



## Developing surgical decision making skills through dynamic branching short cases and reflection

**Sarah Rennie, Phil Blyth, Judith Swan, Joy Rudland, Katherine Hall, Susan Baxter, Michael Tweed, Tim Wilkinson, John Dockerty, Andre van Rij**

Division of Health Sciences, Otago University

**Swee Kin Loke, Michael Winikoff, Peter Vlugter, Ayelet Cohen, Jenny McDonald**

Higher Education Development Centre, Otago University

This paper describes the development of reflective branching short cases to facilitate medical student's acquisition of surgical decision-making skills. Decision-making skills are an important attribute of a competent surgeon. However, the acquisition of decision making skills is often not explicit in medical curricula and is developed by experience after graduation. Formative dynamic branching cases were developed for students to interact with, as part of a surgical decision-making eLearning site. The cases require students to make and reflect on decisions. Feedback is provided about the decision-making process, with links to eTutorials providing more information about decision making factors. Initial feedback from student testers indicates they welcome this learning strategy and feel that it encourages them to be more reflective about their decision-making skills. Interactive branching short cases with a focus on decision-making factors enable students to practice the three recognised modes of reflection; reflection in-action, on-action and for-action.

Keywords: Computer simulation, virtual worlds, decision-making skills

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### Introduction

Decision making within surgery is recognised as a valuable and important attribute of all surgeons. One surgeon suggested that 75% of important events in the operating theatre were related to decision making with only 25% being related to technical skill (Spencer, 1978). Many studies have listed the most important attributes expected of a good surgeon and these include decision making as an important focus (Cuschieri, Francis, Crosby, & Hanna, 2001). Hall, Ellis, and Hamdorf (2003) state that "It is impossible to be a competent surgeon without using higher-order cognitive skills" (p.10).

The ability to verbalise tacit knowledge (how surgeons arrive at a decision) is more important today given the 'episodic' nature of most trainee surgeons' work as a result of moves to reduce surgical trainee working hours (Warshaw & Sarr, 2003). Trainees have lost continuity – they have reduced opportunities to follow a patient case from start to finish and thus, may not see the results and consequences of decisions and actions they have taken (Dewey, 1938; Silen, 2001; Spitz, Kiely, Peirro, Drake, & McAndrew, 2002).

Surgical decision-making skills are largely neglected in university curriculum. Indeed, expert surgical decision-making is developed largely through the engagement in actual practice beyond the university curriculum. Also, decision-making in medical practice is an area that requires intuition and involves ambiguity, where explicit knowledge is often vital but insufficient (Smith, Goodwin, Mort, & Pope, 2003). 'Good' decision-making, being vitally context-specific and subjective, is hence challenging both to teach and to assess in a reliable and valid way (Epstein & Hundert, 2002).

In response to the above challenges, an eLearning website was designed and created that aims to develop surgical decision-making skills through students' engagement in dynamic branching short cases and reflection. Given the focus on decision-making, the emphasis in the short cases was to maximise the opportunities for student reflection and to encourage articulation of their "espoused theories" (Argyris, 1980).

It can be argued that students can best learn surgical decision-making skills in the context of branching short cases for two reasons: firstly, there is an increasing body of research that contend that simulations and computer games—via the immersion of the players in contextualised problem-solving—are effective learning environments to develop such tacit and intuitive knowledge (Cook & Triola, 2009; Gee, 2007). Branching short cases can be considered as a genre of simulations (Aldrich, 2005). Secondly, Argyris (1980) has contended that developing tacit knowledge is akin to developing congruence between people's theories-in-use (world view and values underpinning their actions) and espoused theories (world view and values they *believe* their actions are based on). The key to achieving such congruence, according to Schön (1987), lies in encouraging the learner to reflect, both in-action (reflection that allows us to reshape our action *while* we are working on the problem) and on-action (reflecting back on what we have done *after* action). These two parameters have been expanded by Killion and Todnem (1991) to include reflection for-action (reflection that focuses on planning for the future and how to improve future outcomes based on experience). The short cases have been designed to maximise such opportunities for student reflection in all three areas.

## Methodology

### Surgical Decision-Making (SDM) eLearning website

The SDM e-learning website comprises web-based branching short cases developed by healthcare practitioners (inspired by real-life events). These short cases highlight different aspects of surgical decision-making, based on the Global Model of Decision-Making developed as part of a PhD study by the first author. Each of the five branching short cases (or “short cases”) is enhanced by contextualised links to eTutorials and external reading materials (e.g., research journal articles) and links to relevant external websites. The SDM website has three general objectives:

1. to raise students' awareness of the factors that may influence their surgical decision making
2. to provide a framework for understanding surgical decision making observed in the workplace
3. to enable students to reflect on how to improve their own surgical decision making skills

All 4th and 5th year medical students and trainee interns at a single medical school were invited to use the website in October 2009. On their first visit, students completed a pre-test (MCQs on surgical decision-making), after which they randomly access the short cases and eTutorials. After completing the majority of the site, post test MCQ's and site evaluation are presented. There are plans to make this website a compulsory component of the medical degree course

### Surgical Decision-Making short patient cases

The short cases follow the idea of branching stories, where each decision can take the reader down a different path. However, unlike paper-based branching stories, our short cases are dynamic. For instance, certain decisions may or may not be available, depending on earlier decisions. Additionally, we are able to collect more information than just the discrete decisions. The following briefly describes one short case involving a patient suspected of having breast cancer. Taking on the role of a surgical registrar in a breast outpatient clinic, students receive a GP referral letter which describes the patient and requests exclusion of breast cancer as the diagnosis (Figure 1).

Students express their estimation of the likelihood of breast cancer at three junctures, each preceded by additional information (e.g., history taking, mammography results), using a visual analogue scale and free text response to facilitate student reflection (Figure 2). Beyond estimating the likelihood of breast cancer, students are also asked to order the appropriate investigations (e.g., ultrasound, mammography) and to recommend the best treatment options (e.g. mastectomy, radiotherapy).

After each free text submission, the students receive generic formative feedback on areas they should have considered, with links to relevant eTutorials if they require more information. The summary page displays the students' visual analogue scale responses at all three junctures, specific feedback on appropriate or inappropriate decisions, and how this may have affected patient care. This feedback may prompt students to reflect on their key learning points from having engaged with the short case and links to the relevant eTutorials.

You are the surgical registrar in the Breast Outpatient Clinic. You pick up the notes for the next patient and read the GP referral letter.

E-learning Medical Centre,  
Virtual Town,  
SDM.

Date 01/10/2009

Dear Breast Surgeons,

**Re: Angela Berkley DOB 16/05/1964**

Thank you for seeing Angela who presents with a lump in her right breast.

She has no previous history of breast problems.

She has a maternal aunt who had breast cancer in her 70's.

She found the lump by accident after being bitten by an insect.

On exam, left breast NAD, right breast, 2.5cm smooth lesion north of her nipple.

Please exclude breast cancer.

Yours sincerely,  
Dr Angel

**How likely is it that Angela will have breast cancer?**

●

**How confident are you?**


●

**Figure 1: GP referral letter and first estimation of likelihood of cancer**

**Angela Berkley** Angela04

You take a history from the patient. She tells you that she had an insect bite on her breast and when she was applying some antihistamine cream she felt a lump deeper in her breast. This was actually about four months ago. Initially she ignored it as she felt well and leads a healthy lifestyle, but every time she has a shower she is aware of the lump. She hasn't noticed any nipple discharge, or any other breast changes. She has an Aunt on her Mum's side that had breast cancer when she was 75 years-old, her own Mum was killed in a car accident when she was 46 years old.

When you examine Angela you see that there is symmetry of the breast, no skin tethering, no inversion or discharge of the nipples, there is no lymphadenopathy. You find a small 3cm diameter hard, smooth lump in the outer upper quadrant of the right breast.



**How likely is it that Angela will have breast cancer?**

●

**How confident are you?**

●

**Why have you changed your answer?**

Family history of breast cancer

**Figure 2: Second estimation of likelihood of cancer and opportunity for reflection**

## Evaluation

This paper reports on the early evidence gathered regarding the effectiveness of our short cases via five individual student interviews (in the context of usability testing). These five medical students (S1-S5) were invited to accomplish various tasks on the website (e.g., completing a short case, locating a specific tutorial) and, where appropriate, give their views on the learning effectiveness of the branching short cases.

A more comprehensive evaluation; comprising questionnaires, focus group discussions, and log files of students' online behaviour, will follow at the end of the SDM pilot project in October 2009. In this comprehensive evaluation, students' opinions on the value of short cases to enhance their learning will be canvassed

## Results

Findings from our usability tests suggest that students take 10 to 20 minutes to complete each short case. All the students valued receiving feedback and identified its importance in development of their skills. S3 was excited to receive feedback as she felt she rarely received constructive feedback in her studies. S4 would have liked more precise and specific feedback critiquing her own choices that would encourage her to self-evaluate her responses, rather than generic feedback. Giving students' feedback at the end of cases provides them with the opportunity to reflect on-action.

Students also found the interactive nature of the cases enabled them to reflect in-action. S5 expressed that the frequent articulation of her reasoning in the short cases was "definitely useful" as having to write her thoughts down "makes (her) think" and "evaluate why". She admitted that, without the prompts to stop and reflect, she would have merely clicked through the cases 'unreflectively'. S5 also indicated that she appreciated having to commit to a decision (with incomplete information), to gather more information, and then to remake the same decision (the whole process being punctuated with moments for reflection-in-action).

Students also made comments that indicated they were reflecting on the cases for-action. S2 commented that at the hospital she is expected to give her opinion and that the site made her feel more confident about speaking out.

S4 found that the tutorials made more sense if read in the context of the branching short cases. We also noticed that S2 conscientiously opened all the links to relevant tutorials before making her decisions, suggesting that the relevance of the tutorials lies in supporting the problem-solving required in the short cases rather than stand-alone eTutorials.

All the students were excited by the short cases and generally found them realistic, though one student (S4) would have liked her resources (e.g. number of questions she can ask, number of tests she can order) to be unlimited to increase realism. S5 expressed that the short cases forced her to "pick out key events" herself. One student suggested the addition of different levels of difficulty so she can visit the website every few months and progress to the next level.

Further results from the comprehensive evaluation will also be presented.

## Discussion

Early student evaluation of the branching short cases indicates that students value feedback and the opportunities presented by the branching short cases to reflect in-action, on-action, and for-action. Student responses also suggested that the open-endedness in the short cases allowed them to determine what was salient and what was not, providing the space for them to make their *own* meaning of the cases (Bruner, 1986). The multiple interactive components help the learner to develop ownership of the cases enhancing their learning.

The students found more value in the eTutorials when the latter were read in the context of the short cases. This is congruent with the notion of situated cognition, according to which concepts are most fruitfully learnt in the context of the activities where they will be used (Brown, Collins, & Duguid, 1989).

Using further analysis of the short cases based on the comprehensive student evaluation, the strengths of the branching short cases will be discussed and areas for improving their structure to enhance student

reflection of decision making and encourage development of their decision making skills will be proposed.

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**Contact author:** Ms Sarah Rennie, Department of Surgery, University of Otago, Dunedin, New Zealand.  
Email: [srennie@doctors.org.uk](mailto:srennie@doctors.org.uk)

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