Improving the effectiveness of physiology record books as a learning tool for first-year medical students in India

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Methods

In India, the Medical Council of India mandates that medical students maintain a record of their work in all their preclinical and clinical subjects (14). In compliance with this mandate, preclinical students maintain a record of their laboratory work in physiology. The physiology record books also contain a set of questions to be answered by the students. Faculty members and students had indicated that responding to these questions did not serve the intended purpose of being an effective learning tool. The purpose of this study was to obtain the views of the medical students and faculty members at our institution concerning the usefulness of responding to the questions and to gather suggestions for possible improvement. Data were collected through focus groups and questionnaires to first-year medical students and faculty members in physiology and were analyzed using qualitative and quantitative methods. The students and faculty members viewed the physiology record books as a potentially useful learning aid, but lack of time led the students to write the answers without understanding the topic rather than generating their own responses to the questions. Faculty members and students recommended that the students should write the responses to the questions on site during the practical classes, using relevant on-site resources and interacting with faculty members. The findings of the present study may be of value to other medical colleges in India and outside India with modifications based on their specific needs to improve the effectiveness of physiology record books as a learning tool.

Active learning; qualitative research; undergraduate education

How We Teach


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This study, using focus groups and two written questionnaires, was conducted at the Department of Physiology at our institution. The college admits 60 students/year, both male and female. First-year
medical students in the year of 2006 and faculty members of the Department of Physiology were included in the study. The study was conducted toward the end of the year-long preclinical phase of the curriculum.

**Focus groups.** Two focus groups were conducted: one with preclinical students (n = 7) and the other with preclinical faculty members (n = 7) involved in the physiology course. Students in the focus group were selected by the authors to represent both genders and with different levels of academic performance. Faculty members had found that these students asked questions and were interactive during the lectures and practical classes. These students were also found to be communicative during extracurricular activities. Even though these students were expressive, they had varying levels of academic performance, as seen from their marks in the internal assessments. All the faculty participants were actively involved in writing the procedural instructions and questions in the record book, in demonstrating and supervising the practical classes, and in grading the record books.

Open-ended questions were used to stimulate discussion in the focus groups. Students were asked to discuss the extent to which responding to the questions is a learning experience, the time taken to write their responses, the places where they write their responses, the resources that were used, and recommendations for improving the value of writing their responses as a learning experience. Faculty members were asked similar open-ended questions.

All three authors participated in conducting the focus groups; one facilitated the discussion, and the other two recorded detailed notes. The discussion was also audi-taped. The audiotapes were later transcribed, and the three authors reviewed the notes using the audiotapes to verify that all the comments were captured.

Data analysis was done using a grounded theory approach with constant comparative analysis, a process of reading and rereading the narrative data, developing themes in the process, and then reviewing previously read data to check the appropriateness of the themes developed (9, 10). The three authors independently analyzed the data. An inductive content analysis, which refers to the process of developing themes as one reads, inductively, of the 199 student comments and 134 faculty comments was done. Themes in the comments were identified and coded, and comments were then assigned to the themes. Interrater reliability of the identified themes and comments assigned to the themes was calculated using Miles and Huberman’s formula (15) as follows: reliability = number of agreements/total number of agreements and disagreements.

The three authors who were the reviewers for analysis of the focus group qualitative data initially had 83.3% and 71.4% agreement on the themes identified for the student and faculty focus group data, respectively, and 87.9% and 73.3% agreement on assigning comments to themes for student and faculty focus group data, respectively. After discussion among the three reviewers, 100% agreement was reached.

**Questionnaire.** Based on the themes that emerged from the focus groups with the students and faculty members, two questionnaires were developed, one for each group, to gain additional perspectives about the physiology record books and their use. The questionnaires were administered on a voluntary basis to all the students (n = 60) at a predetermined time and venue. Each questionnaire included 11 questions (including subdivisions), 6 of which were structured questions that yielded quantitative data and 5 of which were open ended to generate narrative comments. The questionnaires have been included as **Appendixes** 1 and 2. The structured questions focused on the logistics of writing the responses to the questions (where and when it was done, time taken to write responses, and resources used) and purposes for responding to the questions. The open-ended questions were asked to obtain the views of the faculty members and students regarding what is useful and not useful about the physiology record books, the reasons why writing the responses to the questions could or could not be a learning experience, and suggestions for improving the effectiveness of the physiology record books in relation to the written responses. In addition, the questionnaire for the faculty members included a question about their expectations from the students regarding the written responses to the questions in the record book.

Quantitative data are reported as percentages. Qualitative data analysis of the comments from the students and faculty members was done the same way as for the focus group analysis.

The following evidences for the validity of the questionnaires were gathered based on the current usage of the term “validity,” where all validity is construct validity (4, 6). The questionnaire was designed based on the themes that emerged from the focus group discussions to obtain further views about the responses to the written questions in the record book. The objectives of the questionnaires were stated, and the questions were then framed in alignment with the objectives representing all the themes identified in the focus group discussions. Content experts reviewed the questionnaires to evaluate if the questions as phrased were appropriate to elicit the desired perspectives and captured the issues of concern. During the process of administration of the questionnaire, the authors went through the questionnaires with the subjects, clarifying any queries about what the questions mean and how they have to be answered. The questionnaires made the subjects reflect on the usefulness and purpose of the responses to the written questions in the physiology record book and offer suggestions for improving its effectiveness as a learning tool. Some of the suggestions were subsequently incorporated.

To ensure the trustworthiness of the data analyses, triangulation, external audit, and member check were conducted as recommended by Barzansky et al. (2). Triangulation was achieved by comparing the consistency in themes between the focus groups and questionnaires. A colleague from the Department of Physiology who was familiar with the record books but who had not participated in the study conducted an external audit. Finally, a member check was also done with one of the students and a faculty member for their respective focus groups and questionnaires. The student and faculty member had participated in the study, were articulate, were believed to have good judgment, and could be expected to spend some time in responding.

**RESULTS**

Of the 60 students in the class, 49 students completed the questionnaire (response rate = 82%), and of the 8 faculty members involved in the physiology course, 6 faculty members completed the questionnaire (response rate = 75%). Of the 49 students who completed the survey, 31 students (63%) responded to the open-ended question asking for suggestions for improvement.

There was an initial agreement of 79.3% and 76.1% among reviewers for narrative comments on questionnaires and themes for those comments, respectively. The reviewers initially had 79% and 82.7% agreement on assigning comments to themes from the student and faculty questionnaires, respectively. After discussion of the criteria used to assign the themes to the text and assigning comments to the themes, 100% agreement was reached.

The themes that arose from the qualitative data analysis of the student and faculty responses to the open-ended questions were as follows:

1. Potential usefulness of the written responses to the questions in the record book, for student learning
2. Reasons why the written responses to the questions in the record book were not effective for students’ learning
3. Suggestions for improving the effectiveness of writing responses to the questions
4. Expectations of the faculty members from the students in writing the responses to the questions in the record book
There were many subthemes under the themes mentioned above. The similarities in the themes and subthemes between the student and faculty responses are shown in Table 1. Additional themes/subthemes are shown in Table 2.

The quantitative data analysis of the student and faculty responses to the structured questions in the questionnaire is shown in Table 3. The vast majority of the students (88%) and faculty members (83%) said that the students wrote the responses to the questions from each other and from their seniors’ records without trying to understand the topic. Three quarters of the students (76%) and all the faculty members felt that the students write the responses to the questions at the last minute, just before the deadline for submission for grading, and thus do not have the time to refer to resources to better understand the topic. The great majority of the students (71%) and faculty members (83%) believed that the students maintained the record as an unthinking ritual or routine, without understanding, rather than using it as a learning experience.

**DISCUSSION**

Both the faculty members and students felt that the written responses to the questions could serve as a useful resource to prepare for the exams. They also felt that the written responses, if done properly, have the potential to help develop knowledge and understanding of physiological principles and their application. The need for their continued use was also voiced. The current method of writing the responses (such as writing the answers at the last minute without understanding the topic) takes away the potential benefits and is not likely to facilitate learning as intended. Due to time constraints mentioned by the faculty members and students, both groups believed that the best approach to make the record books useful for learning would be for students to write the responses on site during the practical class, referring to the physiology textbooks.

The logbooks in the clinical scenarios have a myriad of uses, such as in teaching and learning (5, 8, 12, 13, 19), student assessment (7, 17), curriculum evaluation (11, 13, 19), auditing (19), cross-checking the admission database (11), and log file analysis of a curriculum website to determine server usage (18). Writing the responses to the questions in the physiology record books were primarily used as a teaching learning aid and for student assessment. The types of questions, the responses to the questions, and the students’ grades have a potential for contributing to the curriculum evaluation data. These uses are similar to some of the uses that the clinical logbooks have.

By including the students in the clinical years and thus obtaining a wider range of opinions, especially from past students (who might be better suited to appreciate the full value of the physiology record book), would have improved this study. Nevertheless, this study does reflect the perspectives of both a student group and a faculty group, using both focus

<table>
<thead>
<tr>
<th>Table 1. Similarity in the themes from the faculty and student questionnaires</th>
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<tbody>
<tr>
<td><strong>Respondents</strong></td>
</tr>
<tr>
<td><strong>Students</strong></td>
</tr>
<tr>
<td><strong>Useful learning resource at the time of the exam</strong></td>
</tr>
<tr>
<td><strong>Useful for developing knowledge and understanding of physiological principles and their applied aspects</strong></td>
</tr>
<tr>
<td><strong>Writing the response without understanding the topic</strong></td>
</tr>
<tr>
<td><strong>Lack of time (due to academic workload or extracurricular activities)</strong></td>
</tr>
<tr>
<td><strong>Lack of motivation</strong></td>
</tr>
<tr>
<td><strong>Suggestions for improving the effectiveness of writing responses to the questions</strong></td>
</tr>
<tr>
<td><strong>Write the responses at the end of the practical class, referring to textbooks</strong></td>
</tr>
<tr>
<td><strong>Questions should be asked of the students while faculty members grade the written responses</strong></td>
</tr>
<tr>
<td><strong>Increase student awareness of the importance of written responses</strong></td>
</tr>
<tr>
<td><strong>Disciplinary measures</strong></td>
</tr>
</tbody>
</table>
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Table 2. Additional themes and/or subthemes from the faculty and student questionnaires

<table>
<thead>
<tr>
<th>Respondents</th>
<th>Students</th>
<th>Faculty Members</th>
<th>Example of comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potential usefulness of the written responses to the questions in the record book for student learning</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From students</td>
<td>Useful for confidence building</td>
<td>1/49</td>
<td>“It helps to build confidence.”</td>
</tr>
<tr>
<td>Potential future benefits for the students in their clinical work</td>
<td>1/6</td>
<td>“Clinical practical[s] are useful ... for doctors in the future.”</td>
<td></td>
</tr>
<tr>
<td>From faculty members</td>
<td>Type of questions</td>
<td>3/49</td>
<td>“Non clinical questions were not useful.”</td>
</tr>
<tr>
<td>Difficulty in getting information</td>
<td>3/49</td>
<td>“It was difficult to obtain information to respond to questions.”</td>
<td></td>
</tr>
<tr>
<td>Low level of interest</td>
<td>3/49</td>
<td>“Responding to the questions was a waste of time.”</td>
<td></td>
</tr>
<tr>
<td>From students</td>
<td>Student attitude</td>
<td>4/6</td>
<td>“Students ... do not realize the importance of [answering the questions] ... do not take it seriously.”</td>
</tr>
<tr>
<td>From faculty members</td>
<td>Resources to be used are standard textbooks and notes on tutor discussions</td>
<td>6/6</td>
<td>“Students should write the records referring to textbooks and tutor’s notes.”</td>
</tr>
<tr>
<td>Timely submission</td>
<td>6/6</td>
<td>“... Prompt submission...”</td>
<td></td>
</tr>
<tr>
<td>Neat work</td>
<td>6/6</td>
<td>“Overall the responses to the questions should be neat and tidy.”</td>
<td></td>
</tr>
<tr>
<td>Expectations of the faculty members from the students in writing the responses to the questions in the record book</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>From faculty members</td>
<td>Make questions more relevant and interesting</td>
<td>5/31</td>
<td>“The faculty can include questions more relevant to clinical aspects.”</td>
</tr>
<tr>
<td>Give references for study material</td>
<td>2/31</td>
<td>“Faculty ... can give references to the answers to the questions.”</td>
<td></td>
</tr>
<tr>
<td>From students</td>
<td>Grading</td>
<td>1/6</td>
<td>“Increase marks allotted to written responses to the questions.”</td>
</tr>
</tbody>
</table>

groups and questionnaires, with consistent results between the two groups and data collection methods.

Based on the literature of active learning theory (3), several recommendations can be made. Faculty members should communicate their expectations to students at the beginning of the academic year, so that the students can meet the standards set by the faculty members. Faculty members should help students become active learners through the use of the physiology record books by encouraging students to use resources to respond to the questions. Faculty members should also review and modify the record requirements with the objective of making the questions more relevant and interesting, thereby encouraging active learning by the students. The suggestions made by some of the faculty members and students in this study to improve understanding should be considered. These include asking questions at the end of the practical classes and increasing the marks allotted to the responses to the written questions. These measures will help as assessment drives learning (1).

Based on the results of this study, some changes were made for the study group students. The earlier method, before the study was conducted, where the students were writing the answers at the end of the practical class, was reintroduced with modifications based on the recommendations from the present study. Students wrote the responses during the practical class, referring to textbooks, and the faculty members asked questions to the students while grading the written responses to check for student understanding. Some more clinically relevant questions were added to the existing body of the same. For example, in the experiment requiring estimation of the erythrocyte sedimentation rate, the following question was added: “What is the relation between the erythrocyte sedimentation rate and the acute-phase reaction?” In addition, references to the study material in the context of the questions asked in the record books were also provided.

In India, many medical colleges come under a common medical university, which sets the rules and regulations for undergraduate and postgraduate medical education. Thus, faculty members in medical colleges in India have limitations to the modifications that they can make to medical education. In the future, faculty members should propose to the university to reevaluate physiology practical and increase the proportion of marks that the physiology record books contribute to the final grading, as this would motivate the students to make record writing a learning experience. The impact of these changes on improving the effectiveness of physiology record books as a learning tool needs to be studied.

Since maintaining physiology record books is mandated by the Medical Council of India, the findings of the present study may be of value to other medical colleges in India to improve the effectiveness of the physiology record books as a learning tool. The findings of the present study may also be of value to other medical colleges outside India with modifications based on their specific needs.
APPENDIX 1: WRITING THE RESPONSES TO THE QUESTIONS IN THE PHYSIOLOGY RECORD BOOK: PERSPECTIVES OF THE FACULTY MEMBERS

Please circle your most appropriate response where applicable.

**Question 1A.** Where do you think students write the responses to the questions in the physiology record book?
- During the theory lectures
- In the hostel room
- In a friend’s room
- In the library
- During the same physiology practical class
- During another physiology practical class

**Question 1B.** Average time taken to write the record.
- <15 min
- 15–45 min
- >45 min

**Question 1C.** Most common resource used for writing the physiology records (multiple responses).
- Referring to textbooks with understanding the topic
- Writing the responses to the questions from the record books of seniors without understanding the topic
- Writing the responses to the questions from each other’s record books without understanding the topic
- Referring to tutor’s discussions in the practical class
- Writing the responses to the questions from each other’s record books with understanding the topic
- By referring to tutor’s discussions in the practical class with understanding of the topic

**Question 1D.** When record writing is most often done. (multiple responses).
- During the theory lectures
- At the last minute
- Well in advance

**Question 2.** As faculty, what are your expectations from the students regarding writing the responses to the questions in the physiology record book?
- Ritual/routine
- Learning experience

**Question 3.** In your opinion, what do you think students are not making writing the responses to the questions in the physiology record book as a learning experience for you, then give the reasons for it.
- For fear of disciplinary action
- For understanding the subject
- For getting a grade
- Ritual/routine

**Question 4.** Why do you think students are not making writing the responses to the questions in the physiology record book a learning experience?
- Ritual/routine
- Learning experience

**Question 5.** The reason why students write the responses to the questions in the physiology record book is usually:
- For internal assessment
- For understanding the subject
- For getting a grade

**Question 6.** In your opinion, what is useful about writing the responses to the questions in the physiology record book?
- Referring to tutor discussions in practical class
- Learning experience

**Question 7.** In your opinion, what is not useful about writing the responses to the questions in the physiology record book?
- Referring to tutor discussions in practical class

**Question 8.** List suggestions for making writing the responses to the questions in the physiology record book a learning experience for students.

APPENDIX 2: WRITING THE RESPONSES TO THE QUESTIONS IN THE PHYSIOLOGY RECORD BOOK: PERSPECTIVES OF THE STUDENTS

Please circle your most appropriate response where applicable. Indicate your gender:
- Male
- Female

**Question 1A.** Where do you think the students write the responses to the questions in the physiology record book?
- During the theory lectures
- In the hostel room
- In a friend’s room
- In the library
- During the same physiology practical class
- During another physiology practical class

**Question 1B.** How much time do you think students take, on average, to write the responses to the questions in the physiology record book?
- <15 min
- 15–45 min
- >45 min

**Question 1C.** What are the most common resources used by students for writing the responses to the questions in the physiology record book?
- Referring to textbooks
- Copying from seniors
- Copying from classmates
- Referring to tutor discussions in practical class

**Question 1D.** When do you think students most often write the responses to the questions in the physiology record book?
- During the theory lectures
- At the last minute

**Question 2.** Writing the responses to the questions in the physiology record book is done by students as a:
- Ritual/routine
- Learning experience

**Question 3.** If writing the responses to the questions in the physiology record book is a learning experience for you, then give the reasons for it.
- Ritual/routine
- Learning experience

**Question 4.** If writing the responses to the questions in the physiology record book is not a learning experience for you, then give the reasons for it.
- Ritual/routine
- Learning experience

**Question 5.** The reason why you think students write the responses to the questions in the physiology record book is usually:
- For internal assessment

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Table 3. Percentages of student and faculty responses to the questions on the record book usage

<table>
<thead>
<tr>
<th>Question 1A. Place where record writing is most often done (multiple responses).</th>
<th>Student Responses</th>
<th>Faculty Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. During the theory lectures</td>
<td>2.0</td>
<td>16.7</td>
</tr>
<tr>
<td>2. In the hostel room</td>
<td>65.3</td>
<td>66.7</td>
</tr>
<tr>
<td>3. In a friend’s room</td>
<td>10.2</td>
<td>6.7</td>
</tr>
<tr>
<td>4. In the library</td>
<td>4.1</td>
<td>50.0</td>
</tr>
<tr>
<td>5. During the same physiology practical class</td>
<td>2.0</td>
<td>16.7</td>
</tr>
<tr>
<td>6. During another physiology practical class</td>
<td>18.4</td>
<td>33.3</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1B. Average time taken to write the record.</th>
<th>Student Responses</th>
<th>Faculty Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. &lt;15 min</td>
<td>8.2</td>
<td>0.0</td>
</tr>
<tr>
<td>2. 15–45 min</td>
<td>61.2</td>
<td>83.3</td>
</tr>
<tr>
<td>3. &gt;45 min</td>
<td>24.5</td>
<td>16.8</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1C. Most common resource used for writing the physiology records (multiple responses).</th>
<th>Student Responses</th>
<th>Faculty Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Referring to textbooks with understanding the topic</td>
<td>24.5</td>
<td>50.0</td>
</tr>
<tr>
<td>2. Writing the responses to the questions from the record books of seniors without understanding the topic</td>
<td>42.9</td>
<td>50.0</td>
</tr>
<tr>
<td>3. Writing the responses to the questions from each other’s record books without understanding the topic</td>
<td>44.9</td>
<td>33.3</td>
</tr>
<tr>
<td>Both 2 and 3</td>
<td>87.8</td>
<td>83.3</td>
</tr>
<tr>
<td>4. By referring to tutor’s discussions in the practical class with understanding of the topic</td>
<td>30.6</td>
<td>16.6</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Question 1D. When record writing is most often done. (multiple responses).</th>
<th>Student Responses</th>
<th>Faculty Responses</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Well in advance after understanding the topic</td>
<td>14.3</td>
<td>0.0</td>
</tr>
<tr>
<td>2. At the last minute without understanding the topic</td>
<td>75.5</td>
<td>100</td>
</tr>
</tbody>
</table>

n = 49 total student respondents and 6 faculty member respondents.
2. For understanding the subject
3. For fear of disciplinary action

**Question 6.** In your opinion, what is useful about writing the responses to the questions in the physiology record book?

**Question 7.** In your opinion, what is not useful about writing the responses to the questions in the physiology record book?

**Question 8.** List suggestions for making writing the responses to the questions in the physiology record book a learning experience for you.

**ACKNOWLEDGMENTS**

The authors thank the students of the class of 2005 and the faculty members in the Department of Physiology of the Christian Medical College (Vellore, Tamil Nadu, India) for the generous participation in this study.

**REFERENCES**