CLINICAL & BASIC RESEARCH

The Impact of Small Group Case-based Learning on Traditional Pharmacology Teaching

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أثر التعلم المبني على الحالات السريرية في مجموعات صغيرة لتدريس علم الأدوية على الطريقة التقليدية

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الملخص: الهدف: تهدف هذه الدراسة إلى قياس مدى رضا طلبة الطب عن استخدام التعلم في مجموعات صغيرة المبني على الحالات السريرية في مساق المحاضرات التقليدية لعلم الأدوية. الطريقة: تم جمع البيانات من طلبة السنة الثالثة في كلية الطب بجامعة القدس، فلسطين (عدد = 68، 57% ذكور, 43% إناث). تم عرض تدريس الطلاب مساق علم الأدوية –2 على طريقة مكونة من العمل ضمن مجموعات صغيرة بعدما قام الطلاب بدراسة مساق علم الأدوية –1 بالطريقة التقليدية خلال الفصل الدراسي السابق. تم استخدام استبانه تعبأ ذاتيا لمعرفة رأي الطلبة في البرامج المعاد هيكلتها. النتائج: غالبية الطلبة اعتقدوا أن الطريقة الجديدة كانت أداة تعليمية فعالة بالنسبة لهم (82%) و أنها حسنت مهاراتهم التعليمية (83%)، مهارات التعلم الذاتي لديهم (74%)، مهاراتهم التحليلية (70%) و مستوى التحضير للامتحانات (75%). ذكر معظم الطلبة أن نقاش الحالات السريرية قد تمحور حول أهداف المحاضرات (84%).بالنسبة للحالات السريرية قال معظم الطلبة أنها كانت ملائمة لمواضيع المحاضرات (96%) وبأن الوقت المخصص لمناقشتها كان كافيا (86%). اعتقد غالبية المستطلعة آراؤهم أن الأسلوب الجديد قد ساهم في تحسين مهارات الاتصال لديهم (68%) و رغبتهم في مساعدة زملائهم ضمن المجموعة (80%) و قدرتهم على العمل بروح الفريق الواحد (79%). الخلاصة: إعادة هيكلة مساق علم الأدوية –2 قد أدى لى تحسن هام في الرضا الذاتي للطلبة وكذلك تحمسهم واندماجهم في العملية التعليمية.

مفتاح الكلمات: التعلم ضمن مجموعات صغيرة، التعلم القائم على الحالات السريرية، علم الأدوية.

ABSTRACT: *Objectives:* This study aimed to measure medical students' perceptions of incorporating small group case-based learning (CBL) in traditional pharmacology lectures. *Methods:* Data were collected from third-year students (N = 68; 57% males, 43% females) at Al Quds University Medical School, Palestine. The students were offered a CBL-incorporated Pharmacology-2 course after they had been taught Pharmacology-1 in the traditional format during the preceding semester. Student attitudes towards the restructured course were examined by a self-administered structured questionnaire. *Results:* The majority of students thought that CBL was an effective learning tool for them (82%) and that it improved their learning skills (83%), independent learning skills (74%), analytical skills (70%), and their level of preparation for exams (75%). Most students reported that team discussions addressed lecture objectives (84%). Regarding cases discussed, most responders said that the cases were appropriate to the lecture topics (96%) and that the time allocated for case discussion was sufficient (86%). A large proportion of students thought that CBL improved their communication and collaborative skills (68% and 80%, respectively) and ability to work within a team (79%). *Conclusion:* Pharmacology-2 course restructuring led to a significant improvement of self-reported student satisfaction, motivation, and engagement.

Keywords: Small group learning; Case-based learning; Pharmacology.

Advances in knowledge

- *Students prefer case-based learning (CBL) over the traditional approach for learning pharmacology and other basic medical sciences.*

- *CBL enhances students' self-reported analytical and communication skills.*

- *CBL improves students' self-reported collaborative and team work skills.*

Application to Patient Care

- *CBL develops students' ability to become life-long, self-learners. This is crucial since. once they join the medical workforce, these students will be expected to remain up-to-date in their knowledge in order to provide better care for their patients.*

- *CBL-induced improvement of students' analytical skills is expected to promote their ability to analyse patients' clinical pictures and reach a diagnosis.*

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- *CBL improves students' ability to work as a team with the medical staff. This collaborative work is considered a cornerstone for improving patient care.*
- *CBL-induced improvement in students' communication skills is expected to enhance their ability to communicate with their patients in the future.*

THERE CAN BE NO SINGLE BEST WAY OF learning in medicine since each method has its own advantages and disadvantages. Although the didactic lecture format may be effective for disseminating a large body of information to a large number of students, it presents many challenges to both teachers and learners because it often promotes passive learning and fails to motivate students.[1] Therefore, over the past few decades, a lot of attention has been paid to promoting active learning by adopting interactive student-centred approaches in undergraduate medical education, including problem-based learning (PBL), and case-based learning (CBL).[2,3] Active learning is a student-centred rather than a teacher-centred process; it makes learners responsible for their own learning by self-directed, peer-assisted seeking of new information.[4]

CBL is an interactive, student-centred, instructor-led learning approach that is closely related to PBL.[5] This innovative learning approach was first applied in medical education by the anatomy department of a medical school in Newfoundland, Canada. CBL promotes active learning by utilising clinical case scenarios which reflect real life experiences that students will face during the clinical phase of their medical education.[5] Cases are generally written as problems that provide students with the history, physical findings and laboratory results of a patient. Active learning happens when students are given the opportunity to develop a more interactive relationship with the case, encouraging them to generate rather than simply receive knowledge, organising it in a meaningful manner and developing skills to share with other learners in a group. CBL has several advantages, including promoting self-directed life-long learning; introducing basic medical sciences in a coherent manner closely related to topics in clinical sciences, and reinforcing the reasoning, collaborative and communication skills of students.[6-8]

At Al-Quds University School of Medicine, Palestine, the 6-year programme is divided into independent courses in basic sciences in the first year, basic medical sciences in the second and third years, and clinical sciences in the fourth to sixth years. The challenges facing medical education which our faculty experiences, are similar to other medical schools in the region. The learning process is still problematic with large classes, and most of the curriculum time is spent on traditional lectures. Moreover, student assessment is limited to summative methods which often fail to address the analytical and reasoning skills a medical student needs. Pharmacology is taught to our preclinical undergraduates during their third year of the medical curriculum in two separate courses, namely Pharmacology-1 and Pharmacology-2, which are offered in the fall and spring semesters, respectively.

In this study, we describe medical students` attitudes towards implementing an innovative instructional design that incorporates CBL into a traditional lecture-based Pharmacology-2 course.

Methods

Ethical approval was provided by the Al-Quds University Human Research Ethics Committee in compliance with the Helsinki Declaration for Ethical Principles of Medical Research involving Human Subjects. Oral consent was sought from participants after the purpose and nature of the study were explained.

The course restructuring we describe in this study pertains to the lecture portion of Pharmacology-2, a spring semester course that typically enrolls around 70 third-year medical students. This course was offered during the 2011–12 academic year. The same students were enrolled in the Pharmacology-1 course during the preceding semester. The hypothesis we considered in this study was that students would have a positive attitude towards Pharmacology-2 compared to Pharmacology-1 in response to the new instructional design we introduced.

Our Pharmacology-2 course focused on cardiovascular, respiratory, gastrointestinal

tract (GIT) and, central nervous system (CNS) pharmacology. Pharmacology-1, on the other hand, addressed the basic principles of pharmacology, including pharmacokinetics, pharmacodynamics, autonomic pharmacology, general and local anaesthetics, antibiotics, and chemotherapeutic agents. In both courses, lectures traditionally consisted of two-hour face-to-face sessions twice weekly. Assessment for the lecture portion of the courses consisted of a midterm and final examination, with each exam containing a mixture of quantitative problem solving, short answer, and short essay questions.

Lectures in Pharmacology-1 were purely didactic. In our Pharmacology-2 course redesign, we incorporated small-group CBL into every lecture. Students were organised into groups of 7–9 on the first lecture and were requested to work as a team throughout the semester. Lecture notes, along with their clinical case scenarios and accompanying questions, were sent to the students a few days before each lecture so that they could prepare. For each lecture objective, a brief explanation was presented by the facilitator followed by an introduction of a clinical case scenario accompanied by questions addressing the objectives of this part of the lecture. Thereafter, the groups were given 10–15 minutes to discuss the case and answer the questions. During discussion, the facilitator would move from group to group to monitor student progress, facilitate discussion, and offer suggestions if a group experienced difficulty. The same cycle was repeated for the next objective and so on. We also placed increased emphasis on formative assessment at the end of lectures so that students would receive feedback designed to improve their performance. At the end of each session, two groups were selected and enrolled into a short individual quiz focusing on the objectives of the lecture.

We examined students' attitudes towards implementing the CBL methodology in the newly designed Pharmacology-2 lectures by administering a two-page self-administered questionnaire to the participating students (N = 68; 57% males, 43% females; mean age 21 years). The survey was administered inside the classroom on the last day of the academic year before the Pharmacology-2 final examination. All participating students had been enrolled in the same Pharmacology-1 and Pharmacology-2 courses, and there were no failing or repeating students. The questionnaire focused on the impact of CBL on student' self-reported changes in their learning, collaborative abilities, and teamwork and communication skills, and the quality of cases discussed [Table-1]. Each participant was requested to answer all questions in the survey using a scale that reflected to what degree he or she agreed or disagreed with the statement. The scale was composed of three main categories: agree, disagree, or not sure. Furthermore, the agree and disagree categories were subcategorised into strongly agree or agree, and strongly disagree or disagree. To ensure questionnaire reliability, an internal consistency technique was utilised. These methods ensured that, on the one hand, the students had been exposed to both teaching approaches before they completed the questionnaire and, on the other hand, potential bias due to the stress of the examination was avoided.

Results

Students' attitudes towards the implementation of CBL were examined in this study [Table 1]. Our data showed that the majority of students accepted the incorporation of CBL into traditional pharmacology teaching. When we asked the students about their view of implementing this teaching methodology in other basic medical sciences, most of them responded positively to this question (45% strongly agreed, 38% agreed). A large proportion of students thought that CBL was an effective learning tool for them (82%), out of which 32% strongly agreed, 50% agreed, and 13% disagreed. A similar percentage of respondents said that CBL improved their learning skills (24% strongly agreed, 59% agreed). Most participating students believed that CBL improved their independent learning skills (24% strongly agreed, 51% agreed), analytical skills (16% strongly agreed, 54% agreed), ability to retain information (28% strongly agreed, 45% agreed) and preparation for examinations (27% strongly agreed, 48% agreed). Moreover, 79% of the students reported that their attendance and engagement in Pharmacology-2 lectures were better than it had been in Pharmacology-1 (46% strongly agreed, 33% agreed). Regarding students' views of the case scenarios discussed within the groups, almost all responders said that these cases were appropriate for the lecture topics (48%

Table 1: Third year medical students' perceptions of implementing case-based learning into traditional Pharmacology-2 lectures (n = 68; 57% males, 43% females)

Statement	Strongly agree (%)	Agree (%)	Strongly disagree (%)	Disagree (%)	Not sure (%)	No. of responders
CBL should be utilised in other basic medical sciences	25 (45)	21 (38)	3 (5)	4 (7)	3 (5)	56
CBL was an effective learning tool for me	22 (32)	34 (50)	4 (6)	5 (7)	3 (4)	68
CBL improved my learning skills	16 (24)	40 (59)	2 (3)	3 (4)	7 (10)	68
CBL improved my independent learning skills	16 (24)	35 (51)	3 (4)	7 (10)	7 (10)	67
CBL improved my analytical skills	11 (16)	36 (54)	2 (3)	9 (13)	9 (13)	67
CBL improved my ability to retain information	18 (28)	29 (45)	5 (8)	5 (8)	8 (12)	65
CBL helped me prepare for exams	18 (27)	32 (48)	6 (9)	4 (6)	7 (10)	67
CBL improved my attendance and participation in lectures	26 (46)	19 (33)	3 (5)	5 (9)	4 (7)	57
Case scenarios were appropriate for the lecture topics	32 (48)	32 (48)	1 (1)	1 (1)	1 (1)	67
Student discussion addresses lecture objectives	28 (42)	28 (42)	4 (6)	1 (2)	5 (8)	66
Time allowed for case discussion was sufficient	25 (37)	33 (49)	7 (10)	5 (7)	10 (15)	68
CBL improved my communication skills	13 (19)	33 (49)	7 (10)	5 (7)	10 (15)	68
CBL improved my ability to work within a team	13 (19)	40 (60)	2 (3)	4 (6)	8 (12)	67
CBL allowed me to help other students in my group understand difficult cases	16 (26)	33 (54)	1 (2)	3 (5)	8 (13)	61

CBL = case-based learning.

strongly agreed, 48% agreed). Most responders thought that the group discussions addressed the objectives of the lectures (42% strongly agreed, 42% agreed). A similar proportion of responders thought that time allocated for case discussion was sufficient (37% strongly agreed, 49% agreed). The majority of responders believed that CBL improved their communication skills (19% strongly agreed, 49% agreed) and ability to work as part of a team (19% strongly agreed, 60% agreed). Concerning the effect of CBL on students' collaborative skills, a high percentage of students said that group discussion allowed them to help other peers to understand difficult cases (26% strongly agreed, 54% agreed). Although the participants were requested to answer all questions in the survey, a minority of them decided to leave some of the questions blank [Table 1].

Discussion

Teaching methods which increase student motivation and enhance learning have evolved throughout history. However, the introduction of an interactive student-centred approach in medical education has dramatically changed the way students learn. Our primary goal of introducing team-based case-oriented assignments in traditional Pharmacology-2 lectures was to promote student learning by improving their motivation and engagement. The present investigation was carried out to describe medical students' perceptions after incorporating CBL into a traditionally didactic Pharmacology-2 lecture-based course. By and large, our data demonstrated that the majority of the students not only accepted this innovative technique but were also satisfied about the quality of cases discussed in the lectures. A large proportion of the participating students thought that CBL should be implemented in other basic medical sciences

indicating that our students warmly welcomed the new methodology. Most of them also reported that CBL improved their general and independent learning skills, ability to prepare for examinations, and reasoning skills. The findings of the current investigation are consistent with positive results demonstrated by other studies which examined the impact of CBL on medical education.[9,10] In a maxillofacial radiology course, Kumar et al. reported that the majority of students felt that case-based instruction helped them learn course contents in a more comprehensive manner and increased their knowledge of radiographic interpretation.[11] Our data showed that students' reaction to CBL was overwhelmingly positive as most students believed that this interactive approach boosted their learning and should be implemented in other basic medical sciences disciplines.

Most students thought that their motivation as assessed by self-reported lecture attendance and participation improved as a result of increased engagement in the small group discussions. Yoo et al. examined the effects of CBL on learning motivation in nursing students and found that it was significantly higher in the CBL group than in the non-CBL one.[12] Another benefit of CBL reported by the respondents was the development of their collaborative skills as reflected by an improved desire to help their group members to understand difficult cases. They also reported improved team-work and communication skills as a result of participating in the small group discussions. In line with our findings, Ciraj et al. reported that student communication skills and ability to work within a team were significantly improved due to CBL implementation in a microbiology course.[13] Our data indicated that this innovative pedagogical approach not only improved students' learning but also reinforced their self-reported engagement and motivation, communication and collaborative skills, and their ability to work as part of a team.

There are certain limitations pertaining to this study which should be taken in consideration when interpreting these findings. First, the instrument utilised to assess students' perceptions was only designed to be administered on a single occasion at the end of the Pharmacology-2 course, rather than assessing students' perceptions of both courses separately and comparing the results. A multi-stage assessment of changes in student perceptions would

have been more reliable for measuring student attitudes towards course restructuring. Second, a comparison of students' grades before and after the introduction of CBL, to gauge the effect of this pedagogy on their academic performance, was not possible in this investigation. The reasons for this were related to the differences in the materials that each course covered and the lack of a control group. Finally, we relied on self-reported changes in student attendance and engagement before and after introducing CBL. Comparing actual attendance records in both courses would have been a more accurate way to detect changes in these measures.

Conclusion

In summary, we developed and implemented an instructional design which focused on incorporating active learning and a group-based case-oriented pedagogy into what was previously a traditional lecture-based pharmacology course. These changes were appreciated by students and led to a significant improvement in students' self-reported satisfaction, engagement and motivation.

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