Perceptions of year 1 MBBS students about A novel teaching-learning activity in biochemistry through picture cast learning (PCL)

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Abstract

Background: Innovation in the teaching of medical undergraduates, which would help improve their attention span and make them independent learners, is always encouraged and recommended.

Objective: The current study was designed to assess the perceptions of year 1 MBBS students regarding a novel teaching-learning method of learning biochemistry through a team-based active learning strategy called picture cast learning (PCL). The activity was executed to understand student willingness to participate in innovative learning, and to obtain their perceptions about this specific intervention.

Materials and methods: Mineral metabolism was chosen for PCL activity and was notified to students two weeks before the picture presentation session. Students (n=154) of first-year MBBS were randomly divided into four teams on the presentation day to put up an innovative pictorial representation on their classroom blackboard. The four subtopics on ‘Minerals’ namely, sources, requirements, functions, and deficiency disorders were chosen, based on the learning objectives designed for it in the curriculum and prepared by the teams for picture cast, which was done in the presence of the subject teacher who validated their presentations. E-feedback was collected from students using a structured questionnaire with closed-ended questions and a 5 point Likert scale.

Results: Students opined that PCL made them think innovatively to summarize mineral metabolism (76%). The majority of them liked the team effort involved in PCL (72%). They felt it was ideal for rousing their enthusiasm for dreary topics in biochemistry (78%). They acknowledged the role of the teacher as a facilitator (60%).

Conclusion: PCL can be used as an effective team-based active learning strategy to enhance enthusiasm towards learning biochemistry among undergraduate medical students.

Keywords: Biochemistry; minerals, questionnaire, problem-based learning, feedback, medical students

Introduction

Learning approaches are highly variable and have a direct bearing on the academic success of students.[1] Reports indicate that every model of learning has its strengths and weaknesses. [2,3] Several studies have shown that first-year medical students prefer multimodality and that students with multimodality learning preferences have improved academic performance in both dental and medical education.[1,4-8] Traditional lectures as a method for teaching in a medical school is slowly losing its charm, as today’s students are engulfed on the internet with easily accessible information at their fingertips. Hence,
the teacher is no longer desired as an information fetcher. This is challenging a teacher to devise methods to keep the students’ interest engaged inside a classroom. The medical education scenario in India though currently dominated by traditional didactic lectures is undergoing a trend of path-breaking teaching innovations at a reasonable pace. There is an intense intent to keep students highly motivated and enthusiastic in the process of their own learning.

Visual perception is a highly developed phenomenon in the process of learning. Learning pre-clinical subjects like anatomy through pictures and drawings is vital and is a well-established modality in medical schools. Concepts in biochemistry like metabolic pathways have been assumed by students to be dry and tedious topics. Visualizing these concepts of molecular phenomena is difficult for year 1 MBBS students, and hence biochemistry learning becomes challenging. With this context, the author deployed a learning activity called Picture Cast Learning (PCL) to make students learn biochemistry through pictures. The activity was designed to elicit students’ potential to present vast information as a concise and conceptualized summary through innovative drawings. A literature survey reveals extensive data on the advantages of team-based learning among medical undergraduates. Learning as a team incites interest, motivates students to give their best, and kindles the competitive edge to win and prove themselves the best team. Hence the current activity of PCL wrapped in the essence of team-based learning to enhance its strength further. Picture cast learning (PCL) in biochemistry remains unexplored and relatively uncommon to date. With the hope of creating an environment to foster mastery of biochemistry concepts, the author devised this strategy to etch biochemistry concepts in the minds of students through picture casts.

Certain topics in biochemistry are challenging to memorize and appear somewhat dull and boring for students. Hence, the study was planned to make students learn biochemistry through drawings and explore their readiness for team-based learning. The current study was designed to affect an innovative learning activity in biochemistry for year 1 MBBS students. The study was planned to make students learn biochemistry through drawings and explore their readiness for team-based learning and analyze the feedback and understand students’ perceptions about the implemented innovative teaching/learning activity.

Materials and Methods

The undergraduate MBBS course at Melaka Manipal Medical College, a constituent unit of one of the eminent private universities in India (Manipal Academy of Higher Education), is a five-year course of ten semesters conducted in the twin campuses of India and Malaysia. The MBBS program is recognized by the Malaysian Medical Council and the Srilankan Medical Council. The first five semesters of pre-, para-clinical subjects and an introductory clinical exposure are conducted in the Manipal Campus in India, followed by the next five semesters of clinical training in the Melaka Campus of Malaysia. Biochemistry is taught in a temporal integration model with Physiology and Anatomy with a system-wise approach in semesters one and two of the year 1 MBBS course. Student ethnicity includes Malay, Chinese, and Indian from Malaysia and Sinhalese and Tamil from Srilanka. This cross-sectional study was conducted on year 1 MBBS students (n=154) who were undergoing pre-clinical training in the subjects of anatomy, physiology, and biochemistry. Students who volunteered to participate in PCL were selected for the study. Faculty in our college are strongly encouraged by the management to carry out teaching innovations, and in this regard, Institutional Research Committee permission was granted for this study.

The PCL activity

The topic of ‘mineral metabolism’, a semester-2 learning objective, was chosen for PCL. The current topic has ample facts that emphasize rote learning. However, the significance of this topic in medicine is high, and hence it was decided to deliver the learning through a student-centered team-based picture cast learning activity. The topic was notified to students two weeks before the session for independent learning. The students were kept unaware of the team based PCL activity as a forthcoming presentation session prior to that time.

On the day of the presentation, students were randomly divided into four teams by their teacher based on their roll numbers to put up an innovative pictorial representation of mineral metabolism on their classroom blackboard. Each team comprised a maximum of 39 students. The four subtopics of this ‘minerals’ topic, namely sources, requirements, functions, and deficiency disorders, were chosen as per their learning objectives designed in the curriculum. All teams received the topics randomly assigned by the teacher and were given 30 minutes for discussion and preparation for picture representation. The respective teams brainstormed their topics to summarize in pictures relating to human body parts, day to day food sources, etc. Every team chose 3-4 representatives for picture casting their respective topic in the presence of the subject teacher. The subject teacher’s role was kept minimal, who validated the picture cast at the end of each
of the presentations. The entire PCL activity was accomplished in a two-hour-long activity period. The pictures were innovative and were duly appreciated by the author. For example, picture casting of the 'sources' of minerals included a large plate of Nasi Lemak (a traditional Malaysian wholesome meal) (Figure 1), which was labeled with the contribution of each of its contents towards improving the mineral value of food. Similarly, the team picture-casting the 'functions' of minerals drew a human body depicting various tissues and organs, and representations of the role of minerals in each of these were drawn beautifully (Figure 2).

![Picture casting of the 'sources' of minerals](Fig1.png)

Fig 1. Picture casting of the 'sources' of minerals

![Picture-casting the 'functions' of minerals](Fig2.png)

Fig 2. Picture-casting the 'functions' of minerals

At the end of the session, student perspectives regarding the effective practice and advantages of PCL were compiled through an e-questionnaire in our digital laboratory. The nine-item questionnaire with closed-ended questions was presented to students. This questionnaire was prepared by the author and duly validated by those subject faculty of our department with a medical education background. Perceptions were collected as agreement or disagreement on a five-point Likert scale using google forms. Data was reduced a level by combining all agree, and all disagree responses. The data were collected and expressed as mean ± SD and percentage scores using MS Excel.

Results

A total of 154 Phase I MBBS students agreed to voluntarily participate in this PCL session on mineral metabolism in biochemistry. Their feedback was collected in a questionnaire regarding their acceptance and opinions of various aspects of this activity. Traditional didactic lectures provide a limited scope of interaction for students with their teachers because a fixed large set of learning objectives will have to be taught by the teacher in a limited time frame as structured by the department. This was an attempt to encourage independent learning among students. The views of our students regarding PCL were compiled and are presented below in Tables 1 and 2.
Students have opined that this activity made them think innovatively to summarize the concepts of minerals in health as a picture cast. The majority of them liked the team effort involved in the learning process. They felt it was ideal for rousing enthusiasm for dreary topics in biochemistry like mineral metabolism. They appreciated the role of the teacher as a facilitator rather than a tutor. Overall, there has been a reasonably positive response of students towards this team-based activity of learning biochemistry.

### Discussion

It is a well-established fact that students learn better by doing rather than just listening and seeing. Innovative teaching-learning strategies that harness students’ strengths should be explored regularly to provide a better learning platform for medical students. Learning anatomy through picture casts is well established in a medical curriculum. [14,15] However, PCL in biochemistry is a relatively novel idea, according to the literature survey. Certain topics in biochemistry are quite dreary to learn and filled with mere facts and challenge students to stay focused in a lecture class. Identifying such topics for PCL can create a better impact among medical students in their pre-clinical phase of training, as analyzed from our students’ feedback. The attempt to explore PCL for mineral metabolism was made, which received reasonably good feedback from students. Team-based learning activities are intertwined in curriculum delivery in medical schools extensively worldwide. [16,17] Our current intervention has provided ample opportunity for team activity regarded by students as an asset for this study. Students had

### Table 1. Student perceptions of the Picture Cast Learning (PCL) activity collated as agree and disagree responses with percentage scores

<table>
<thead>
<tr>
<th>STUDENT RESPONSES (n=154)</th>
<th>Agree</th>
<th>Uncertain</th>
<th>Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>This activity was a unique way of learning and summarizing the concepts of mineral metabolism</td>
<td>117</td>
<td>30 (20%)</td>
<td>7 (4%)</td>
</tr>
<tr>
<td>Picture casting the concepts of minerals proved beneficial to me</td>
<td>109</td>
<td>35 (23%)</td>
<td>10 (6%)</td>
</tr>
<tr>
<td>This activity enthuses learning biochemistry for boring topics like minerals</td>
<td>120</td>
<td>22 (14%)</td>
<td>12 (8%)</td>
</tr>
<tr>
<td>Teamwork strengthened this picture cast learning activity</td>
<td>111</td>
<td>31 (20%)</td>
<td>12 (8%)</td>
</tr>
<tr>
<td>There was scope for innovation and involvement for all the teammates</td>
<td>103</td>
<td>39 (25%)</td>
<td>12 (8%)</td>
</tr>
<tr>
<td>Teachers should try innovative active learning strategies in classroom teaching</td>
<td>110</td>
<td>33 (21%)</td>
<td>11 (8%)</td>
</tr>
<tr>
<td>Learning biochemistry through drawing pictures is beneficial</td>
<td>117</td>
<td>28 (18%)</td>
<td>9 (6%)</td>
</tr>
<tr>
<td>The role of a teacher was that of a facilitator</td>
<td>93</td>
<td>43 (28%)</td>
<td>18 (12%)</td>
</tr>
<tr>
<td>The topic was notified early, and sufficient time was available for independent learning</td>
<td>116</td>
<td>25 (16%)</td>
<td>13 (9%)</td>
</tr>
</tbody>
</table>

### Table 2. Feedback scores for Picture Cast learning (PCL) in biochemistry expressed as Mean ± SD

<table>
<thead>
<tr>
<th>STUDENT RESPONSES (n=154)</th>
<th>Mean ± SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>This activity was a unique way of learning and summarizing the concepts of mineral metabolism</td>
<td>4.07 ± 1.05</td>
</tr>
<tr>
<td>Picture casting the concepts of minerals proved beneficial to me</td>
<td>4.10 ± 0.96</td>
</tr>
<tr>
<td>This activity enthuses learning biochemistry for boring topics like minerals</td>
<td>4.05 ± 0.99</td>
</tr>
<tr>
<td>Teamwork strengthened this picture cast learning activity</td>
<td>4.01 ± 1.04</td>
</tr>
<tr>
<td>There was scope for innovation and involvement for all the teammates</td>
<td>4.12 ± 0.96</td>
</tr>
<tr>
<td>Teachers should try innovative active learning strategies in classroom teaching</td>
<td>3.95 ± 0.98</td>
</tr>
<tr>
<td>Learning biochemistry through drawing pictures is beneficial</td>
<td>4.11 ± 0.96</td>
</tr>
<tr>
<td>The role of a teacher was that of a facilitator</td>
<td>3.77 ± 1.16</td>
</tr>
<tr>
<td>The topic was notified early, and sufficient time was available for independent learning</td>
<td>4.21 ± 0.89</td>
</tr>
</tbody>
</table>
received a fortnight to prepare the topic independently. The passive role of a teacher can provide an opportunity to bloom students’ capacity to be independent learners. This strategy has proved beneficial in that way too. Students’ role in a traditional lecture is often passive, given the meager scope for active interaction and participation in the process of learning. Reports indicate the need to shift the focus from teaching to learning and redefine a teacher’s role for a modern educational environment. Our current study with PCL has proved to be an attractive learning mode for students, with the teacher assuming the passive role in this activity. The process has made active efforts to remodel the teacher from a mere instructor to a more dynamic guide by students’ side. The students’ positive feedback makes us infer that teaching innovations like PCL need to be effectively put into regular practice in today’s curriculum, particularly for pre-clinical subjects like biochemistry.

Limitations of the Study

The current study was unable to do a performance assessment. This was a sole topic, even though this topic was a part of the regular sessional and final evaluation in biochemistry. Time constraints and lack of proper planning were also reasons for this limitation. Due to this, the impact of this activity on student learning could not be analyzed thoroughly. However, the encouraging feedback obtained from students has led the author to believe that this study serves well as a preliminary step in implementing such activities to benefit students in biochemistry.

Conclusion

Picture cast learning in Biochemistry can be an effective active learning strategy for medical students in their pre-clinical phase of undergraduate medical education. The visual impact of medical concepts through PCL needs to be encouraged to benefit the student community. A positive attitude to welcome innovative teaching-learning activities like PCL into the curriculum is desirable: to both enthuse learners in medical school with a team-based approach, and provide scope for independent pedagogic research for faculty eager to improve the teaching and learning (T/L) of biochemistry concepts.

Acknowledgement

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References


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