A Team-Based Approach Compared with Two Other Case Study Methods

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Introduction

The scheme inductive approach, developed by Henry Mandin, uses clinical presentations as a framework for integrating basic medical sciences and clinical diagnostic reasoning in clinically relevant contexts [1]. The intention is that, as students learn and progress, the tasks they face will grow with them until the cases and practice exercises are real situations. Worked case examples sessions, which challenge students to work through unfolding real or realistic clinical case studies are guided by a written explanation of clinical experts' diagnostic reasoning at each branch point of a scheme inductive algorithm. Worked case examples are an important component of the integrated clinical presentation curriculum. Clinician experts tutor students to draw on their increasing fund of applicable medical knowledge, interpersonal communication skills, collaborative teamwork, and evolving professional identity, attitudes and values. The sessions at the end of each week during the preclerkship phase challenge learners to become better problem-solvers, reinforce prior learning, and bring a disciplined diagnostic decision-making scheme and process to bear on four different clinical cases.

Small group clinical case tutorials are a long-established active learning pedagogy that effectively combines elements of cooperative learning, and elements of experiential learning through which students tackle increasingly complex learning

tasks, beginning with worked case examples, and standardized patient encounters in the clinical skills course that is integrated under the same clinical diagnostic scheme every week. Cooperative learning engages learners in relevant and authentic tasks that encourage positive interdependence, face-to-face promotive interaction, individual accountability, and refinement of interpersonal small group processing skills for learning to work in teams. The problem-based learning process is another tutored small group approach in which students take on roles and construct their own learning, requiring process expertise but not necessarily clinical expertise on the part of the tutors.

The small group tutorials, whether problem-based or traditional, pose financial and resource challenges that, compounded by escalating class size, are proving increasingly difficult to sustain and justify [2]. Case in point, our institution utilizes an “educational value unit (EVU)” system to reimburse the clinical departments for faculty time and effort in preclerkship phase small group instruction. Based on current enrolment of 100–114 students/year, and a tutorial group size of eight to ten students, 28 clinician contact hours are required for each of our weekly 2-h case-based small group sessions. There are 29 such sessions in preclerkship year 1, and 20 in year 2, accounting for up to 1372 clinician faculty contact hours. Based on our 2017–2018 EVU rate/contact hour of \$345, the small group format is already requiring \$473,340 in EVU system funds. Plans to increase enrolment to 150 students/year would entail the cost of taking more clinicians away from billable patient services to teach in preclerkship sessions.

Campus-wide competition for a limited number of customized small group tutorial rooms has required interim changes in class scheduling (see photo of a small group worked case examples session. Online Resource: ESM_1.jpg). Twelve clinician tutors are needed to teach 100 learners in groups of eight, posing an escalating challenge to confirm sufficient clinicians, who are typically all seconded from the same clinical division, e.g., cardiologists, nephrologists, gastroenterologists, and others corresponding to the organ system unit organization of the

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clinical presentation-based curriculum. Accordingly, six clinicians tutor two consecutive groups of students, given that taking either 2 or 4 h away from clinic amounts to the same sacrifice of a clinic half day for most clinicians.

Team-based or computer-based worked case examples, in which fewer clinician educators can accommodate larger groups of students, might be more feasible sustainable alternatives to small group tutorials. This article weighs the advantages and trade-offs of transitioning from small group tutorials to two alternative case-based learning approaches: team-based and distance-amenable computer-based clinical case study methods.

A sustainable expert-driven curriculum necessarily involves clinical specialists in development of curricular content, but the tradeoffs of having them commit scheduled time to deliver content needs to be reevaluated. Treating patients and teaching preclerkship classes require different skill sets. TBL requires a complex set of facilitator skills different from the small group schema activity. Not all clinical specialists and not all Ph.D. scientists come with lots of teaching experience and skill sets superimposed on understanding their part in this scheme-inductive curricular model. Committed to maintain an expert-driven curriculum, we cannot develop and continually revise content without clinical specialists. Educationalists in faculty development play a key role in developing our clinical and basic medical educators to become increasingly effective process experts and facilitators.

To improve the quality of our clinical tutorials and reduce the demand for clinician facilitators, we have modified our approach to a TBL-inspired format. For the mental health unit, we created or converted existing cases which cover the clinical concepts found in the DSM 5. We incorporate relevant clinical questions and combine them with basic science covered in that week. Faculty with learning materials in that week contributes questions and act as facilitators at our TBL-inspired sessions. Students are asked to complete a readiness quiz before coming to class and then discuss the questions in small groups of six students. Overall, student responses were extremely positive. Students noted that session quality was much more uniform than our traditional small group tutorials. When large numbers of facilitators participate, there's potential for excess variance in learning experiences between small groups. In those TBL sessions, the students have also enjoyed the competitive interaction that spontaneously spurs discussion. The only con of the new format is that some students felt less comfortable speaking out in the larger group. Given the high level of student satisfaction, the reduced number of clinical faculty required, and better quality control, this approach may be an excellent substitute for small schools with limited resources.

Team-Based Learning Versus Small Group Tutorials

The TBL method developed by Larry Michaelsen and collaborators, especially when implemented in its formal practice, has several potential advantages over small group tutorials, problem-based or otherwise, while preserving attributes of small group dynamics in a large group setting [3–5]. Indeed, a large class can be an asset to the extent that it tends to generate more diversity between teams of students regarding the best solution to problems as they unfold in the case study. Discord provides intrinsic motivation for teams to challenge, defend, and then critically and analytically reconcile knowledge and reasoning through debate, concluding with consolidating feedback and explanation focusing specifically on aspects illuminated as remaining conceptually problematic for learners [6]. The five-step readiness assurance process motivates students to arrive prepared to spend most of class time on problem-solving activities that can progress in complexity over sequential sessions of desired intervals and durations. The four part framework (significant problems, same problem, specific choice, simultaneous reporting) engages learners in energetic cooperative learning.

TBL provides a more uniform experience for the entire cohort, and mitigates the incongruence between educational theory and practice that can transpire when multiple tutors are deployed to small groups. Individual accountability to contribute to the problem-solving dynamic in small group tutorials depends on each member's desire to be conspicuously concordant with expectations in their small group's culture.

TBL drives accountability on three levels: graded individual performance on the individual readiness assurance test (iRAT), accountability to teammates in the group readiness assurance test (gRAT), and peer evaluation adjusted grade distribution within teams. The gRAT scores almost inevitably exceed iRAT scores, which underscores the importance of each individual's contribution to their group's score [5].

The economic case to transition from small group tutorials to TBL is compelling: compared with the \$473,340 of system funding that 1372 EVUs with class sizes of 100 learners at \$345/EVU-hr expend to maintain small group tutorials in an academic year, TBL sessions can reasonably be developed and run collaboratively by two clinicians, which corresponds with 392 EVUs/academic year, decreasing the cost by \$338,100 in the same academic year, and sparing the clinical service mission by reallocating clinicians' commitment of substantially more hours instead toward revenue-generating patient services. It is difficult to weigh whether most of the qualitative differences in learning experiences favor one or the other approach, but most medical educators value that small group tutorials afford more early individual interactions between students and clinician role models of many different specialties.

Competition for our single TBL-customized learning space has increased steadily. It is a large room that can accommodate 108 students with eight students seated at each of 18 hexagonal tables, each table has eight conference-style microphones, one per student, and a dedicated Wi-Fi system to support use of student response systems connected wirelessly to students' portable devices. On surrounding walls, there are eight paired flat screen monitors, a SMART Board™ and a large white board (Fig. 1 pdf).

The aforementioned economic and logistical drivers have motivated pilot demonstrations of formats for transitioning worked case example sessions from small group tutorials to TBL-inspired approaches. Dan Blunk and collaborators have been especially successful in developing worked case examples for the psychiatric component of the Mind and Human Development unit to case-based TBL-styled integration of basic sciences with scheme-inductive clinical diagnostic reasoning sessions using the “four clinical concepts” framework [7] (Survey results can be accessed as Online Resource: ESM_2.pdf). Diana Pettit has similarly led colleagues in piloting conversion of the endocrine unit to asynchronous learning modules offered in advance of case-based TBL-styled sessions integrating basic sciences with scheme-inductive clinical diagnostic reasoning. Notably, higher performing student scores on the summative unit examination were not significantly different than summative scores from the previous year. However, summative exam scores

from students in the lower quartile improved significantly, justifying the economic advantage.

Computer-Based Case-Study Approaches as Alternatives to Small Group Tutorials

Virtual patient cases are taking case-based learning to new levels, although they can be notoriously difficult to create [8]. This approach can employ an expanding repertoire of technologies, including augmented reality, to provide students with interactive learning experiences and innovative assessments [9–14]. Virtual patient cases can promote self-paced self-directed learning, and even mastery learning. Although elements of team-based learning can be used in online and hybrid courses, they do not provide the face-to-face interaction that builds interpersonal communication skills for working collaboratively in teams [15].

Conclusions

Curricular change can be prompted by a variety of factors, including the evolving needs of learners, faculty, institutions, professions, or society, unsatisfactory student evaluations or learning outcomes, shifting accreditation standards, or changes in available resources. In this report, we describe the need for curricular change which is largely influenced by the limited availability of clinical faculty to facilitate frequent expert-guided small-group clinical case activities. Prior to expending resources to implement large scale curricular change; however, we firmly established that the need for change was (1) sufficiently important, (2) impacts a large number of people (students, faculty, and staff), and (3) will persist or worsen if not appropriately addressed [16]. By managing change through the preliminary development, implementation, and assessment of a small-scale TBL-formatted pilot, we were able to establish the effectiveness of this instructional method as a practical, scalable, powerful, and cost-effective alternative to more resource intensive small-group approaches. Based on the outcomes of this study, our institution plans to launch a full-scale implementation of TBL-formatted diagnostic reasoning exercises in our clinical presentation-based preclerkship curriculum within the next 2 years.

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Fig. 1 Photograph of TBL learning space

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