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Inquiry learning-An effective E learning approach for knowledge retention

Dr. Amrutha Mary Zachariah
Associate professor of Physiology, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla, Pathanamthitta, Kerala
Corresponding author email: marymitha100@gmail.com

Dr. Meenu S
Assistant professor of Physiology, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla

Dr. Gaddam Vijayalakshmi
Professor of Anatomy, Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla.

Dr. Lillykutty Pothen
Professor of Pathology Pushpagiri Institute of Medical Sciences and Research Centre, Thiruvalla

***Abstract*---**Background: COVID-19 pandemic has given pace to the existing E-learning methods in medical education. Prerecorded video lectures (LL) and online inquiry learning (IL) are two online teaching learning methods. In online recorded classes, more of a teacher centric learning happens. Inquiry learning, a problem based learning method, the learning process is student centric. It is important to find out which one of these virtual approaches to teaching and learning is having a better outcome to plan the delivery of academic contents more effectively.Aim and Objective: To determine whether online inquiry based learning or lecture based learning is more effective education method in Phase 1 MBBS students. Materials and Methods: The study was conducted in 100 students from phase 1 MBBS who gave written informed consent. They had undergone LL and IL for three sets of topics in Physiology of equal difficulty level each. Knowledge acquisition and retention of knowledge by each method were assessed by multiple choice tests conducted soon after intervention and two weeks later and the marks were analyzed using independent student T test. Results: The mean marks in test conducted immediately after interventions (LL and IL) showed a statistically significant better result ($p<0.001$) for LL for one set of topics out of three. The mean calculated for all topics together did not

vary significantly between two methods. The tests conducted two weeks later showed statistically significant better results for IL for two sets of topics (p=0.003 and 0.039). The mean for all topics together when compared was also in favor of IL with a p<0.001. Conclusion: The effectiveness of IL and LL for acquiring knowledge is comparable. IL is more effective to retain knowledge than LL.

***Keywords*---**E-learning, inquiry based learning, lecture based learning, medical education, problem based learning.

Introduction

COVID-19 pandemic has instigated an immense impact on all branches of education including medical education. Teachers as well as students were in the middle of multiple challenges to continue the process of education. Optimal use of the available technology i.e E learning has emerged as the best way to overcome this situation. E-learning can be used both as a stand-alone teaching tool and in a blended learning environment where it is linked to face-to-face teaching. Several online learning methods have been explored to deliver educational contents to the students. They are comparable to traditional classroom teaching in terms of acquisition of knowledge. [1, 2, 3]Prerecorded lecture classes (LL) and online inquiry based learning (IL) are E learning techniques among many.

Online Video lectures are online variant of conventional teaching learning methods which can be delivered in synchronous and asynchronous modes. Both have a definite advantage over text-based online resources as they incorporate audio and visual approaches. Studies have shown that properly constructed videos are effective in imparting knowledge and is helpful in skill acquisition [4]. Recorded as well as live video lectures are equally effective[5].However major advantage of recorded classes is that the student can go through the contents repeatedly at his own pace in a comfortable environment. The problems with network connectivity issues are also less in this method. However, lack of social interaction and tendency of less motivated students to fall behind and are some of the drawbacks.

The traditional approach to teaching stresses on unidirectional flow of preprepared contents to the student from teachers. However the fast progressing new millennium demands people to adapt and evolve with changes. They should be capable of applying the knowledge they gained at various contexts instead of simply memorizing many facts. This compelled the educators to design curricula that engages the learner in certain intellectual tasks through which the learning process occurs; rather than passively imbibing knowledge from experts. Inquiry learning is one of such methods. In this method, students are presented with questions to be answered, problems to be solved, or a set of observations to be explained. knowledge acquisition ensues as they address the challenge. The challenges are designed such a way that students can build on their existing knowledge and the learning objectives are met. Inquiry based learning can be structured inquiry, controlled inquiry, guided inquiry and free inquiry depending on the autonomy given to the students[6]. It has been pointed out that it is ideal to

start with a structured inquiry gradually shifting toward more self-directed learning as the curriculum progresses[7].The online version of inquiry based learning is also effective as shown by previous studies [8]

Although LL and IL are effective E learning methods, there are comparable differences between them. In online recorded classes more of a teacher centric learning happens, whereas inquiry based is a student centric learning method. At this point in time, it is important to find out which one of these virtual approaches to teaching and learning is more effective to deliver the contents in the suitable way to benefit the students to the maximum. Therefore, the purpose of this study is to determine the impact of inquiry based learning using online question forms versus lecture based learning using recorded video classes in the academic performance of Phase 1 MBBS students.

Objective

To determine whether online inquiry based learning or online lecture based learning is more effective education method in Phase 1 MBBS students

Material and Methods

This was an interventional study conducted in Department of Physiology, Pushpagiri Institute of Medical sciences and research center, Thiruvalla. Permission from institutional Ethical committee was obtained initially. The procedure of the study was explained to Phase 1 MBBS students and those who gave written informed consent to participate were included in the study. In online lecture based learning, the learning process was through prerecorded video class using PowerPoint presentation with narration. This was uploaded on an online platform. Students were asked to listen to the class and submit notes on the assigned day. This was done to ensure that they had gone through the academic contents.

A case scenario with associated questions given as online forms were used for inquiry based learning. The questions were framed to meet the learning objectives of the topic. Appropriate learning materials were also suggested for reference. Students were expected to search and find out the answer for each question and submit it within the stipulated time. Multiple choice test was conducted once they completed each assignment. This was followed by live discussion on the same topic. The multiple choice test was repeated after 2 weeks to assess the retention of knowledge. 3 sets of topics of equal difficulty level were chosen for intervention which were peer evaluated. In each set; one topic was covered by recorded video lectures and the other one by online question sheets. Thus there were a total of 6 sessions of interventions.

Analysis

The mean marks obtained in each set of topics by two intervention methods were compared by Independent student's t test.

Results

There was a total of 100 students included in the study. Students who had not submitted the assignment on any of the topics on the given date or those who had not attended any of the two tests conducted per topic were excluded from further analysis of the study. As a result, the final sample size was 72. All of them underwent online inquiry based learning and online lecture based learning for three sets of topic of equal difficulty level. Tests were conducted shortly after intervention and two weeks later. The maximum marks were 10 for each test. Mean marks obtained after intervention by two methods in each set of topics were compared. Results are expressed as mean +/- standard deviation. $p<0.05$ is taken statistically significant.

Academic performance shortly after intervention

Table 1: Mean marks obtained in tests conducted soon after intervention for each set of topics are compared in this table. Results are expressed as mean +/- standard deviation. A statistically significant result was obtained for lecture based learning for one set of topics ($p<0.001$). The difference between two intervention methods was statistically insignificant when the mean of all topics together compared.

Table 1: Marks obtained soon after intervention for each set of topics

Interventions	Online recorded Lecture-based learning group	Online inquiry-oriented learning group	P
1st set of topics	8.15+1.60	6.64 + 1.97	0.001
2nd set of topics	7.11+2.55	7.72+1.86	0.194
3rd set of topics	7.03+1.49	7.49 +1.70	0.108
Final mean	7.5+1.9	7.21+1.9	0.153

Academic performance 2 weeks after intervention

Table 2: Mean marks obtained in tests conducted 2 weeks after intervention is shown in table 2. Results are expressed as mean +/- standard deviation. The test mean marks of inquiry based learning was statistically significant for two sets of topics. The two methods differ significantly when mean of all topics together compared.

Table:2 Marks obtained in test conducted 2 weeks after intervention for each set of topics

Interventions	Recorded Lecture-based learning	inquiry-oriented learning group	p

1st set of topics	7.74+1.53	8.23+1.68	0.067
2nd set of topics	7.76+1.98	8.59+1.60	0.003
3rd set of topics	8.17+1.50	8.70+1.32	0.039
Final mean	7.87+1.71	8.50 +1.57	<0.001

Discussion

Inquiry learning; a comparatively newer concept in the field of education is a learner centric learning process. Here, the desired learning is achieved during the process of responding to a challenge; which can be a question to be answered or a problem to be solved. Active participation of the students in learning process is the key factor which distinguish it from a traditional learning technique. The feel of satisfaction the students attain, as they accomplish the task act as an additional motivating factor for further learning too[9].

In our study, we assessed the effectiveness of online inquiry based learning and recorded video lecture classes as a teaching learning method in phase 1 students. The academic performance of the students shortly after interventions and also two weeks later were assessed using multiple choice questions. This study revealed a better retention of knowledge in inquiry oriented learning compared to lecture based learning; both done by online methods. Several published meta-analyses conclude that inquiry-based instruction is generally more effective than traditional instruction for achieving a variety of learning outcomes such as understanding the concepts and their practical implications, building sense of responsibility and providing personal motivation[10,11]

Our study revealed mixed results when inquiry based learning is compared with lecture based learning immediately after intervention. A statistically significant difference was not found between the two groups for two topics. Whereas for one topic, students showed a better score with lecture based teaching. In lecture based learning in the form of recorded video classes, students are getting the pre prepared learning material which is very easy to go through. The effort they need to put in is very less. A well prepared video class can make the student understand the concepts clear. But inquiry learning requires a lot of motivation and involvement from the student .It is more of a self directed learning. They might have experienced difficulty to understand some of the concepts due to many reasons . This may act as hindrance to learning at least for some topics. The result we got in the present study emphasizes this fact. A similar result was shown by a study conducted by Fengying et al in nursing students[12] although most of the other studies are in favor of inquiry based learning.[13,14,15]

Although lecture based learning may have an immediate positive effect, whether the information gained is retained for long is often debatable. Here the process of acquisition of knowledge is passive which the students can quickly forget. The result of the present study also points towards the same. In our study, the post test conducted two weeks later to assess the retention of knowledge showed

significantly better results in inquiry based learning when compared with lecture based learning.

In inquiry based learning ,students are actively involved in learning process. Active learning enhances memory as it involves self pacing, goal driven exploration and metacognitive monitoring[16]. The discussions conducted after each intervention might have helped them to understand the concepts better and to consolidate them in a better way. The results also emphasizes the role of teacher as a facilitator to enhance the knowledge as shown by the better performance of the students after discussion**.**

Conclusion

Inquiry based learning is an effective method to promote active learning and retention of knowledge compared to lecture based learning. The effectiveness of inquiry based learning and lecture based learning for acquiring knowledge is comparable.

Recommendations

Medical Educators should be equipped and prepared to promote inquiry learning for meaningful and deeper instruction and learning.

Limitation

As the study was conducted in an online mode, contamination of groups was possible if honesty was breached among study groups. Hence same topic could not be used for intervention by two methods which would have added more value to the study.

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Conflict of interest
None

Ethical approval

Ethical clearance was obtained from institutional review board of Pushpagiri Medical college and research center.
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