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Original Article

Education Section

# Multiple Case Scenarios Based Integrated Teaching among First Year Medical Students- A Cross-sectional Study

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**Introduction:** Integrated teaching helps the students to understand the concepts well and conceptualise the subject well. Clinical cases introduced in the first year are interesting and stimulative for the student but may overwhelm and confuse the student.

**Aim:** To know the perception and acceptance of integrated teaching among the first year MBBS students which include multiple case scenarios.

**Materials and Methods:** This educational research is a cross-sectional observational study involving first year medical students in Ramaiah Medical College, Bangalore. Study was conducted for a period of one year (August 2018 to June 2019). Horizontal integration of a system in the first year MBBS subjects were done. This was followed by an interactive session conducted by a Clinician basically comprising of multiple case scenarios on the particular system. The sessions focussed on integration of basic medical science subjects and their application in the case scenarios. Six organ-systems were similarly covered. The integrated sessions involved in-class discussions of the clinical cases and were designed, implemented and moderated by two faculties (clinicians and basic science faculty). Collected data were entered into MS Excel, and analysis was done using SPSS software. The students' feedback regarding the perception of integrated teaching was collected on the Five point likerts scale using a validated questionnaire and analysed.

**Results:** The number of students included in the study was 140. About 135 (96.4%) of the students felt that integrated teaching using multiple case scenarios motivates them to learn in a better way. About 133 (95%) of students felt that integrated teaching helps them to understand concepts well, stimulates the critical thinking. About 136 (97.14%) of students felt that integrated teaching helped them to understand the topic in a holistic way.

**Conclusion:** The students felt that the integrated teaching using multiple case scenarios enhanced their perception and comprehension of the diseases and helped them to understand the relevance of application of pre-clinical knowledge in clinical practise.

**Keywords:** Comprehensive learning, Critical thinking, Reasoning skills, Students' perception

## INTRODUCTION

The need to improve the quality of medical education is ongoing, as, good quality medical education is always a boon to the society. The first year of medical education is the most vital part in the career of a medical graduate [1]. Knowledge gained in the first year of medical education forms a strong foundation for the future of the students. Students first learn basic and biomedical sciences and then move to clinical sciences. A major drawback of this approach is that students may not see the relevance of basic and biomedical sciences applied to clinical practice. The undergraduate medical curriculum is vast, and students are expected to learn many subjects at the same time. This could lead to knowledge being imparted in a disjointed manner and could curb the pupils' ability to develop the skills to investigate, analyse and prepare to perceive the patient as a whole [1]. A fusion of knowledge from different disciplines, in a holistic manner would be most valuable. The teaching of undergraduate medical students is generally conducted in different academic departments, without integration of concepts [2]. In order to achieve comprehensive teaching learning experience, intellectuals, academicians and teachers have proposed a new progressive concept in medical education- Integrated teaching. Integration is defined as organisation of the subject in a holistic manner without any compartments created between different departments [3]. Traditional teaching always focussed on imparting the principles of medicine, but these principles are now modified with presenting an integrated approach with focus on reasoning skills, clinical application and communication skills and other related competencies [4].

The importance and clinical applications of basic concepts which are taught in the first year of medical college are often forgotten by the time the student reaches the final year. These concepts are extremely important for the proper perception of the disease process, disease prevention and treatment. Often students feel disconnected with the basic concepts which are taught in first and second year of medical college. Students forget the basic concepts and start focussing on learning super-speciality subjects without the strong foundation of basic concepts. Would it not be pertinent, therefore, to encourage students to think as doctors from the day they enter medical college [4]. Hence, the authors conceptualised that early integration from the first year medical curriculum can bring more aspects of clinical learning and make understanding the basic sciences more interesting. Greater scientific advances, greater expectations from students, increased demand from patients and public for quality medical care have resulted in a change in the objectives and pattern of medical education. The incorporation of early integration in the medical curriculum will help to shift from fragmented learning perspectives to more effective and meaningful amalgamation [5]. There are two types of integrated teaching: Horizontal integration where the subjects of the same academic year are integrated and vertical integration- where subjects of the different academic years are integrated. In many medical universities, vertical integrated teaching is often started in the second year of the medical curriculum [5]. In this article, the authors would like share their experience of conducting multiple case scenarios based integration in a medical college for first year medical students, two years before the current Competency Based Medical Education (CBME) curriculum came into practice. The objective of this study was to understand the perception and acceptance of the case scenario based integrated teaching among students of the first year medical students.

## MATERIALS AND METHODS

This was a cross-sectional observational study conducted in Ramaiah Medical College, Bangalore from August 2018 to June 2019. Ethical clearance was obtained from institutional Ethics Committee (MSRMC/EC/AP-04/11-2020). All the procedures were in accordance with the ethical standards of this committee and with the Helsinki Declaration of 1975 that was revised in 2013 [6]. The process of incorporating integrated teaching into the medical curriculum of first year MBBS was started off by forming a curriculum committee comprising the Principal and Dean of Ramaiah Medical College, the heads of the three pre-clinical departments (Anatomy, Physiology and Biochemistry) and the medical education unit. In order to assess the effectiveness of an integrated approach to the medical curriculum, it was decided to adopt a two pronged approach, horizontal as well as vertical integration. All the first year MBBS students (150) were included in the study. Students who remained absent for two classes were excluded. The curriculum committee met on several occasions to organise and schedule topics for integration in the first year subjects Anatomy, Physiology and Biochemistry. The teaching schedule was drafted such that a particular organ system would be covered in all the three pre-clinical subjects during the span of one month. For example: anatomy of liver, physiology of liver function tests and biochemical analysis of liver function tests were all conducted during the same month. A concerted effort was made in making lectures more interactive in all the three subjects. All the three basic (Anatomy, Physiology and Biochemistry) concepts of a particular organ system were taught during the same time frame. The mode of delivery of these classes was didactic lecture. After this, a clinician with expertise in that particular subject was invited to present multiple case scenarios in order to make the students aware about the importance of understanding the basic concepts (Anatomy, Physiology and Biochemistry) of the organ system in clinical practice. The clinician would explain to them the importance of knowing the anatomical landmarks, physiological aspects and the underlying biochemical processes which help in diagnosing and treating the illness. The clinician also focussed on eliciting the physiological basis of symptoms and signs of the disease of a particular organ. The abnormalities in the laboratory tests were taught with the biochemical/metabolic basis, so that the concepts which were learned earlier were reinforced. A few days after each session, the students were divided into groups each having 10-15 students. Each group was asked to make charts, concept maps, presentations or write-ups about the particular topic and the same was displayed in the museum in the medical college for about two weeks. This served not only to add completeness to the session but to also reinforce the concepts discussed and bring forth the creativity of the students. Six such sessions were conducted in one year on various organ systems which have been listed in the [Table/Fig-1]. Each of these classes were conducted as an interactive didactic lecture. These classes had multiple case scenarios which had applied importance of basic science concepts. These scenarios were made by clinicians and were validated by the senior faculty of Medical Education Committee. The duration of each session was around 90 minutes. The case scenarios, learning objectives are summarised in the [Table/Fig-2].

After the conclusion of the sessions, at the end of the academic year, feedback was collected the last day by using a questionnaire and source of questionnaire was Vashe A et al., [7]. This questionnaire was developed to evaluate students perception to the integrated teaching process. It was validated by the experts in medical education. Internal consistency was calculated using Cronbach's alpha which was found to be 0.929 for this questionnaire) It consisted of a five point likerts scale (strongly agree=5, agree=4, neutral=3, disagree=2, strongly disagree=1). Mean score of each of the parameter was calculated by total cumulative score divided by the number of students. The feedback was collected by distributing the hard copy of the questionnaire to all the students. Open ended questions about the positive and negative aspects and the student's suggestions were asked to improve the integrated teaching. These questions were "What was your experience regarding Integrated teaching? How can we improve the sessions of integrated teaching?". The open-ended questions and the student's response were analysed by two senior members of Medical education committee. The ethical committee did not deem it essential to take individual informed consent from the students. However, students were briefed about the study, and verbal consent was taken and the permission was taken from them and the head of the institution.

## STATISTICAL ANALYSIS

Collected data were entered into MS Excel, and analysis was done using SPSS software. Descriptive statistics of the student feedback was analysed in terms of mean and standard deviation. The average scores of the response to the questions were calculated by adding the total cumulative score divided by total number of students. The percentages of the individual responses in the Likerts scale were calculated. The analysis was carried out using SPSS Inc. released 2009. PASW Statistics for Windows version 18.0, Chicago.

## RESULTS

Out of 150 students, 10 students had remained absent for more than 2 classes, hence were excluded from the study. Total of 140 were included in the study that gave the feedback. A total of 88 (62.86%) were male and 52 (37.14%) were female. Mean age of the students was 19.5 years (SD-2.5). A total of 135 (96.43%) of the students felt that integrated teaching using multiple case scenarios motivated them to learn in a better way and 132 (94.3%) of students felt that integrated teaching helps them to understand concepts well, stimulates the critical thinking [Table/Fig-3]. Students

| Sl. No. | Basic science classes | Integrated classes with clinical correlation conducted by clinician |
|---|---|---|
| Neurology | Anatomy of Brain, Areas of Brain, Tracts, Internal capsule, Hypothalamus, cerebellum, Neurotransmitters. | Neurological symptoms and signs with special correlation with anatomical areas. Localisation with the neurological condition. Biochemical basis of Parkinsons and role of other neurotransmitters |
| Liver | Anatomy of Liver, porto-caval anatomosis, liver functions and biochemical aspects of Liver function tests | Symptoms and signs of Liver cell failure, anatomical areas of porto-systemic anastomosis, brief summary of diseases of Liver with the patho- physiology. Interpretation of Liver function tests. Some common case scenarios |
| Kidney | Anatomy of Kidney, functions of kidney, physiology of glomerular filtration and urine concentration, urine analysis, renal function tests. | Brief summary of renal diseases, symptoms and signs of kidney diseases. Interpretation of Renal function tests, urine analysis, Common case scenarios. |
| Heart | Embryology and Anatomy of Heart, cardiac cycle, electrophysiology of heart, cardiac biomarkers. | Brief summary of cardiac diseases, symptoms of cardiac disease with underlying pathophysiology, cardiac sounds and murmurs correlating with cardiac cycle. Applied importance of cardiac biomarkers. |
| Lungs | Anatomy, surface markings of lungs and pleura, physiology of ventilation, arterial blood gas analysis. | Symptoms and signs of respiratory diseases, interpretation of Pulmonary function tests, respiratory failure, common respiratory diseases with case scenarios. |
| Thyroid | Anatomy of Thyroid gland, physiology of thyroid hormone synthesis and functions, thyroid function tests. | Symptoms and signs of hypothyroidism and hyperthyroidism along with the reasoning, Interpretation of thyroid function tests. Important anatomical landmarks for thyroid surgeries. |

**[Table/Fig-1]:** Topics for multiple case scenario based integrated teaching.

| Organ system | (Case scenario) | Discussion |
|---|---|---|
| Renal system | A 60-year-old male presented to the hospital with history of swelling of lower limbs since 6 months, facial puffiness since 4 months. He also complained of fatigue and generalised pruritis. He was a known diabetic since 25 years. He was initially compliant with his medications, but since past 6 years he was irregular with his anti-diabetics and his diet. His daughter told that he was very irregular with his doctor visits. There was no history of chest pain, palpitations. Pulse rate was -90/minute<br>Blood pressure- 180/100 mm Hg. Serum Urea- 50 mg/dL<br>Serum creatinine- 2.5 mg/dL<br>Serum sodium- 128 mmol/dL<br>Serum potassium- 5.9 mmol/dL<br>Serum calcium- 6.9 mg/dL<br>Serum phosphorous- 5.8 mmol/dL<br>• Haemoglobin- 8.5 grams/dL<br>• Urine routine<br>Albumin- ++<br>RBC- Nil<br>WBC- 2-3/high power fields<br>Broad waxy casts | 1. Pathophysiology of individual symptoms mentioned in the case.<br>2. Relevance of the long standing hypertension and diabetes.<br>3. Relevance of treatment history.<br>4. Interpretation of the biochemical reports.<br>5. Physiology of chronic kidney disease. |
| Renal system | A 25-year-old male presented to the hospital with history of loose stools which was watery in consistency, 20 times and vomiting 10-15 times in 2 day. On examination he looked dehydrated. Pulse rate-120/min, Blood pressure-80/60 mmHg, He also complained of reduced urine output since 1 day. Serum urea-70 mg/dL<br>Serum creatinine- 2.1 mg /dL<br>Urine routine-<br>Albumin- +<br>RBC- 4-5/HPF<br>Leucocytes- 1-2/HPF ABG<br>PH- 7.2<br>HCO3- 16 mmol/dL<br>Po2- 78 mmol/dL<br>Pco2- 35 mmol/dL | 1. Interpretation of symptoms.<br>2. Interpretation of the vital signs.<br>3. Definition of Acute Kidney Injury and criteria for diagnosis. |
| Renal system | A 16-year-old boy presented with history of passing cola-coloured urine since 3 days, facial puffiness since 3 days. He had suffered from sore throat, cough and cold 1 month back for which he had taken some medications over the counter from medical store. On examination his Blood pressure was found to be 150/90 mmHg. Urine routine<br>RBC- 40-50/HPF<br>WBC- 10-20/HPF<br>Albumin- ++<br>RBC casts present<br>Serum urea- 60 mg/dL<br>Serum creatinine- 2.0 mg/dL | 1. Interpretation of symptoms.<br>2. Relevance of past history.<br>3. Interpretation of the urinary findings.<br>4. Definition of Glomerulonephritis. |
| Renal system | An 18-year-old lady presented with h/o facial puffiness since 1 week, swelling of lower limbs and abdomen since 1 week. She also complained of passing frothy urine. On examination there was generalised swelling of the body, her blood pressure was 110/80 mmHg.<br>Urine routine-<br>Albumin- +++<br>RBC- 1-2<br>WBC- 1-2<br>24 hour Albumin excretion- 4 grams/24 hours<br>Urinary Albumin creatinine ratio >200<br>Serum urea- 28 mg/dL<br>Serum creatinine- 1.1 mg/dL<br>Serum cholesterol- 210 mg/dL.<br>Serum triglycerides- 430 mg/dL.<br>Serum low density lipoproteins- 200 mg/dL.<br>Serum high density lipoproteins- 30 mg/dL.<br>Serum VLDL- 80 mg/dL.<br>Serum albumin- 1.2 mg/dL | 1. Pathophysiology of symptoms.<br>2. Interpretation of the urinary findings.<br>3. Interpretation of Biochemical reports.<br>4. Definition of Nephrotic syndrome. |
| Neurology | A 50-year-old male presented with sudden onset of weakness of right upper limb and lower limb. There was slurring of speech. He was known diabetic and hypertensive and not on regular treatment. On examination, the power of limbs on right side was 0/5, hypotonia and plantar reflex was extensor. | 1. Describe the anatomical basis of the symptoms.<br>2. Describe the physiology of Upper Motor Neurons (UMN) and Lower Motor Neurons (LMN) lesions.<br>3. Describe physiology and applied importance of plantar reflex.<br>4. Explain applied importance of blood supply of brain. |
| Cardiovascular system | A 40-year-old male presented with breathlessness on exertion since 6 months, swelling of lower limbs since 4 months, palpitations since 2 months. On examination Jugular venous pulse was raised, bilateral pitting pedal edema was present. There were crepitations in bilateral lower lung fields. | 1. Describe the physiological bases of the symptoms.<br>2. Explain the physiology of selling of lower limbs.<br>3. Explain the clinical features of Cardiac failure.<br>4. Anatomical basis and importance of Jugular venous pulse. |
| Endocrinology (Thyroid) | A 24-year-old female presented with history of fatigue since 6 months. She complained of excessive sleep, constipation and weight gain. On examination pulse rate was 56/minute. Blood pressure was 120/90 mm Hg. There was bilateral non pitting pedal oedema. There was diffuse enlargement of thyroid. | 1. Describe the physiological basis of the symptoms in the case.<br>2. Enumerate the symptoms and signs of hypothyroidism.<br>3. Describe the applied anatomy of thyroid gland.<br>4. Describe the physiology of the vital parameters in this case. |

**[Table/Fig-2]:** The table contains the case scenarios used in the integrated teaching sessions on Nephrology, Cardiology, Thyroid and Neurology.

commented that integrated teaching classes helped them to understand the concepts well. The case scenarios helped them to understand real life situations and helped them to understand the importance of basic science subjects. Following are some of the comments from students.

"Integrated classes have actually been really interesting. Helps me understand a lot of the clinical aspects in more detail and in retrospect the entire topic itself became a lot clearer".

"The experience of having integrated classes has been extremely fruitful And an interesting journey. It helped us connect the dots, understand topics in depth and encouraged us to think like a clinician which is really exciting knowing that we will have the responsibility and opportunity to do the same in the near future."

"It has given me the opportunity to learn more than what is in the textbook assigned to us for that year and when the clinician talks about the cases they handle it inspires me and gives me an idea of

| Parameters | Average score (Cumulative score/ Number of students) | Strongly agree and agree | Neutral | Strongly disagree and disagree |
|---|---|---|---|---|
| Motivated me to learn the topic | 4.2 | 135 (96.43%) | 3 (2.14%) | 2 (1.43%) |
| Improved the understanding of the topic. | 4.0 | 132 (94.3%) | 5 (3.6%) | 3 (2.1%) |
| Helped to gain an in-depth knowledge about the topic | 4.1 | 134 (95.71%) | 4 (2.86%) | 2 (1.43%) |
| Stimulated my interest in the topic | 4.0 | 132 (94.3%) | 5 (3.6%) | 3 (2.1%) |
| Stimulated my critical thinking about the topic | 4.1 | 133 (95%) | 4 (2.86%) | 3 (2.14%) |
| Helped to enhance my reasoning skills | 4.3 | 136 (97.14%) | 2 (1.43%) | 2 (1.43%) |
| Helped me perceive the topic better, in a real life situation | 4.1 | 133 (95%) | 3 (2.14%) | 4 (2.86%) |
| Helped me to give much attention to the topic | 4.3 | 136 (97.14%) | 2 (1.43%) | 2 (1.43%) |
| I hope will help me to prepare better for exams. | 3.6 | 120 (85.7%) | 12 (8.6%) | 8 (5.7%) |
| Helped me to understand the interrelations among the basic science subjects. | 4.1 | 134 (95.71%) | 4 (2.86%) | 2 (1.43%) |
| Helped me relate basic science subjects in clinical contexts in a better way | 4.0 | 134 (95.71%) | 2 (1.43%) | 4 (2.86%) |
| It helped me to appreciate the importance of basic science subjects in clinical practice. | 4.0 | 132 (94.3%) | 6 (4.28%) | 2 (1.42%) |
| It helped me to learn the topic as a whole and get a holistic view of the topic. | 4.5 | 137 (97.86%) | 1 (0.71%) | 2 (1.43%) |
| Discussion by the clinician helped me to understand the topic better | 4.0 | 134 (95.71%) | 4 (2.86%) | 2 (1.43%) |

**[Table/Fig-3]:** Perception of students regarding Integrated teaching on likerts scale.

what to expect in the near future. Therefore, I am really happy that due to the new syllabus there is more focus on such aspects which will surely help me gain competence."

The students felt that the most positive aspect of integrated teaching was that it enhanced their perception and comprehension of the diseases and helped them to understand the relevance of application of pre-clinical knowledge in clinical practise. The drawback or negative aspects which were stated were that the sessions were lengthy and time consuming and that this cut down the time for the self-study.

The other methods of teaching that were suggested by the students included group discussions, seminars and concept maps for better learning. The students suggested that integrated teaching should be conducted more often, by including more topics. The students were enthusiastic about the idea of extending the integrated teaching to all the important topics. The results of the summative assessment/final exam conducted by the university for the first MBBS batch 2018-2019 was commendable with 65 students securing a distinction as against 41 distinctions in the previous batch and pass percentage of 91.2% as against 85% pass percentage of the previous batch. This to a large extent can be attributed to the integrated teaching approach using multiple case based scenarios that was adopted.

## DISCUSSION

The importance and clinical applications of basic concepts which are taught in the first year of medical college are often forgotten by the time the student reaches the final year. These concepts are extremely important for the proper perception of the disease process, prevention and treatment. Often students feel disconnected with the basic concepts which are taught in first and second year of medical college. There are many studies done in the past which demonstrates the effectiveness of integrated teaching. Few studies have used case scenarios as a means for integrating concepts [1,3]. In the present study, 132 (94.3%) of the students felt that integrated teaching stimulated their interest [Table/Fig-3]. The findings of our study were similar to the study conducted by Jumkar A et al., in which the students perceived the Case Based Learning (CBL) method to be an interesting learning activity which resulted in better clinical reasoning skills, increased their critical thinking and motivated them to learn and understand the concepts well. Students also indicated that CBL motivated them to do self-learning and improved their attitude towards medical education. Faculty found the method to be time-intensive, but noted that students appeared to have more active involvement in patient management [1]. Waliany S et al., developed a curriculum that promoted prospective case-based discussions and avoided hindsight bias by having a blinded discussant and blinded group of students work through real case in the sequence encountered by the treating doctor. They framed this course with intermediate-sized groups of students. They found significant improvements in self-assessed understanding of the subject and clinical reasoning [8].

In this study, 137 (97.86%) of students felt that integrated teaching helped them to learn the topic as a whole and get the holistic view of the topic [Table/Fig-3]. These findings were concordant with a study conducted by Bowe CM et al., which showed that case based teaching represents a practical and feasible format to stimulate comprehensive thinking and to integrate basic science concepts during the preclinical education [3].

It was observed in this study that, 134 (95.71%) of students opined that case scenario based integrated teaching helps to improve the understanding of the topic in depth [Table/Fig-3]. Similar findings were observed in a study conducted by Muthukumar T et al., in a medical college in Tamil Nadu, showed that the feedback obtained from students regarding integrated teaching was positive. On comparing the pre- and post-test scores, there was statistically significant increase in the knowledge gained in the topics conducted by integrated teaching method. 56.7% (38) students felt that integrated teaching was very good and 25.4% (17) of students felt that the session as excellent [9].

According to the study conducted by Vashe A et al., it was seen that students gave positive feedback regarding integrated teaching. There were significant higher scores for self-directed learning, inter-relations among subjects and in comprehensive understanding of the subject. The students were very happy with the study method and learning experience [7]. Similar findings were seen in our study, 134(95.7%) of students felt that integrated teaching helps them to perceive the concept as a real life experience and importance of understanding basic subjects.

According to a study done by Gustavo A et al., curriculum reform in medical education is both difficult and challenging. They felt that the need to consider and understand the issues emerging from the revision may help the students to succeed in the new curriculum practice [10].

Integrated teaching for first year curriculum has its own challenges. As stated by Newble D et al., "A Integrated model of curriculum development has evolved which is relatively simple in concept and is easily understood by students and teachers. They felt that, integrated curriculum should be simple and can be applied in the difficult practical problems. The study also stated that, students must accept it and should have relevance to the medical curriculum.

It should have a realistic and acceptable way of defining a core curriculum" [11]. Hence, we need to have a practical approach which will make integrated teaching a good experience for students.

### Limitation(s)

The objective assessment of the students regarding the understanding of the topics covered by integrated teaching compared to traditional teaching could not be conducted as benefit of integrated case based teaching with concept maps were given to complete class. Due to time constraints we could not evaluate individual student. Sample size of the study was small.

## CONCLUSION(S)

The integrated teaching using case scenarios in the first year of Medical curriculum is very impactful. Horizontal and vertical integration in the first year of the curriculum will help the students to understand the concepts in a better way. Majority of the students felt that integrated teaching using multiple case scenarios promotes comprehensive learning, critical thinking and helps them to understand the concepts of basic science subjects in a better way. Our experience with integrated teaching is probably at the fledgling stage and has to be fine tuned before it fully takes off. Yet, the experience has taught us that it is possible to adopt integrated teaching under a conventional curriculum in spite of all the challenges.

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