Original Article

A Survey of Medical Students' Experiences with Online Practical Pharmacology Classes during Covid-19 Lockdown

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ABSTRACT:

Background: Due to Covid-19 restrictions, medical education now embraces online teaching.

Aim: To determined medical students' perception of online pharmacology practical classes conducted during COVID-19 lockdown**.**

Methods: Years 2 and 3 students participated in the study. Before the pandemic, they used the exercises for on-site classes. They used Cyber Patient, Organ bath, Virtual Cat, and Virtual Rat software to conduct pharmacokinetics, pharmacodynamics, autonomic, cardiovascular, and neuropharmacology exercises. Through Moodle, they received instructions and resources; and the tutors accessed and rated their reports. To determine their readiness and perception of the exercises, the study conducted a cross-sectional survey using a questionnaire that included a demographic section, a section on ICT readiness, and a section on perception of the exercises. Statistical analysis included mean scores, t-test, Cronbach's coefficient, and principal components.

Results: Sample size for both classes (total enrolment = 191) was 128. Seventy-eight students participated (45 from year 2 and 33 from year 3). Response rate was 60.94 %, mean age 21.7 (SD = 4.0); 74.4 % had no formal ICT training, 92.3 % had personal computers, 95 % used computers often, and 79.5 % required ICT training. Cronbach's coefficient was 0.8, and factor analysis yielded two principal components that accounted for 54.5 % of the variance. The participants were "satisfied" with the exercises, reported that these programs were "quite user-friendly," "somewhat-easy" to use, and "supportive" of learning. They would "likely" recommend them for future use.

Conclusion: The online exercises provided an effective method of delivering practical pharmacology classes to medical students.

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INTRODUCTION

The outbreak of SARS Cov-2 virus (Covid-19) pandemic in 2020 and the accompanying public health restrictions to control and prevent the spread of infections had a considerable impact on medical education globally. In many countries, teaching and learning in the preclinical and clinical phases of medical education were suspended for most part of the year.[1, 2] Some medical schools resorted to online learning,[3] but there were huge challenges because

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many teachers and students were not well equipped for online teaching.[4-6] These challenges led to several innovations and adaptive measures designed to sustain teaching and learning during the lockdowns and restrictions. At the setting of this study, pharmacology teaching and learning continued online using Moodle and Zoom. The faculty had earlier introduced computer simulation exercises as part of the practical classes in pharmacokinetics, pharmacodynamics, cardiovascular pharmacology, and neuropharmacology.[7]

The major educational issues for the study were to determine the students' preparedness for online practical classes judging from their experiences in using computer applications, to know how acceptable and user-friendly the simulation exercises were in the online learning environment, and to determine whether the exercises enhanced their understanding of pharmacology. To address these questions, the study used a quantitative cross-sectional survey to determine the students' readiness, perception, and acceptance of the simulation exercises.

METHODS

The study used a cross-sectional survey to determine the perceptions and readiness of medical students in the months of August and September 2020. Before the pandemic and lockdown, pharmacology practical classes were delivered to year 2 and year 3 medical students using both wet labs and computer simulations. Therefore, the students were familiar with the software programs. They carried out the exercises with the aid of the Cyber Patient,[8] and OBSim,[9] Virtual Cat,[9] Rat CVS,[9] and Virtual Twitch,[9] software programs. These exercises included pharmacokinetics, pharmacodynamics, autonomic pharmacology, cardiovascular pharmacology, skeletal muscle pharmacology, and neuropharmacology. The required software programs were freely available on the internet, and the tutors provided laboratory manuals that included annotated instructions and clinical questions.[7] The students received adequate online tutorial support and guidance from the faculty during the exercises. However, they carried out the exercises on their own. They downloaded and installed the software programs on their computers and completed exercises, and uploaded their laboratory reports. The tutors graded these submissions and provided feedback where necessary.

To assess the students' perception of the online learning experiences, the authors developed and piloted a sixteen-item questionnaire which had 3 demographic items (age, sex, and year of study), 4 items on ICT experience, and 9 items on their perception of the practical exercises. Each of the 9 items on the perception of the practical exercises had 5 Likert-scale options rated 0 to 4.

The total number of actively enrolled students in years 2 and 3 of the Bachelor of Medicine and Surgery program at the time of this study was 191. Based on this, the researchers calculated a sample size of 128, using an online sample size calculator, Raosoft® (*www.raosoft.com/samplesize.html?nosurvey*), with a margin of error of 5 %, confidence level of 95 %, and response distribution of 50 %. The sampling method was convenience non-random, giving all eligible students in the two classes opportunity to participate. The researchers provided information on the purposes and implications of the study to the participants, and accepted as consent to participate, their agreement to complete the online questionnaire. Consenting students downloaded, responded to the items, and uploaded the completed questionnaires on Moodle. The appropriately completed questionnaires were then graded, and the scores entered into Microsoft Excel and exported to PSPP statistical analysis software (version 1.2.0). Statistical analysis included mean, standard deviation, normality of distribution, equality of variance, t-test, Cronbach's coefficient, and principal component (exploratory factor) analysis.

The survey was conducted during the peak of the Covid-19 lockdown when social restrictions were

high, and the study involved very little or no risk to the participants. In the light of this, the study received ethical waiver from the local ethics committee.

RESULTS

In total, 78 students responded to the questionnaire, giving a response rate of 60.94 %. Of the 78 students who participated, 45 were from year 2 and 33 from year 3. The mean age was 21.7 (± 4.0) years. Ninety-five students (74.4 %) had no formal ICT training. Notwithstanding, 118 of them representing 92.3 %, had personal laptop computers, and 122 of them, that is 95 %, used computers often. Interestingly, 102 students (79.5 %) indicated that they required formal ICT training.

Statistical analysis of the responses to the 9 Likert items gave a Cronbach's coefficient of 0.8 as shown in table 1, while exploratory factor analysis yielded two principal components which accounted for 54.5 % of the total variances. Table 2 shows the results of the principal component analysis, with two components having Eigenvalues greater than 1.0. Table 3 shows the components' matrix, while figure 1 shows the Scree plot. The Scree plot also indicated the extraction of two principal components.

Table 1: Reliability of the dataset

		N	%
Cases	Valid	78	100.00
	Excluded	0	0.00
	Total	78	100.00
Reliability Statistics:			
Cronbach's Alpha		**No of Items**	
0.80		9	

Table 2: Principal Component Analysis (exploratory Factor Analysis) Total Variance Explained

Component	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	**3.70**	**41.08**	**41.08**
2	**1.21**	**13.41**	**54.49**
3	.96	10.71	65.19
4	.76	8.46	73.65
5	.67	7.40	81.06
6	.61	6.76	87.81
7	.47	5.26	93.08
8	.33	3.66	96.73
9	.29	3.27	100.00

Table 3: Component Matrix for the two principal components

	Component	
	1	2
Item 1	**.74**	-.17
Item 2	**.81**	-.23
Item 3	.54	**-.58**
Item 4	.48	**.54**
Item 5	**.56**	.55
Item 6	**.45**	.31
Item 7	**.52**	-.30
Item 8	**.79**	.11
Item 9	**.76**	-.02

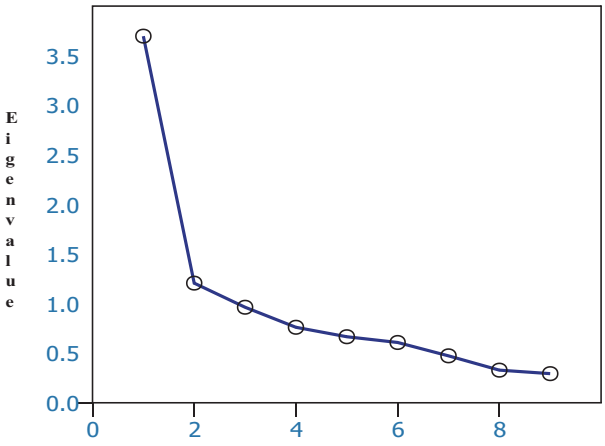

Figure 1: Scree plot for the nine Likert items

Table 4: Group statistics for the nine perception items

Questionnaire item/Question	Level	N	Mean	SD	*P*
1. How user friendly did you find the software programs?	year 2	45	2.64	0.80	0.079
	year 3	33	2.94	0.66	
	Total	78	**2.77**	0.74	
2. How satisfied are you with the look and feel of the software programs?	year 2	45	2.62	0.81	0.231
	year 3	33	2.85	0.83	
	Total	78	**2.72**	0.82	
3. In the online environment, how easy was it for you to use the programs?	year 2	45	1.60	1.01	0.025
	year 3	33	2.18	1.24	
	Total	78	**1.85**	1.14	
4. How supportive was the Cyber patient for your understanding of pharmacokinetics concepts?	year 2	45	2.67	0.60	
	year 3	33	2.12	0.74	0.001
	Total	78	**2.44**	0.71	
5. How supportive was the Organ bath for your understanding of pharmacodynamics concepts?	year 2	45	2.87	0.84	0.804
	year 3	33	2.91	0.58	
	Total	78	**2.89**	0.74	
6. How supportive was the Rat CVS for your understanding of cardiovascular pharmacology?	year 2	45	2.51	1.06	0.983
	year 3	33	2.52	0.62	
	Total	78	**2.51**	0.89	
7. How supportive was the Virtual cat for your understanding of autonomic pharmacology?	year 2	45	2.24	0.65	0.001
	year 3	33	2.85	0.91	
	Total	78	**2.59**	0.82	
8. Overall, the programs improved my understanding of pharmacology:	year 2	45	2.62	0.78	0.283
	year 3	33	2.82	0.81	
	Total	78	**2.70**	0.79	
9. How likely are you to recommend the programs for teaching in future?	year 2	45	2.44	1.01	0.550
	year 3	33	2.58	0.87	
	Total	78	2.50	0.95	

Table 4 shows the group statistics for the 9 quantitative items in the questionnaire. The mean scores for most of the items were greater than 2.0 out of 4.0 indicating a positive perception, except for item 3 ("in the online environment, how easy was it for you to use the programs?") which was perceived negatively by year 2 students and gave an overall mean value that was less than 2.0. By interpretation, the scores indicate that the students were "satisfied" with the exercises. They reported that the computer programs were "quite user-friendly" and "supportive" to their learning, and that they would "likely" recommend the programs for future use in online pharmacology classes. Many of the study participants perceived that the programs were "somewhat easy" to use.

DISCUSSION

The purposes of this study were to determine the students' readiness for online learning, acceptability, and user-friendliness of the computer-simulated practical exercises in the online platform, and the effectiveness of the programs and exercises in enhancing the students' understanding of pharmacology. The findings revealed that many of the students were not IT trained and were just using experiential knowledge to access Moodle and online resources. The less than average rating scored by the item that measured this factor, confirmed this, and several research reports from recent articles corroborate this observation.[10-12] Faculty unpreparedness for the sudden transition to e-learning during the lockdown compounded this. Other factors reported in literature that could affect online teaching and learning in developing countries include poor electric power supply, unstable internet connection, and high cost of data.[13-16]

Despite the challenges faced by these students, they reported that they were satisfied with the online simulation exercises, that the software programs were user-friendly, and that the exercises enhanced their understanding of pharmacology. These observations supported the view that the online practical simulation exercises were effective for

delivering hands-on practical lessons to students in the era of lockdowns and social distancing. Some studies reported negative perception of online learning by medical students. Some others show that undergraduate medical students adapt and accept this mode of teaching.[3] Other studies have also reported the successful administration of practical lessons and examinations in the online environment in medical education.[6, 17] However, authors of this article are not aware of any previous report on the online use of computer simulation programs in preclinical medical pharmacology practical classes. In view of the satisfaction expressed by participants in this study, the authors recommend the adoption of this model by medical education programs in this era of social restrictions where online teaching and assessment appear to be the ways out.

The major concern of this teaching approach is that it might not lead to the acquisition of laboratory skills needed by some programs. For such students, this model may only serve as an adjunct to wet laboratory classes.

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