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IMPLEMENTATION OF EARLY CLINICAL EXPOSURE AS A TEACHING-LEARNING TOOL TO TEACH CLINICAL ANATOMY TO PHASE 1 MBBS STUDENTS

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Abstract:
Background: Early clinical exposure (ECE) can bridge pre-clinical and clinical subjects and improve students' comprehension and perception of the subject by making it enjoyable. So, the primary objective of the present study was to assess the impact of ECE on the teaching-learning of phase 1 MBBS students.
Methods: The prospective interventional study was conducted among 1st year MBBS students (n= 180) at the Department of Anatomy, Government Medical College Srinagar, J&K, India. A pretest was conducted, after which ECE sessions comprising lectures, case presentations, hands-on and videos regarding the topic, and a post-test was conducted. The data obtained was analyzed quantitatively by t-test and qualitatively by thematic analysis.
Results: There was a significant difference in pre and post-tests ($p < 0.001$), showing a gain of cognitive knowledge. The mean and standard deviation of pre and post-tests for the sessions were nerve injuries (3.570, .762), fractures (3.133, 1.115), lumbar puncture (3.468, .644), and intramuscular injections (3.356, .658). The mean values ranged from 2.08 to 3.91. Variability in the data ranged from 1.033 to 1.546 (standard deviation) and 1.067 to 1.441 (variance). As per the feedback analysis, most of the students observed ECE helps to develop an interest in the medical profession (62.1%), change the negative attitude toward basic sciences (58.8%), develop communication skills (54.3%), and correlate clinical diseases with basic science subjects (62.1%).
Conclusion: The ECE program was introduced as an additional teaching approach to reinforce didactic instruction in Anatomy for Phase 1 medical students. The study demonstrated that students enjoyed the experience and perceived that it was valuable.

Keywords: Medical Comprehension, Feedback, Intramuscular injections, Lumbar Puncture, Communication, Perception

Introduction:

Anatomy is one of the basic science subjects in the Phase 1 MBBS course and is one of the most complex subjects. It is a subject for elementary medical education, so understanding it is crucial for professional development and good clinical practice. It is believed to play an essential role in expertise in clinical subjects. [1] The traditional teaching method through lectures and dissection leads to monotonous teaching, and ultimately, students lack interest in the subject. Implementing interactive, clinically oriented teaching methods enhances students' interest and helps them develop cognitive skills that help them in future clinical practice. The undergraduate medical program in India aims to create an "Indian Medical Graduate" (IMG) with the necessary knowledge, skills, attitudes, values, and responsiveness so that he can function effectively and efficiently as a first-time public health consultant. For that, IMG must work effectively, ethically, and efficiently as a clinician, leader, healthcare team member, communicator, lifelong learner, and professional. Establishing a solid association between pre-clinical information and its relevance with clinical practice is essential for students, as it helps them to know the practical value of the subject during their pre-clinical course and to utilize the knowledge more precisely in the future. [2] Early clinical exposure (ECE) can act as a bridge between pre-clinical and clinical subjects. Countries like Europe, Nepal, and Indonesia have already implemented the ECE curriculum in their medical courses. [3] In India, the Graduate Medical Education Regulation 2019, by the National Medical Commission of India, has recommended various facets of medical education, including ECE, Self-directed learning, integration, and family adoption by undergraduate medical students. [4] Early clinical exposure gives Phase 1 MBBS students an excellent chance to develop clinical skills and knowledge of anatomy. It also helps the students to develop and understand the doctor-patient relationship and provide feedback. Student feedback is valuable for improving and modifying the education system to understand the drawbacks and limitations of teaching-learning methods. Various studies have proved that ECE helps students better understand the concept of medical education compared to traditional teaching. [5,6] Problem-based learning is valuable for integrating pre-clinical, para-clinical, and clinical subjects. It is an innovative teaching method that solves difficulties faced by students during their transition from the pre-clinical to the clinical phase. It integrates all the subjects associated with the given problem and teaches them to conclude for the same problem. [7]The significance of anatomical knowledge in successfully diagnosing and managing patients cannot be overemphasized as “classroom education” frequently serves Phase 1 medical students perceive as if they are collecting data without knowing where to apply the knowledge. [1] It is perhaps even more important in developing nations than established countries for students to accept the need to prepare society and primary health-care settings untimely in their medical career. Preclinical exposure to general practice improves medical students’ communication skills and knowledge of patients’ perspectives as well as their understanding of patients as human beings and their recognition of the value of the doctor–patient relationship. [4,5] Applications of ECE are wide-ranging and reflect the important role that ECE plays in medical education. By providing students with the opportunity to engage with patients and observe clinical care early in their training, ECE can help to develop the clinical skills, professional attitudes, and patient-centered approach that are essential for success as a physician. [3] For generations, medical students have spent the preclinical years in classrooms and laboratories. In the traditional curricula of medical education, students learn theoretical knowledge without contact with the patient in a clinical context. Moreover, in clinical fields they cannot recall important basic science concepts; therefore, parts of their academic education become impractical. Traditionally, the foundation years of medical students have made them thorough in biomedical sciences but have hardly provided them with any clinical experience. [5] In the new Competency-Based Medical Education (CBME) curriculum, the ECE program was developed and introduced by the Medical Council of India in 2019, with the primary objective of preparing students for a lifetime of patient care. [4] This simple program allows patient interaction in a supervised setting- which will facilitate the students to learn from the patient's problems and their effects on health, family relationships, and professional activity. Therefore, The MBBS curriculum has been modified to introduce clinical exposure early. The time allotted for ECE

in Phase 1MBBS (as per GMR, 2019) is 90 hours, which has to be equally divided among three pre-clinical subjects, so the time available for each subject is 30 hours. It can be further divided as follows- Basic science correlation, Clinical skills, and Humanities merged with AETCOM. ECE can be assessed by formative and summative assessment. Medical education systems now emphasize early clinical exposure combined with horizontal and vertical integration. The objectives of Early Clinical Exposure for phase 1 MBBS students are to enable them to recognize the relevance of basic science in diagnosis, patient care, and treatment and to provide a context that will enhance basic science learning. The primary objective of the present study was to assess the impact of ECE on the teaching-learning of phase 1 MBBS students. The secondary objective was to determine students' perception of the utility of ECE for feasibility and acceptability.

Material and Methods

Study population: After obtaining ethical approval from the Institutional Ethical Committee vide IRBGMC/ANAT 352, Dated 20/10/2022, this prospective interventional study was carried out in the Department of Anatomy, Government Medical College Srinagar, Jammu and Kashmir, India. Convenience sampling method was used and students of phase 1 MBBS were selected for the present study. Informed written consent was obtained from the participating students (n= 180). *Questionnaire designing:* The subject experts prepared and validated questionnaires on the topics, consisting of close-ended questions (MCQs). For each session, the students were assessed by a pretest questionnaire consisting of ten questions, and the same questionnaire was used to assess them after the session. Feedback questionnaires were designed on the perception of students regarding the feasibility and acceptability of the ECE module. The questionnaire was validated by taking the opinion of experts of the Medical Education Unit (MEU) of the college.*Inclusion and exclusion criteria:* 180 willing phase 1 MBBS students of Government Medical College Srinagar were included in the study. Unwilling students and students from the previous batch (failed students) were excluded from the study.

ECE module implementation: The topics taught during ECE classes were Nerve injuries of the upper limb, Fractures of the upper limb, Lumber puncture, and Intramuscular injection. For nerve injuries to the upper limb, the session was conducted in collaboration with the Department of Neurology by case scenario, clinical history, clinical examination findings, and nerve conduction tests. For upper limb fractures, the faculty of Orthopedics collaborated to discuss various commonly involved fractures along with a discussion on X-ray analysis of fractures and their management. The session on Lumbar puncture was conducted as case-based learning, along with a demonstration of the lumbar puncture procedure on the cadaver. A skill lab visit was organized for the module on intramuscular injection. The students were first given a short lecture on the anatomical basis of intramuscular injections and then demonstrated the procedure on mannequins at various sites. It was followed by free hand training for students on manikins. All these sessions were clinically oriented sessions with hands-on training. Before each session, a pretest questionnaire was given through Google form, followed by ECE sessions comprising short lectures, case presentations, procedures, and videos regarding the topic. After each session, a post-test was conducted. At the end of the four sessions, all participating students were given a feedback questionnaire via Google form to assess the module's effectiveness. *Data analysis and statistics:* The collected data was entered into MS Excel 2016 sheet. SPSS 22 software was used to analyze and create visual data representations to determine whether the research hypothesis could be accepted or rejected. The pre-and post-test scores were added for all four sessions of ECE, and the average was calculated to determine the cumulative score. Student's paired t-test was used to compare pre-and post-test scores. A p-value of 0.05 or less was considered significant.

Student Feedback/Perception:

The students' feedback on the session was assessed using a validated questionnaire through Google survey forms (Google LLC., Mountain View, CA). The feedback questionnaire consisted of ten

statements on the Likert scale (Figure 1) and three open-ended questions. Feedback was obtained regarding various aspects of the session and analyzed quantitatively and qualitatively. The questionnaire was first tested for validity by taking Cronbach's alpha as a parameter. The value of Cronbach's alpha, a measure of the internal consistency of questionnaire items was 0.768. The quantitative data were entered in Microsoft Excel. It was then imported into IBM SPSS 22 for analysis. Central tendencies and distribution were analyzed appropriately. The quantitative data were analyzed using an independent samples *t*-test The mean and standard deviation are shown in Figure 1 and Tables 2 and 3. The perception of the students regarding ECE was qualitatively analyzed using thematic analysis. The goal of thematic analysis was to identify themes, that is, patterns in the data that are important or interesting, and use these themes to address the research questions. This reflects that the data have been summarized, organized, and analyzed through proper themes.

Result:

The collected data from the adopted scales were thoroughly looked for missing values or unanswered questions. The demographic analysis showed that 50% of respondents were females (70) and 50% of respondents were males. The ratio of males and females was the same thus giving the full representation of the population under study. The average age of the respondents was found to be 20.0 (SD ±0.749) years. All the students were from the phase I MBBS course, having uniform base knowledge as all the students had qualified for the uniform National Eligibility Cum Entrance Test (NEET). In the ECE module, students went through a pretest followed by ECE. Then, a post-test was conducted related to the topics taught (nerve injuries of upper limb, fractures of upper limb, lumbar puncture, intramuscular injections). There was a significant difference in pre and post-test, as shown in Table 1 ($p < 0.001$).

Table 1: Paired Samples Test of pre- and post-exposure test scores

				95% Confidence Interval		
		Mean	Std. Deviation	Lower	Upper	P
Pair 1	Pre-test marks (10) - Post-test marks (10)	-3.570	.762	-3.692	-3.447	<0.001
Pair 2	Pre-test marks (10) - Post-test marks (10)	-3.133	1.115	-3.303	-2.962	<0.001
Pair 3	Pre-test marks (10) - Post-test marks (10)	-3.468	.644	-3.565	-3.371	<0.001
Pair 4	Pre-test Marks (10) - Post-test Marks (10)	-3.356	.658	-3.462	-3.249	<0.001

Pair 1: nerve injuries; Pair 2: fractures; Pair 3: lumbar puncture; Pair 4: intramuscular injections

It is clear from the table that there was a significant improvement in cognitive gain of the students in all four sessions: nerve injuries of the upper limb, fractures of the upper limb, lumbar puncture, and intramuscular injections subject ($p < 0.001$)

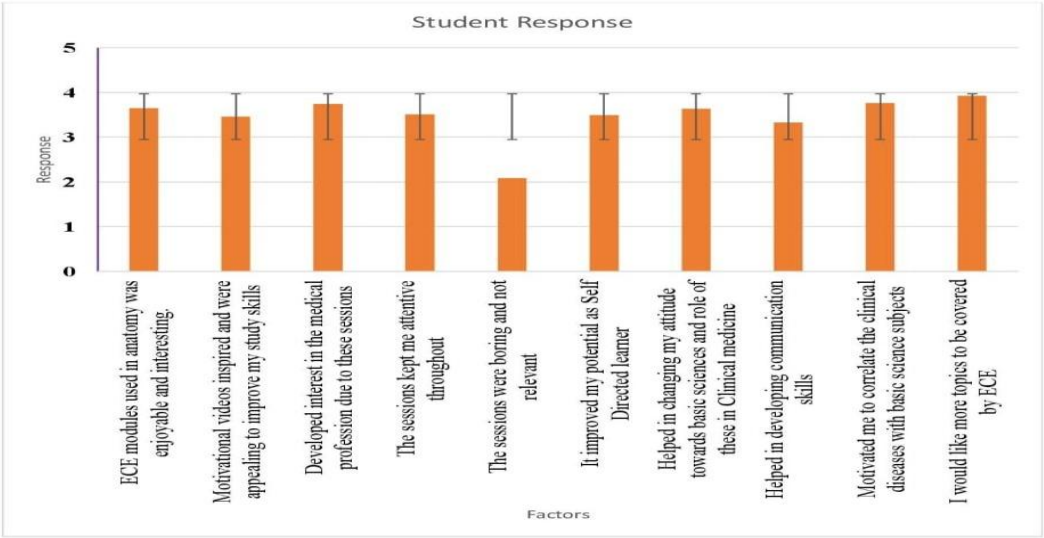

Figure 1: Histogram showing the response of students to the feedback questionnaire regarding ECE in Anatomy. (1 = strongly agree; 2 = agree; 3 = neither agree nor disagree; 4 = disagree; 5 = strongly disagree).

The students were asked to give feedback regarding the feasibility and suitability of ECE. The questionnaire consisted of ten statements based on the Likert scale (1= Strongly Agree, 2= Agree, 3= Neutral, 4= Disagree, and 5= Strongly disagree) and three open-ended questions. It was found that most students strongly agreed that the ECE module was enjoyable and interesting (Table 1 and Figure 1). The videos, case presentations, and clinical procedures used during sessions improved their conception for a better understanding of the subject. Most of the students expressed their desire that ECE should cover more topics.

Table 2: Students response to ECE on Likert scale

S No:	Statements:	SA (%)	A (%)	N (%)	DA (%)	SDA (%)
1.	ECE modules used in anatomy were enjoyable and interesting	21.3	37.7	28.3	7.5	4.4
2.	Motivational videos inspired and were appealing to improve my study skills	20.7	27.0	37.1	5	9.4
3.	Developed an interest in the medical profession due to these sessions	30.1	32	23.2	8.8	5.0
4.	The sessions kept me attentive throughout	21.5	32.2	28.4	12	5.6
5.	The sessions were boring and not relevant	3.7	8.8	15.7	36.4	35.8
6.	It improved my potential as a directed learner	20.2	32.2	29.7	12.6	5
7.	Helped in changing my attitude towards basic sciences and the role of these in Clinical medicine	21.5	37.3	28.4	8.8	3.7
8.	Helped in developing communication skills	24	30.3	25.9	12.6	11.3
9.	It motivated me to correlate clinical diseases with basic science subjects	30.1	32.0	25.7	8.1	3.7
10.	I would like more topics to be covered by ECE	42.4	24.6	21.5	4.4	6.2

(SA- Strongly Agree, A- Agree, N- Neutral, DA- Disagree, SDA- Strongly Disagree)

Table 3: Statistical analysis of student response to ECE on the Likert scale

		V2	V3	V4	V5	V6	V7	V8	V9	V10	V11
N	Valid	171	161	161	161	161	161	161	161	161	161
	Missing	2	12	12	12	12	12	12	12	12	12
Mean		3.63	3.44	3.73	3.49	2.08	3.48	3.62	3.31	3.75	3.91
Std. Deviation		1.033	1.169	1.143	1.138	1.095	1.111	1.048	1.243	1.100	1.200

As is evident in Table 3, the mean values range from approximately 2.08 to 3.91. This provides an idea of the central tendency of the data, suggesting the typical value for early clinic exposure may differ across these variables. The median values range from 2.00 to 4.00. The median is less affected by extreme values, providing an alternative measure of central tendency. Variability in the data ranges from 1.033 to 1.546 (standard deviation) and 1.067 to 1.441 (variance). Variables with higher standard deviations and variances are more dispersed, indicating a wider range of responses.

Qualitative analysis of data

One of the objectives of the present study was to qualitatively explore the perception of medical students' engagement toward ECE using thematic analysis. Three open-ended questions were asked in the feedback questionnaire- A: What did you like about ECE sessions? B: What did you not like about ECE sessions? And Any suggestions for improving the teaching through ECE. The responses to these open-ended questions were varied and analyzed qualitatively, and the following themes were elucidated:

a. **Knowledge and clinical orientation:** The majority of the students reported that ECE increased their interest in the subject and motivated them to read more. They also felt that ECE enhanced their understanding of Anatomy, enabled them to remember the subject better, contributed to their knowledge of the subject and also helped them to integrate their knowledge with the clinical subjects.

b. **Coordination and cooperation:** Participants reported understanding the importance of teamwork in teaching-learning which helped them in gaining knowledge and getting clinical exposure.
c. **Integration:** Many students reported that ECE helped them to integrate Anatomy with the clinical subjects, thus developing interest in the learning of Anatomy
d. **Active learning strategies:** Students reported incorporating active learning strategies in ECE can engage students and enhance their understanding and retention of knowledge. These strategies can include small group discussions, case-based learning, problem-solving exercises, and hands-on activities that simulate real clinical scenarios
e. **Information overload:** Some students reported that in ECE sessions, students may feel overwhelmed by the information they need to learn and apply in a clinical setting which may lead to feelings of inadequacy and frustration.
f. **Time management:** Students also reported balancing the demands of clinical exposure with other academic responsibilities can be challenging for students. They may struggle to prioritize tasks, manage their time effectively, and meet deadlines, leading to stress and frustration.

Discussion:

The challenge for health professions education is to look for ways to improve the quality of clinical education by comparing students' understanding and modifying the practices of clinical education in new circumstances. [(9)] Early clinical experience will play an important role in this context. Early clinical exposure is a teaching-learning methodology that fosters exposure of medical students to clinical aspects as early as phase 1 medical education via classroom, hospital, or community settings. The objective of ECE is to enable the first professional medical students to recognize the relevance of basic science subjects in diagnosing and treating disease and patient care. It generates interest in the learner and dispels monotony. Furthermore, the students learn professional behavior, ethics, communication skills, and the correct attitude needed for an appropriate doctor-patient relationship. It will help the student correlate basic science with clinical science and understand socioeconomic and cultural factors involved in the delivery of health care through the study of humanities and social sciences. ECE is a form of vertical integration between pre-clinical subjects and clinical subjects that helps to develop professional behavior in students.

ECE acts as a platform for phase 1 MBBS students to experience clinical exposure in their early years of teaching. It is a useful method for a basic science subject like Anatomy if it is introduced with other traditional teaching methods. [(8)] Students usually lose interest in Anatomy lectures, but if the lecture format is innovative like discussing case presentations related to Anatomy, will make students develop an interest in Anatomy. [(9)] A similar observation was observed by Kar (2017), [(9)] while teaching neuroanatomy to students using the ECE module. Another study done by Gune et al (2020) [(10)] observed that implementing the ECE module significantly helped phase 1 students to comprehend the topic better. The finding of our study was also in accordance with the study conducted by Vyas et al (2008) [(11)] and Sathishkumar et al (2007) [(12)] where feedback was taken on a 5-point Likert scale and 96.4 % of students gave a positive response for ECE. Another similar study was done by Ravekar et al (2016) [(13)] where 1st-year MBBS students were exposed to ECE as an adjunct teaching method and students were evaluated by OSCE (Objectively Structured Clinical Examination) and they concluded that there was a significant difference in pre and post-OSCE and 66 % of students rated ECE as an excellent tool. Another study used a videography-based early clinical exposure, conducted among MBBS 1st year students, in which pre and post-tests were taken after demonstrating common clinical cases. A positive impact in the form of an increase in knowledge was seen in the students due to better comprehension and correlation of the subject. [(14, 15)] Another study done by Duara et al (2020) [(16)] also concluded early clinical-diagnostic exposure has a significant impact on acquiring knowledge and skills by students. 90% of students expressed positively that Early Clinico Diagnostic (Radiological) Exposure increases their interest in the subject. Another study done by Nitin et al. (2022) [(17)] concluded that the CBME curriculum is highly promising and assures that this curriculum enables UG students to gain better knowledge, skill ethics, values, and attitude to work as competent

and skillful healthcare professionals. Chinmay Shah [18] concluded that ECE is a useful method for basic science subjects if it is implemented along with other traditional teaching ways. ECE helps to make better understanding and problem-solving skills and the students get a feeling of being in a medical profession. It is a better learning method than traditional teaching alone. A pilot study on problem-based learning was done by Chandramouli et al [19] where they divided the students into two groups, one group was taught by the traditional method and another group was taught by problem-based learning. They concluded that problem-based learning group students scored higher marks in the post-session evaluation and were more satisfied with the teaching method as compared to the traditional group of students. A study done by Kumar [20] on first-year MBBS students during the pandemic found that students recognized the ECE session as helpful and videos related to clinical cases were useful and helped them in making the topic interesting and also motivated them to read the topic. So, from all these studies we can say that imparting ECE modules in basic science subjects is proving effective among Phase 1 MBBS students, as theoretical classes alone on such topics often lead to disinterest among students.

What students liked most about the ECE session were patient-entered teaching, inter-professional collaboration, self-reflection and personal growth, and clinical skills development. What students did not like about ECE sessions was information overload, lack of confidence, time management, lack of practical application, limited patient diversity, and inadequate feedback and assessment. Any suggestion for improving the teaching through ECE, students mentioned: preparatory materials, clear learning objectives, active learning strategies, regular debriefing sessions, and simulation-based training

Limitation:

The study's sample size was limited to Phase 1 MBBS students and results could have been more objective-oriented with larger samples. In the present study, only the cognitive domain was tested. To test psychomotor and affective domains, multiple ECE modules over longer periods have to be studied. Faculty engaged in conducting ECE was not surveyed in this study. This could affect the input that could have been found from their perspective.

Conclusion:

The rapid growth in the health care system in the present time has led to corresponding changes in medical education. Early clinical exposure was introduced as a teaching-learning intervention in Anatomy for phase 1 medical students. The study demonstrated that students enjoyed the experience and perceived it as valuable. The ECE program is an alternative approach to reinforce didactic instruction in Anatomical sciences. ECE is a new and rewarding trend in medical education in India. This approach can be applied to other basic science subjects as well. ECE helps students to clear conceptualization, critical thinking, and correlate anatomical basis in clinical cases. The topics taught during ECE sessions are better perceived, understood, retained, and later practically applicable. Retention of knowledge is more because of the integration of basic and clinical sciences. It also helps in the development of attitude and professionalism. Teachers' commitment to their roles with adequate preparation, and the contribution of the curriculum in providing the learning objective and cases for each session will be the factors that will facilitate effective implementation of ECE. Heavy workload and poor orientation about the program could impede ECE implementation and have to be taken care of. Implementation of ECE can be improved better by addressing the identified critical factors that hinder ECE implementation. Future studies should ascertain improved attainment of clinical learning outcomes in an ECE curriculum using a quasi-experimental study design.

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Conflict of Interest Statement
The authors declare, "We have no conflict of interest to declare."

Ethical statement
Our article titled, “Implementation of Early Clinical Exposure as a teaching-learning tool to Teach Clinical Anatomy to Phase 1 MBBS Students,” has been prepared taking into consideration all issues in ethics in publication. The project was cleared by the Institutional Review Board vide communication: IRBGMC/ANAT 352, Dated 20/10/2022.

Author Contributions Statement
1. NK: Project administration, Supervision, Writing an original draft.
2. UR: Project administration, Validation
3. IHB: Project administration, Statistical analysis
4. GMB: Conceptualization, Methodology design
5. ANS: Review & editing of the document

All authors have critically reviewed and approved the final draft and are responsible for the content and similarity index of the manuscript.

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