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Analysing the examination results to measure the effectiveness of online vs. physical teaching during the COVID-19 pandemic among undergraduates in Sri Lanka

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Abstract

Introduction: Several nations around the world had to close schools, colleges, universities, and other educational institutions as they were badly affected by the spread of COVID-19. The purpose of this study was to measure the effectiveness of online vs physical teaching during the COVID-19 pandemic, at the Faculty of Allied Health Sciences (FAHS), University of Ruhuna (UoR) Sri Lanka.

Method: A cross-sectional study was conducted among 200 undergraduates. The data were collected through displayed/approved results sheets of the students of selected batches in the Department of Nursing, Department of Pharmacy, and Medical Laboratory Science (MLS). Paired sample T-test was used to compare the results of undergraduates.

Results: The examination results of 47-54 undergraduates in nursing, 28 in pharmacy, and 22 in MLS were analysed. Significant differences in Psychiatry in Nursing and Nursing Clinical Attachment were identified in the Department of Nursing ($p=0.001$). In the Department of Pharmacy, only Pharmaceutical Chemistry I ($p=0.012$) reported a significant difference. The undergraduates of MLS who underwent online theory sessions had scored more in Microbiology and Immunology ($p=0.022$) and Basic Genetics and Molecular Biology ($p=0.000$) whereas in Research Methodology and Epidemiology, the undergraduates who participated in physical lectures had scored more marks ($p=0.001$).

Conclusion: Practical/interactive session-based course units and clinical appointments had a higher impact on the mode of teaching than many theoretical course units. The results might serve as a primer for the creation of an action plan to support the academics and clinical/practical components of undergraduates.

Keywords: Undergraduates, Online Teaching, Physical Teaching, Examination Results, COVID-19

I. INTRODUCTION

The provisional closure of educational institutions during the coronavirus disease-19 (COVID-19) pandemic has unexpectedly transformed the Sri Lankan education landscape in favour of distance learning or online learning. As a result of this, drastic changes in digital platforms and applications i.e., digital learning management systems became common among

universities (Ariyananda et al., 2022). These universities used existing modular object-oriented dynamic learning environment-based learning management systems (Moodle) and the Lanka Education and Research Network (LEARN) was connected to university web servers and used for online education to mitigate the effects of disrupted learning (Hayashi et al., 2020).

Online teaching was a novel experience for university lecturers and undergraduates, and it was a huge challenge for both parties. In the beginning, both parties had to face several issues due to the unfamiliarity of these novel methods, the unavailability of basic facilities, and insufficient network coverage in Sri Lanka. Though it would be an effective alternative to conduct Zoom lectures again as physical lectures once the university reopened, we were unable to conduct lectures due to limited time during the semester. Therefore, the need emerged to identify a more effective mode to deliver lectures to undergraduates. This study aims to address the effectiveness of online vs. physical teaching during the COVID-19 pandemic, by analysing the examination results at the Faculty of Allied Health Sciences (FAHS), University of Ruhuna (UoR).

II. METHODS

A cross-sectional study was conducted to measure the effectiveness of online teaching vs. traditional/physical teaching and its impact on the performance of undergraduates. The data were collected through displayed/approved results sheets of the students of selected batches in the Department of Nursing, Pharmacy, MLS, FAHS, UoR. Nursing, though considered as a separate discipline from other paramedical disciplines in other countries, is considered under the Faculties of Allied Health Science in Sri Lanka. The examination results of two batches of undergraduates in a similar semester but who had learned in a different mode (in this group one batch has completely learned online while another batch has learned physically) were purposefully selected from each department. All lectures done via Zoom were recorded and distributed among students. Both groups underwent the same types of examination, mainly multiple-choice questions (MCQs) and short structured questions (SEQ) for theoretical knowledge. Practical and clinical skills were assessed using practical-based examination and patient-based clinical examination respectively. These examinations had been conducted in 2021 and 2022 and results were released in 2022. The analysis of results was conducted in January and February 2023.

Data from approximately 208 proper undergraduates (who sat for the first time) were analysed. The population was composed of nursing (n=108), pharmacy (n=56), and MLS (n=44) students. However, the results of repeat undergraduates were excluded. Six subjects were considered under the Department of Nursing. The number of candidates for the subjects was not equal. To analyse the effectiveness, a comparative analysis of the results of the end-semester examinations was performed by three departments separately. Mainly, in the

Department of Nursing and Pharmacy the end semester examination results (two examinations/academic year) were evaluated while in the Department of MLS, the final term results were evaluated (three examinations /academic year).

Statistical Package for Social Science (SPSS) 26 software was used to analyse data. The mean and standard deviation (SD) values of the results sheets were analysed using descriptive statistics. After considering the distribution of the data set, paired sample T-test was used to compare the means of two batches. All results were regarded as statically significant at $p \leq 0.05$.

Ethical approval was obtained to analyse the published data from the Ethics Review Committee, Faculty of Allied Health Sciences, University of Ruhuna, Sri Lanka (Ref. no. 200.01.2023). Consent was obtained from all relevant authorities before taking results from the notice board.

III. RESULTS

Two batches were selected in the nursing department and each batch consisted of 54 undergraduates. An equal number of candidates had not participated in every subject and therefore results were analysed based on students' attendance for the different subjects. Under the nursing department, there were six subjects for students. Four subjects out of these six subjects consisted only of theory components. One subject had both theory and clinical components and the other subject had only clinical-based examination.

All the subjects had only a theory component in the selected semester in the pharmacy department. Under the department of MLS, all subjects consisted of theory and practical components.

Course units	Component (Theory/ practical/clinical)	Physical mode			Virtual mode			p-value
		n	Mean value	±SD	n	Mean value	±SD	
Nursing (2 nd year 1 st semester results)		2016/2017 batch			2017/2018 batch			
Pharmacology in Nursing	T	50	55.9	15.9	50	60.16	19.14	0.24
Medical Nursing 1	T	50	54.9	7.8	50	68.09	15.6	0.053
Surgical Nursing 1	T	47	57.83	8.47	47	57.61	10.08	0.914
Psychiatry in Nursing	T+C	51	59.53	7.38	51	66.03	10.69	0.001*
Psychology in Nursing	T	54	67.41	12.88	54	62.51	14.5	0.071
Nursing Clinical Attachment III	C	47	71.85	9.79	47	66.03	10.69	0.001*
Pharmacy (1 st year 1 st semester results)		2017/2018 batch			The 2019/2020 batch			
Pharmaceutical Chemistry I	T	28	66.14	10.49	28	69.62	12.11	0.012*
Pharmaceutics IA	T	28	76.96	9.43	28	76.56	14.50	0.412
Mathematics	T	28	66.25	19.09	28	62.10	16.10	0.230
MLS (2 nd year-end examination results)		2016/2017 batch			2017/2018 batch			
Microbiology and Immunology	T+P	22	68.11	4.86	22	72.69	7.94	0.022*
Statistics, Research Methodology & Epidemiology	T+P	22	62.01	5.28	22	57.09	5.14	0.001*
Haematology	T+P	22	57.22	3.58	22	60.42	4.98	0.058
Medical Parasitology	T+P	22	68.26	6.14	22	70.53	5.41	0.185
Basic Genetics, Molecular Genetics & Molecular Biology	T+P	22	61.32	5.98	22	70.31	5.68	0.000*
Transfusion Medicine	T+P	22	66.68	6.84	22	69.87	6.20	0.163

Table 1. Comparison of results among undergraduates

*Paired sample T-test $p \leq 0.05$; T-theory, P-practical, C-clinical

IV. DISCUSSION

Online teaching was a big challenge to Sri Lankan undergraduates and teachers due to inadequate internet and infrastructural facilities for online teaching at the beginning of the COVID-19 pandemic. There was no other substitution except to conduct lectures online to provide continuous education during the lockdown. Therefore, this study was carried out to analyse the effectiveness of online teaching and student performances in selected batches of the FAHS, University of Ruhuna, Sri Lanka.

The mean value of the students' marks for the several theoretical subjects was comparable in both groups. These findings show that the undergraduates in all three courses have appropriately adhered to the online method, and it may probably show the adherence of the lecturers to the technology. Indeed, free access to the LEARN platform may provide a huge impact on the results and the high information literacy of the undergraduates and lecturers may be the reason for it (Sample survey

division, 2021). Though poor internet facilities disturbed and demotivated the undergraduates, the opportunity to listen to video recordings repeatedly may have mitigated the effect of this barrier. The reasons for the higher marks scored by the students who learned via Zoom than physical mode might be the favourable environment that prevailed by listening to lectures at their homes; fewer travel costs and time; the opportunity to have a better conversation with lecturers; having more time for self-learning/studying; and minimum disturbances from colleagues.

However, the mean value for the practical and clinical subjects was significantly low among the online group compared to the physical group. The clinical component is an essential part of the nursing undergraduate since it is vital to have adequate clinical exposure to gain competence to work in a real patient situation. Mainly, students learn how to handle patients with various disease conditions during their clinical practices. Furthermore, undergraduates can apply their theoretical

knowledge in a real patient environment (e.g. evidenced-based practice); understand real patient matters; get technical and caring skills through interaction with patients and healthcare workers; and develop empathetic attitudes. Undergraduates did not get an opportunity to continue their clinical attachments as done previously due to the COVID-19 outbreak in Sri Lanka. During their clinical placements, they had to face several internal (fear, anxiety, etc.) and external (maintaining distance, lockdowns, close contacts, PPEs, etc.) constraints. It may be the reason for the lower performance.

However, another study conducted with final-year medical students found that some part of clinical exposure can be gained by providing online interactive learning materials (Ariyananda et al., 2022). Simulations are the recommended method for students to develop their clinical skills (Koukourikos et al., 2021) but these methods are not very popular in Sri Lanka due to the high cost of such kind of manikin. Likewise, practical subjects are essential to have a factual environment to get adequate training and robust hands-on skills. Nursing procedures/practical was not conducted due to the closure of the university and the limitations of close contact. This may also reduce the practical skills of nursing undergraduates. Under the pharmacy department, a significant difference was observed for the subject of Pharmaceutical Chemistry 1, which contains a lot of physical interactive parts. In the Zoom platform, it was difficult to conduct that much of interactive sessions with limited resources. That might be the reason for the difference. However, MLS and pharmacy departments have provided recorded practical sessions which may be the reason for the different results among departments.

In the study conducted in one faculty of the University of Ruhuna, a low number of participants were limitations of the study. A mixed-method study approach with a larger sample was recommended and further recommendations were made to assess the experience of undergraduates and lecturers.

V. CONCLUSION

Mode of teaching had not impacted the theoretical course units of undergraduates whereas practical/interactive session-based course units and clinical appointments had a greater impact on the mode of teaching. The findings can act as a primer for the development of an action plan to support university undergraduates' academic and clinical works during pandemics. Further, the findings of this study would be helpful in robust the quality of online teaching methods in future pandemics.

Note on Contributors

TDS and EW contributed to the data analysis, manuscript drafting, and final editing of the revised manuscript. PW and SK contributed to the data analysis and manuscript drafting. ES and KY contributed to the data analysis. All authors read and approved the final revised manuscript.

Ethical Approval

Ethical approval was obtained from the Ethics Review Committee, Faculty of Allied Health Sciences, University of Ruhuna, Galle, Sri Lanka (Ref. no. 200.01.2023). Permission was obtained from the Dean/Faculty of Allied Health Sciences, University of Ruhuna, Assistant registrar/Faculty of Allied Health Sciences, University of Ruhuna, and Heads of the Department of Nursing, Department of Medical Laboratory Science, and Department of Pharmacy/Faculty of Allied Health Sciences, University of Ruhuna.

Data Availability

Data sets analyzed during the current study would be available from the corresponding author upon reasonable request.

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Declaration of Interest

The authors declare that they have no competing interests.

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