

Group-based Asynchronous E-learning Incorporating Revised Bloom's Taxonomy: An Innovative Approach

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ABSTRACT

Introduction: Faculty development programs like Foundation for Advancement of International Medical Education and Research (FAIMER) have integral mentoring learning web sessions, a type of group based asynchronous e-learning. The e-learning sessions, mostly involving cognitive domain, should not only stimulate the senses but also bring out the best from participants. The Revised Bloom's Taxonomy (RBT) involving cognitive domain was therefore selected to conduct the mentoring learning web session.

Aim: To explore the dimensions of Early Clinical Exposure (ECE) in an innovative manner incorporating RBT in an e-learning activity.

Materials and Methods: It was a qualitative study with 16 participants from 2014 batch and 16 participants from 2015 batch of GSMC FAIMER. The topic was ECE for the whole month (continuous) divided into four weeks and objectives for the week were as per the verbs mentioned in RBT. Week one

objectives incorporated the verbs "remember and understand"; week two "apply and analyse", week three incorporated the verbs "analyse and evaluate"; and week four's verb was "create". Week four activity also had a section on feedback divided into themes like input, process and output. The topic of ECE was discussed comprehensively during the month. The data gathered was analysed according to the number of responses for the week and the excerpts of the week.

Results: There were 49, 34, 41 and 46 responses in week one, week two, week three and week four respectively. The excerpts from the feedback incorporating the themes of input, process and output had an affirmative dimension, stressing the need for such innovative methods to conduct the e-learning sessions.

Conclusion: The learning journey of 'ECE' through this innovative method of using RBT was appreciated and the participants endorsed that conduction of e-learning sessions incorporating this method helped them to engage in discussion and elucidated their concepts.

Keywords: Analyse, Early clinical exposure, Faculty development program

INTRODUCTION

E-learning proposes a multimedia environment for accessing information incorporating several varieties of information, supporting a communication which is collaborative and wherein users have a total control of their own learning situations [1,2].

Various modalities of e-learning include individualised self-paced e-learning online, individualised self-paced e-learning offline, group-based e-learning synchronously and group-based e-learning asynchronously. Group-collaborative e-learning asynchronously refers to situations where groups of learners work over on intranet/internet, where participants exchange information, not in real time [3]. Foundation for Advancement of International Medical Education and Research (FAIMER) utilises such learning through asynchronous discussions as a part of Faculty Development Program. Foundation for advancement of international medical education and research runs a two year fellowship at one of its regional institute at Seth G S Medical College (GSMC), Mumbai, in India and includes two residential sessions and two distance learning online sessions, which is referred to as Mentoring and Learning web (ML web) sessions, lasting for 11 months. In ML web sessions, there is asynchronous e-learning on a particular topic for one month. This leads to idea sharing, networking and gain in knowledge and concepts [4].

Asynchronous communication in e-learning possess advantages of flexibility, a learning approach whereby related ideas can be discussed in one's own environment of work and being effective in terms of its cost [5,6]. In order to avoid merely one way and limited

communication in asynchronous e-learning, interactivity should also be focussed upon [7,6]. Formation of one's own perspectives through deeper subject understanding and fostering a learning culture through sharing of efforts of each other is the goal of the learning community [6]. Unless the interaction between participant and instructor is a planned one, it is difficult to achieve active learning in an environment of online learning [8,6]. In order to foster active learning, the authors decided to streamline the discussion through the application of RBT for the cognitive domain as the online discussions mainly feature cognitive domain [9].

The taxonomy of educational objectives being a scheme for classifying educational objectives and mostly standards lays down an organisational structure that provides a meaning to objectives classified in one of its categories, which is commonly understood, further enhancing communication [10].

The RBT comprises of two taxonomy dimensions namely knowledge and cognitive dimensions [9,11], the cognitive dimension being the focus of our study. The Cognitive domain of RBT consists of six overlapping levels of thinking skills namely remembering, understanding, applying, analysing, evaluating and creating. The six categories were shifted to verb from noun in order to reflect various forms of learning as an active process [9,12]. Categories of cognitive process in RBT no longer form a cumulative hierarchy. The major six categories are presumed to be ordered by increasing complexity, such that 'remember' is less complex than 'understood' and 'understood' is less complex than 'apply' and so on [9,13].

Revised Bloom's Taxonomy has been used in different platforms of e-learning like studies on Linux system Administration Assessments [11], accounting information systems [14], Pharmacy [15] and also in environmental studies involving early middle childhood classes [12] and kindergarten to year six in elementary schools [16]. However, there is a hardly any study on incorporating RBT in medical education e-learning platform.

The aim of the study was to explore the dimensions of ECE in an innovative manner incorporating RBT in an e-learning activity.

MATERIALS AND METHODS

This study was a qualitative study. Consent of the participants was obtained for publishing the content of the study. There were 16 participants from 2014 batch and 16 participants from 2015 batch. In 2014 batch, there were four male members and 12 female members. The participants were from Puducherry (n=1), Mumbai (n=8), Ahmedabad (n=1), Rajasthan (n=1), Karnataka (n=1), Pune (n=2), Loni (n=1) and Manipal (n=1). In 2015 batch, there were two male members and 14 female members. The participants were from Nagpur (n=1), Wardha (n=2), Mumbai (n=7), Sangli (n=2), Gujarat (n=1), Patna (n=1), Nashik (n=1), and Malaysia (n=1). Sixteen fellowships, being offered every year in FAIMER, in 2014, 16 fellows were enrolled and in 2015, 16 fellows were enrolled in FAIMER in GSMC Mumbai. The fellowship was divided into four sessions over a two year period which included two on-site residential sessions and two online distance learning sessions. The ML web sessions were conducted once with a batch namely Batch A as primary participant for 11 months and after a new batch arrived for onsite, online session was again held, this time Batch B as primary participants for 11 months and Batch A fellows provided mentoring support. In this example, 2015 were primary participants and Batch 2014 provided mentoring support. The timeline of FAIMER is provided in [6,17] [Table/Fig-1].

Mentoring and learning web process was briefed to the fellows and they brain stormed to collect a range of topics considered important by the fellows for online discussion of 11 months. After preparing the topic list, each fellow voted thrice for the topics which were most important as per their perspective by a process called multi-voting [6].

The topic chosen by the authors of 2015 batch was ECE. Experiences of ECE help students socialise to medicine, strengthen learning and acquisition of skills leading to relevant learning [18,19].

Early clinical exposure is also associated with challenges like it being time and resource intensive [20], it demands more manpower and extra efforts on part of faculty to frame clinically relevant learning objectives [21], coordination with the clinical departments [22].

	April 2015	May 2015- March 2016	April 2016	May 2016- March 2017	April 2017
Attending Batch	Fellows of Group B	Fellows of Group B and A	Fellows of Group C	Fellows of Group C and B	Fellows of Group D
Session Duration	One week	11 months	One week	11 months	One week
Nature of session	Onsite residential session of one week with two days overlap for Batch A to develop co-mentoring qualities.	Online session with Batch B as primary participant (moderators) and batch A provides mentoring support	Onsite residential session of one week with two days overlap for Batch B to develop co-mentoring qualities. Batch A receives fellowship.	Online session with Batch C as primary participant and batch B provides mentoring support	Onsite residential session of one week with two days overlap for Batch C to develop co-mentoring qualities. Batch B receives fellowship.

[Table/Fig-1]: Timeline of FAIMER program.

The positive and not so positive aspects may or may not lead to favourable mindset on the part of faculty to implement ECE. This topic was chosen since, the studies on ECE mainly focus on the students as stakeholders but hardly on the problems encountered or anticipated by the faculty, their concepts about ECE and its conduction.

The purpose of the discussion on ECE was to explore on ECE and convert the piece meal view into a bird's eye view, moving from 'known to unknown'.

The discussions were carried out from 1st february 2016 to 29th february 2016 in the FAIMER program.

The discussion was spread over four weeks and moderated by the authors.

Week 1: from 1st February 2016-7th February 2016

Week 2: from 8th February 2016-14th February 2016

Week 3: from 15th February 2016-21st February 2016

Week 4: from 22nd February 2016-29th February 2016.

The draft of the discussions was prepared by the first and second author who were the moderators . It was edited by third author, who also acted as our mentor. The faculties from FAIMER who were allotted for the month also guided regarding the draft and during the discussions.

Week 1st

Week first started with a prologue on ECE. Then the instructions were given regarding the framing of the objectives.

The questions in that week were from the 'remember and understand' level of cognitive process dimension of Revised Bloom's Taxonomy [Table/Fig-2].

Question three of [Table/Fig-2] from 'understand' was converted into a debate. The participants were divided into two groups. Group 1 was in for ECE. Group 2 was against ECE.

Level of Revised Bloom's Taxonomy	S.No	Objectives for the week
Remember	1.	Define ECE
	2.	Explain the objectives/rationale of ECE.
Understand	3.	State whether ECE is the need of the hour. Defend your answer with explanation.

[Table/Fig-2]: 'Remember' and 'Understand' levels of bloom's taxonomy and objectives for the week.
ECE: Early clinical exposure

Week 2nd

It was conducted as follows:

The questions in that section were from 'apply' and 'analyse', where they would formulate an ECE encounter, which would not only simplify the "How to do it", for the faculties in the pre-clinical phase, but also the faculties from clinical phases could render a helping hand to their fellow colleagues from the pre-clinical departments [Table/Fig-3].

[Table/Fig-3]: (*) we had 3 Groups: We needed to formulate mainly a blueprint of the encounter as many of the participants were from varied departments. We had to formulate as if we are incharge of conducting an ECE encounter in the best possible manner.

The points to be stressed were:

1. Overall goal.

Level of Revised Bloom's Taxonomy	S. No.	Questions for the week
Apply	1.	Use the principles of ECE to formulate an ECE encounter, given a chance to do so. (*)
Analyse	2.	Review the term 'Professional Socialisation'.

[Table/Fig-3]: 'Apply' and 'analyse' levels of bloom's taxonomy and objectives for the week.

- Objectives of the ECE encounter.
- Plan: (to include the meetings with the clinical departments, venue, students, what would be included etc).
- Plan to evaluate (if included in objectives) and feedback.

Group A: formulated an encounter in their respective disciplines which could be deemed as Early clinical exposure.

Group B: formulated an encounter in Anatomy subject.

Group C: formulated an encounter in Physiology subject

Group D: formulated an encounter in Biochemistry subject

The groups were formed in the manner that Group A included the participants from Dentistry, Ayurveda and Physiotherapy and group B included participants from Anatomy, Group C included participants from Physiology and Group D included participants from Biochemistry subject. Each group included eight participants.

Level of Revised Bloom's Taxonomy	S. No.	Questions for the week
Analyse (15 th -19 th Feb)	1.	Compare the case scenarios one to five given below and label the scenarios as to whether they can be termed as an ECE. Defend why it is an ECE or Why not.
Evaluate (20 th -21 st Feb)	2.	Rate your own case scenarios as being an ECE encounter or not.

[Table/Fig-4]: 'Analyse' and 'evaluate' levels of Bloom's Taxonomy and objectives for the week.

Week 3rd

It was planned as follows:

The questions of this week were from 'analyse' and 'evaluate' [Table/Fig-4].

Rate your own case scenarios as being an ECE encounter or not:

Case Scenario 1: Departments had been instructed to conduct ECE as a part of the routine sessions. Faculty from Department of Physiology prepared a powerpoint of a lecture on Growth hormone. She included a plain case scenario of a patient of acromegaly as a part of ECE.

Case Scenario 2: Department of Physiology consulted the medicine department and arranged for a visit of the first year students to medicine ward. The students were explained on some pre-decided patients, the symptoms and signs important at the level of first year.

Case Scenario 3: One of the departments in the pre-clinical phase as a part of ECE, made the students of first year as subjects for their fellow students. The students were given the assignment of measuring the blood pressure of their fellow students.

Case Scenario 4: Department of Physiology arranged for a patient of nephrotic syndrome and brought it to the classroom in a lecture which dealt with nephrotic syndrome as an applied aspect as a part of ECE.

Case Scenario 5: Department of Anatomy planned an ECE on inguinal canal for which they taught inguinal canal in lecture and then arranged photograph of patient of hernia and video of hernia repair operation while teaching inguinal canal.

Week 4th

It was planned as follows:

The highest level of taxonomy was reached i.e. create.

Here the questions were from 'create' level and a section of feedback [Table/Fig-5].

Feedback: (27th Feb-29th Feb).

Please provide your valuable feedback on these themes:

- Input: The framing of the objectives and questions.

Level of Revised Bloom's Taxonomy	S. No.	Questions for the week
Create (22 nd -26 th Feb)	1.	Generate your summary regarding ECE. (The word limit for summary is 500 words)

[Table/Fig-5]: 'create' level of Bloom's Taxonomy and objectives for the week.

- Process: The quality of discussions during the month.

- Output: The gain in the concept regarding the early clinical exposure.

The data gathered was analysed according to the number of responses for the week and the excerpts of the week.

RESULTS

In the study, there were 49, 34, 41 and 46 responses for week first, second, third and fourth respectively [Table/Fig-6].

Excerpts of the weeks first, second, third and fourth on the topic of ECE.

Week	Number of responses
Week 1	49
Week 2	34
Week 3	41
Week 4	46

[Table/Fig-6]: Number of responses for each week: 16 members of Batch 2015 and 16 members of batch 2014 participated in the discussion.

Week 1st

'Remember' and 'understand' levels of RBT.

The discussion in week first was focussed around defining ECE which emerged with the following:

- M C I Booklet, Vision 2015, hints to definition of ECE as "Acts/ Deeds/Steps that ensure well integrated knowledge of the basic sciences, clinical sciences and social functions especially doctor-patient interaction"[23].
- Early clinical exposure is a teaching learning methodology, which fosters exposure of the medical students to the patients as early as the first year of medical college [24].
- Early clinical exposure is defined as 'authentic human contact in a social or clinical context that enhances learning of health, illness and/or disease and the role of the health professional, occurring in the early or pre-clinical years of undergraduate education' [25].

In the level of 'understand', the excerpts from the debate are tabulated in [Table/Fig-7] as Group 1 for ECE and Group 2 against ECE as need of the hour.

Week 2nd

'Apply' and 'analyse' levels of RBT.

The participants were asked to formulate the encounters in order to explore the basic concepts and views regarding ECE. The encounters were formulated from Anatomy, Physiology, Biochemistry, Dentistry, Ayurved and Physiotherapy.

Week 3rd

'Analyse' and 'Evaluate' levels of Bloom's Taxonomy.

In week three, during the first half of the week, the responses started with the comparison and labelling of the case scenarios as ECE or not. One of the participants pointed out that it was a nice exercise as these scenarios are always in front of them during teaching and they wondered that were these a ECE or sending the students to the wards the only ECE.

Case first, case third were very well pointed out to be not ECE and case second, fourth, fifth were ECE encounters. The participants also added that if the case first included photographs and videos, then it could be called as ECE.

Group 1: For ECE as need of the hour	Group 2: Against ECE as need of the hour
'Due to lack of clinical exposure students are not able to correlate textual knowledge with its application. Early clinical exposure can give chance to apply knowledge into practice to students to perform what they learn.'	'ECE will reduce time to teach basic subjects, so students basic knowledge will be compromised'
'Clinical experience could be provided in the classroom with a real or simulated patient or using video recordings with consent of the patient'	'Feasibility of ECE is a issue with large number of participants'
'It allows me to put together the big picture about why I'm learning the basic sciences and how they will enable me to see what's really going on'.	'ECE requires coordination between faculty involved in teaching preclinical and clinical subjects'
'Early clinical exposure prepares students to cope up with anxiety as they move from preclinical to clinical years' [26,27]	'ECE would increase stress of the students'
ECE allows us to see and implement what we read theoretically.	'It is a time consuming exercise and needs proper planning with clear learning objectives'
"Once a medical student understands WHY he or she should learn something, the rest just falls into place. The student must feel that every single aspect of the preclinical subjects related to good patient care. The issue is really not about whether or not it is required- on this score there can be no doubt that it is. The problems are How to do it. There is no need to burden the clinicians-the pre-clinical teachers are all competent to bring basic clinical experience into the classroom"	'Mindset of the faculty needs to be prepared and they should be trained to conduct ECE'
'The WHY of learning has to be addressed first to make knowledge meaningful. Also only then will students understand that their goal is not just passing the exam but healing a real live person. I think once they truly understand this, ethical practice will naturally follow.'	

[Table/Fig-7]: Excerpts from the debate of week first, level of 'understand'.

Clarifications regarding case first and case third were also provided by the faculty, in which an article was quoted that "ECE involves an active, experiential learning from patients with practicing clinicians, designed to be the 'beginning of a lifetime of learning focussed on the patient'. Early clinical exposure programs are an increasingly widespread component of undergraduate medical education. There seems to be no "best" way to conduct ECE" [28].

It was said that the article describes case based lecture followed by hospital visits which is classically ECE. However, the concern raised was that with large number of students in a class, it may not be feasible to provide ECE in this way. So, a wider definition would include anything that provides a link of the condition being taught and a patient with a case scenario with photos, videos etc (if the students cannot be taken to the hospital or patient brought to the class) as long as it stimulates active learning and problem solving with clinical relevance.

In the second half of the week, the participants rated their case scenarios that they had prepared as ECE or not and they had to modify it to convert into an ECE encounter. The participants not only rated their encounters as ECE or not but also incorporated the modifications like inclusion of photographs and videos in a classroom setting and assessment plans. One of the participants also shared her views as how she advises and motivated her students during first year to observe the procedures and way of diagnosis at least for an hour or two in a week which not only gives a practical exposure but also gives them more confidence.

Week 4th

'Create' level of RBT.

The first half of week four started with the summaries of ECE by the participants. The summary included the meaning of ECE, the need of ECE, the settings of ECE like classroom, hospital and community; advantages which mentioned that with ECE it is easy for vertical integration of teaching, can create better medical graduate compared to 'paper graduate', instilling the qualities of a patient-centered humanistic physician and increasing motivation for classroom teaching.

It was also highlighted that during a time when students often spend long hours in the classroom, it serves to reminding students why they want to be physicians. ECE brought up the value of communication skills which would help students in 'knowing what they are doing' and feeling less useless in clinical settings and starting to act in a professional way. Assessment of ECE in which a list of tools were provided like feedback, reflections, logbook, MCQ's, viva etc were included.

One of the participants also formulated take home message which stated that a "Well-structured and pre-validated clinical scenarios

can serve the purpose of providing ECE to students".

It was suggested that every time exposure to patient (physical presence of patient) is not mandatory. Patient, multiple structured clinical scenarios, videos, photographs-rays, laboratory reports and other relevant clinical material can have synergistic effect and definitely it will enhance the learning behaviour of students. Either clinic comes to classroom or class room goes to clinic in both the way purpose of ECE can be said to be fulfilled.

One of the participants in her summary also mentioned about the challenges to provide clinical experiences to medical students without jeopardising their education in basic sciences.

It was mentioned that the curriculum are overloaded and each medical college has to find its own balance and way to implement ECE.

One of the views in summary was that ECE allows us to put together a big picture about why we are learning the basic sciences and how they will enable us to see what's really going on and that ECE is vital to the learning experience in many ways since learning about a clinical presentation from a book is one thing and actually seeing it in real life is totally different. One of the participants expressed that ECE is a great concept, but for it to materialise in reality one needs to work at various levels such as, a) sensitisation of students and faculty, b) Preparation of a formal

Input	<ul style="list-style-type: none"> 'Very well structured and presented in a stepwise manner to gradually build up the whole picture'. 'The objectives were nicely framed and served to gradually progress the discussion.' 'I found the objectives and questions pertinent and positive' 'The questions were structured well to meet the objectives. The case scenarios helped me to review the literature.' 'Questions well structured, well planned especially the case scenarios which forced the participants to think, analyse and reflect'
Process	<ul style="list-style-type: none"> 'Discussions were vibrant and helped clear many of my own concepts'. 'There was no repetition or copy/ paste in any of the response. Even the timely and intermittent summary provided by the moderators kept everybody alert.' 'ECE scenarios and comments on it was the best part in entire session' 'The activities were interesting and encouraged participation' 'Quality of discussions were high and quite satisfactory.'
Output	<ul style="list-style-type: none"> In output it was also expressed that not only does each ECE have to be properly planned and structured to get maximum benefits, the method of assessment should also be suitable for that exercise. 'I personally feel that some questions/topics which can initiate some sort of debate are very helpful for interactive discussion and to clarify our concepts. And the most important thing is it creates an interest also. ECE scenarios discussion can be one of the examples of it. It would be better to have these type of questions in subsequent ML web sessions also'

[Table/Fig-8]: Excerpts from the feedback in week fourth.

curriculum by experts, c) Training the faculty in the curriculum, d) Application of ECE, e) constant upgradation and improvement and if a step wise approach is followed, our goals could be achieved of quality medical education.

In the second half of the week four, the participants gave their valuable feedback.

Many of the responses started with the encouraging words like 'let me congratulate February ML web team for conducting wonderful and meaningful session on ECE'. The excerpts from the feedback segregated as input, process and output clearly reveals the satisfaction and interest that was generated and they stressed that throughout their discussion, there was no repetition of responses which can many a times occur in an e-learning discussion [Table/ Fig-8].

Week four sessions and the month of February ended with thanks to all participants, mentors and faculty for their participation and guidance.

DISCUSSION

It was stated by Kozma RB that instructional methods and media are in an integral relationship, technology being most useful for engagement of learning Bloom's taxonomy was reviewed and an updated categorisation system known as RBT was created which had advances in cognitive research and learning [29,15]. Revised Bloom's Taxonomy is presently a standard tool to describe, measure and classify learning objectives and academic standards in the cognitive domain resulting from instruction and widely used by educators [9,11]. In this group based asynchronous e-learning session of ECE, we planned to move from simple to complex i.e. understand their preliminary knowledge regarding ECE and then explore the dimensions of ECE through their participation using the RBT.

This was an attempt to channelise the discussion through formation of learning objectives using RBT. The discussion which was divided into four weeks, promoted ventilation of thoughts of the participants; they were made to think, learn, apply, analyse, evaluate the situation and create a particular situation which promoted active learning and interaction.

Bloom's taxonomy was also utilized by Ertmer PA et al., for student-content interaction in online courses, with Bloom's taxonomy for grading the questions and found that high level of student's responses were obtained with higher levels of Bloom's taxonomy [30]. A study by Timothy NT et al., proposed that Bloom's taxonomy can aid in examining the limitations and strengths of technology enhanced training [31]. These studies utilised Bloom's taxonomy. Revised Bloom's Taxonomy was utilised by Airasian PW and Helena M, by in relation to assessment [32]. Studies on RBT in online learning in medical education has not been documented yet.

The input, process and output of the online discussion of the month using RBT was appreciated by the participants. In a study by Noble T but in kindergarten to year six in elementary schools, there were positive feedbacks regarding the use of RBT [16]. This innovative approach of using RBT to move from 'known to unknown' aspects of ECE was also recommended by the participants to be included in the conduction of online discussions.

CONCLUSION

The various aspects regarding ECE were unfolded among participants through RBT in this group based asynchronous learning month. The participants appreciated the learning journey and also explored the means to provide ECE to students without hampering their education in basic sciences. The e-learning sessions conducted in this innovative manner helped the participants engage in the discussion and clarify concepts as evidenced by the feedback received.

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