

Medical Education

An effective integrated learning programme in the first year of the medical course

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ABSTRACT

Background. An integrated approach to teaching medical subjects is an effective educational strategy. Yet, this has not become popular in medical colleges in India. We describe an integrated learning programme to teach the gastrointestinal system in the first year of the medical course.

Methods. The integrated learning programme was conducted for 3 years (2003–2005). It incorporated elements of problem-based learning, early clinical exposure, lectures and small group laboratory work. Student assessment was formative (for problem-based learning sessions) and summative (using problem-based learning and knowledge tests). Evaluation of the programme was based on feedback from the students and faculty members.

Results. Ninety-six per cent of the students obtained more than 60% marks in the problem-based learning test. The mean (SD) score in the knowledge test was 62(0.89)%. The majority of students received satisfactory and more than satisfactory grades for their performance in the problem-based learning sessions. The feedback from faculty members and students was positive, which highlighted benefits such as integrated learning of the basic sciences, their application to clinical cases and active student learning. The challenges encountered included the higher input required from faculty members. Most of the faculty members and students recommended that the integrated programme should be continued and extended to other parts of the curriculum.

Conclusion. An integrated learning programme is feasible within a conventional medical curriculum of an Indian medical college.

Natl Med J India 2008;21:21–6

INTRODUCTION

An integrated approach to the teaching of topics in a course is well accepted as an effective educational strategy.^{1–3} Its introduction in the medical course has been advocated by the General Professional Education of the Physician's report,² the General Medical Council of the UK⁴ and the Medical Council of India.⁵

Problem-based learning (PBL) has been acknowledged as a

method that enhances integration of learning, self-directed learning and provides relevance and context to the subject. It is also used to prepare students for professional life as physicians.⁶ The use of PBL has been reported from several medical colleges.^{6–8} To overcome some of the shortcomings of a purely PBL curriculum, some schools such as the University of Otago Medical School, New Zealand, have used a hybrid system in their preclinical curriculum.⁹ A hybrid system incorporates elements of conventional curricula, such as lectures and tutorials, in a problem-based curriculum.⁹

To integrate teaching of preclinical subjects at Christian Medical College, Vellore, India, we decided to introduce a hybrid integrated learning programme (ILP) in the first year of the MB,BS course. Our hypothesis was that the ILP would not only provide horizontal and vertical integration of teaching of the preclinical subjects, but would also provide students opportunities to actively participate in the learning process, introduce them to skills for self-directed learning and group interactions and, at the same time, help them prepare adequately for their university examinations. The programme used newer educational methods within a conventional curriculum.

We describe the design, implementation and evaluation of the ILP introduced for first year MB,BS students at our institution.

METHODS

The ILP was introduced in 2003 and continued, with modifications, in 2004 and 2005. MB,BS students at our institution start their course in the month of July or August. The programme was implemented in the month of October/November, about 3 months after the course started. The duration of the intervention was 3 weeks in each year and the area chosen was the gastrointestinal system. Until 2003, the departments of Anatomy, Physiology and Biochemistry used to follow their respective schedules to teach the gastrointestinal system. These schedules consisted of lectures and sessions of laboratory work. For the ILP, these departments made a common 3-week time-table for the gastrointestinal system. It consisted of a module incorporating the following components: PBL, lectures, small group laboratory work and clinical visits. The participants consisted of 60 students each year. The faculty members who took part were drawn from the departments of Anatomy, Physiology, Biochemistry, General Medicine, General Surgery, Gastroenterology and Radiology. The programme was approved by the Medical Education Cell of our institution.

Preliminary preparatory work

Representatives from these departments formed the core group involved in the ILP. This core group set the objectives for the

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programme and prepared the case scenarios for PBL sessions. A typical PBL case was a paper-based clinical case, with cues and learning objectives focused on the basic sciences. A guide for facilitators was also compiled for each case. The faculty members of the participating departments underwent training in facilitating PBL sessions.

An orientation session was held for students to familiarize them with the concept of PBL. They watched a mock session of PBL in which faculty members participated. The students were then divided into small groups to participate in a practice PBL session. Trained faculty members facilitated these practice sessions.

Design of the ILP

The duration of the ILP was 3 weeks. A schedule for the entire programme was made. A typical weekly schedule is shown in Table I. Attendance by students at each of the sessions was marked and tabulated. The ILP had 4 components which are explained below.

1. Problem-based learning (PBL)

For these sessions, the students were divided into small groups of 6–8 students. The discussions in each group were facilitated by a trained member of the faculty. For the first batch of students, 3 PBL cases were used. Each case consisted of 3 sessions of discussion and 3 periods of self-study. The topics used for the PBL cases were:

1. Upper gastrointestinal tract: A case of peptic ulcer
2. Lower gastrointestinal tract: A case of malabsorption
3. Hepatobiliary system: A case of obstructive jaundice

The cases were coordinated in time with relevant lectures, anatomy dissection sessions and clinical visits each week.

The feedback from students and faculty members suggested that it was difficult to discuss 3 cases in 3 weeks; thus, the number of PBL cases was reduced to 2 in the second and third years of the programme. Each PBL case followed the following format:

Session 1. Students, in small groups of 6–8, met with the trained facilitators at predetermined venues and times. The students were given copies of the first part of a case. They nominated a chairperson and a scribe from among themselves. The chairperson moderated the discussion during the session and the scribe took notes of the discussion points on a flip chart provided to each group. The students read the case and went through the first 5 steps of the Maastricht 7 jump process described by Wood.¹⁰ The facilitator ensured that the discussions did not digress from the relevant learning objectives. At the end of the session the group depicted a concept map of the case under discussion on the flip chart and evolved a consensus on the learning objectives to be

pursued. All the learning objectives were given to all the students. However, each student in the group took responsibility for one or more specific learning objectives. The group then broke up and went through step 6 of the Maastricht 7 jump process.¹⁰ Periods of study time were provided in their schedule. This time was used for accessing resources to acquire information to meet their learning objectives.

Session 2. The group came together again, a day or two later, with the same trained facilitator. They chose a new chairperson and scribe. They shared the information they had gathered during the study time. Once they had done this comprehensively, they were given the next part of the case. The group then proceeded as described under session 1.

Session 3. A day or two later, the group came together again and proceeded as described for session 2. At the end of this discussion, students were given the third part of the case. They proceeded as for sessions 1 and 2. However, no time schedule was set for a formal meeting of the group to discuss the information acquired with reference to the last part of the case. The option of further discussions outside of the scheduled hours was left to the students.

At the end of session 3, the facilitator assessed each student's participation in the sessions. The group did a self-assessment of their performance and that of the facilitator, using a similar scale.

2. Integrated lectures

Lectures related to Physiology and Biochemistry consisted of

1. Case-based lectures (for example, a case of pancreatitis was used to discuss the physiology of pancreatic secretions),
2. Overview lectures (such as an overview on secretions in the gastrointestinal tract), and
3. Enrichment lectures (such as one on the historical evolution of knowledge concerning peptic ulcers).

These lectures were taken by participating faculty members of basic sciences and clinical departments. Integration of the content of lectures was achieved mainly between physiology and biochemistry. Anatomy lectures and laboratory work continued as in the regular curriculum but the topics were re-arranged to coincide with the PBL cases. The decision to retain the conventional anatomy curriculum in the new programme was taken because of concerns, by the faculty members of the Department of Anatomy, that students might perform poorly in university examinations if the format of teaching was changed too radically.

3. Clinical visits

The students were divided into 6 groups of 10 each. Each group visited clinical wards to see patients in medicine and surgery, and

TABLE I. Typical weekly schedule for the integrated learning programme

| Time | Monday | Tuesday | Wednesday | Thursday | Friday | Saturday |
|-----------|------------------------|--------------------|------------------------|--|------------------------|--|
| 0800–0830 | Problem-based learning | Anatomy lecture | Bible class | Anatomy lecture | Problem-based learning | Biochemistry practical/clinical visits |
| 0830–0900 | | Lecture | Problem-based learning | Lecture | | |
| 0900–1000 | | | | | | |
| 1000–1030 | Anatomy dissection | Anatomy dissection | | Anatomy dissection | Anatomy dissection | |
| 1030–1130 | | | Anatomy dissection | | | Lecture |
| 1130–1230 | | | | | | |
| 1230–1400 | Break | | | | | |
| 1400–1500 | Histology practical | Self-study | Self-study | Biochemistry practical/clinical visits | Self-study | Free |
| 1500–1600 | | | | | | |
| 1600–1700 | | | | | | Summary session |

also visited the departments of radiology and gastroenterology. These included:

1. *General medicine.* Patients with diseases of the gastrointestinal tract such as gastrointestinal bleeding, malignancy and cirrhosis of the liver.
2. *General surgery.* Preoperative and postoperative patients with cholecystitis, appendicitis and colonic malignancies.
3. *Gastroenterology.* Students watched gastroscopies being performed by senior gastroenterologists.
4. *Radiology.* Students were shown images of barium meals, ultrasonograms and computerized tomography (CT) images of the gastrointestinal tract by radiologists, who emphasized the anatomical correlations in health and disease.

4. Small group laboratory work

These sessions consisted of anatomy dissection and practical exercises in histology and biochemistry. The topics for anatomy dissection and histology were scheduled to coincide with the PBL cases. The practical exercises in biochemistry related to investigations for assessment of liver function.

Assessment of performance and skills acquired

1. Assessment of performance of students and facilitators in PBL sessions. At the end of each PBL case, facilitators scored the students' performance during the discussions, based on the criteria described in the PBL handbook.¹¹ The students were assessed on their skills of critical appraisal (whether the student was able to clarify, define and analyse the problem, was able to generate and test a hypothesis and was able to identify learning objectives), self-directed learning (whether the student utilized relevant resource materials, applied previous knowledge to current problems, demonstrated initiative and curiosity, was organized and prepared for small group sessions), group participation (whether the student participated constructively and contributed to group processes, demonstrated commitment and responsibility for group process, was able to provide and accept constructive feedback and contributed to group harmony), humanistic attitude and skills (whether the student was aware of personal strengths and limitations, integrated physical, biological and behavioural components of each problem, listened to conflicting opinions, tolerated shortcomings of fellow students). The facilitator made an overall assessment based on the above points. The scoring was done on a qualitative scale. It was assumed that all students were 'satisfactory' (S) at the start of the session. If they performed well, they were graded S+ and if their performance was below average, they were awarded an S-. Each student was given his/her copy of the facilitator's report. The report was confidential and there was no public discussion of individual performances.

Similarly, students assessed their own performance during the discussions, at the end of each PBL case, using similar criteria. Students also assessed the facilitator on his/her ability to facilitate, using the same 3-point grading scale.

2. Assessment of self-directed learning skills (the content and the process)—the PBL test. This was done over 3 days at the end of the 3-week period. It was a modification of the triple jump test.¹² A paper case was designed by the core group (see Box for an example). The case was given to the students on day 1 of the assessment. They were given an hour to work individually. They had to study the case, identify the important cues in the case, explain briefly the possible basis of the patient's signs and symptoms and make a list of the essential learning objectives to

resolve the problem. These analyses were submitted at the end of this session. The students were then given 24 hours to read up about the case and prepare and submit a 1-page written report, explaining the deranged anatomy, physiology and biochemistry in the hypothetical patient under discussion. They were required to provide a list of relevant references at the end of their report. The analysis and report were assessed by one of the facilitators. A viva voce was conducted for each student on day 3 by the same facilitator. The viva voce assessed the students' understanding of the pathophysiology of the case under discussion and his/her ability to learn through a PBL format. A structured scoring pattern was used to assess the students' analyses, reports and performances in the viva voce and was meticulously followed by the facilitators. The facilitators had discussed the scoring pattern before the PBL test. Model answers were compiled and provided to them. Any discrepancies were dealt with before the commencement of the PBL test. The students were informed of the scheme for assessment before they took the PBL test.

3. Assessment of knowledge (the content). This test was designed to assess whether the ILP had been effective in helping students acquire adequate knowledge in anatomy, physiology and biochemistry of the gastrointestinal system. The test was based on the pattern of a typical university examination. It consisted of 1 essay question, 3 short notes and 20 multiple choice questions from anatomy, physiology and biochemistry with equal distribution of marks for all 3 subjects.

Programme evaluation

A questionnaire was developed for students to evaluate various aspects of the programme. This was administered to them at the end of the 3-week period of the ILP. The students also did a self-assessment of their study habits during the period of the ILP. Similarly, the faculty members, who had participated in the ILP, also evaluated various aspects of the programme at the end of 3 weeks.

The average marks obtained by each student in the class tests in the 3 subjects (anatomy, physiology and biochemistry), before the start of the ILP, were compared with their scores in the ILP knowledge test to compare their performance level before and after the introduction of this programme.

Statistical analysis

Comparison of the average marks obtained by each student in the class tests in the 3 subjects, before the start of the ILP, with their

Example of a case given to the students during the problem-based learning test

Ramnath, a 40-year-old labourer, is an alcoholic. He presented to the emergency services with severe right upper abdominal pain and vomiting of a few hours' duration. The pain radiated to the back and was relieved on sitting up and leaning forward. On examination, he was found to have tenderness and guarding of the abdomen. No palpable mass was felt. Bowel sounds were decreased. He was admitted in the ward and kept nil per orally. He was given intravenous fluids. A nasogastric tube was inserted and the secretions drained out. He was given intravenous analgesics and proton pump inhibitors.

scores in the ILP knowledge test was done by a paired *t*-test and the data were analysed using SPSS (version 11).

Semi-quantitative data analysis was done using a 5-point Likert scale where 1 was poor, 2 less than satisfactory, 3 satisfactory, 4 good and 5 excellent. The scores on the Likert scale were expressed as frequency distributions.

Analysis of qualitative data from faculty members and student feedback questionnaires was done using a grounded theory approach to identify themes. The constant comparative method was used to identify themes and coding categories.^{13,14} Data were independently analysed by 3 faculty members. The themes that emerged were coded and comments assigned to the codes. Units of analysis were the comments, words and phrases that appeared in the feedback questionnaires. Inductive content analysis was done and all the comments were assigned to the themes identified. After discussion of the criteria for assignment of codes to text, recoding and reassigning comments to the themes, a 100% agreement was achieved.

Data obtained on the performance of students in PBL sessions were analysed using chi-square test to compare data over 3 years.

RESULTS

The data presented are cumulative over the 3 years of the ILP. The mean (SD) students' attendance for the period of the ILP was 96.1 (4.91)%, while for the period before the start of the ILP was 95.3 (4.47)%. The majority of students (95.6%) obtained more than 60% marks in the PBL test. The mean (SD) score of students in the knowledge test on the gastrointestinal system was 62.04 (0.89)%. The assessment of students' overall performances by the facilitators in the PBL sessions is shown in Table II. All the facilitators were rated S or S+ by the students. All the groups of students rated themselves S or S+ in their self-assessment.

The mean score of students in the knowledge test on the gastrointestinal system conducted at the end of the ILP was significantly higher than the mean score of class tests done by these students before the ILP (Fig. 1).

Feedback from faculty members

The themes that emerged in the qualitative analysis were:

Benefits of the ILP. The faculty members stated that ILP enhanced 'group participation' among the students and 'cooperation among the staff of the departments of basic sciences'. They commented that it provided 'motivation, interest and responsibility' in the students to learn on their own. The ILP also encouraged the students to 'think and reason'. They felt that the programme brought about 'good integration' of the basic medical sciences and helped the students to 'apply' their knowledge in understanding clinical problems. Faculty members also commented that they were 'able to observe individual students and assess their strengths and weaknesses'. They perceived that 'all students were capable of self-learning' and that even 'quiet students can be made

to participate' in a group discussion.

Challenges posed by the ILP. The faculty members commented that some students read only the learning objectives allotted to them and neglected the other learning objectives in a PBL session. Sometimes, the students gathered a lot of non-specific information, since the 'must know' facts and important points were not specified. Absenteeism at some sessions also posed a problem, since a particular topic allotted to a student who was absent was not discussed adequately. It was also their opinion that conducting an ILP required input from a large number of faculty members.

Suggestions for improvement. These included making attendance compulsory for the students and that all students should 'learn all learning objectives'. More topics should be covered as 'integrated lectures'. Facilitators should play a more active part in guiding the students towards the learning objectives, so that students do not go off-track into irrelevant areas. Another opinion voiced was that detailed facilitator guides be made available to the facilitators, who were from different disciplines, so that all groups would attain uniform standards in their discussions.

Overall rating of the ILP. The majority of faculty members rated the ILP as good/excellent or satisfactory and thought this was a useful learning experience and should be extended to other parts of the curriculum.

Feedback from students

Benefits of the ILP. Students felt that the ILP enhanced student learning, produced positive group dynamics and helped them apply concepts in the basic medical sciences to understand clinical disease.

Challenges faced in the ILP. Some students commented that too much emphasis was placed on clinical aspects. They did not know how much information to gather and how to limit their searches. It was felt that some students read only the learning objectives assigned to them and hence did not learn enough of the rest of the topic.

Suggestions for improvement. These included suggestions that there should be more emphasis on aspects of basic sciences during the case discussions and clinical visits during the ILP. Integration of more topics in the teaching conducted by the preclinical departments concerned was also suggested. The students were enthusiastic about the idea of extending the ILP to the teaching of

TABLE II. Faculty assessment of students' overall performance in problem-based learning (PBL) sessions

| Grade | Percentage of students who obtained each score | | |
|------------------------|--|-------|-------|
| | 2003* | 2004† | 2005† |
| More than satisfactory | 41.9 | 36.7 | 50.4 |
| Satisfactory | 47.0 | 49.0 | 40.2 |
| Less than satisfactory | 11.1 | 14.3 | 9.4 |

* average of combined results of 3 PBL cases † average of combined results of 2 PBL cases

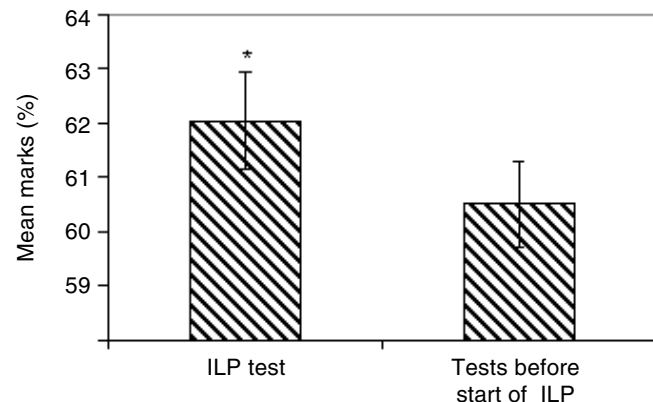


FIG 1. Average marks obtained by students in the integrated learning programme (ILP) knowledge test and in tests before the start of the ILP. Data are means (SD). Data were analysed by paired student's *t*-test. * $p < 0.05$

TABLE III. Scores for different components of the integrated learning programme

| Component | Likert scores (expressed as frequency distributions) | | | |
|---------------------------------|--|----------------------------------|---------------------|-----------------------------|
| | Poor (1) | Less than satisfactory (2) | Satisfactory (3) | Good/ excellent (4/5) |
| Problem-based learning sessions | 1.7 | 3.4 | 24.6 | 70.3 |
| Clinical visits | 0.0 | 0.6 | 9.3 | 90.1 |
| Lectures | 1.8 | 5.8 | 33.3 | 59.0 |
| Small group laboratory work | 3.5 | 5.2 | 21.7 | 69.5 |

other systems as well.

Assessment of study habits. Students made several observations regarding the effect of the ILP on their study habits—77% of them said that they spent more time in self-study after a PBL session than after a didactic lecture; 91% of them said that they accessed a greater variety of study resources after PBL sessions than after a lecture. Nearly all of them (93%) discussed the subject more with others than after a didactic lecture and 85% of students felt that it improved their self-study skills.

Overall rating of ILP by students. The majority of the students rated the ILP as good or excellent on a 5-point Likert scale and thought that the ILP was a useful learning experience, should be continued for future students and extended to other parts of the curriculum (Table III).

DISCUSSION

This preclinical educational innovation was successful in achieving its goal of teaching first-year students the gastrointestinal system, using an approach that integrated all the 3 preclinical subjects. It was sustainable over a 3-year period. The faculty members assessed that the performance of the majority of students was satisfactory and above for learning in a PBL-based format. It also helped students develop self-learning skills. These skills are not attainable using a didactic lecture format. Almost all the students said that their self-learning skills had improved following PBL sessions. Similar experiences have been cited by others.^{6,15} Obtaining feedback data from different sources in the questionnaire used shows triangulation¹⁶ and validates the findings of the programme evaluation.

Active learning was facilitated by the opportunity for students to work in small groups during PBL sessions and during anatomy dissection. Careful organization of schedules allowed the students an opportunity to correlate material learnt during PBL sessions with that experienced in the laboratory or wards. In addition, the lectures helped to bridge the gaps in knowledge and provided relevance and insight into the subject.

We also found that exposure of students to clinical material in the first year of the course greatly improved the levels of interest and understanding generated in the students. This can be summarized in the students' comment 'we remember what we see'. Other studies have also documented this observation.^{17,18}

Overall, the attendance of students during the ILP was found to be very good. The figures were far higher than the mandatory level of 75% for each student set by the university. However, there were a few instances of absenteeism, for which a major extracurricular student activity was cited as a reason. Prior discussion with students may help prevent this.

The results of the ILP 'knowledge test', which was designed

to assess the students' performance in a test set in the pattern of a conventional university examination, showed that the students had acquired adequate knowledge of the system under study.

The reports of facilitators on the students showed that there was remarkably good participation by the students in the group discussions. This was evidenced by more than 80% of them being graded S or S+. This indicates that, if introduced to the PBL process and adequately trained for it, students who have just graduated from high school are capable of performing well in group-learning activities. We found that the performance of students in the ILP over the years was consistent. We also found it easy to identify those students who were under-performing. This is important as early identification of poor performers and institution of remedial measures can help students cope better with the medical course. In addition, students showed adequate understanding of the pathophysiology of the cases under discussion and adequate learning through a PBL format, as shown by their performances both in the PBL test and their marks in the knowledge test. We observed that students had a significantly higher score in the knowledge test in the ILP than they had in the tests conducted in all the 3 subjects before the start of the programme. This suggests that ILP, a hybrid curriculum, could enable students to perform better in examinations, a finding that is not reported to be achieved by PBL alone. It highlights the advantage of a hybrid approach that achieves the dual benefits of PBL and improved performance in conventional university examinations. This has been an encouraging finding of our programme. However, this observation needs to be confirmed with continuation of the ILP for future batches of students.

We felt that the enthusiasm, hard work and integrated effort by the faculty members who participated in the programme were extremely important for the success of this intervention.

In conclusion, the ILP described above achieved the stated goals of integration, active student participation as well as acquisition of adequate knowledge in the subjects concerned. The programme was rated highly by both the students and faculty members, contributing to its feasibility and sustainability over a 3-year period. This programme has now become a regular feature of the basic sciences curriculum at Christian Medical College, Vellore and it is hoped that the lesson learned here will inspire similar innovations in this and other institutions across India.

ACKNOWLEDGEMENTS

We acknowledge the following for their contribution to our study:

- Foundation for Advancement of International Medical Education and Research (FAIMER), Philadelphia, USA for their support and guidance.
- Dr Anand Zachariah for help and guidance in formulating the programme
- Drs J. Prakasa Rao, B. S. Ramakrishna and Ashis Mukhopadhyay for being part of the core groups that prepared the cases for the PBL sessions
- All facilitators who participated in the programme
- Staff of the preclinical departments and Curriculum Office, Christian Medical College, Vellore, India, for help with conducting the programmes.

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