A WEB TOOL (✓TICTT) TO SUPPORT REASONING IN THE HEALTH PROFESSIONS

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Abstract

This tool is designed to help prepare graduates to use theoretical knowledge to become independent critical thinkers ready for the workforce and career and life changes.

Keywords

clinical reasoning, critical thinking, cognitive tools, Internet, health sciences

Introduction

Medicine and nursing are highly complex professions operating within a rapidly changing health care environment. Teaching physicians and nurses to think analytically and reflectively and use knowledge and skills to provide safe and effective care is essential to the future of both professions. Considerable research has been undertaken to elucidate the skills that underpin clinical reasoning in nursing and medicine since they are critical to professional practice. Since many medical graduates, Australian and international, show one or more deficiencies in their capacity for clinical reasoning (Neame, 1984), developing the capacity for clinical reasoning in medical and nursing curricula is of great importance. This paper describes the development of ✓TICTT (The Critical Thinking Tool), an Internet tool to aid development of students' clinical reasoning skills in case-based or problem-based curricula.

One well-recognised method of inducting novices into a community of expert practitioners is apprenticeship (Rogoff, 1984). *Cognitive* apprenticeship specifically involves the induction of novices into expert ways of knowing, thinking and reasoning (Brown, Collins & Duguid, 1989). The characteristics of an ideal learning environment to support cognitive apprenticeship were elaborated by Collins, Brown and Newman (1989). In essence, knowledge and cognitive skills are learned through observation, coaching, practice and feedback in real life contexts. After observing an expert execute an activity (modelling), the learner tries the task with expert guidance (coaching). Whilst coaching, the expert provides reminders and feedback (scaffolding), which are gradually removed (fading) as the task is performed independently and with increasing proficiency. Coaching includes careful sequencing of instruction from simple to complex, increasing the variety of examples and practice contexts, and proceeding from global to specific skills. Novices are encouraged to think about their actions and justify their decisions (articulation), analyse their own performance (reflection), and try out different strategies and observe their effects (exploration). Exposure of novices to complexity, multiple ways of accomplishing a task, and interaction with experts and peers, the varying degrees of skill help learners to recognise that there is no one embodiment of expertise and encourages them to view learning as a continuing process (Vygotsky, 1978) embedded in a social milieu.

The conceptualisation of clinical reasoning in medicine is based upon three elements: a well developed discipline specific knowledge base from which further context-specific knowledge can be derived, higher order cognitive skills (analysis, synthesis etc) and metacognitive skills. Since there is no set of generic reasoning skills that can be used to correctly resolve all clinical problems (Norman & Schmidt, 1992), varied and flexible teaching approaches are necessary to develop graduates' clinical reasoning skills. Recent curriculum innovations in medicine and nursing have moved toward teaching and facilitating clinical reasoning rather than focusing on specific content and solving specific problems (Elstein, Shulman & Sprafka, 1984). Problem-based learning (PBL) curricula aim to facilitate the development of an appropriate knowledge base for clinical practice and to foster explicitly hypothetico-deductive and clinical reasoning strategies and reflective practice (Barrows, 1988).

Problem-based learning curricula are based upon the cognitive apprenticeship model and the premise that knowledge and cognitive skills are best learned when embedded in the social and physical contexts in which they must be used (Brown, Collins & Duguid, 1989; Norman & Schmidt, 1992). It draws on all characteristics of the ideal learning environment. In medical PBL curricula, students participate with physicians in a community of learning and practice to develop the explicit knowledge, reasoning processes and skills required of competent physicians. Learning is centred on authentic problems or patient cases and facilitated by a clinician who models, coaches and scaffolds the process. Interaction with peers provides opportunities for consideration of different perspectives and elaboration and articulation of knowledge in a collaborative and supportive environment (Barrows, 1988). Through learning with medical professionals and contact with patients, students also become aware of the metacognitive skills and collective behaviour, values and communication systems that operate within the profession.

Cognitive Apprenticeship & Design of ✓TICTT

✓TICTT provides opportunities for learners to develop the cognitive processes of experts within the constraints of the technology. ✓TICTT is designed for use in a variety of macro teaching and learning contexts (lectures, for collaborative small-group tutorials or self-directed, independent study), and the degree to which the various elements of the ideal environment for cognitive apprenticeship (Collins, Brown & Newman, 1989) are present in a curriculum, depends to a great extent on the author/teacher. The relationship between ✓TICTT and these elements is described.

Content ✓TICTT itself is a shell in which the author presents case scenarios, expert opinions and in which peer opinions accumulate with program usage. Content-specific resources can be hyper-linked or added to the shell to serve as an aide memoir for student learning. Problem-solving strategies used by experts, shortcuts and tips of the trade are often embedded in the reasoning and commentary of experts. Through combination with other teaching strategies, the metacognitive capacities of experts can also be uncovered for learners.

Methods It is intended that the first case/scenario is the author's opportunity to model the cognitive processes of experts; comparative feedback provided from expert and peer opinion develops user's analytical skills and serves as both coaching and scaffolding for learner users as they understand the elements drawn upon for expert practice. Learners develop their ability to clearly articulate their thoughts and reasoning through practice and observation and discussion and feedback through a discussion forum. Reflection is promoted in ✓TICTT through a number of strategies: opportunities for learners to revise and edit answers to questions, the ability to write personal comments in a cumulative note-book; and explicit questioning by the author. Finally, the discussion forum and opportunities within the program to "pause" and research issues or use their own metacognitive processes before continuing with the program facilitates reflection, perhaps the most powerful tool in the expert's repertoire of practice (Schon, 1984).

Exploration involves placing students into a new problem-solving situation where they play the role of expert (Collins, Brown & Newman, 1989). In the challenge section of ✓TICTT students meet new scenarios based upon their initial model case/scenario, thereby enabling them to apply their knowledge and reasoning skills to broader topics.

Sequence The ✓TICTT case builder encourages authors to build cases that include a narrative that leads users through the case scenario in a logical and sequenced manner. Cases in ✓TICTT are intended to build from prototype scenarios to more complex variations on the same theme, or along combined themes arising from earlier modules. Use of a structured sequence of questions modelling simple reasoning (e.g. hypothetico-deductive reasoning), scaffolds students' own reasoning capacity before they embark on increasingly diverse and complex scenarios. This staging enables the learner user to build the various skills, language and knowledge base underlying expert practice.

Sociology This tool enables novices to "sit-in" on the thinking and reasoning processes of an expert. The tool is designed for use in a lecture situation, by a small learning group in a tutorial or by individuals in a self-directed manner. Thus the collaborative element is largely determined by the environment created by the teacher. The linkage of a discussion forum raises opportunities for unstructured collaboration amongst peers and discussion with experts.

Overview of the Tool (✓TICTT)
✓TICTT is tool useful for case-based teaching. It is a framework in which an author presents case scenarios, expert opinions and in which peer opinions accumulate with program usage. The program content is mainly generated by users; it changes and grows as users access and engage with the materials. Data accumulates within the shell and with time a resource is developed that may be edited, re-visited by course participants and analysed for purposes of educational research.

Design and Development The design of ✓TICTT was initially conceptualised for use in PBL curricula to acknowledge the unique contribution workplace practitioners can make to students' learning and thus assist students to develop the skills to think like experienced practitioners and facilitate graduate transition to the workplace. The core design of ✓TICTT was based on an assessment tool developed for a PBL medical curriculum (Zimitat & Alexander, 1997).

User Requirements The two user populations considered in the design were academic staff responsible for the construction of cases, and students, the ultimate users of ✓TICTT. Academic staff required a flexible system that can be structured for and used in a variety of teaching and learning settings depending on the number and nature of students in their course and the level of the course. A case-building interface enabling upload of multiple file types was required for use by academic staff with a range of IT skills. Finally, the whole student-work database needed to be available for down load and analysis. From the perspective of students, ✓TICTT should also be able to access and run ✓TICTT from any computer on- or off-campus. Students and staff need to use ✓TICTT on Windows-based university staff computers and computer laboratories. It was a secondary requirement that ✓TICTT operate across platforms and across browsers.

Features of the Tool
✓TICTT enables authors to create a course consisting of several modules. Each module consists of several sequentially encountered sections: a model case, resources, a reflective pause, up to three challenge cases, debriefing element and discussion forum (Figure 1). The model case section allows the author to present, sequentially, a case scenario supported by multimedia elements (sound, images, video) and interspersed with questions. Learner users are requested to enter responses. They then have the opportunity to examine expert and peer responses to that question before revising their answer and continuing. The author can hyperlink to external web resources (e.g. textbook), software or course material to assist students. There are opportunities for learners to review the case elements, see their original and improved answers and write personal notes. The reflective pause enables the author to focus the learner on one particular aspect of the case, their learning or past experience before they continue with the challenge cases. It can also be used as a natural break-point for students to identify learning issues for further study before continuing. The challenge section is intended to aid the transfer of cognitive skills to scenarios beyond the initial case encountered in the module. This section allows the author to present similar cases, or increasingly complex cases that draw upon learning and skills in previous modules. The case author might choose to use the discussion form to facilitate interaction among peers or with experts to facilitate learning in this section or in

the debriefing section where learner users have the opportunity to reflect on the module, their learning and the commentary of experts.

Finally, an Intelligent Case Editor facilitates construction of the modules and analysis of the underlying cumulative database of student navigation and peer responses. The author can determine: the length of cases; the questions asked; the number of resources made available; whether certain sections in cases are omitted; how, where and if the use of the discussion forum is used and the nature of other teaching and learning activities associated with the tool.

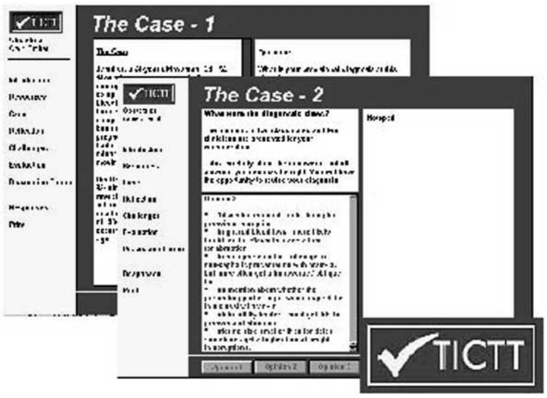

Figure 1: A screen shot illustrating elements of the tool and the prototype interface

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