage 4: The tutor demonstrates the skill a third time and requires the student to provide an explanation of each step whilst the tutor coaches and provides necessary correction to the student. This step is repeated several times until the tutors are satisfied that the student fully understands the skill.

Stage 5: The student is allowed to demonstrate the skill while other students provide commentary and instructions while learning from each other. Once the students have mastered the necessary clinical skills, they are left to work independently.

For many years, this method has been implemented and still remains powerful and popular among students and tutors (Munster *et al.,* 2016).

As the transition from face-to-face to remote teaching became a necessity and to ensure continuity of student's education, the clinical skills lead lecturer and tutors got together remotely using online platforms, WhatsApp chat groups and emails to initially outline the skills to be covered and the principle teaching approaches. Tutors further collaborated over multiple meetings towards working out a practical framework within which these could be implemented remotely. They agreed on using a pre-existing bank of bookmarked examination skills videos from recommended clinical methods textbooks (Douglas *et al.,* 2013). These videos had been used previously by the tutors to augment and reinforce their teaching, hence, making the process of searching and selecting videos easier.

3. STEPS TO ADAPTING AND DEVELOPING A PLAN FOR CLINICAL SKILLS TRAINING REMOTELY

3.1 Core principles and structure that we aimed to retain

The COVID-19 lockdown and the need to transition to remote online teaching required retaining the key principles and structure of the clinical skills teaching to as close as possible. To do this, the clinical skills tutors first identified the important aspects to retain. These included the following:

1. George's (2001) five teaching stages: The NRMSM's teaching material and sessions have been based on this framework for years and have been found to be effective for students and tutors.
2. Small group sessions: For practical teaching the NRMSM has always agreed that the teaching and learning experience in smaller groups is more effective as it enhances more personalised engagement compared to larger cohorts of hundreds of students. The small group work is indicative of the movement from a teacher-centred approach to education to a more student-centred approach where students can take responsibility for their own learning (Walton, 1997; Dent *et al.,* 2017). In addition, deliberate practice with clear specific tasks and ongoing feedback from tutors has been found to have a positive effect on students' acquisition of skills and improved clinical performance (Abraham & Singaram, 2019).
3. Clinical tutors: Using the existing clinicians was important as they are experienced with delivering clinical skills teaching and are aware of the expectations of the students.

The core session structure that we aimed to maintain included:

At the beginning of a new theme, the lead lecturer coordinating the clinical skills academic programme in the school often briefed the clinical tutors about the structure of the teaching sessions through a teaching schedule. During departmental meetings the lead lecturer shares the teaching content (PowerPoint presentations, skills protocols, and links to videos) with the tutors. S/he then discusses the technical aspects of the skills to ensure structure and consistency in teaching between tutors while allowing opportunities for tutors to ask questions and clarify examination techniques etc.

One clinical tutor would be assigned a skills topic based on the teaching schedule to deliver the teaching content to the whole class as a lecture during a large group resource session (LGRS). Typically, classes comprise around 250 medical students. During this session students are provided with an overview of the skill for the week using a PowerPoint presentation. This covers the first teaching stage mentioned by George (2001) as outlined above.

The class is then divided into four smaller practical skills group of over 60 students for the skills demonstration in the clinical skills laboratory. The teaching often began with an audio-visual session where a video of the skill to be taught is shown to reinforce the teaching and learning. Each skills group was further divided into four subgroups. This was followed by skills demonstration by tutors to the assigned subgroup. Usually four tutors are allocated for a three-hour practical session with approximately 15 students per group. The tutors keep to the session plan and adhere to the skills protocol to implement George's (2001) other four teaching stages. The tutors ensure that the students are engaging during the skills demonstration and answer questions to support their learning. Afterwards students practise their clinical skills by examining each other, simulated patients or mannequins and seek feedback from tutors and the lead lecturer.

The use of the large group lectures and small group demonstration sessions may be complementary to the learning process. A mixed approach to the learning situation is often appropriate and may be positively encouraged (Baeten *et al.,* 2010).

3.2 How these key aspects were preserved in the remote online setup

We used a flipped or blended learning approach. The approach included a combination of asynchronous and synchronous learning strategies (Bourne, 1998; Wu *et al.,* 2008). As part of the asynchronous learning, students were given learning outcomes and activities that they conduct on their own. This included self-directed learning through engaging with learning material posted on the university's online learning platform (Moodle). This replaced the large group didactic traditional lectures. The asynchronous learning method was then followed and supplemented by synchronous learning that involved face-to-face interaction with tutors for the small group skills teaching using an online videoconferencing platform.

To deliver teaching remotely UKZN opted to use Zoom (Zoom Video Communications Inc., San Jose, CA, USA) as the institutional online videoconferencing platform for teaching. Zoom is a portal that allowed hosts and participants to conduct real-time online meetings and webinars. It allowed participants to see and hear each other using webcams and microphones on computers and smart phones. The screen sharing function enabled documents and web browsers to be shared. Most importantly it allowed meetings with a whole class to be set up for a general introduction to the topic after which participants can be broken up into groups to special breakout rooms for small group sessions. Alternatively, small group meetings can be set up directly. It also allowed for discreet observation of group meetings by the lead lecturer to view sessions without intervening.

Considering the functionality of the university's online learning platform (Moodle) and of the Zoom videoconferencing software, it provided an opportunity for us to preserve all our key teaching components i.e. clinical tutors to deliver sessions to large and small groups of students through George's (2001) five stage approaches.

3.3 Modifying George's (2001) five stage approach to a remotely deliverable format

In the absence of "real" face-to-face practical clinical skills teaching, the biggest challenge was adapting George's (2001) five stage approaches onto an online format to replicate our usual teaching format.

Tutors initially considered demonstrating and broadcasting the skills online from the skills laboratory using the simulated patients or mannequins for students to view as a live broadcast at home. However, this idea had to be abandoned due to the potential risk of COVID-19 transmission through physical contact. This was also against the government's social distancing guidelines and travel restrictions during the lockdown period (RSA, 2020).

In view of these limitations a decision was made to modify George's (2001) five stage skills teaching approach to a format that could be delivered purely on an online platform using voiceover recordings of PowerPoint presentations and recommended clinical examination videos available through off-campus UKZN library resources as well as on YouTube. The tutors also produced audio and video recordings through Zoom meetings where they role played a clinical scenario from home to reinforce the history-taking skills using the Calgary-Cambridge framework for a clinical consultation (Kurtz *et al.,* 2003).

4. THE ADAPTED "FIVE STAGE APPROACH" THAT WE DREW UP FOR ONLINE TEACHING

For the pilot session cardiovascular examination skills was taught online to second-year undergraduate medical students. For each of George's (2001) five stage approaches I discuss the traditional method of clinical skills teaching prior to COVID-19 and how it was replaced by the adapted asynchronous and synchronous online method of delivering the teaching.

4.1.1. Stage 1

Traditional method – The tutor introduces students to the clinical manifestations and the pathophysiological bases of common clinical symptoms, signs and measurement of vital signs of the skill through large group face-to-face lecture sessions.

Online method: Introduction – The tutor developed a voiceover recording of a PowerPoint presentation of the cardiovascular examination skill working from home. The presentation included description of the a) systematic approach and techniques; b) physical signs demonstrated; c) common mistakes by medical students and d) clinical relevance. This presentation was converted to a video by the multimedia department and was uploaded on the online learning platform (Moodle) for students to listen to and engage with in preparation for the next stages i.e. online demonstration and discussion of the cardiovascular examination skill.

4.1.2. Stage 2

Traditional method – The tutor demonstrates the skill with little or no explanation while the students observe.

Online method: Demonstration – Recorded and online videos were used to replace the demonstrations. Links to the full cardiovascular examination videos were uploaded and made available for the students to view on Moodle during their self-directed learning time. There is no commentary or discussions happening during this time.

4.1.3. Stage 3

Traditional method – The tutor repeats demonstrating the skill while discussing the skill. Students are encouraged to ask questions.

Online method: Discussion – After students previewed the online material on Moodle, they were split into small groups of approximately 15 students for a single 60-minute tutorial with a clinical tutor on the Zoom cloud-based video conference platform. The tutor shared Zoom invites on Moodle with the particular group of students they were allocated to before the online teaching session. During the Zoom interactive session, the tutor explained and described the cardiovascular examination skill using a PowerPoint presentation. The tutor determined the precise time within a cardiovascular examination video to play and embedded these video clips onto a summarised PowerPoint. To facilitate the discussion the skill was divided into sections e.g. General examination, Examination of the pulses and pressures and Examination of the Precordium. The tutor then discussed each section of the cardiovascular examination highlighting important systematic approaches, techniques, pitfalls and clinical knowledge. The discussion was augmented and illustrated by the short clips of the selected videos demonstrating the section being discussed. Using the private message/chat function, students were able to send live questions as some wanted to maintain anonymity. Hence, a combination of multiple video clips and discussions replaced this stage of the traditional tutor demonstration and discussion of a skill.

4.1.4. Stage 4

Traditional method – The tutor demonstrates the skill and allows each student to provide instructions and explanations of each step until the student fully understands the skill.

Online method: Comprehension – The tutor invited each student in the group to narrate from memory each step of the skill without referring to the skills protocol. The tutor selected one student for each step-in order to cover the entire group by the end of the Zoom session. Hence, the group narration replaced this stage of student's understanding/comprehension.

4.1.5. Stage 5

Traditional method – The student demonstrates the skill while other students provide commentary and instructions while learning from each other.

Online method: Execution – With the limited time provided for Zoom sessions (approx. 60 minutes) and the fact that students are unable to afford data charges, tutors opted at this stage to shift from the Zoom platform to the university's zero-rated learning platform, Moodle. Students were requested to post their questions and any doubts they might have about the cardiovascular examination skill on the discussion forum on Moodle. Moodle discussion forums were developed by the lead lecturer for each topic. A tutor was available to answer the questions and interact with the students. The advantage of a discussion forum was that students could post their questions at their own time and they benefited from questions posted by other students. Academically strong students also answered other student's questions providing opportunities for students to learn from each other. Peer learning is accepted as being a powerful learning tool (Tai *et al.,* 2014). The tutor added to or reinforced the answers provided by other students. This provided clinical context to the skill to finish the student's learning by helping them to consolidate, clarify and reinforce the skills learnt. This online step can be referred to as "consolidation".

The tutors discussed the possibility of students practising their cardiovascular examination skills at home and capturing videos of their practise to share with tutors. However, they decided against this as the government urges social distancing among other family members and especially with those considered "at risk" (RSA, 2020). An agreement was therefore made not to encourage or promote any such interaction.

The modified online remote five stage teaching approaches can be summarised as follows:

1. Introduction (Introduces the overview of the skill using PowerPoint presentations converted to voiceover recording as pre-reading material on Moodle)
2. Demonstration (Demonstrates the skill using recommended examination skills video shared on Moodle with no commentary as a pre-viewing material)
3. Discussion (Discussion and illustration of the skill by tutor using multiple short video clips embedded in a presentation during the Zoom interactive session)
4. Comprehension (Narration of the skill by students assisted by other students during the Zoom interactive session)
5. Consolidation (Question and answer with clinical contextualisation on the Moodle discussion forum)

For comparison, the traditional "five stage approach" is as follows:

1. Stage 1 – (Introduces the overview of the skill by teacher as a lecture)
2. Stage 2 – (Demonstration of skill by tutor on a simulated patient without commentary)
3. Stage 3 – (Demonstration of skill by tutor on a simulated patient, whilst providing explanation and discussing with students)
4. Stage 4 – (Demonstration of skill by tutor on a simulated patient, whilst instructions and explanations are provided by students)
5. Stage 5 – (Demonstration of skill by student on a simulated patient, with commentary and instructions from other students)

5. RESULTS

A dry run online teaching week gave us the opportunity to pilot this remote "adapted five stage teaching approach" to deliver clinical skills teaching to the second year undergraduate MBChB class. Out of a total of 248 medical students enrolled for the second-year cardiovascular system theme, an average of 160 students participated in the online learning. Online Google survey forms were generated by the school for assessing the dry-run sessions for feedback. The purpose was to identify gaps, both positives and negatives in terms of lessons learnt and then try to bridge the gaps for the formal online teaching.

5.1 Survey data

A total of 91 (57%) out of the 160 medical students that participated in the online learning completed the survey. The majority (62%) of students that responded were female. Open-ended response questions were also included in the survey and the student responses are illustrated with quotations below.

Of all the respondents, 85.6% indicated that they were able to access and engage with the voiceover presentations on Moodle before the online Zoom clinical skills demonstration

session. Almost 90% (88.9%) of the students found the voiceover presentations helpful with developing their self-preparation before the online skills session. Network connectivity issues and added responsibilities at home were often reasons for those that did not access the pre-reading material before the online Zoom skills sessions.

When asked what they felt about the learning material uploaded on Moodle, 56.7% of respondents found the voiceover presentations as good as a clinical skills face-to-face lecture. Most of them echoed that though face-to-face lectures are more interactive and informative, the transition to online learning provided opportunities to develop deeper learning strategies and to self-direct their learning:

> Obviously there is a difference when a lecture is online. Face-to-face interaction helps you focus better. But it's up to us to learn, so it's okay if the lecture is online. We will just study harder to compensate for the lack of face-to-face interaction,

In response to which format they would prefer the learning material to be shared on Moodle, 55.6% of respondents preferred the voiceover presentations converted to video, while 36.7% preferred PowerPoint presentation with audio viewed as a slide show and 7.8% the traditional PowerPoint without audio. The students confirmed the strength of the videos, in that they could be viewed multiple times, stopped for note taking and reviewed later again. These were all features felt not to be available with an in-class lecture. It was also felt that, generally, the videos offered a better line of sight than occurred in-class:

> The PowerPoint with audio teaching found in the media gallery was an extremely effective way to learn. I was able to pause the video when I made notes and replay things I didn't understand. It was a lot more detailed and easier to go through as the audio made things clear and was as good as face-to-face lessons.

A student mentioned how the lack of face-to-face interactions with tutors motivated them to find other means of communication with their teachers on a more personal level:

> The video is just like the actual lecture, the only difference is that you can't raise your hand to ask a question but in that case you can just email the lecturer to clear up any confusion you might have or can ask a private message during the zoom session.

When asked which method of teaching (traditional vs. online) did they prefer, 85.6% of students preferred a combination of pre/viewing the audio/video presentations and the online Zoom skills demonstration sessions. They indicated how their need to attend an online Zoom skills session motivated their engagement with the learning material. Knowing that in-class demonstrations were not going to occur as in the traditional method disciplined the students to make better use of the video tools as a preview, even if it took time and organisation to preview the videos.

When students were asked what they thought of the Zoom teaching session, the majority of respondents (71.4%) thought it was well organised and met the objectives of the skill demonstrated. Most (75.8%) found the demonstration part of the session interactive while 78% of students thought the use of multiple short audio/video clips augmented the discussion around the cardiovascular examination skill and assisted them to consolidate their understanding of the systematic approach and techniques of performing the skill in the absence of direct face-to-face instruction.

Most students (83.3%) seem to understand that while replacing actual clinical presentations with videos are not perfect, they are the best possible option for reducing the health and safety risks in the current situation. They mentioned that the online teaching method was a welcome alternative they appreciated in the current scenario but could never replace the face-to-face skills demonstration sessions in the skills laboratory:

> It is difficult to learn a skill without being able to practise [practise] and have tutors correct you. Having the opportunity to practise [practise] on simulated patients with individual attention from a skills tutor better aids skills development as opposed to the online teaching method. A lot of skills need physical contact and observation of non-verbal cues so online classes cannot replace that aspect of skills that needs human contact. However, for learning theory, it's sufficient. In these times, it is not possible and the online methods used by the skills department is effective and I am grateful for the effort put into online teaching, as it is nearly as good as a face-to-face practical.

The students were asked to identify any difficulties and benefits they experienced in using the online learning tool. Many of the respondents (70.3%) highlighted challenges with transitioning to a purely online teaching approach with majority of issues centred around technical difficulties such as access to data, devices, electricity, and situations of living circumstances that allow for e-learning:

> I for one need to practice the skill when being taught. That is impossible online. Also, as much as my online session was good, our mates faced difficulties. Most of the students, including myself are not ready for online learning due to various issues at home. There are internet connection problems that cause a barrier in learning. The environment at home is not as accommodating for learning as that on campus...

Students also mentioned noticing their tutors experiencing “use of technology” issues:

> My lecturer had difficulty using the platform [Zoom] and did not get much into teaching due to the difficulty.

A few students mentioned identifying benefits for considering transitioning to the blended learning approach in the future:

> Ideally, I would prefer to have online lectures like this and then attend skills practical sessions to demonstrate and learn the physical techniques. Well for communication skills and possibly for analysis skills (analysis of an ECG, x-ray, etc.), this method can be extremely beneficial due to the fact that it is easier to fully pay attention to the demonstrator and take down notes, as well as edit additional information into our personal notes and use a textbook as reference when needed. For skills that require a hands-on approach and require us to get a feel of the tools needed, the traditional method dominates.

While students’ feedback has been mostly encouraging so far, some have shared a reasonable frustration about the lack of “face-to-face” opportunities to learn clinical skills. The dry run online teaching week worked out successfully with positive feedback from tutors and students. However, there were a few technological challenges by some tutors such as creating Zoom invites and navigating the functionalities of the Zoom platform efficiently. While the university has been offering numerous online workshops to enable staff to explore and familiarise themselves with the different technology platforms, tutors mentioned learning from their mistakes during the online teaching process. One tutor’s comment resonated a lot with challenges when implementing any new programme. He said:

> The more mistakes we make now the better. After all that is the purpose of the dry run. We will make less later on.

6. DISCUSSION

This study was a pilot investigation into the feasibility, utility and perceived effectiveness of an adapted clinical examination skills online teaching strategy within a second year MBChB cardiovascular theme. The five-stage approach to teaching clinical skills as mentioned before has been found to be popular and evidently superior towards students' development of clinical, professional and communication skills (George, 2001; Krautter *et al.,* 2011). As it has proved to be easy to use by the tutors and acceptable to the students, we decided to retain these key approaches during the pandemic as we adapted and moved towards remote teaching. Our five-pronged approach was designed to retain students' knowledge acquisition and competency attainment in clinical skills.

Voiceover PowerPoint presentations and clinical examination videos uploaded on Moodle and the multiple short video clips embedded in the Zoom presentations were used as the sole method of instruction. The students overwhelmingly preferred a combination of the two. The students who reported benefits from the PowerPoint presentations and videos, as a preview component combined with practise Zoom sessions, clearly elucidated the positive aspects of a more "active" and engaged learner. Introducing an element of self-directed learning to precede the Zoom session provided an opportunity for reinforcement of self-directed learning followed by the online clinical demonstration during the Zoom interactive session (Wu *et al.,* 2008; Waseh & Diker, 2019). This teaching method has provided an opportunity to shift from the traditional lecturing and passive students to a more collaborative and interactive approach in which students and teachers contribute to the learning process.

Whilst some students adopted these active behaviours spontaneously, others reported they needed to be forced into this pattern of learning. Though working with better prepared students who know the theory is always more rewarding for teachers; however, it does not mean that s/he will be able to practically execute the skill which can be a limitation of this study. This was a concern echoed by nearly all students. To learn a cardiovascular examination skill which includes hands-on instruction, students first need available simulated patients to practise on. Furthermore, much of the difficulty in this skill is in understanding the correct approach and the techniques of palpation, percussion and auscultation when examining the precordium. Student-patient engagement that includes face-to-face demonstration and tutor correction of techniques is still a more effective means of teaching clinical skills. Though tele-teaching does not substitute actual patient contact, considering the probable duration of a pandemic and to avoid a substantial loss of student learning time, along with depreciation in student confidence it is still the best option in the current situation. Studies have found that interacting with telemedicine technologies during undergraduate medical training can contribute to improved medical knowledge, core competencies and overall learning (Waseh & Diker, 2019).

While students' feedback has been mostly encouraging so far, some have shared their frustration with the move to a strictly online teaching approach. Most of the issues have focused on technical difficulties such as internet data access, lack of computers and living conditions for e-learning. Technical access issues need to be addressed before any changes to alternate online teaching methods are instituted as this can have a detrimental effect on maintaining all the core concepts of George's (2001) five-stage approach effectively. In response to the

foregone suspension of face-to-face teaching and learning and the need to take a decision to switch to remote online teaching and learning, the University of KwaZulu-Natal rolled out laptops to students in need and arranged for 20GB data per student monthly through South Africa's three largest mobile network providers (MTN, Vodacom and Cell C). The university also made the learning management platform (Moodle) zero-rated and provided online training to get students familiar with using the various online platforms. As we are still in an early stage of rolling out such a programme, we will need to continue to evaluate this system with more feedback.

An important revelation that resulted from the introduction of Zoom sessions was the ability for students to post questions privately in the chat facility to the clinical tutor. Also, students found it more comfortable to privately email their tutors or post a question on the discussion forum anonymously. It allowed the tutors to read out and address the questions for the entire group's benefit without the student having to reveal his or her identity. This is a unique advantage especially in African schools where students are often uncomfortable asking questions in public during lectures and group tutorials fearing embarrassment (Adendorff *et al.,* 2017). Furthermore, another significant advantage of our adaptation was that recordings of the Zoom sessions were made available to students to re-watch later at their own pace. It also allowed accommodating for students that had network connectivity issues to catch-up whenever they were able to connect.

There are advantages to online teaching methods, although not enough to adequately replace the traditional method (Mian & Khan, 2020). A major advantage is to force both students and staff to use information technology skills which will be of advantage in both their future professional lives considering the digital age we are in now (Phyllis & Guze, 2015). Many skills can still be taught almost as well as in the traditional method using e.g. audio (auscultation of the heart and lungs) and visual (skin lesions, x-rays, ECGs, examination of the eye, ear, mouth etc.) technology. These skills can be emphasised using these technologies so that less time can be spent during actual clinical teaching sessions with live patients (Moran, 2018; Waseh & Diker, 2019). Transitioning to online platforms allows student preparation for learning sessions to be monitored using e.g. grade books in Moodle. In addition, students can be encouraged to express their opinion of tutors and tutorials through online surveys to allow for further improvement of teaching methods. Electronic learning can therefore provide students with more educational possibilities while increasing professional efficiency and effectiveness at the same time. However, a certain degree of institutional readiness in both human and infrastructural resources are required to implement e-learning skill, which can be a constraint particularly in low- and middle-income countries (Frehywot *et al.,* 2013).

7. CONCLUSION

As universities worldwide have been forced to provide remote teaching in the absence of face-to-face interaction during the COVID-19 pandemic, teaching clinical skills remotely offered significant challenges. By adapting George's (2001) "five-stage approach" using PowerPoint presentations converted to voiceover recordings and multimedia videos, clinical teachers can deliver clinical skills at a distance and maintain the core concepts and frameworks of conventional face-to-face programmes. The adapted George's (2001) 5-stage clinical skills teaching approach includes: 1. Introduction – The tutor introduces the overview of the skill using PowerPoint presentations converted to voiceover recording as a pre-reading material on Moodle; 2. Demonstration – The tutor demonstrates skills with the use of a recommended

examination skills video shared on Moodle with no commentary as pre-viewing material; 3. Discussion – Discussion and illustration of skills by tutors with multiple short video clips embedded in a presentation during the Zoom interactive session; 4. Comprehension - Narration of skills by students assisted by other students during the Zoom session and 5. Consolidation – Question and answer with clinical contextualisation on the Moodle discussion forum.

In summary, within the constraints of a remote set-up during the COVID-19 outbreak, the adapted approach retains the significant aspects of the five-stage process and can be used by clinical educators to deliver clinical skills teaching remotely until face-to-face instruction can be resumed. Not only will this strategy be applicable to the current crisis, but it can also help to lay the groundwork for teaching during future disasters. The outbreak also provides an opportunity for re-evaluating our teaching methods. The use of video and online-based teaching methods provides lessons as feedback to clinical teachers on how medical students acquire knowledge and express themselves. To promote student-centred learning approaches that include reflection skills and improved self-directed learning, medical institutions should consider transitioning to a combination of asynchronous and synchronous instructional designs early in the curriculum. Further studies on identifying and understanding the practicalities of appropriate e-learning tools in resource constrained countries as well as student's ability to transfer learning from an online platform to the real patient will serve as a useful theoretical guide to the planning and evaluation of e-learning interventions that would be useful for educational purposes.

REFERENCES

Abraham, R.M. & Singaram, V.S. 2019. Using deliberate practice framework to assess the quality of feedback in undergraduate clinical skills training. *BMC Medical Education*, 19: 105. https://doi.org/10.1186/s12909-019-1547-5

Adendorff, M., Mason, M., Modiba, M., Faragher, L. & Kunene, Z. 2017. *Being a teacher: Professional challenges and choices.* SAIDE: Oxford publication.

Baeten, M., Kyndt, E., Struyven, K. & Dochy, F. 2010. Using student-centred learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. *Educational Research Review,* 5(3): 243–260. https://doi.org/10.1016/j.edurev.2010.06.001

Bourne, J.R. 1998. Net-learning: Strategies for on-campus and off-campus network-enabled learning. *Journal of Asynchronous Learning Networks*, 2(2): 70–88.

Dent, J., Harden, R. & Hunt, D. 2017. *A practical guide for medical teachers*, 5th ed. London: Elsevier.

Douglas, G., Nicol, E., Robertson, C. & Macleod, J. 2013. *Macleod's clinical examination*, 13th ed. Churchill Livingstone Elsevier.

Frehywot, S., Vovides, Y., Talib, Z., Mikhail, N., Ross, H., Wohltjen, H., Bedada, S., Korhumel, K., Koumare, A. & Scott, J. 2013. E-learning in medical education in resource constrained low- and middle-income countries. *Human Resources for Health*, 11: article 4. https://doi.org/10.1186/1478-4491-11-4.

George, J.H. & Doto, F.X. 2001. A simple five-step method for teaching clinical skills. *Family Medicine*, 33(8): 577-578.

Krackov, S.K. & Pohl, H. 2011. Building expertise using the deliberate practice curriculum-planning model. *Medical Teacher*, 33(7): 570–575. doi: 10.3109/0142159X.2011.578172

Kurtz, S., Silverman, J., Benson, J. & Draper, J. 2003. Marrying content and process in clinical method teaching: enhancing the Calgary-Cambridge guides. *Academic Medicine*, 78: 802–809. https://doi.org/10.1097/00001888-200308000-00011

Lewis, M.J. 2003. Computer assisted learning for teaching anatomy and physiology in subjects allies to medicine. *Medical Teacher*, 25(2): 204–206. https://doi.org/10.1080/0000000000000000000a

Mian, A. & Khan, S. 2020. Medical education during pandemics: A UK perspective. *BMC Medicine*, 18: article 100. https://doi.org/10.1186/s12916-020-01577-y

Moran, J., Briscoe, G. & Peglow, S. 2018. Current technology in advancing medical education: perspectives for learning and providing care. *Academic Psychiatry*, 42: 796–799. https://doi.org/10.1007/s40596-018-0946-y

Muñoz, D.C. 2010. Effective e-learning for health professional and medical students: the experience with SIAS-Intelligent Tutoring system. *Studies in Health Technology and Informatics*, 156: 89–102.

Münster, T., Stosch, C., Hindrichs, N., Franklin, J. & Matthes J. 2016. Peyton's 4-steps-approach in comparison: Medium-term effects on learning external chest compression – A pilot study. *GMS Journal for Medical Education*, 33(4): Doc60. https://doi.org/10.3205/zma001059.

Phyllis, A. & Guze, M.D. 2015. Using technology to meet the challenges of medical education. *Transactions of the American Clinical and Climatological Association*, 126: 260-270.

Republic of South Africa. 2020. *covid-19/novel corona virus*. Available at https://www.gov.za/Coronavirus/travel [Accessed 12 May 2020].

Salyers, V.L. 2007. Teaching psychomotor skills to beginning nursing students using a web-enhanced approach: A quasi-experimental study. I*nternational Journal of Nursing education Scholarship,* 4: article 11. doi: 10.2202/1548-923X.1373.

Schwan, S. & Riempp, R. 2004. The cognitive benefits of interactive videos: learning to tie nautical knots. *Learning and Instruction*, 14: 293–305. https://doi.org/10.1016/j.learninstruc.2004.06.005

Tai, J., Haines, T., Canny, B. & Molloy, E. 2014. A study of medical students' peer learning on clinical placements: What they have taught themselves to do. *Journal of Peer Learning*, 7: 57–80.

Walton, H.J. 1997. Small group methods in medical teaching*. Medical Education,* 31(6): 457–464. doi:10.1046/j.1365-2923.1997. 00703.x

Waseh, S. & Dicker, A.P. 2019. Telemedicine training in undergraduate medical education: mixed methods review. *Journal of Medical Internet Research Medical Education*, 5: e12515. https://doi.org/10.2196/12515

Wu, D., Bieber, M. & Hiltz, S. 2008. Engaging students with constructivist participatory examinations in asynchronous learning networks. *Journal of Information Systems Education*, 19(3): 321–330.