

Innovative “Case-Based Integrated Teaching” in an Undergraduate Medical Curriculum: Development and Teachers’ and Students’ Responses

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Abstract

Introduction: We developed “Case-Based Integrated Teaching (C-BIT)” in our medical school to integrate the content of various disciplines through a core patient design that introduces major diseases to students. This article presents the concepts, development and initial evaluation of the teachers’ and students’ responses to C-BIT. **Materials and Methods:** Teachers’ manuals for 18 major diseases were completed. Eighty teachers from various disciplines participated in writing the first 10 manuals. On the basis of this experience, 57 teachers subsequently prepared another 8 manuals. Each manual is composed of a brief summary of a patient with a major disease, learning objectives, case presentation, questions, a teaching guide and references for all disciplines. Teachers’ and students’ responses to a questionnaire were recorded. **Results:** Most respondents agreed that C-BIT is patient-centred and can be used to improve curriculum integration, reduce duplication in teaching and enhance communication among the faculty members from various disciplines. One-third of the teachers contributed to more than one C-BIT manual, indicating their enthusiasm for the development of C-BIT. Most of the students agreed that C-BIT can enhance discussion, integrate the curriculum and promote active learning. **Conclusion:** We have developed a new format for teaching materials that enhance teacher-student and teacher-teacher interactions, reduces redundant content and integrates disciplines through patient-oriented medical education.

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Key words: Case-based learning, Integrated disciplines, Medical education, Teaching materials, Teaching methods

Introduction

In Asia, the challenges facing medical education are similar across different countries. The learning process is still problematic with large classes, and most of the curriculum time being spent on traditional lectures.¹ Many medical schools are still taught by discipline, and basic and clinical sciences are not yet integrated. Most students may lack active and self-directed learning. Teachers may lack skills in teaching methods and student assessment.

In most universities in Taiwan, the 7-year medical school curriculum is divided into independent courses in the liberal arts and humanities in the first and second years, basic medical sciences in the third and fourth years, and clinical sciences in the fifth to seventh years. Traditionally, these 3 major categories of courses are taught independently

of each other without coordination or integration. Ideally, the liberal arts and humanities and basic medical sciences should be introduced to students in a coherent manner, closely related to topics in clinical sciences that are learned in the senior years.

In our medical school, the fifth and sixth year students attend a 3-day clerkship course per week in hospitals. The students can obtain relevant clinical knowledge through clinical conferences and practice their clinical skills from the bedside. For lower grade students, however, our curricula are not designed to integrate clinical medicine and basic science. There is a lack of teaching guides for case-based discussion courses. Communication and cooperation among teachers of various disciplines are less than expected.

To overcome these disadvantages, “Case-Based

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Integrated Teaching (C-BIT)" was first developed at Taipei Medical University, where a discipline-based curriculum and a traditional departmental structure are still maintained. Basically, C-BIT is a series of teaching manuals centred on core patients with major diseases that combine knowledge from various disciplines. The aims of C-BIT are to improve horizontal and vertical interactions across the 3 major categories of courses among teachers in different fields, integrate the teaching content from various disciplines, increase active and self-directed learning in students and improve discussion among students.

This article reports the development processes of C-BIT and the initial evaluation of the teachers' and students' responses to C-BIT.

Materials and Methods

Development Processes

Selection of major diseases. The Centre for Faculty Development at Taipei Medical University played the key role in assembling a large group of teachers from various disciplines to prepare the teaching content for C-BIT. This department, directed by the Vice-President for Academic and Administrative Affairs, held regular group meetings beforehand to create a list of major diseases ranked by priority for developing C-BIT cases. Once a major disease was identified as being of high priority, a core group of teachers covering the whole spectrum of the disease was organised to formulate the outline and teaching objectives. Participation in C-BIT was voluntary. For each major disease, a summary of the patient profile was prepared by the group leader who, in most cases, was a senior attending physician specialising in the disease and had been teaching for at least 5 years.

Contents of the teaching manual. Each manual was composed of a core patient (summary of a patient with a major disease), learning objectives, case presentation (with increasing coverage of clinically relevant information as a student progresses), questions (for group discussion), teaching guides and references for all disciplines.

Selection of a patient with typical manifestations of a major disease was the first step to writing a C-BIT manual. The clinical scenario of a major disease could be extended to integrate the various teaching needs of an individual discipline, including social and humanistic issues, basic science mechanisms and clinical features. The patient profile was prepared in a manner that would enhance the students' understanding of the disease process from the patient's perspective. No detailed clinical data were provided, as the case presentation section was to be gradually expanded to cover relevant clinical information with the increasing sophistication of students in subsequent years.

Learning objectives focused on the scope of the teaching materials that should be learned by students in each year. Case presentation within each discipline was tailored to the teaching objectives of the individual discipline. With the increase in seniority of the students, the breadth (e.g. historical background in the first year to epidemiology in the second year) and depth (e.g. anatomy of the organ affected in the third year to pathology of the disease in the fourth year) were increased accordingly.

The summary of the patient profile was distributed among members of the core group for revision. For the final summary, teaching materials were prepared by each member in the core group from his or her own expertise. Teaching materials were then developed for each year: the first year was on historical background and humanistic aspects of the disease; the second year on social impact, public health and epidemiology; the third year on relevant anatomy, biochemistry and physiology; the fourth year on pathology, pharmacology and diagnostic approaches; and finally, the fifth year on clinical features, therapeutic interventions and response to treatment and outcomes.

Questions aimed to facilitate group discussion and provoke self-search for additional information about the disease were designed.

Teaching guides were provided for teachers of different disciplines so that they would be familiar with the teaching material that would be covered by various disciplines. Teaching guides also served to focus the group discussion and to direct the yearly expansion of knowledge and advances in sophistication each year. Only the patient summary, case presentations, questions and references were provided to the students before the class for each year. Students were asked to prepare answers to the questions through group discussion and reading the references and other sources (e.g. textbooks, literature search through PubMed).

The teaching manual was then compiled, revised and edited through intense interaction among the teachers within the same group to improve its appropriateness and relevance and to achieve a high degree of coherence for gradual advances in knowledge and expertise year by year.

Development of 18 cases. A total of 112 teachers or teaching assistants joined the project to prepare teaching materials: 70 teachers from the School of Medicine (61 full-time and 9 with an adjunct appointment), 11 attending physicians in the affiliated hospitals without faculty appointments, 28 teachers from other schools (26 full-time and 2 with an adjunct appointment), and 3 teaching assistants. Among the 112 teachers, 36 (32%) were involved in the preparation of more than one C-BIT manual.

Sixteen teachers acted as group leaders: 11 teachers had

more than 10 years of clinical and teaching experiences, and 5 teachers had 5 years or more experiences (2 of them with each directing 2 groups).

The pilot C-BIT project entailed the preparation of 18 cases in 2 steps. Ten cases were prepared to establish the format and collect feedback. An additional 8 cases were developed subsequently to refine the structure and organisation and for a survey of teachers who participated in this project.

Teaching materials for 10 cases were completed by 80 teachers by October 2005. After completion of these 10 cases and a review of the entire process, an additional 8 cases were prepared by 57 teachers in February 2006. Among the teachers involved in the second phase, 25 (44%) had participated in the first phase: 14 were from basic science departments, 7 from clinical departments, and 4 from others. The second batch of 8 manuals were completed in May 2006, and questionnaires were collected at that time. The development of C-BIT addressed our goals of reducing duplicated materials and enhancing cooperation and communication among teachers in various disciplines.

Implementation

C-BIT was implemented in the third and fourth years between February and June 2007. Problem-based learning

and group discussion with C-BIT materials were applied in these 2 years.

Preliminary Evaluation

Questionnaires were delivered via e-mail to the teachers who contributed to the development of C-BIT cases. A separate survey was delivered to the third- and fourth-year students in the last class and final examination of the academic year, respectively. The Centre for Faculty Development directed the distribution and collection of the questionnaires. Data from the questionnaires were compiled and analysed using SPSS 11.0 program.

Results

More than 83% out of the 80 teachers in the pilot group and the 57 teachers in the second work group responded to the questionnaires (Table 1). Most of the teachers understood the aims and content of C-BIT. Most of the responders agreed that C-BIT is patient-centred and case-based oriented, and can be used to improve curriculum integration, minimise duplication in teaching material, and enhance communication through coordination of meetings among faculty members in various disciplines.

The response rates of the third- and fourth-year students were 45% and 96%, respectively (Table 2). Most of the students agreed that C-BIT can be used to improve

Table 1. Evaluation of C-BIT by 69 and 47 Teachers Who Contributed to the Preparation of the First 10 Cases* and, in Parentheses, 8 Additional Cases†, Respectively

	Very good	Fair	Poor				
Your understanding of the objective of C-BIT	95.6* (91.5)†	4.4 (6.4)	0 (2.1)				
Your understanding of the C-BIT content	91.2 (93.6)	8.8 (6.4)	0 (0)				
	More content	Comparable content	Reduced content				
C-BIT in comparison with traditional teaching	29.9 (31.1)	37.3 (35.6)	32.8 (33.3)				
	Yes	Somewhat	No				
Relevance of the C-BIT content to the core patient with major diseases	94.2 (95.7)	5.8 (4.3)	0 (0)				
	Sufficient	Insufficient					
Adequacy of the C-BIT content to cover major diseases	95.5 (97.9)	4.5 (2.1)					
Your view of C-BIT (multiple selections allowed)	Horizontal curriculum integration	Vertical curriculum integration	Problem-based learning	Patient-based learning	A novel teaching modality	Effective in reducing duplicate teaching	Others
	82.6 (89.4)	78.3 (83.0)	59.4 (57.4)	88.4 (83.0)	75.4 (68.1)	59.4 (72.3)	5.8 (4.3)
	Yes	Somewhat	No				
Improvement of the communication and cooperation among teachers in various disciplines with C-BIT‡	(91.5)	(8.5)	(0)				

Numbers are percentages

* 80 copies of the questionnaire were distributed and 69 returned (response rate 86.3%)

† 57 copies of the questionnaire were distributed and 47 returned (response rate 82.5%)

‡ This question was not used in the survey of the initial 67 teachers

Table 2. Evaluation of C-BIT by the Third-Year* and, in Parentheses, Fourth-Year† Medical Students

	Yes	Somewhat	No
Effectiveness in reducing duplicate teaching	29.1* (26.7)†	47.3 (34.9)	23.6 (38.4)
Your view of C-BIT can integrate curriculum	40.4 (30.2)	45.8 (49.0)	13.8 (20.8)
Overall C-BIT can be helpful to your learning	40.2 (43.8)	41.7 (40.4)	18.1 (15.8)
Improvement of the communication and discussion with teachers with C-BIT	60.9 (52.1)	34.8 (35.1)	4.3 (12.8)
Improvement of the communication and discussion among students with C-BIT	56.6 (63.1)	39.1 (28.8)	4.3 (8.1)
Improvement of your active learning attitude with C-BIT	56.7 (61.0)	37.0 (27.4)	6.3 (11.6)

Numbers are percentages

The response rates were 45.3% and 96.0% for the third- and fourth-year medical students, respectively.

curriculum integration, reduce duplicate teaching, help students to learn, improve communication through group discussion with teachers and among classmates, and improve active self-learning.

Discussion

C-BIT has been developed as an innovative approach for improving the effectiveness of medical education with limited resources. Through the process, we have also enhanced the interaction among teachers from various disciplines to reduce duplication of teaching materials and to facilitate integration of knowledge and information. After completion of the first 18 manuals, we believe the initial objectives of C-BIT have been fulfilled. The teachers' responses to surveys supported our impression. The results indicate that most of our teachers fully support the C-BIT project. That 32% of the teachers contributed to more than one C-BIT manual is evidence of their enthusiasm. Teachers who wrote the teaching material were very familiar with the aims and content of C-BIT.

Teachers are encouraged to use C-BIT teaching manuals in different formats, depending on the content. C-BIT, however, does not alter the traditional departmental structure or increase the students' burden, i.e. it does not increase the number of credits or require extra classes. C-BIT can be used to supplement current teaching in our medical school. Teachers can regulate their curricula and integrate a C-BIT "case" into their teaching method, where it can be coordinated with small group discussion, problem-based learning (PBL), distance e-learning and didactic classes. C-BIT also aims to improve the clinical correlation of the liberal arts and humanities and basic medical sciences in medical education, and increase learning interest and efficacy by introducing actual case examples earlier in medical education. Therefore, students can address an integral picture of the whole patient instead of separate views of diseased organs.

Current trends in medical education have moved toward learner-centred teaching and student-initiated problem

solving. The transition of the medical curriculum from a classical didactic and discipline-based approach to integrated PBL has also been adopted in Asia and Australia.^{1,2} Many medical schools use the PBL model to encourage students to develop self-directed learning and encourage teachers to make the basic disciplines more clinically relevant through the use of clinical scenarios.

In Taiwan, PBL complements didactic lectures in most medical schools. Clinicians are recruited as tutors to introduce clinical concepts in small-group discussion or in didactic lectures for basic sciences. It is a validated learning process and encourages student-centred self-guided behaviour.^{3,4} However, because it is inherently restricted in scope and fragmented, the PBL mode cannot substitute for the traditional discipline-based didactic lectures, which are more comprehensive and systematic in introducing knowledge.

Despite the introduction of PBL, discipline-based learning remains the mainstream teaching method in all medical schools in Taiwan. This traditional method is essentially centred on the domain knowledge of the teachers. Although it is efficient, the segmented knowledge from various disciplines taught in isolation may not be assimilated by students for solving actual medical problems. Lack of integration results in the accumulation of so-called "inert knowledge",⁵ which may not be effectively utilised in practice.

Case-based teaching was first applied at Harvard Law School in 1870⁵ and later adopted by Harvard Business School in 1920.⁶ For medical education, it was first applied by the anatomy department of a medical school in Newfoundland.⁷ Clinical case studies allow students to effectively apply acquired knowledge to the clinical problems they face in simulated or real situations. Applying the PBL discussion method to clinical cases requires using information gained from subject-based learning and discipline-based teaching.⁸

Case-based discussion is frequently applied in case conferences of various clinical disciplines (i.e. internal

medicine, surgery, radiology, pathology) in hospitals. At our medical school, sixth-year students attend a clerkship course in hospitals. Students can obtain clinically relevant knowledge through these conferences and practise their clinical skills at the bedside. However, our curricula for earlier-year students have not been designed to integrate clinical medicine owing to limitations of faculties and a lack of teaching guides for PBL courses. Similar limitations also commonly exist in other medical schools in Asia.

Integration is a key issue in medical undergraduate programmes, particularly in the basic and clinical sciences.⁹ As our third- and fourth-year students have no previous experience in encountering “real” patients, C-BIT can provide them learning in a non-threatening environment before clinical rotations. Case-based learning is thought to be motivational to learners and it can provide scenarios from which complex concepts can be more easily understood. Through PBL and group discussion, students are allowed more time for self-directed learning and brainstorming with teachers and classmates. Most of our students agree that C-BIT can integrate different unit courses, enhance communications and promote an attitude of active learning.

Currently, more C-BIT manuals are being prepared. It is expected that most of the medical curriculum could be covered when most of the major disease cases are completed.

Some may argue that case-based teaching is by no means innovative in medical education. It is the coordination of all disciplines in a medical school curriculum centred on core patients with major diseases using clinical scenarios, the integration of knowledge and information in a patient-centred approach, and the engagement of teachers from various disciplines that makes C-BIT an innovative undertaking.

There is no perfect teaching mode for medical students. C-BIT may have limitations in that the manuals for most major diseases cannot cover comprehensively every aspect of various disciplines taught by traditional methods. This potential weakness can be compensated by didactic lectures. C-BIT is supplementary material rather than a substitute for lectures. The relative low response rate (45%) of the third-year students might affect validity of the present study. Our experience with the fourth-year students indicated that the response rate could be increased by delivery of the

survey in the final examination. In this study, less than 44% students felt that overall C-BIT can be helpful to their learning. In the future, to improve students' learning with C-BIT, teachers could hold discussions with students to obtain their feedback rather than just provide questionnaires for survey.

In summary, we have developed a new format for teaching materials that enhance teacher-student and teacher-teacher interactions, reduces redundant content and integrates disciplines through patient-oriented medical education.

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Competing interests

None identified.

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