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ORIGINAL ARTICLE

Effectiveness of online multi-level assessment of research methodology in integrated curriculum - Students' performance in Year 3 of undergraduate Medical Education.

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ABSTRACT… Objectives: To evaluate the effectiveness of the integrated method of teaching and learning for research methodology taught from year 1 to 3 in a private medical college assessed online through multiple assessments during COVID-19 lockdown. The secondary objective was to explore students' feedback regarding the online assessment of research methodology. **Study Design:** Non-randomized Interventional study. **Setting:** Private Medical College in Islamabad. **Period:** January 2021 to May 2021. **Material & Methods:** Research methodology has been incorporated longitudinally in the academic curriculum from year 1 to 3 for the last five years. Students' knowledge was assessed online through 3-pronged approach using MCQs, SAQ's and Viva. The total marks of these assessments were 100. An online questionnaire was designed on Google form to get students' feedback regarding online assessment using the Likert scale. Data was entered and analyzed using SPSS version 23. **Results:** A total of 111 students participated in this study. The mean ± SD score of students in all the three assessments were 6.7±1.6, 19.5 ± 6.5, 26.2 ± 17.6 in the viva, MCQs, SAQ's respectively. **Conclusion:** The integrated curriculum of teaching and learning for research methodology is useful in terms of achieving learning outcomes. However, students' performance in SAQ's was just average which needs to be addressed. Majority of the participants found online assessments to be very useful.

Key words: Integrated Curriculum, Multi-level Assessment, Online Assessment, Research Methodology, Students' Performance.

INTRODUCTION

Research being the core of every field of education has been incorporated in the academic curriculum of almost all professional disciplines. Research methodology is being taught to medical students in their professional years because of its importance in the advancement of medicine.[1] Young intellectual minds have brought wonders to this field. It guides student towards the application of theoretical and practical knowledge.[2]

With the passage of time, mode of teaching has evolved through the use of innovative methods. Integrated mode of teaching has become the new norm of teaching methodology where multiple disciplines are linked and interrelated to increase the conceptual yield of learning among students.[3,4] While integrated teaching and learning has proved beneficial in basic and applied medicine, its role in research methodology is yet to be assessed.[5] This offers the medical educationists a significant challenge.

Research is taught through an integrated curriculum by interrelating and interlinking with other disciplines. Research methodology has been incorporated longitudinally in the academic curriculum from year 1 to 3 for the last 5 years. In COVID-19 lockdown, educational institutes were left with online method as the only platform for teaching and learning.

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The primary objective was to evaluate the effectiveness of integrated method of teaching and learning for research methodology taught from year 1 to 3 in a private medical college through multiple online assessments during COVID-19 Lockdown. The secondary objective was to determine students' feedback regarding online assessment of research methodology. This study was aimed to explore how effectively the learning outcomes are achieved through teaching in an integrated system.

MATERIAL & METHODS

A non-randomized interventional study was conducted over a period of five months from January to May 2021 after taking Ethical approval from Shifa Tameer-e-Millat University (IRB-447-1267-2020). A three pronged approach was used for online multilevel assessment among year 3 students. Students' knowledge was assessed in terms of achieving 60% passing marks in all assessments. The learning outcomes for research methodology revolve around conceptual understanding of different concepts applied in writing a research synopsis. This is the only medical college which has shifted the discipline of Community Medicine in terms of its assessment from Year 4 to 3 in the year 2020 in the undergraduate medical education. Therefore, the sample size is limited to Year 3 students. Students of year 3 who were present in all 3 assessments and gave consent were included in the study. While all those who were transferred to in year 3 with the background of traditional curriculum were excluded from the study. Among 112 students in Year 3, 111 fulfilled the inclusion criteria and thus were enrolled in the study. Therefore, sample size comprises of the students of all year 3 which is 112. Out of these, 111 were enrolled in the study while one student was excluded.

A holistic approach was adopted to assess different concepts of research methodology in which 20 domains including topic selection, literature search and review, rationale, objective, operational definitions, sampling and sample size, selection criteria, bias, confounding, questionnaire, consent form, informed consent, research ethics, types of variables, hypothesis, p-value, statistical tests, reference writing and synopsis /research proposal were explored thoroughly. An online quantitative assessment of students' performance was done in all the domains. The total marks of these assessments were 100.

Twenty Short Answer Questions (SAQs) of 3 marks each comprising 60 marks in total were shared through the chat box of google meet, 3 minutes were given to attempt each question. Following which the next question was given. Duration of this activity was 60 minutes. The students were asked to self-assess the SAQ's according to the plausible answer shared with them. After marking their SAQ's, students shared their scores through e-mail which were verified by the faculty with the help of the checklist. The gap of learning was filled through verbal feedback in online interactive sessions.

Similarly, 30 Multiple Choice Questions (MCQs) were designed in a manner that they covered each and every topic of research methodology. A time duration of 1.5 minutes per MCQ equal to total 45 minutes was given to attempt through Google form in which going back option was restricted. Total marks of MCQ's were 30. An individual result was generated upon submission of all MCQs, students got the scores as well as description of the correct answer.

As a mandatory requirement, students of year 3 submit a research proposal /synopsis in groups under supervision of assigned mentor. In order to facilitate the completion of their synopsis a group viva was arranged from their respective projects. Faculty was trained in 3 sessions regarding the zoom software which was utilized to assess the above mentioned 20 domains, using a checklist. There are 4 rotation groups of students in year 3, each comprising of 25-30 students. Within each rotation group there are 5 subgroups of students each consisting of 4-6 students, with a mentor assigned. In total there are 6 mentors supervising each of the 4 rotation groups. Each mentor has 4 students' research groups. In total there are 24 groups.

The viva voce was conducted through zoom for a period of 20-30 minutes for each student group, ensuring 5 minutes on an average per student. Each student was asked a different question and was scored out of 10. While one group was appearing in the viva, the next group was kept in waiting for efficient utilization of the time. The viva was focused on students' research project, this approach was meant to facilitate students towards their project / synopsis completion. At the end of viva, students were given feedback on their performance as well as submitted synopsis. The students appreciated these steps.

An online questionnaire was designed on Google form focusing on students' feedback regarding online assessment. Students feedback was taken regarding the usefulness of online assessments using Likert scale from 1-5, where 1 was the minimum score and 5 was the maximum score. Students were given five minutes to fill out the feedback form after all the 3 assessments had taken place.

Data was entered and analyzed using SPSS (Statistical Package for the Social Sciences) version 23.0. Descriptive statistics were calculated. Correlation of scores of SAQ's, MCQ's and Viva was done using Pearson's correlation. Independent samples t-test was used to compare all the 3 scores among both genders. P-value < 0.05 was considered statistically significant.

RESULTS

A total of 111 students participated in this study. Out of which 59 (53.2 %) were female while 52 (46.8%) were male. The mean ± SD score of students in all the assessments is presented in Table-I.

Independent samples t-test was applied to compare the score in all the 3 different assessments across male and female students, results were statistically significant in MCQ's only, p value 0.000. No statistically significant difference was seen in the scores of Viva and SAQ, p-value > 0.05. This is presented in Table-II.

Multiple Assessment Score	Mean	SD	> 60% Score
Viva (out of 10)	6.7	1.6	72.1
MCQ's (out of 30)	19.5	6.5	68.5
SAQ's (out of 60)	26.2	17.6	47.7
Total (out of 100)	52.4	20.1	52.3

Table-I. Descriptive statistics of students score in Viva, MCQ's, SAQ's related to Research Methodology

Total Score in Multiple Assessments	Year 3 MBBS Students		P-Value
	Male (n=52)	Female (n=59)	
	Mean ± SD		
Viva (10)	6.3±1.7	7.0±1.4	0.27
Multiple Choice Question (30)	18.9±8.2	20.0±4.7	0.00
Short Answer Question (60)	24.3±18.2	27.8±17.0	0.10
Total Score	49.6±21.6	54.9±18.6	0.06

Table-II. Gender distribution of scores in multiple assessments.

Pearson correlation was applied to correlate total score with all the three assessments. The results were statistically significant between Viva and MCQ's ($p < 0.05$), and total score was statistically significant with all three assessments ($p < 0.01$).

Feedback of students was taken regarding the usefulness of all the 3 online assessments on a Likert scale from 1 -5. Results are presented in Figure-1.

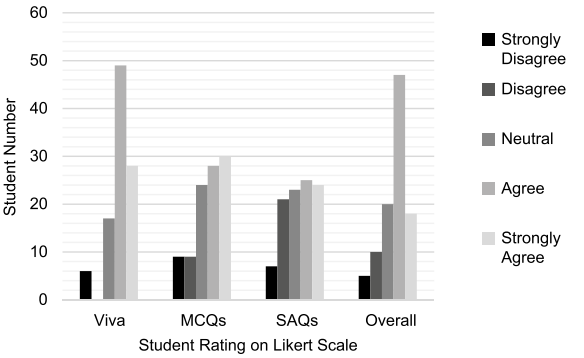

Figure-1. Students' Feedback on online assessment using likert scale 1-5.

DISCUSSION

With the global COVID-19 pandemic being declared and the public being forced to stay indoors during lockdown, educational institutions were left with online mode as the sole teaching

platform. During this period both faculty and students were initially trained and later assessed regarding online learning and teaching. Both students and faculty were exposed to multiple online teaching and learning platforms like Zoom, Google classroom, Coursera and Ted-Ez etc. All these online platforms provided the faculty with ways to communicate with the students and assess their progress accordingly.[6,7] Multiple level assessment gave a comprehensive idea of the effectiveness of the innovative curriculum.[22] It helped us to assess every student's knowledge of basic, clinical and practical medicine precisely. Innovative medical education designs have focused more on the learning outcomes but much emphasis has not been made on assessment frameworks whereas mode of assessment has a very strong impact on the student's performance.[8,9] Very limited data is available in this regard.

According to a study carried out by Jeffrey Bird, both students and faculty agreed on the viewpoint that essay-based questions give them a more detailed picture of the students' medical knowledge and concepts at an undergraduate level. About 54% of the students preferred the essay-based format of assessment.[10] Essay based format allows the young medical professionals to exhibit a more comprehensive and multidisciplinary approach towards problem-based scenarios. In our study 47% students performed well and above average, but the majority could not perform well as these were short answer questions (SAQ's), showing that students were not easy with this format. In an integrated curriculum, attempting SAQ's is one of the students' limitations due to inadequate exposure to writing.

Multiple choice questions are regarded as the ideal format of assessment comprising its validity, authenticity and feasibility.[10] MCQs allow the examiners to assess multiple topics in less time and students are more active and reflective about their preparation. Another study suggests MCQs being more preferred over SAQs due to assessment of problem solving skills of the students as well, with the only drawback being the cueing effect.[11] Where in our study, the majority of the participants performed well, a small minority scored below average giving us a view that a majority of students were more than satisfied with MCQ based examination. Mode of assessment directs the students' preparation for examination, applying surface strategies or deep learning depending on the nature of assessment.[11] They mostly focus on the high yield topics for MCQs. There are different schools of thoughts; according to one researcher patients do not present as MCQ's, so short essay based questions are preferred but it still has some drawbacks owing to the educational effect, reproductively and feasibility.[10,12] According to another study, viva gives the examiner a much clearer, comprehensive and direct approach to the students' knowledge. The examiner has an open chance to explore the field of knowledge. But viva voce has many limitations as well such as lack of objectivity, greater inter-rater variability, leniency, central tendency, time consumption and testing of lower cognitive domain of learning.[13,22] Through interpretive analysis it has been observed that viva is a valid mode of assessment as it assesses a deep level of learning strategies, problem solving skills and application of theory to practice.[22] It is a complement rather than a substitute to written examination. It allows the examiner to assess areas of curriculum that were otherwise difficult to explore via written format.[14] However, in our study majority of the students performed well and were satisfied with the viva as the mode of examination in the form of research groups, which was introduced for the very first time to which the students felt comfortable for group activity, thus would share the workload to update the research project.

According to Mukhtar K and Javed K, Students' feedback on online assessment was positive keeping in mind a few limitations that affect smooth running like classroom discipline issues, shorter attention span, connectivity and video issues due to the remoteness of their location.[6,15] In our study the majority of the participants supported MCQ based and viva-based assessment in their feedback. The students who performed well in MCQs also performed exceptionally well in viva. Thus, supporting MCQs and viva as the ideal

mode of assessment of students' knowledge.[12] Leaving behind short essay questions with very little interest.

Although an integrated system has helped medical education adapt best to the evolving era, mere integration of the basic and clinical sciences' leaves the students with a few drawbacks. Students exposed to this system lack in expressing their knowledge in essay-based questions. It is suggested in one of the studies that along with this system the students should also be exposed to problem-based learning in the vertical axis during the entire curriculum in order to overcome the deficiency which is in line with our study findings.[16,17]

Teaching research methodology at an undergraduate level has proved very crucial to the association of research at postgraduate level. Studies suggest that students who had been exposed to research during the entire curriculum showed much more interest in research at a post graduate level and improved the ratio of biomedical researchers.[18-20]

Although student-led research is increasing gradually, the ratio of overall physician scientists has been decreasing and quality research needs to be emphasized.[21]

Our study also showed that 50% of the students scored more than 60% overall in the assessments, reflecting that attention should be paid towards strengthening research teaching at undergraduate level in order to have better researchers at the postgraduate level.

In this research, a limited number of MCQ's were assessed. Limited literature is available on assessment of research methodology at undergraduate level as well as on the integrated teaching and learning which limits the scope of this research in terms of its discussion.

We recommend blended learning in integrated teaching for achieving outcomes of not only research methodology but also other concepts in undergraduate medical education in the basic sciences curriculum.

CONCLUSION

We conclude that integrated method of teaching and learning for research methodology taught longitudinally and assessed online through multiple assessments during COVID-19 lockdown to be very useful in terms of achieving learning outcomes in the prevailing pandemic. However, students' performance in SAQ's was just average which needs to be emphasized in the integrated curriculum. Also, majority of our study participants found online assessments to be very useful. Thus, other than the pandemics, an online assessment should be incorporated into blended learning.

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