

An innovative approach to facilitate critical thinking and reflective learning in prescribing and therapeutics e-learning

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NPS: Better choices, Better health

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A fully online and standardised national curriculum for prescribing education, National Prescribing Curriculum (NPC), is offered to students of multiple health disciplines in Australia. The NPC consists of 28 self-paced one hour modules based on World Health Organisation's Guide to Good Prescribing. Health professional education requires didactic teaching to be blended with interactivity, problem solving, critical thinking and self-reflection. The NPC offers the students flexibility and interactivity and increases their prescribing knowledge to help them solve relevant problems. Going forward, there is a need to enhance the teaching capabilities of the module by facilitating critical thinking and reflective learning. In this paper, we discuss an innovative approach of embedding certainty based multiple choice questions in the NPC modules to facilitate critical thinking and reflective learning in a highly demanding learning environment and present the results of a study to evaluate the usefulness of this approach.

Keywords: Prescribing, therapeutics, national prescribing curriculum, problem based e-learning, health professional students

Introduction

Prescribing is an important part of medical practice but may not necessarily be a strong focus in the training of medical students or other health professionals. There is evidence that e-learning has some effectiveness in prescribing education (Maxwell & Mucklow, 2012). In 2001, the National Prescribing Curriculum (NPC), a nationally standardised curriculum in prescribing, was developed for senior medical students in Australian universities (Smith et al., 2006). The user base of the NPC has diversified to include other health professional student groups such as pharmacy and nurse practitioners and it is also used by an increasing number of hospitals for junior doctors and professional bodies as a continuing professional development resource.

The NPC was based on the World Health Organization's Guide to Good Prescribing (de Vries, Henning, Hogerzeil, & Fresle, 1994). It currently comprises 28 modules covering common therapeutic topics. NPC modules have been designed to offer flexibility to the learner and are self-paced and the modules can be attempted individually or completed as part of small group work. In recent years with the improvement in technology, the focus of the NPC has shifted towards interactive activities. As an example, students can now see de-identified peer answers followed by expert feedback to allow them self-evaluate their performance.

Although the online environment offers unprecedented opportunities for the NPC in terms of accessibility and upkeep, attaining and measuring learning outcomes can be a challenge. Problem based learning (PBL), the primary pedagogical approach in healthcare education, fundamentally requires real-life case scenarios, interactivity and guidance to help learners develop and improve critical thinking, knowledge transfer and problem solving skills (Wood, 2003). The NPC covers the basic elements of PBL with clinical case scenarios and peers' comments which are followed by guidance from experts. To ensure that the NPC continues to meet increased expectations for it to be a one-stop resource for prescribing and therapeutics education in Australia and thereby remain relevant in future as an e-learning resource, innovative approaches are required to incorporate reflective learning and critical thinking into the resource.

Aim

The aim of this paper is to describe the findings from our evaluation of the usefulness of certainty based MCQs as a critical thinking and reflective learning tool in the NPC for students from multiple disciplines of healthcare.

Methods

The study was conducted at universities of Melbourne, Sydney and Tasmania. Ethics approval was obtained from the human research ethics committees of each participating university and written consent was obtained from all participants before their inclusion in the study.

A total of 83 medical, 40 pharmacy and 13 nurse practitioner students from three different universities completed a set of MCQs before and after completing an online module from the NPC using an iframed survey ("http://www.surveymzmo.com//,"). For each MCQ, students were asked to indicate how certain they were of their answer on a three-point certainty scale of low, medium and high (Figure 1). The certainty-based questions (Gardner-Medwin & Curtin, 2007) were used to assess the confidence level of students and to control for any overestimation of knowledge due to correct guesses. The MCQs were scored using a validated certainty-based marking scheme resulting in a composite score. Students were also asked to rate their perception of the usefulness of the MCQs and the certainty based questions as a learning resource. At the end of the post module MCQs, students were asked to provide their email address if they wanted personal feedback emailed to them.



Figure 1: An example showing how the MCQ and the certainty-based question were presented to the students on their computer screen. Students could not proceed to the next question unless they answered the MCQ and indicated the level of certainty for their answer.

For each question the students got correct, they received 3 marks if they were highly certain, 2 marks if the certainty level was medium and 1 mark for low level of certainty. Similarly, if the students got the answer wrong, they lost 6 marks if the students were highly certain that their answer was correct, 2 marks for medium level of certainty and did not lose any marks if they were uncertain of their answer. Students' responses were also grouped into six ordinal categories based on whether the answers were correct or incorrect at the three levels of certainty. The pre and post responses for a student were adjusted using generalised estimating equations. The Kruskal-Wallis test was used to analyse data on students' perceptions of the usefulness of NPC.

Results

In the survey, a significantly higher proportion of pharmacy students perceived the pre-module MCQs to be easy compared to the other students; however, they found the MCQs equally useful as a learning resource as the other groups. Furthermore, the marks obtained by individual pharmacy students were similar to the marks obtained by medical or nurse practitioner students at the pre-module stage. For the pre-module MCQs, there was no significant difference in the marks obtained by students who perceived them to be easy compared with those who did not ($p=0.7$). Almost all students found the post-module MCQs (97.1%, 132/136 students) and the feedback (94.9%, 129/136) to their answers to be useful learning resources. A substantial proportion (91.2%, 122/136) of students also suggested that completing the modules helped them answer the MCQs.

All student cohorts answered more MCQs correctly in the post-module phase compared to the pre-module phase. Significant differences were seen in the certainty levels of the answers for all student groups, with more of the MCQs answered correctly with higher certainty levels and lower levels of certainty in incorrect answers ($p<0.01$ for all groups; Table 1) However, across all groups, 39.4% (37/94) of the MCQs answered incorrectly with high levels of certainty at the pre-module phase did not improve at the post module phase. Only 8 medical students (5.9% of all students) asked for their personal feedbacks to be emailed to them.

Table 1: Student responses to the survey that the students had to complete after completing the post module MCQs

| | Medical N (%) | Pharmacy N (%) | Nurse practitioner N (%) |
|--|------------------|-------------------|-----------------------------|
| Pre-module MCQs easy | 10 (12.0) | 16 (40.0)* | 0 (0.0) |
| Pre-module MCQs useful | 61 (73.5) | 32 (80.0) | 11 (84.6) |
| Completing NPC module helped answer MCQs | 81 (97.6) | 34 (85.0)* | 12 (92.3) |
| Post-module MCQs useful | 81 (97.6) | 40 (100.0) | 13 (100.0) |

* represents statistically significant difference in comparison with the medical students

Discussion

In our study, certainty based MCQs coupled with certainty level helped gauge the level of overconfidence in the different student groups which would have not been possible otherwise. Pharmacy students saw a lesser need for certainty based MCQs and were more confident of their answers compared with medical and nurse practitioner at the pre module phase. However pharmacy students' performance on the pre module MCQs was not any better than the other two groups and the improvements in their knowledge was also similar. From a clinical perspective, it is not surprising that pharmacy students saw lesser relevance for the MCQs given that they would have received more pharmacology and pharmacotherapy training than the other students. Other studies have also found that pharmacy students tend to be overconfident in their self-assessment, (Austin & Gregory, 2007; Valdez, Thompson, Ulrich, Bi, & Paulsen, 2006) whereas medical students are said to be moderately able to self-assess (Danielle, 2011). If e-learning is to be expanded, identifying these types of issues is critical given that well-founded confidence of health practitioners enhances the delivery of health care but their overconfidence can potentially have undesirable consequences.

The embedded survey in the NPC modules allowed us to maintain anonymity of the data and de-link the MCQs from the module for the purpose of this study. However, it also meant that we were unable to provide instantaneous personalised feedback to students. As the survey tool was developed for research purposes, it did not offer the flexibility to combine responses and generate automated feedback. If personalised feedback is provided, overconfident students may have gained sufficient knowledge from the activity to improve their knowledge. Computerised personal feedback, which has been proven to have an impact (Zakay, 1992), would have been useful to incorporate but could not be done in our study due to programming limitations and ethics requirements. Students were offered email feedback within a week but very few took up the offer although previous studies have shown that learners are usually keen to receive feedback on their performance (Hattie & Timperley, 2007). Some students probably did not seek feedback because their performance in the study would not contribute to their university grades. However, if certainty based MCQs are implemented as a learning resource, it is essential to incorporate automated and instantaneous feedback for the MCQs to ensure that all students, including those who remain overconfident of their wrong answers even after completing the modules, learn optimally from the NPC.

In addition enhancing learning, certainty based MCQs can strike a balance between the ease of administering MCQs and the rigor of essay type questions in assessments. Incorporating certainty levels to the MCQs decreases the probability of a student correctly guessing the answer compared with the use of MCQs only from 25% to approximately 8%, thereby increasing the validity of the assessment process. Furthermore, the marking scheme disproportionately penalises wrong answers at higher certainty levels whereas students can guess without losing marks if they admit their uncertainty about the answer. The process of answering MCQs and indicating levels of certainty requires students to use higher level cognition compared with MCQs only as they have to think through the reasons for their answers in context. This adds a level of sophistication and accuracy to the assessment (Nicol, 2007) without losing the advantages MCQs offer in e-learning assessment (Govindasamy, 2001).

A characteristic limitation of certainty based MCQs is that a student who is reserved by nature can indicate a low level of certainty although they may be entirely sure of their answers. This may result in such students being inappropriately penalised with lower marks than they deserve for their knowledge. It is important to explain the grading system to students before using certainty based MCQs as an assessment tool to ensure that none of the learners are disadvantaged. It has been reported that students value this approach of marking if it is explained properly and they have ample time to practice before the assessment (Cook & Jenkins, 2010). Costs and the resource intensive process of developing algorithms for certainty based MCQs can also be a barrier to their

usefulness in e-learning environments, particularly at universities where resources are limited. Resource implications can be further exacerbated if immediate personalised feedback is to be provided. Technical failures can also cause huge setbacks and detract learners if support is not readily available. With advances in technology however, it would be expected that computing issues can be resolved as they arise.

Conclusions

With the need for a streamlined prescribing education for multiple health professionals working in the same health system likely to grow in the future, incorporating certainty based questions in online modules increase their utility by encouraging self-reflection. The advantages of incorporating certainty based questions into online modules can also add value to other problem based e-learning courses on offer in university education for health professional students.

As an outcome of the study, pre- and post-module MCQs and the certainty based questions used in the study and another module on diabetes have been made available as an optional learning activity to all students enrolling in the NPC in 2012. Up until this paper was drafted in June 2012, approximately 75% of students who had signed up to the NPC modules had completed the MCQs. In addition to enhancing students' learning experiences, the MCQs will be used as an ongoing quality monitoring tool to ensure that the NPC is meeting the needs of its users. Data collected until the end of 2012 first semester will be analysed to further understand the utility of certainty based MCQs in a self-paced and primarily self-regulated learning environment for health professional students. The role of certainty based MCQs in facilitating critical thinking and reflective learning will also be reassessed on a larger and wider non-experimental sample to help devise more holistic e-learning strategies for health professional students.

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