USING E-LEARNING TO IMPROVE PRESCRIBING PRACTICE IN EMERGING PRESCRIBERS

by Karen Baskett

Educational Designer, Curriculum and Training

National Prescribing Service

Sydney, Australia

kbaskett @ nps.org.au

Abstract

This paper reports on The National Prescribing Curriculum (NPC), a series of online, case-based modules designed to improve prescribing performance and confidence in emerging Australian prescribers. The modules mirror the decision-making process outlined in the WHO Guide to Good Prescribing (de Vries *et al.*, 1994) and were developed as an initiative to combat emerging data that, increasingly, medical graduates demonstrate shortfalls in basic pharmacological knowledge and prescribing skills (Hilmer *et al.*, 2009). The modules are situated in real life situations and include complex, authentic tasks. As most learners access the modules in a self-paced mode, sophisticated levels of expert and peer feedback have been integrated into the modules.

Introduction

Prescribing errors and adverse drug reactions are largely preventable but remain the most common cause of injury to hospitalised patients (Nichols *et al.*, 2008, Bobb *et al.*, 2004, Roughhead & Semple, 2008). In one study, 9.2% of inpatient medication orders contained at least one prescribing error, of which 4% were serious enough to report as medication incidents (Dean Franklin *et al.*, 2007). This percentage of error appears to be increasing and has significant consequences for patient safety (Heaton *et al.*, 2008, Maxwell *et al.*, 2006). Prescribing errors may be caused by a combination of factors involving the environment, team, individual, patient and task. Therefore the idea that a single intervention will prevent prescribing errors is simplistic. As part of a multi-layered solution Coombes *et al.* (2008) note that "Safe-prescribing skills and awareness of medication errors is required by all members of the health care team, and should be a core component of undergraduate and post-graduate training programs." (Coombes *et al.*, 2008: 93)

Increasingly data is emerging internationally that medical graduates demonstrate shortfalls in basic pharmacological knowledge and prescribing skills and that graduates feel they have had inadequate training in this area (Heaton *et al.*, 2008, Hilmer *et al.*, 2008,

Coombes *et al.*, 2008). Results from an Australian study involving 191 interns, indicated that "Interns about to commence supervised clinical practice in NSW teaching hospitals demonstrated severe deficits in prescribing of regular medications, initiation of new therapies, prescribing of discharge medications and particularly prescribing of Schedule 8 medications." (Hilmer *et al.*, 2009: p8) The authors note that most of these graduates recognize they are inadequately prepared and would have like more pharmacological training as undergraduates. Similarly, 74% of 2413 UK medical students (who participated in a web-based survey) felt that the amount of clinical pharmacology teaching was 'too little' or 'far too little'. (Heaton *et al.*, 2008)

PBL and changes in Medical Education

Problem Based Learning (PBL) has now been adopted as the major teaching methodology by most universities in Australia (and many around the world). One consequence of this change has been that some scientific disciplines have now been "synthesized in a horizontal integration of the scientific curriculum around studying the major body systems." (Woodman *et al.*, 2004: p. 1195) This has resulted in a minority of graduates receiving distinct courses and assessments in basic and clinical pharmacology, an area that was previously taught as a specific discipline (Heaton *et al.*, 2008, Maxwell *et al.*, 2007). Given that we know that safe and effective use of medicines requires an understanding of clinical pharmacology, it's not surprising that a British Government report reviewing the causes of medication errors, recommended enhanced pharmacology and therapeutics training for medical students and junior doctors (Coombes *et al.*, 2007). The challenge in this context is providing students with more exposure to the principles of clinical pharmacology in a manner that is congruent with a PBL curriculum.

Additionally in Australia, many undergraduate medical courses have dropped from a 6 year to a five year degree and graduate medical degrees can be completed in 4 years. The second challenge is in finding innovative ways to help medical students absorb large amounts of knowledge in shorter time periods. Dalziel (2007) also notes that in the continuing education of doctors, there is an onus on medical practitioners, as adult learners, gaining medical knowledge offsite and after hours and that the most common way for doctors to access scientific information is through online journals, articles and research databases. Education of undergraduate students therefore needs to prepare them for a self-directed adult learning style, while being flexible enough to fit around other commitments.

The National Prescribing Curriculum

In meeting the above mentioned challenges, an e-learning solution seemed ideal. The National Prescribing Curriculum (NPC) is a series of case-based modules which mirror the decision-making process outlined in the World Health Organization (WHO) Guide to Good Prescribing (de Vries *et al.*, 1994). The modules are offered free of charge and are currently used by all Australian medical schools and a number of Pharmacy, Dental and Nurse Practitioner schools. The emphasis in the NPC is on learners building their own personal formulary of preferred drugs for specific conditions enabling them to prescribe confidently and rationally.

The WHO Guide to Good Prescribing

The WHO Guide to Good Prescribing provides a set of structured stages that include; setting therapeutic goals for a particular patient, deciding on a therapeutic approach (including considering non-drug options), if a drug is needed, choosing and checking the effectiveness, safety and appropriateness of the preferred agent for that individual patient, writing a prescription, monitoring treatment of the patient and providing the patient with information, instructions and warnings (Woodman *et al.*, 2004, de Vries *et al.*, 1994, Shakib, 2003).

Developing a personal formulary

The WHO guidelines (de Vries *et al.*, 1994) focus on the process of prescribing and at its centre is the development of a personal formulary. The rationale is that emerging prescribers will develop a limited set of drugs which they will use rationally for specific indications (Heaton *et al.*, 2008, de Vries *et al.*, 1995, Maxwell *et al.*, 2006, Shakib & George, 2003). "In view of the impossibility of teaching students all basic knowledge on the thousands of drugs available, the approach seems to be an efficient way of teaching rational prescribing." (de Vries *et al.*, 1995: p. 1454).

In selecting drugs to be added to their personal formulary, the WHO method forces emerging prescribers to make important decisions. Taking into consideration, pharmacological, clinical and epidemiological principles, prescribers narrow down the process from choosing drug classes to specific preferred (P)-drugs to add to their own formulary. By having to consider alternative therapies prescribers are better equipped to choose alternative drugs for specific patients, based on rational, evidence-based decisions. The framework for decision-making will also assist prescribers make decisions more critically throughout their career when appraising new drugs on the market (de Vries *et al.*, 2008).

Learning design – a template for self-paced delivery

There are three central ideas behind learning design; that learning should be active, that activities are orchestrated (using workflow) and that learning designs can be recorded, modified, shared and re-used (Britain, 2004). Currently the most common mode of delivery for the modules within universities is self-paced and therefore our basic template is for a self-paced delivery model. The template is, however, flexible enough to be easily modified to suit different delivery methods (a blended environment in a tutorial for example) and to incorporate different activities when needed.

We have developed our modules using LAMS (Learning Activity Management System) software. Each module takes learners approximately one hour to complete. Learners access the modules through a self sign-in process, organized with their universities. The following figure represents each stage of the WHO Guide to Good Prescribing (de Vries *et al.*, 1994) mapped to a LAMS activity and sequenced together to form one module.

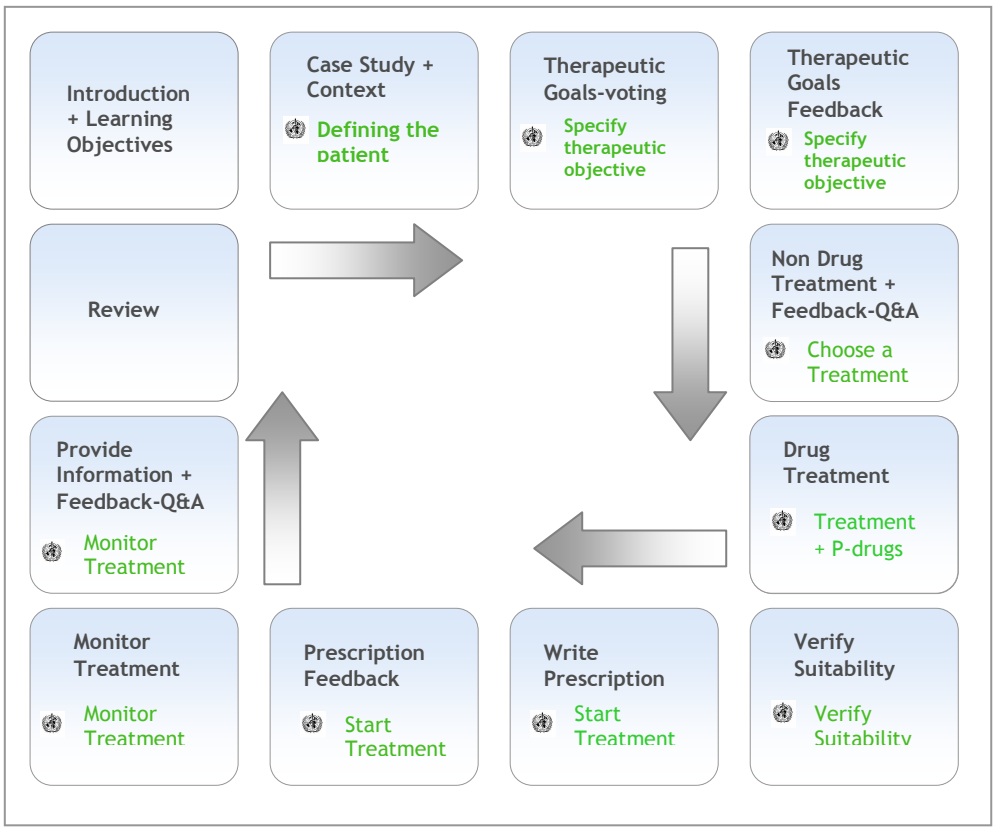

Figure 1. Stages of the WHO Guide to Good Prescribing mapped to LAMS activities.

Description of a typical module

The following table briefly describes the content of each LAMS activity in a typical module. The information includes the activity title, the LAMS tool used, the stage mapped to the WHO Guide for Good Prescribing (de Vries *et al.*, 1994) and a description of the activity.

Table 1: Explanation of the Content in Each LAMS Activity (of a typical module).

1. Title: Introduction **Tool:** Flash object inside a LAMS Noticeboard Learners are introduced to the topic, given the learning objectives and links to the Australian Medical Handbook (AMH), WHO and National Prescribing Service (NPS) Guides to Good Prescribing.
2. Title: Case Study and context **Tool:** Flash object inside a LAMS Noticeboard **WHO**: 'Defining the patient problem' Learners are given the context where the prescriber is working and who they report to. Students are also given a provisional diagnosis for the patient along with other necessary patient results.
3. Title: Therapeutic Goals **Tool:** Voting tool LAMS **WHO**: 'Specify the therapeutic objective' A list of short term therapeutic goals (including red herrings) are given. Learners may nominate as many as they wish. They then see their peers' answers represented in graphical format.
4. Title: Therapeutic Goals Feedback **Tool:** Flash object inside a LAMS Noticeboard **WHO**: 'Specify the therapeutic objective' Expert feedback on the previous exercise is given. Literally the expert is an industry specialist who wrote a particular module. The concept of the expert is represented through an image.
5. Title: Non Drug Treatment + feedback **Tool:** Question and Answer tool LAMS **WHO**: 'Choose a treatment' The next four steps are the most critical in the prescribing process. Drug options are not always the most appropriate form of treatment - non drug options must also be considered. The Q&A tool was chosen so that learners can see peer answers and have a sense of their peers' presence online. Peer feedback is followed by expert feedback.
6. Title: Drug Treatment **Tool:** Drug Tool +My Formulary LAMS (custom built tools for the NPS) **WHO**: 'Choose a treatment + P-drugs'

Drug treatment should be based on: efficacy, safety, suitability and cost. This tool consists of 3 pages that narrow down the process from choosing drug classes to specific P-drugs to add to their own formulary. All drugs in this tool are linked with the most current information from The AMH and Therapeutic Guidelines in line with requirements for evidence-based, rational resources.

7. Title: Verify Suitability
Tool: Flash Object inside a LAMS Noticeboard
WHO: 'Verify suitability'
The prescriber now needs to check that the P-drug is suitable for their individual patient. They are given more specific patient information (medical history, allergies, test results and so on) to narrow down their choices before writing a prescription.

8. Title: Write a prescription
Tool: Prescription tool LAMS (custom built tool for the NPS)
WHO: 'Start treatment – e.g., write an accurate prescription'
Learners follow a process where they search for drugs in their formulary, select drugs for the prescription, enter doctor, patient and drug details into the prescription, preview and print the prescription and get feedback from an expert on the correct prescription. This process mirrors real life prescribing.

9. Title: Expert Feedback
Tool: Flash Object inside a LAMS Noticeboard
WHO: 'Start treatment
Feedback from the previous section shows correct prescribing. This section allows feedback on incorrect answers, common mistakes, adverse reactions and allergies.

10. Title: Monitor Treatment
Tool: Flash Object inside a LAMS Noticeboard
WHO: 'Monitor treatment'
The process of prescribing does not stop after writing a prescription. This activity (and the following 2 activities) require learners to think about what is needed to monitor a patient's progress. Learners choose between a list of possible options, get feedback on each individual choice and then get more detailed feedback from the expert.

11. Title: Provide Information + feedback
Tool: Question and Answer tool LAMS
WHO: 'Give information and instructions'
Learners are asked to list information, advice and warnings that they need to provide to the patient, carers and other health professionals. They then see their peers' answers and expert feedback.

12. Title: Review

Tool: Flash Object inside a LAMS Noticeboard
This MCQ activity provides a quick review of the module. Learners can do the quiz as many times as they like and are provided with feedback.

Design values

Design values are always an integral part of the instructional design process. Goodyear states that learning designs should represent "educational values and vision" (Goodyear, 2005, p.82). Reigeluth concurs; "And we have seen that values play an important role in an instructional–design theory in that they underlie both the goals it pursues and the methods it offers to obtain those goals" (Reigeluth, 1999: p. 14). The following are some of the design values that impacted on our learning design for the National Prescribing Curriculum.

Greater levels of feedback for learners

One of the central components of constructivist learning theory is that students should be given complex and authentic tasks that reflect the types of problems they need to solve in real life (Herrington *et al.*, 2000, Reigeluth, 1999). In addition learners are increasingly being given more responsibility for their own learning, and asked to act as self-directed learners and identify and bridge gaps in their own knowledge (Waters & Johnstone, 2004). As noted earlier, medical students are time poor and have many competing curricular interests. In requiring students to be increasingly autonomous in their learning, it is also vital to provide them with adequate support and scaffolding. "Learner autonomy means increased responsibility for the student which, if it is to succeed, requires a strong framework of support and guidance for the students from the outset" (Herrington *et al.*, 2000: p. 403).

Expert feedback. Given that we know that the majority of our students use our modules in a self-paced mode with little input from tutors, built-in mechanisms for feedback were vital in the development of our curriculum. At various points throughout a module, students receive expert feedback. There are visual clues to indicate that the model answer is expert feedback (see Figure 2 below). In order to provide more appropriate and extensive feedback to learners, we have engaged in a process of consultation with key industry experts to write content. Additionally learners have access to a series of four interactive tutorials on how to use the curriculum.

Figure 2. Expert Feedback – Learners equate this image with 'the expert'.

Peer feedback. Increasing student autonomy means a shift in role for the instructor as the main agent of learning to that of a facilitator of learning – a "guide on the side" versus a 'sage on the stage'. (Reigeluth, 1999: 19). Reigeluth notes that with this shift, opportunities arise for other 'agents' in leaning, one of which is other learners. Moore (1996) has also noted 3 levels of interaction that are important to consider when designing online curriculum; learner to content, learner to instructor and learner to learner.

With this in mind, we have tried to provide a learning environment that fosters learner to learner interaction. In a number of points in a module we used the question and answer tool in LAMS. Students are asked a question, which they type into a space provided. On the following screen they can then see all their peers' responses (see Figure 3 below) before going on to receive expert feedback. This provides students with the opportunity to not only learn from their peers, but to reflect and assess how their responses compare to others.

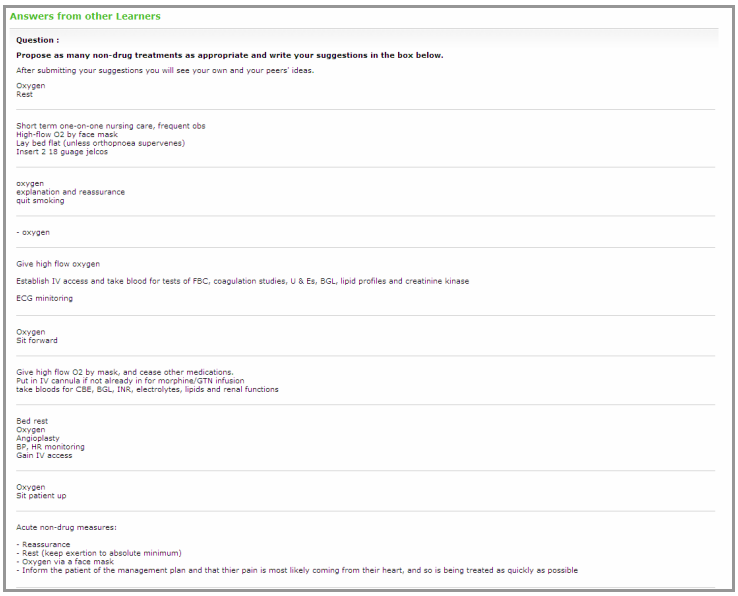

Figure 3. Peer Feedback – The Q&A tool in LAMS allows learners to see each others responses.

Active and authentic tasks

Giving students real world problems and authentic tasks to complete, aims to provide learning experiences in which students are actively involved, giving direct experience of new concepts (Waters & Johnstone, 2004). The rationale is that students are better able to transfer knowledge to new situations when they are able to make meaningful connections between what they are learning and how they can apply it. "This is because a learning environment that mirrors the real world and provides students with concrete experiences is likely to promote the application of knowledge and, therefore, a deeper understanding" (Waters & Johnstone, 2004: p. 415).

The 'write prescription' activity is one example of authentic task design. Learners follow a process where they search for drugs in their formulary, select drugs for the prescription, enter doctor, patient and drug details into the prescription, preview and print the prescription and get feedback from an expert on the correct prescription. The five prescription types have the same fields and look very similar to real life prescriptions used in Australian public hospitals and general practice.

But writing the prescription is only a small part of the prescribing process. By using a case-based, patient-centred curriculum, aligned to the stages outline in the WHO Guide to Good Prescribing (de Vries, 1994), our curriculum emphasizes prescribing as a process and not as a single activity. We have been able to delve into other related aspects of each case such as engaging in clear and effective communication with the client, their careers and other

health professional colleagues and offering non-drug and lifestyle measures as management options (National Prescribing Service, 2006)

Conclusion

> These modules are the anchor for this unit of study and an invaluable resource for the student nurse practitioner. The use of clinical cases allows the students to integrate the process of safe and efficacious prescribing within the context of real life situations and is a major strength of the prescribing modules. Students overwhelmingly appreciate the resources provided within the modules - Dr Tom Buckley (Course co-ordinator, University of Technology Sydney).

Thus far we have had very positive feedback from both learners and educators on the National Prescribing Curriculum. Later in 2009 we look forward to formally evaluating the modules to provide us with more concrete data on whether we are achieving our aims to improve prescribing performance and confidence (in emerging prescribers). We are also committed to a process of continuous improvement and are therefore also very interested in learner and instructor experiences and perceptions in using our curriculum. This process will involve collecting process data through survey and outcome data through Objective Structured Clinical Examinations (OSCE).

Note

1. The National Prescribing Service is an independent, non-profit organization who provide accurate, balanced, evidence-based information and services to help people choose if, when and how to use medicines to improve their health and wellbeing.

2. Please cite as: Baskett, K. (2011). Using e-learning to improve prescribing practice in emerging prescribers. In J. Dalziel, C. Alexander, J. Krajka & R. Kiely (Eds.), Special Edition on LAMS and Learning Design. *Teaching English with Technology*, *11*(1), 98-109.

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