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`Systems Integration': a middle way between problem-based learning and traditional courses

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'Systems Integration': a middle way between problem-based learning and traditional courses

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SUMMARY *We sought to obtain through an alternative format some of the well-known benefits of problem-based learning (PBL) during multidisciplinary teaching in a new modular curriculum at a medical school that had previously rejected PBL. To integrate learning within and between systems-based modules, we developed a series of case studies, each lasting 1 or 2 weeks. Key components are small group, case-based tutorials employing non-expert tutors at the start and end of each case study, with discipline-based specialist sessions in-between. Unlike PBL, our programme features tight direction of students' activities, objectives prepared by teaching staff, and extensive feedback/answers provided for the students. The Systems Integration course is the most highly rated component of the new curriculum by the students. Teachers who previously rejected PBL have readily contributed to the case studies and volunteered to act as non-expert tutors. The format offers an attractive alternative for teachers at traditional medical schools that wish to obtain many of the benefits of PBL without adopting full PBL.*

Problem-based learning (PBL) is a teaching/learning method that has become increasingly popular since it was first introduced at McMaster University in the late 1960s. A number of medical schools around the world have adopted it as their sole or major teaching strategy (Albanese & Mitchell, 1993; Boud & Feletti, 1997; Kaufman, 1985). Even more have incorporated it into parts of their curricula (Jonas *et al.*, 1994), although it is arguable whether many of these are true PBL (Camp, 1996; Charlin *et al.*, 1998). Some schools, including our own, have failed to get their faculties to agree to wholesale adoption of PBL (Abrahamson, 1997; Schwartz *et al.*, 1994). In our case, this outcome led us to develop hybrid methods that obtain many of the benefits of PBL while still ensuring that the methods are acceptable to teachers who hold traditional philosophies of medical education (Schwartz *et al.*, 1994). We describe here our latest development in this direction.

Preclinical curricular revision over the last decade at the Otago Medical School could best be described as a series of 'learning experiences'. Many of the lessons learned have been documented elsewhere (Egan *et al.*, 1994; Schwartz, 1997; Schwartz *et al.*, 1993, 1994). One of the main observations was that, while there was a lack of commitment in the School for such a radical departure from traditional teaching styles as PBL, there was a good deal of enthusiasm for case-based, small group tutorials. When these tutorials were introduced into courses run within a single department or even shared by two departments, they were extremely successful (Schwartz *et al.*, 1994), but an earlier attempt to introduce a multidisciplinary course that included several different departments and utilized case-based, small group tutorials failed for reasons that will be discussed below.

Over the last 2 years a new modular preclinical curriculum has been successfully implemented at this School. It includes a highly successful multidisciplinary course designed to integrate the different components of this 2-year curriculum. The development of this multidisciplinary, integrative course, called the Systems Integration course, has benefited greatly from lessons learned from our past failures, and a number of significant innovations have been implemented successfully. We suggest that this course offers a format for a 'middle way' for curricular change which falls between true PBL and traditional styles. We therefore describe the background out of which the Systems Integration course developed and then the course itself and its innovations.

Background

In our School, curricular changes which introduced case-based small group learning into courses run within departments have virtually all been successful (Schwartz *et al.*, 1994). On the other hand, more ambitious inter-departmental multidisciplinary case-based courses have, until now, not succeeded and, due to withdrawal of contributors, have not had a chance to evolve to become successful. Major factors underlying the failures of these courses include:

- lack of real commitment and cohesion among contributing staff;
- uncertainty among some contributors about the value of new styles of teaching and learning;
- unwillingness of contributors to negotiate the content of their contributions with other contributors and/or convenors;
- resistance of contributors to spending extra time setting up and maintaining a multidisciplinary programme;
- antagonistic/intolerant responses of contributors to negative evaluations by students of their material, leading them to withdraw rather than modify the material;
- insufficient clarity in contributors' understanding about ways to use case studies in their teaching.

All of these factors impinged on our strategy for development of the Systems Integration course. Other factors which shaped the eventual course structure included the requirements that the course be designed to:

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- rapidly generate student interest in multiple aspects of each case during the introductory session;
- clearly define the objectives for each case study without inhibiting wider student inquiry;
- effectively use a heterogeneous group of non-expert tutors in sessions in which feedback to students as well as facilitation is required from tutors;
- make optimal use of the limited availability of appropriate clinical experts for each case;
- engage students in application of their learning to multidisciplinary problems in the concluding sessions;
- allow students to obtain some understanding of a patient's experience of the condition under study;
- encourage vertical and horizontal integration of learning and particularly to integrate psychosocial and ethical issues into the cases;
- model the 'clinical process' in the approach to cases.

These, then, were the goals and some of the constraints we kept in mind while designing the course.

Description

Students at Otago are selected for medical school either after completing a previous degree or after a first year university course which includes physics, mathematics, chemistry, biology, biochemistry and English. The new preclinical curriculum occupies years two and three of the 6-year course and is a modular, systems-based, 2-year curriculum that is followed by 3 years of clinical studies. The systems modules are similar to those found in other schools and include a sequence of modules such as musculoskeletal, cardiovascular, respiratory, gastrointestinal and kidney, etc, some of which run concurrently in our curriculum. During each of the systems-based modules, the students study the relevant basic medical sciences (anatomy, biochemistry, physiology, pharmacology, pathology, microbiology) in a variety of class formats, including lectures, laboratory classes, small group tutorials and clinical demonstrations. The Systems Integration course runs over both years of this curriculum. Its major goals are to promote integration of concepts across the systems-based modules that are running at the same time, to link concepts introduced in previously completed modules to modules currently being studied, and to allow revision and reinforcement of concepts from earlier modules. The course consists of 18 multidisciplinary case studies which are distributed through the four semesters as follows: two in semester 1; four in semester 2; three in semester 3; nine in semester 4.

Most case studies run over 2 weeks (a few in semester 4 run for 1 week), and the timing of particular cases within the curriculum has been planned to coincide with topics that are being studied in the systems modules which are running concurrently. The general structure of all case studies is the same and consists of:

(1) A brief paper-based trigger which is distributed during the week before the first Systems Integration tutorial.
(2) Systems Integration tutorial 1—Case Introduction. This is a 1-hour small group tutorial run by non-expert Systems Integration tutors, with a roving expert who moves between the eight tutorial rooms in use during the hour.
(3) 'Specialist Sessions' provide discipline-based learning about the case during the interval between tutorials 1 and 2. They take the form of tutorials, lectures, seminars, or laboratories run by contributing disciplines. The format of each session is decided by the contributing discipline(s). For a typical case, there would be 4–8 hours of specialist sessions.
(4) Systems Integration tutorial 2—Integrated Application of Learning. This is a 2-hour small group tutorial run by non-expert Systems Integration tutors, with a roving expert.
(5) Clinical Demonstration—Presentation of a similar or contrasting case. This is a 1-hour interactive case presentation. Whenever possible, the patient is present.
(6) In-course Assessment—A modified-mastery type assessment, closely linked to the objectives for the case study. This is a computerized assessment, except for one case which has a written assessment and one other which has a written component.

Although this structure is uniform for all 18 cases, there is considerable variation in what the students actually do in the different sessions for the case studies. In the following paragraphs we elaborate on each of the components.

The *trigger* paragraph, which is distributed before the first Systems Integration tutorial, gives information about the clinical presentation of the patient. The amount of information given is limited and designed to start students thinking about the organ(s) involved and the types of processes and conditions that should be considered.

Systems Integration tutorial 1 is run in two non-simultaneous streams, each of 95 students divided into small groups of 12 students. Each group is further divided into two subgroups of six students in the same room, each subgroup around a single table. Each group of 12 has its own tutor. The tutors are non-expert but well briefed, and as far as possible each group works consistently with one tutor. For many cases a 'roving expert' tutor, usually a senior clinician, moves among the eight small groups which are running concurrently. During the session, the group's tasks are defined by a series of worksheets. These are distributed sequentially, interspersed with written information and feedback/answer sheets. Each student receives a copy of every sheet. Use of the worksheets removes the need for the tutor to organize the group tasks. The tutor's most important roles, therefore, are to facilitate group discussion, to give interactive feedback, and to distribute the paper material and other resources at the appropriate times.

In the usual format, Session 1 attempts to model the 'clinical process' and involves the students in initial brainstorming over possible organs and processes that may give rise to the type of clinical presentation described in the trigger. Often this exercise is formalized into a group task to compile a list of the possible organs and possible processes in these organs which should be considered. These exercises are surprisingly (to us) popular, probably because they make students draw together in a relevant context ideas about different conditions or processes they have learned about in the systems-based modules. On completion of this task, each subgroup reports back to the whole group and a written feedback sheet is provided for the purpose of comparison. The next task for the students is to ask about history items and then examination findings of relevance. All of the relevant information (including significant negatives) is available to the tutor and students elicit answers interactively from the tutor. We have been impressed at how well preclinical students are able to perform this task and interpret the answers. At the end of the interactive derivation of the clinical history and examination, students are given a sheet with all this information on it. They then move on to request the results of relevant investigations. The group's analysis of investigation results is often guided somewhat to help them focus on particularly significant findings. Interpretation of radiographs and other imaging studies is a challenge to our preclinical students, but they enjoy the challenge as it allows them to apply their knowledge of anatomy and pathology. These exercises are greatly helped by providing a small graphic of each radiograph on the students' worksheet for labelling. Feedback for the imaging studies is provided through plastic overlay sheets which highlight the significant findings. This has revolutionized our use of imaging. By this point a diagnosis has usually been reached and there is time for only one or two further tasks. Throughout this first tutorial we attempt to emphasize the preclinical learning issues which are important. Some of these will be the subjects of subsequent specialist sessions.

A handout of self-study material is distributed at the end of this first Systems Integration tutorial. This includes an expert commentary on the case, which shows how an expert's knowledge of the basic sciences underlies a thorough understanding of the clinical topic and the diagnosis and management of the condition under consideration. Sets of objectives, reference lists, and self- assessment questions are provided for each contributing discipline.

During the interval between the first and second Systems Integration tutorials (usually 9–10 class days), students are expected to work through the self-study materials provided by each contributing discipline in preparation for that discipline's '*Specialist Session(s)*'. These sessions take place between the two Systems Integration tutorials, interspersed with sessions from the systems-based modules which are running concurrently. In the Specialist Sessions, each discipline is free to teach in the style it favours. As examples, Physiology uses lectures, Pathology and Clinical Biochemistry use small group tutorials, and Anatomy and Pharmacology use combinations of formats. The learning objectives for each of these specialist sessions are expected to be encompassed by the objectives for the case, as these form the basis of the multidisciplinary assessment.

Systems Integration tutorial 2 has the same small group format as the first tutorial. In this 2-hour session, students are expected to apply to new problems what they have learned during the 2 weeks of the case study. The problems are based on further issues arising out of the index case and on new mini-cases.

The regular contribution of the Bioethics Department can be used as an example of one of the ways in which some of the time during the second tutorial is used:

- Relevant preparatory readings on the ethical issues have been provided in the self-study material distributed at the end of the first tutorial.
- A series of questions and often some further information about the case are provided for group discussion on the ethical issues arising from the case. The use of a series of discussion points seems to allow students to get traction on the issues. Once started, these discussions are often very engaging for the students and require little input from the non-expert tutors.
- Roving expert tutors from the Bioethics Department are able to visit each group. This provides the opportunity for interactive feedback. Written feedback in the form of important points to consider is also provided for the students at the end of the session.

Other activities that are employed during the second tutorial include:

- work-up of new short cases in a format similar to that described for the index case during Session 1;
- work on overview exercises related to the topic being considered, such as:

  - 'Six Hypertensive People'. This exercise starts with the students having to match thumbnail sketches of six hypertensive people with diagnoses of essential hypertension or one of the causes of secondary hypertension. The students then work through problems related to the pathophysiology of each type of hypertension and to the general treatment and complications of hypertension.
  - 'Integrative Puzzle on Glycosuria'. This involves students matching brief clinical histories, sketches of physical examination findings, sets of laboratory results, pathology/imaging findings, and biochemical/physiological parameters with diagnoses for a series of patients, all of whom have glycosuria. The finished puzzle takes the form of a grid, each column of which should give a unified picture of a patient who has a condition causing glycosuria, if the puzzle has been completed correctly.
  - 'A Jaundiced Man'. This exercise requires the students to apply their knowledge of biochemistry, pathology, and anatomical imaging to solve a stepwise diagnostic puzzle to determine the cause of jaundice in the patient.

Whatever the format used, the exercises are designed to tie together multidisciplinary aspects of learning from the case study itself, as well as relevant previously learned material and material covered in the systems-based modules running concurrently.

When they are available, roving expert tutors are organized to move between the tutorial rooms—to answer questions related to the tasks, to answer queries about the index case, and to allow the students to explore ideas they have thought or read about in relation to the topic overall.

The *Clinical Demonstration* is a 1-hour session which concludes each case study. During the demonstration, a case similar to or contrasting with the index case is presented in a lecture theatre. It is run interactively by a senior clinician, who has usually also been the roving expert for the case study. This means that the clinician has a good background from which to work with the students. Whenever possible, the patient is invited to attend and interact with the students. Having this session at the conclusion of the case study means that the students have a good foundation on which to interact with both the patient and the clinician. It has proven to be an excellent way to obtain closure of each case study.

In-course Assessment occurs during the 2 weeks following each case study. Students are expected to pass a computerized modified-mastery assessment based on the stated objectives for the case. Each contributing discipline provides questions, the numbers of questions being in proportion to the size of the discipline's contribution to the case study. Two of the in-course assessments for the course involve written responses. One is a case study presented on computer (to allow use of the same rich visual milieu as in the tutorials) with questions requiring written answers for each contributing discipline. This assessment also gives the students an opportunity to experience the style of question which is used in the integrated end-of-year examinations for all modules. The other opportunity for written assessment is provided by the Bioethics Department for one case in which they have a major input.

Results/evaluation

The Systems Integration course has been subject to extensive evaluation by the students. Tables 1 and 2 show the results from students in each preclinical year in 1998 on seven of the 19 rating items on the questionnaire which the students are asked to complete at the end of each module or course. (Most of the remaining items are of a more general nature, but on each of those which allow a comparison of courses, the Systems Integration course was more highly rated than virtually all of the other modules/courses.) When asked on a separate questionnaire to rate all their courses on a scale of +3 [extremely good] to −3 [extremely bad] in terms of the overall goal of promoting learning, the students gave the following ratings:

- first preclinical year medical students' mean rating for Systems Integration was +2.52. The mean rating for the next most highly rated course for that year was +2.07;
- second preclinical year medical students' mean rating for Systems Integration was +2.61. The mean rating for the next most highly rated course was +1.98.

It is extremely difficult to determine the effect of the Systems Integration course on students' learning. The in-course assessment of the course is of modified mastery format, so no marks are recorded. However, the students have performed at least as well in this assessment as in those for the other modules. The end-of-year assessment is more extensive and is graded, but it is also integrated so that no module or course is assessed independently of the others, although individual items are set and graded by different disciplines. Furthermore, the end-of-year assessments utilize questions which are all case based. This is a change in style of question for most disciplines, so there is no basis for comparison with the old curriculum. For clinical biochemistry, the one discipline which has set similar types of questions in both the old and new curricula, performance on clinical biochemistry questions scattered through the examinations during the last 2 years (including questions on material derived solely from the Systems Integration course) has been virtually identical with that seen when the discipline was assessed as a course in its own right in the old curriculum.

Discussion

As seen in Tables 1 and 2, the Systems Integration course has been very well received by the students. (Interestingly, module I in the second preclinical year, the one other course that consistently received ratings comparable with Systems Integration, is based on a philosophy similar to that of Systems Integration and relies almost entirely on small group, case-based teaching.) Teaching staff also hold the Systems Integration course in high regard and some refer to it as 'the flagship' of the new preclinical curriculum. The success of the course has led to approaches from other modules about linking into relevant Systems Integration cases. This should expand the richness of the multidisciplinary teaching on the cases. It is in marked contrast to our previous attempts to mount multidisciplinary courses, where interest rapidly faded amongst contributing staff, in both the provision of learning material and tutoring. In fact, despite needing a large tutor pool to run the Systems Integration course, we were oversubscribed for potential tutors during 1998, the second year of running the course.

We suggest that the format of the Systems Integration course offers an alternative to PBL for schools wishing to change from a traditional curriculum to one having a significant component of multidisciplinary case-based learning. It appears to obtain many of the benefits of true problem-based learning, particularly in terms of engaging students in group-centred, problem-solving, multidisciplinary learning, without the radical restructuring of both the curriculum and staff attitudes which seems necessary to implement true PBL.

We believe that our success in implementing a multidisciplinary programme on this occasion arises in large part from a high degree of enthusiasm and commitment among the organizers, careful planning of the course (including identification of goals, objectives, and activities for the programme), intensive negotiation with all potential contributors, and the 'snowball' effect of early and marked success. None of these had been present in our earlier attempts.

We also believe that several features of the Systems Integration format have contributed to successful implementation. These include:

- the use of written feedback/answers to supplement oral feedback from non-expert tutors in the Systems Integration tutorials. While running counter to the precepts of PBL, this has led to both students and tutors being relaxed and confident about the tutorial process. With good facilitation by the tutor, this availability of detailed feedback has not resulted in students becoming passive recipients of answers to questions or problems which they have not attempted to answer or solve themselves. In fact, most groups are irritated by any attempt to provide feedback before they have finished their discussions on the problems;
- the utilization as roving expert tutors of the small number of senior clinical staff and bioethics staff who are available to participate in the course. This has been immensely popular with students, non-expert tutors, and the roving experts themselves. The students and non-expert tutors are confident that interesting or difficult questions will receive an expert response. Students are happy to leave their questions hanging and wait for the expert to come around to their room if an issue has not been resolved by the non-expert tutor or the written feedback. The experts

Table 1. Results of students' evaluations of the Systems Integration course (SI) and other modules in the first preclinical year, 1998.

Questions			SI	Module A	Module B	Module C	Module D	Module E	Module F	Module G	Module H
The course objectives were clear	1 = very clear	5 = not at all clear	1.6 (0.7)	2.3 (0.9)	2.6 (0.9)	2.8 (1.1)	2.0 (0.9)	2.2 (0.9)	2.0 (0.8)	1.8 (0.8)	2.5 (0.9)
Did this course improve your understanding of concepts and principles in this field?	1 = yes, greatly	5 = no, not at all	1.5 (0.7)	1.8 (0.8)	1.9 (0.7)	2.5 (1.0)	1.7 (0.8)	1.8 (1.0)	1.7 (0.8)	1.7 (0.8)	2.0 (0.8)
Did you gain skills in applying principles from this course to new situations?	1 = yes, greatly	5 = no, not at all	1.5 (0.7)	2.2 (0.9)	2.3 (0.9)	2.7 (1.0)	2.0 (0.8)	2.0 (0.9)	1.8 (0.7)	1.9 (0.8)	2.2 (0.8)
Did you improve your ability to solve problems in this field?	1 = yes, greatly	5 = no, not at all	1.6 (0.6)	2.2 (0.8)	2.3 (0.8)	2.6 (0.9)	2.1 (0.8)	2.0 (0.9)	1.8 (0.7)	2.0 (0.9)	2.2 (0.8)
The course seemed:	1 = v. well organized	5 = v. disorganized	1.4 (0.7)	2.2 (0.7)	2.3 (0.8)	2.9 (1.0)	2.0 (0.7)	2.0 (0.8)	2.0 (0.8)	1.8 (0.8)	2.4 (0.7)
Was there agreement between announced course objectives and what was taught?	1 = strong agreement	5 = little agreement	1.9 (0.8)	2.2 (0.6)	2.5 (0.7)	2.4 (0.7)	2.2 (0.8)	2.1 (0.9)	2.1 (0.7)	2.0 (0.8)	2.6 (0.7)
Teaching methods used in this course seemed:	1 = very well chosen	5 = poorly chosen	1.9 (0.7)	2.5 (0.9)	2.3 (0.7)	2.7 (0.8)	2.2 (0.8)	2.1 (0.9)	2.1 (0.8)	2.1 (0.8)	2.7 (0.7)

Notes: Results are expressed as mean (SD). n (number in class) = 185. Response rates (%) were 90.3 (SI), 70.8 (Module A), 76.2 (Module B), 49.7 (Module C), 75.1 (Module D), 48.6 (Module E), 73.5 (Module F), 89.2 (Module G), 60.0 (Module H).

Table 2. Results of students' evaluations of the Systems Integration course (SI) and other modules in the second preclinical year, 1998.

Questions			SI	Module I	Module J	Module K	Module L	Module M	Module N
The course objectives were clear	1 = very clear	5 = not at all clear	1.4 (0.7)	1.3 (0.7)	2.8 (1.0)	1.9 (1.0)	2.1 (0.8)	2.4 (0.7)	2.3 (1.2)
Did this course improve your understanding of concepts and principles in this field?	1 = yes, greatly	5 = no, not at all	1.4 (0.6)	1.4 (0.5)	2.1 (1.0)	2.1 (0.7)	2.0 (0.8)	1.9 (0.7)	2.6 (1.1)
Did you gain skills in applying principles from this course to new situations?	1 = yes, greatly	5 = no, not at all	1.4 (0.6)	1.7 (0.7)	2.3 (0.9)	2.1 (0.7)	2.1 (0.8)	2.2 (0.8)	3.0 (1.0)
Did you improve your ability to solve problems in this field?	1 = yes, greatly	5 = no, not at all	1.5 (0.6)	1.7 (0.7)	2.3 (0.9)	2.6 (0.7)	2.2 (0.8)	2.2 (0.7)	2.9 (1.0)
The course seemed:	1 = v. well organized	5 = v. disorganized	1.3 (0.6)	1.4 (0.6)	3.0 (1.0)	2.2 (0.8)	2.0 (0.8)	2.0 (0.6)	2.7 (1.0)
Was there agreement between announced course objectives and what was taught?	1 = strong agreement	5 = little agreement	1.8 (0.8)	1.6 (0.7)	2.8 (0.9)	2.6 (0.9)	2.1 (0.8)	2.3 (0.7)	2.9 (1.1)
Teaching methods used in this course seemed:	1 = very well chosen	5 = poorly chosen	1.7 (0.7)	1.6 (0.8)	2.9 (0.9)	2.4 (0.8)	2.1 (0.8)	2.1 (0.6)	3.5 (1.1)

Notes: Results are expressed as mean (SD). *n* (number in class) = 188. Response rates (%) were 92.0 (SI), 97.9 (Module I), 68.1 (Module J), 61.2 (Module K), 69.1 (Module L), 56.4 (Module M), 52.1 (Module N).

enjoy the chance to interact with preclinical students in a more personal setting than they have been used to. They have thus been able to much better gauge the levels of knowledge and understanding of the students in the preclinical years;

- the flexibility for contributing disciplines to offer specialist sessions for the case in whatever format they prefer, and also to be involved in the development of multidisciplinary problems for the small group tutorials run by Systems Integration. This has permitted small departments to participate in small group tutorials without having to set up their own infrastructure, which can be provided by the Systems Integration course. We see this as having an important role in promoting interest in and use of small group teaching.

Two other features of the Systems Integration course are noteworthy:

- the integration of ethics into most of the case studies. The Bioethics Department in this School is small, but it makes a big impact through its use of the Systems Integration course. In fact, bioethics staff believe this to be their best teaching, as the material has immediate relevance and is seamlessly woven into the case studies, and the format allows them, despite their small numbers, to rove around all groups and interact with students in an in-depth fashion. Non-expert tutors in the Systems Integration course have commented on the changing attitudes of students during the 2 years of the course, from being generally sceptical and uninterested in 'non-scientific' aspects of the cases, such as ethical issues, to seeing these aspects as vitally important and interesting for discussion;
- the use of a concluding clinical case presentation, as an ideal method of closure for each case study. These sessions are an excellent way to tie together the many important threads of learning from the case in an interesting and immediately relevant context—the patient is sitting there!

With its high degree of direction, its provision to the students of both objectives and detailed feedback/answers, and its limited use of self-directed learning, the programme we have described is clearly different from true PBL (Barrows, 1986; Harden & Davis, 1998). Nevertheless, we believe that it promotes both the learning of basic science material in a relevant, clinical context and the development of the clinical reasoning process, and it is highly motivating. These are three of the four important objectives in medical education that Barrows maintains are well addressed by PBL (Barrows, 1986). Furthermore, the format features frequent student–faculty contact, cooperative learning among students, active learning, prompt feedback to students, and teaching methods which take into account students' diverse ways of learning. All of these have been recognized as principles for good practice in undergraduate education (Chickering & Gamson, 1987), and all of the above have been obtained without demanding the major changes in teaching methods and attitudes that would be required for any successful implementation of full PBL. In addition, the format has been readily accepted by staff and departments that previously have been unwilling to engage in significant multidisciplinary teaching.

Over the longer term, we are hopeful that, as a consequence of the Systems Integration course, our students will be better able to integrate their knowledge of the basic sciences and apply it to their practice of medicine, to incorporate consideration of social and ethical issues into their practice, and to maintain the high levels of curiosity and enthusiasm engendered by the programme. And as our teachers become more aware of the students' capabilities from working with them in the Systems Integration course, we also hope to see our teachers becoming more comfortable with this style of teaching and more willing to let the students take responsibility for their own learning. Our curriculum may then be able to evolve to a more student-centred and less didactic one than it is now. The first signs are promising, but it will be at least several years before we see whether our hopes are fulfilled. In any event, we believe that the format of our Systems Integration course merits consideration by those involved in curricular reform at traditional medical schools that are unwilling or unable to move to PBL but would like to obtain many of its benefits.

Notes on contributors

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ERNEST ('DAVE') LOTEN, MB ChB, PhD, Associate Professor in Pathology at the University of Otago Medical School, began a new career as Associate Dean for Preclinical Education in the early 1990s. Since then he has been a major force in guiding a new preclinical curriculum into being at Otago Medical School.

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