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Streamlining pathology e-learning-lessons learnt on COVID-19 lockdown

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Abstract
Undergraduate pathology teaching is a challenging assignment for teachers and students especially in distant learning mode during the COVID-19 pandemic lockdown. Every tutor has to evolve his/her effective methodology but for the pathologists it is especially challenging because they have to bring both morbid anatomy and live clinical cases to bring together to make a clinical meaning for the students. So, we evolved a module called "SSVIPS' ' and followed in our presentation. While we followed the school guideline and exact schedule on due dates but modified our presentation based on the above module. A preliminary mid-term assessment of our cohorts of year 3 students showed marked improvement in assessment post-online teaching vis a vis pre online teaching session. So, the result of our modification of the teaching learning session had positive results. This is also supported by positive student feedback. We also reviewed literature on the subject using key words mentioned below in PUBMED, and Google scholar and highlighted the differences and benefits in pre and post-assessment and student feedback. However, we did not evaluate time and cost effectiveness of our online innovative teaching learning program.

Keywords: online teaching, e-learning, internet learning, zoom-teaching, distant- learning, computer-learning, e-pathology, telepathology

Introduction
Undergraduate medical education in pathology is evolving through various stages [1, 2]. It is generally agreed that pathology teaching was extensively covered in classical or traditional medical teaching curriculum while in integrated medical education pathology is being taught in integrated fashion with clinical cases to make sense to medical students [3]. Many schools follow a hybrid format for pathology teaching [4]. In Monash curriculum pathology is more extensively covered in initial two years and in clinical pathology taught in year 3 along with mortuary visits and clinical lab in-situ teaching is also conducted on a regular basis. In in-situ teaching it is much easier to interact with students and deliver desired effect which is rather more challenging in distant online teaching because of various inherent issues with the internet and individual student issues which all tutors face and have to adjust [5]. But overall, both tutors and students are happy with online teaching sessions. The students are given liberty to record these pathology sessions so that they can revise later-on. All pre-session reading materials are forwarded as requested by our students who are proactive, they freely can communicate with tutors on WhatsApp and via email which make life easy for students. But the sudden eruption of the pandemic of coronavirus caused sudden closure of schools and universities that had to go online teaching mode without much thought or preparation. Practically tutors were left with their own device [6]. Hence, we have to evolve a program which should be stimulating, interactive and also deliver the core knowledge which can help students to solve the intricacies of clinical presentation. This also involves time management in a very effective way and sustains students' attention and interest on the topic being discussed for 2 hours' session. Hence we evolved a model called "SSVIPS".

Review of Literature
Latest advancements in the field of information and communication and easy access to technology have given educational institutions the capability to enhance old and inactive distance education methodologies via improved communication techniques, better interaction within student groups by means of collaboration facilitating teaching methods, especially via advanced networking softwares [7, 8, 9]. In the current era of enhanced methods of online education, students prefer better interaction that resembles traditional pedagogy based on classroom setting. The need for online education, enhanced by easy accessibility, increased attention by media, and increased demand from the private teaching institutions, has fastened the pace of online distance education courses [10]. This need for online distance education especially in the current era of Covid has also increased the need for effective facilitation of online teaching by educators. The following teaching strategies can help to increase the efficiency of online teaching sessions.

Short
Retaining students and making them complete online video sessions is a big challenge. The longer the video, the harder the challenge. Even though it is a well known barrier, in reality, most educational videos are longer and do not engage students or have

any interactive component. Fewer studies have been conducted to check if introducing interactive elements can increase the attention span of students while watching longer video lectures. Research data shows that introducing interactivity in long video lectures significantly increased the attention span of students by 10-20% [11].

Educators from all around the world constantly strive to find ways to keep students engaged in their sessions for a better outcome. This becomes challenging when it comes to online teaching since holding the students attention without being physically present is close to impossible. Some of the renowned educators share their techniques that they follow to keep students attention into their sessions for the maximum possible time duration. Most of them tend to divide their lectures into smaller segments based on their subtopics and only take so much that is absolutely essential to deliver the contents. Some of them call their lectures a mini-lecture series. Another technique they do is to mix up mini-lectures with short hands on training sessions. In between the mini-lectures, activities like asking them to open up a webpage related to the subject matter and answer a series of questions. Passive learning is much worse when it comes to online lectures. In a traditional classroom setting, all the students will be working together and there is a high chance of staying concentrated throughout the session. A sense of belonging will be present. Whereas in online teaching, getting lost is easy. Some educators pass in between their online lectures and show some fun videos. They could sense that after a fun break, when they return to their lectures, students are much more focused on the topic that is discussed. Students also felt that the lecture sessions seemed shorter when they had fun intervals [12].

Spicy and Variety

It is a well known fact that lectures are monotonous and tend to be boring. One of the surveys state that more than 59% of students found half of their lectures to be boring whereas around 30% of students said that all of their lectures are boring [13]. Latest advances in communication and technology over the past few years have increased the intensity of this problem that some educators call this as an era of crisis of traditional lectures [14].

One of the best philosophies of current trends of education is mixing up different teaching and learning techniques especially by using newer tools of multimedia. Learners must also acquire time management skills and learn how to appropriately balance life long learning with rest of their activities. The important factor regarding mixing different teaching techniques that require skills, knowledge and innovative thinking together with information technology, computers and multimedia effects is to utilise new softwares and other computer programs. To enhance the standards of education that learners are given access to in recent times, multimedia teaching tools are frequently utilised together with traditional teaching sessions conducted routinely by teachers. Teachers can use the multimedia techniques in the traditional classroom to aid in providing extra teaching instruction, and also to allow students to go through the database or moodle page of the school to do unguided self directed learning. Multimedia techniques also are made available for many online programs in renowned universities for international learners who are unable to attend courses elsewhere. Multimedia teaching techniques for education render useful knowledge on utilising new information technology education systems that will help all learners of the future, both in the traditional classroom setting and also for distance learners from all over the world. Even though there are several varieties of teaching techniques, a mixture of different techniques with or without using traditional classroom settings along with new communication multimedia tools could be the best of all education for learners of different ages. Teaching institutions should introduce new multimedia incorporated education courses that will permit students to master the skills of creative thinking along with a strong base for core concept, information and skills and hence will get the most efficient overall training to equip them to be the part of a competitive workforce of the future. Researchers of education indicate that the American teaching system is beginning to elevate its learning and teaching standards by utilising more information technology multimedia education techniques that have been stated to be efficient in traditional routine classroom settings as well as in distance online teaching programs [15].

Other than using the multimedia education techniques to enhance the already followed traditional classroom settings, they might be very useful in designing distance online courses. Distance learning programs provide learners with the higher skills that they require to be efficient in their future work title in competitive working conditions of the future. With the enhancement of information and communication technology, distance learning courses and online learning programs have grown to be very famous. Several international learners prefer to get university degrees by distance learning and hence require access to the learning materials. The learning technologies involve utilising the World Wide Web and other Internet resources to grant remote access, online collaborative softwares, e-mail, forum discussion groups, discussion groups in bulletin boards and also techniques that could be used alongside with traditional classroom settings. High speed downloads and wireless modalities like tablets and mobile phones render operability with various global softwares and hardwares and hence learners across the globe will be capable of participating in the online teaching sessions and discussions virtually.

Many universities of the west are already using improved multimedia instructional methods to enhance the already existing communication system among classmates, students and teachers by means of virtual classroom sessions, collaborative online discussion platforms, online feedback, online assignment submissions with time flexibility time schedules to suit student needs. The teacher and the students can interact real time about their programs in a virtual online classroom at any time of the day such as retrieving homework questions from the bulletin board, and then save in their desktops. Desktop collaborative softwares, realtime video softwares, online discussion forums, and virtual classroom settings permit for creative interaction between teachers and students [16, 17, 18].

Microburst Teaching and Learning is one other interesting strategy for combining different teaching techniques and methodologies in small bursts with various learning techniques to improve the teaching and learning process. The method encompassses learning theory, average attention span, student motivation, the different types of learning techniques seen in learners, and the requirement for improving effectiveness. Primary response to the Microburst method reveals its appealing and motivational nature as a helpful teaching and learning method [19].

Interactive

In the recent past, quality of teaching and learning has been considered to be of prime importance. The teachers are not just the resource person carrying and transferring knowledge to the students, they are also expected to do managing and administration along with teaching inorder to enhance the student interaction and train them for improving their essential social and personal attributes. Learners need to grasp the phenomena of nature, to understand concepts of science and to gain adequate information on the subject matter for the purpose of application of the same in real life and because of these factors, students generally are not satisfied with the traditional classroom setting teaching. The educators and learners, in almost all institutions that have been using the traditional one way lecture based classroom setting, have been shown to have less efficacy in the learning process. The educator should use techniques to enhance the skill of learning by discovery and also by means of research. Dynamic and communicative teaching methodologies, also known as interactive teaching models, comprises the base structure that is capable of motivating students to learn and hence the students tend to develop critical opinion about the knowledge that they thus acquired. Using the techniques and strategies that promote interaction among students, the learners become more involved and engaged in the process of learning. Also they are more likely to retain knowledge for a longer duration and hence feel more satisfied with the learning sessions [20].

Interactive learning is a method of learning that is implemented by means of collaborative work of students such as group discussions, games, workshops in small groups, negotiations, mini lectures and case studies. This method ensures direct interaction of students with the educators and among themselves. Classroom in practice is where the students interact and make new learning experiences [21]. Interactive learning method includes interesting logic of the process of learning which is not merely a shift from theory towards practice, but by innovating a fresh experience via applying and conceptualizing accordingly. Experiences and existing knowledge of learners in the process of learning are important sources of shared learning and growing, joint motivation of one another leading to more efficient learning processes. Professional growth most of the time is reinforced by the other students that could be indicated directly as a live integer, and also by indirect means by reading a textbook or by means of a software application [22]. Interactive learning method is meant to concurrently obtain the below results: 1) learning the information to the maximal effect; 2) enhance communication and professional development in relation to general emotion and intelligence in the background of the learning process; 3) social acclimatization, the outcome of which could be seen outside of the classroom [23]. Educational research studies that analysed the theoretical and practical advantages of online education in teaching institutions and in the scheme of added vocational skills training provided the conclusion regarding the efficiency of interactive learning process in comparison with traditional education [24, 25].

Some of the important applications of interactive learning especially in higher education include: interactive learning process enhances the process of learning, increases understanding of concepts and applying knowledge in more creative ways to solve complex issues. Effectiveness is obtained by means of increased engagement of learners in the learning process. The students not only gain knowledge, but also learn to directly apply the knowledge to solve practical problems. If the methods of interactive learning processes are implemented on a regular basis, the learners were noticed to have developed a prolific capacity to be the master of the art of learning. Additionally, interactive learning method helps for every learner of the involved in the learning process, the capability to do innovative and creative thinking, in their own unique way to view the problem at hand and find different methods to solve it [26].

Interactive learning method leads the students who gained knowledge to justify their own position in life, learn important life values and form unique character traits that includes the capability to listen to various aspects of the same subject matter, the capability to work with others together as a team and ability to form collaborative partnerships. Interactive learning process also teaches students to be flexible and tolerant, and also allows the students to develop grace, tact and humbleness that are required for effective communication. Interactive learning processes teach ways to transmit organization of activities, to obtain fresh experience from the activities, effective communication and to gain emotional intelligence. Interactive teaching methods provide not only information and practical skills but also provide us with effective conduct of life and interaction, and opens up innovative learning opportunities for students [27].

The utilization of interactive teaching methods in the designing of training sessions especially training in the scheme of added skills in higher education in the form of groups of few has been shown to result in increased efficiency. Every student gains: 1) the expertise in actively developing learning material in collaboration with their teacher and fellow students; 2) increased emotional intelligence; 3) better self reflection; 4) develop tolerance and communication skills. In a addition to the above, if the training involves a smaller group, the following results are achieved: 1) the development of communication skills with better interaction capability; 2) capability to orient themselves towards the goal with unity; 3) the capability to develop social responsibility depending on the living condition, social norms and rules of the society in which they live in; 4) capability to solve disputes and conflicts; 5) expertise in analytical skills and introspection ability by means of reflection as a group. Recent techniques that can be used for the purpose of interaction aid in revealing the high standards of the educational institute. These techniques also help to develop unique instructive learning material with multiple dimensions for easy understanding of the students. This type of learning materials form the basis for building up the motivation and willingness of the students for professional and interpersonal interaction [28].

Practice

Formative assessment is a strategy that is founded to promote learning, aiding learners to thrive in a safe and non threatening environment. Students, upon self reflection or feedback from teachers based on formative assessment, learn how to enhance their performance [29]. Formative assessment that is made available for the students early in the curriculum along with specific teacher feedback is found to be very efficient [30]. Formative assessment tools that are properly designed must be informatory to students and should reveal any knowledge gap they have. Formative assessments are designed to answer the

question "How am I doing?" unlike summative assessment that is the end assessment where it answers the question "How did i do?" [31]. The concept of formative assessment has been well established in all higher education including medical education, particularly. Most medical education licensing committees of the west have made formative assessments in addition to summative assessments to be compulsory for all courses and clerkships. All learning outcomes need to be emphasised in formative assessment which must be accompanied by specific feedback and remedial classes provided [32]. Educational researchers have recorded improved outcomes if formative assessments were conducted before the final summative assessments [33, 34]. On the contrary, some researchers found no relationship in student performance was observed in formative tests when compared with summative assessments, but a positive impact of formative tests was identified later in the course [35, 36]. This enforces the need for proper audit and evaluation of different formative assessment tools. Research shows that learners who opt to do formative and practice tests had good grades on summative assessment tests. But if the formative tests were optional and did not carry any course credit, students who choose to do it are very low in number. Some ways to encourage students to participate in formative assessments include rendering course credit and adding a certain percentage grade of the formative assessment to the final summative assessment. Also, formative assessments were known to predict students' outcome in their summative exams. Hence it's a useful tool to evaluate students' knowledge and allows time for remedial action before the summative assessment tests [37].

Summarization

Summarization is a teaching strategy that is often underrated. One interesting study looked into efficiency of summarisation as a learning strategy. University students were chosen for the study. They attended lecture classes, took notes and prepared for their exams in their own learning strategy. In addition to this, a group of randomly chosen subjects were asked to summarise the lectures. It was clearly seen that the study group who are the summarisers were able to recall information better than the control group. Also, summarisers had more ideas regarding the subject matter when compared to the control group. The researchers suggested that using generative learning strategies must be implemented to enhance learning and also for long duration of retention of knowledge [38]. Literature has adequate evidence to prove that summarisation as a learning strategy enhances learning, encourages student involvement and hence results in better outcomes. Studies were performed to evaluate the positive impact of implementing summarization as a learning strategy in a virtual reality learning condition on various cognitive learning skills. The outcome of these studies revealed that summarization of content decreased students' perceived learning effort significantly [39].

Methodology

We followed the model of SSVIPS abbreviation for short, spicy, variety, interactive, practical and summarization. So we divided the 2 hours session into 4 quarters of 20-25 minutes for the first hour in which delivery of various modes of pathology lesions in various formats as shown below. Our all presentations are always short and crips which are always based on concept delivery on each topic under discussion.

The variety is spicy and all our sessions are interactive and conducted by students themselves. In each of the presentations there is active interaction by tutors as guides and provide little explanations if required.

Following is the our schedule of the session:

Table 1

Time	Session	Comment
1ST 20-25 minutes	Synopsis on topic	Concept delivery on topic by tutor
2nd 20-25 minutes	Gross and microscopy	Students to describe
3rd 20 – 25 minutes	MCQs & true- false	Students to solve
4th 20-25 minutes	OSCE/OSPE/SEQs	Student attempt to answer
5th session 1 hour	Extended matching questions	Students conduct-SOLVE
		Tutor acts a guide, provide feedback

Data Analysis

We conducted pre-test and post-test with multiple choice questions before and after the teaching session. The SSVIPS was an experimental method. We tested it on a class of 53 undergraduate medical students. The experiment was done on an already taught pathology topic by means of traditional online one way one hour lecture through zoom sessions. Hence, the knowledge of all the students at the start of the experiment is assumed to be even theoretically. An initial pre-test on the topic was conducted before the intervention (SSVIPS) session. After an SSVIPS session, a post test was conducted. Data collected from pre-test and post-test marks were analysed using the SPSS software.

Results

The total number of students was 53. The mean for pre-test marks is 72.40 and mean for post-test marks is 91.06. As we can deduce that the mean marks of the students have increased by 18.6 after our SSVIPS model of online teaching session. For testing the significance of the results achieved in Table 2, we did a paired t-test with our pre and post test mean marks (Table 3). The P- value achieved is 0.000 which is less than 0.005 and hence our results are significant.

Table 2: Mean and Standard deviation for pre-test and post test marks for 53 students

	Mean	N	Std. deviation	Std. Error Mean
Pre-test	72.402	53	11.3943	1.5651
Post-test	91.06	53	8.837	1.214

Table 3: Paired sample differences test (t-test)

Paired Differences					t	df	Sig. (2-tailed)
Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
			Lower	Upper			
-18.6547	8.0314	1.1032	-20.8685	-16.4410	-16.910	52	.000

Discussion

The coronavirus disease pandemic has had severe global impact on the global economy and healthcare industry. While the extent of the spread of the disease has caused enormous ramifications, the closing of educational institutions has resulted in the discovery of innovative approaches of delivering teaching sessions online, making sure that students carry on with their education, in spite of the different teaching modalities. The coronavirus disease pandemic, albeit negative consequences, has sighted the launch of novel approaches to delivering education online to medical students. Lectures have been quickly made adaptable to be broadcasted as webinars by means of different online platforms such as Google classroom and Zoom, with such technologically augmented methods that have been evidenced to have increased student engagement [40].

Even though didactic traditional classroom teaching sessions, presentations, practical demonstrations and bedside clinical teaching and learning have largely been replaced by self-directed learning and online teaching & learning platforms, the advantages of direct student teacher communication and two-way feedback in real time are challenging to duplicate at forums online [41]. Online lectures have been favourably acknowledged by students all over the world. However, it is essential to take note that medical students, especially those who are in their preclinical years, may be vulnerable to the burnout phenomenon, particularly during these challenging times where they are subjected to have little or no contact time with their teachers and facilitators [42]. Hence, we have to evolve a program which should be stimulating, interactive and also deliver the core knowledge which can help students to solve the intricacies of clinical presentation. This also involves time management in a very effective way and sustains students' attention and interest on the topic being discussed for 2 hours' session. Hence we evolved a model called "SSVIPS". The model involves redesigning didactic online lecture sessions into short sessions containing a variety of combinations of teaching modalities including interactive components and a brief summarisation at the end of the session. We split the session into multiple short sessions, each session involved a variety of interactive activities which warranted active student participation [Table 1]. We tested this model in our year 3 medical students. We conducted pre-test and post-test with multiple choice questions before and after the teaching session. Statistical analysis of the posttest and pretest marks showed significant positive impact of our SSVIPS model on student knowledge.

Conclusion

We conclude that monotonous lengthy online lectures need to be replaced with more interactive teaching models such as SSVIPS. This will help us to bring online sessions to closely replicate the benefits of participation and interaction achieved through traditional classroom sessions. During the difficult times of COVID-19, where transfer of practice and skills happen online, we need models like SSVIPS to do our best.

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