Managing patient deterioration: enhancing nursing students' competence through web-based simulation and feedback techniques

Final Report 2014

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http://first2actweb.com

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Acknowledgements

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List of acronyms

ALTC	Australian Learning and Teaching Council
BP	blood pressure
CRT	capillary refill time
ECG	electrocardiogram
FIRST^{2}ACT™	Feedback Incorporating Review and Simulation Techniques to Act on Clinical Trends
FIRST^{2}ACTWeb™	Feedback Incorporating Review and Simulation Techniques to Act on Clinical Trends web-based learning program
HR	heart rate
MCQ	multiple choice questionnaire
MET	medical emergency teams
MONA	morphine, oxygen, nitrates, aspirin
OSCE	objective structured clinical examination
OLT	Australian Government Office for Learning and Teaching
RR	respiratory rate
SA	situation awareness
SAGAT	Situation Awareness Global Assessment Technique
SpO2	oxygen saturation
TAFE	Technical and Further Education
TEAM™	Team Emergency Assessment Measure

Executive summary

Studies show that the management of deteriorating patients is poor and, when left untreated, this leads to expensive and often unsuccessful resuscitation procedures[4–9]. In addition, it is acknowledged that non-metropolitan settings in Australia have fewer resources for managing deteriorating patients[10,11] and that communication and referral processes are less well established[9,12] with demands on enrolled and registered nurses to take leadership roles. However, there has been a lack of knowledge about the educational needs, decision-making strategies and clinical practices of students to enhance their future practice and leadership roles.

In response, the aim of this project was to produce an evidence-based, sustainable, online learning package to enhance nursing students' management of deteriorating patients. This was achieved in a four-phase project. Nursing students attended a face-to-face simulation-based program that informed development of a web-based learning package that was subsequently demonstrated to have a significant impact on students' knowledge and ability to manage deteriorating patients.

Phase 1 – Results from the face-to-face teaching program:

- Through a face-to-face simulation based program, 97 final-year nursing students from three Australian universities were found to lack the knowledge, clinical skills, team work and situation awareness required to competently manage a deteriorating patient.
- However, delivery of multiple components of the two hour program were reported to enhance these skills amongst the students. The program delivery format, clinical focus, feedback and debriefing aspects were positively appraised.
- Self-ratings of knowledge (e.g. managing patient deterioration; setting emergency priorities; understanding patient changes) improved significantly following participation in the teaching program ($p < 0.05$), as did perceived confidence and competence.

Phase 2 – Development of the web-based program:

An interactive web-based educational package was produced that included six components. These were: a course handbook; a voice-over PowerPoint lecture; two assessment tests; three interactive scenarios; feedback techniques and a course completion certification. Central to this program is the innovative, interactive set of three scenarios that include:

- video recordings of a patient deteriorating in a hospital setting;
- a range of interactive clinical tasks (based on 'mouse over' clicks that generate pop-up videos) e.g. taking blood pressure (BP) and an electrocardiogram (ECG);
- a range of 'pop-up' patient responses to questions about pain, previous medical history and presenting condition etc;
- timed performance over eight minutes (creating a sense of urgency) with acute deterioration at the four minute mark; and
- background data collection on a central database to enable accurate performance feedback and to provide individual performance outcomes for educators.

Phases 3 and 4 – Web-based trial and stakeholder focus groups

A total of 367 participants from three universities and two colleges (TAFEs) completed the online program. As in Phase 1, deficits in performance were noted at commencement but with the following improvements:

- Knowledge on completion increased significantly (69% to 79%; $p < 0.001$).
- Clinical performance increased by 15% between the first and subsequent scenarios ($p < 0.001$).
- Self-ratings of knowledge (managing patient deterioration; setting emergency priorities; understanding patient changes) improved significantly ($p < 0.001$), as did the students' perceived confidence and competence.
- Multiple components of this web-based program were reported to assist skills development with positive ratings for the form of program delivery, the clinical focus and relevance, and the feedback and debriefing aspects of the program.

Findings/recommendations

In arguing that 'multiple methods of teaching are the best methods of teaching', face-to-face options supported by web-based programs such as FIRST^{2}ACTWeb™ (Feedback Incorporating Review and Simulation Techniques to Act on Clinical Trends) are an effective way to enhance students' confidence, competence and mastery of patient deterioration management. Final-year nursing students should therefore be exposed to holistic, high-fidelity simulation delivered face to face and supported by FIRST^{2}ACTWeb™. In settings where resource restrictions demand rationalisation to a single method, either option can enhance students' confidence, competence and mastery of patient deterioration management.

Project outputs

i. Website available at: http://first2actweb.com/ .
ii. Publications are listed under the FIRST^{2}ACT™ resource tab on this website. Manuscripts either published, in press, under review or near completion are detailed in Appendix B.
iii. Conference presentations and workshops to date include nine presentations at national and international meetings as detailed in Appendix B.

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1 Introduction

Background

Through collaboration with Australian University and Technical and Further Education (TAFE) sector partners, the aim of this project was to produce an evidence-based, sustainable, online learning package to enhance nurses' management of deteriorating patients. Deteriorating patients tend to have changes to vital signs such as high heart rates and low blood pressure and these criteria provide clinicians with guidance on when to call for assistance from hospital-based Medical Emergency Teams (MET). The prevalence of deteriorating patients in hospitals ranges from 3.3% in a recent Australian study[1] up to 18% in a Danish study[2]. Importantly, those patients whose conditions meet MET calling criteria have double the risk of mortality both in hospital and 30 days later[1–3].

Studies show that the management of deteriorating patients is poor and, when left untreated, this leads to expensive and often unsuccessful resuscitation procedures[4–9]. In addition, it is acknowledged that non-metropolitan settings in Australia have fewer resources for managing deteriorating patients[10,11] and that communication and referral processes are less well established[9,12] with demands on enrolled and registered nurses to take leadership roles. However, there has been a lack of knowledge about the educational needs, decision-making strategies and clinical practices of students to enhance their future practice and leadership roles.

Based on these concerns, and following a series of simulation-based, exploratory studies examining the performance of nursing and midwifery students and registered nurses, we developed a program of learning called FIRST^{2}ACT^{TM} (Feedback Incorporating Review and Simulation Techniques to Act on Clinical Trends). In trials since 2008 the program has demonstrated a significant positive impact on learning including a positive impact on registered nurses' clinical practice[13]. Based on an audit of patients' medical records, nurses who had completed FIRST^{2}ACT^{TM} demonstrated improvements in the charting of vital signs (respiratory rate, blood pressure, etc.), pain score recording and in the correct delivery of oxygen therapy[14].

The overall educational approach used in this project includes five key components:[15]

1. Developing core knowledge;
2. Formative assessment as a learning stimulus;
3. Simulation;
4. Summative assessment and reflective review; and
5. Performance feedback.

The theoretical underpinning for these stages is the belief that the critical-thinking skills necessary for clinical practice are best acquired through experience[16], an approach supported by Experiential Learning Theory (ELT)[17,18], and the notion of concrete experience and abstract conceptualisation that is achieved through activity or reflective observation. In addition, modalities of learning such as visual, visual/verbal, physical (or kinaesthetic) and auditory techniques[19] were a key consideration that demand a variety of teaching approaches to meet the learners' needs. Put more simply: 'multiple methods of teaching are the best methods of teaching'.

In addition, assessment as a stimulus for learning is known to contribute to the development of independent learning skills and ongoing professional development[20] and encourages students to 'think, decide and act'[21 p305]. Simulation was a key component of this project and is defined as 'an education technique in which elements of the real world are appropriately integrated to achieve specific goals related to learning or evaluation'[22 p75]. Although clinical simulation can be enacted

through mannequins, we chose simulated patients (human actors) to increase the fidelity (believability) of the scenarios and role play, to aid consolidation of theory into practice in a safe environment[23–26]. Simulation-based training is known to increase self-reported knowledge and/or confidence in nursing and medical students[26,27] and has benefits over didactic teaching techniques[28]. It improves outcomes in objective structured clinical examinations (OSCEs)[29] and, most importantly, has a direct impact on patient care[30].

Alignment with OLT objectives

This project primarily aligns with the Office for Learning and Teaching's (previously the Australian learning and Teaching Council) priority of 'Innovation and development in learning and teaching, including in relation to the role of new technologies', but also covers issues in relation to 'assessment and promotion of student learning' and 'improvement of tertiary pathways'. The project team's prior work and theoretical foundations of experiential active learning has driven the development of this innovative program which incorporates new and important approaches to simulation including student-driven scenario outcomes. Phase 1 enabled a deeper understanding of team performance informing the development of the electronic version and a sustainable set of educational material. This has had a significant impact on student learning in particular, ALTC Threshold Learning Outcomes[31] two ('assess health status and implement management plans'); five ('deliver safe and effective collaborative healthcare'); and six ('reflection and planning for personal development'). Development of multiple choice questions and OSCEs also enabled greater understanding of assessment and promoted learning, whilst the collaboration with the TAFE sector improved networking between the University and TAFE sectors and enhanced understanding of training needs of Enrolled Nurses.

Project aims and objectives

In the current project we aimed to further develop educational approaches to the management of deteriorating patients using simulation-based face-to-face scenarios for nursing teams, and develop educational resources, assessment processes, and innovative web-based high-fidelity simulations using actors as simulated patients (SP).

Reflection and self-assessment are essential for building skills[32]. We know that these approaches have had an impact on learning but we also know that individually focused educational approaches are resource intensive. In addition, whilst emergency responses are often initiated by an individual, team responses, either as informal or formal groups (e.g. MET teams) are more likely to occur in the real world. Based on these issues the questions we focused upon in this project were:

1. In emergency situations how do students perform and what are their decision strategies in primary response teams (Phase 1)? Specifically we aimed to:
    a. examine participants' ability to recognise patient deterioration in a simulated environment and establish which clinical cues are most commonly identified or missed as signs of deterioration;
    b. identify the relationship between knowledge and skills in the recognition of physiological changes in a simulated environment; and
    c. develop an understanding of decision-making processes through student reflection.
2. What impact does the web-based learning program (Phases 2 and 3) (FIRST^{2}ACTWeb) have on student learning and on their clinical activity (Phase 4)?

The project was designed as an interventional analysis incorporating mixed methods in several phases of investigation, each of which is described below.

2 Methods

The project was designed as an educational intervention using quantitative and qualitative methods with a triangulated convergent design[33]. The intent was to draw together the quantitative and qualitative data to inform the development of each project phase and ultimately also the final outcomes of the study. The project protocol has been published in the open access journal *BMC Nursing*.

Publication of the project protocol:

Cooper S, Beauchamp A, Bogossian F, Bucknall T, Cant R, DeVries B, Endacott R, Forbes H, Hill R, Kinsman L, Kane VJ, McKenna L, Porter J, Phillips N, Young S. Managing patient deterioration: A protocol for enhancing student nurses' competence through web-based simulation and feedback techniques. *BMC Nursing* 2012; 11: art 18.

The project comprised four phases, with research questions, objectives and activities linked to each phase. These phases and the methods used are detailed below.

University and Institutional Ethics approvals were received for all phases of the study [Lead institution: Monash University Human Research Ethics Committee CF11/3414 - 2011001825]; Deakin University Human Research Ethics Committee: 2012-030; The University of Queensland Human Research Ethics Committee: 2012000115.

Phase 1: Understanding teamwork and decision making

In this first phase, we developed an understanding of nursing students' *team* performance and decision strategies to inform the educational approaches for Phase 2. The information was collected using a mixed methods approach in order to capture both quantitative and qualitative data during/after face-to-face simulation events. Much of the first phase followed the educational strategy first developed in FIRST^{2}ACT™[15]. The primary outcome was measures of the student teams' clinical performance.

Research question to be answered in Phase 1

In emergency situations how do students perform and what are their decision strategies in primary response teams?

We aimed to:

- examine participants' ability to recognise patient deterioration in a simulated environment and establish which clinical cues are most commonly identified or missed as signs of deterioration
- identify the relationship between knowledge and skills in the recognition of physiological changes in a simulated environment
- develop an understanding of decision-making processes through student reflection.

Teaching and learning activities: Teams of three nursing students participate in three simulated patient deterioration scenarios plus debriefing.

Assessment: Knowledge, performance, situation awareness, feedback.

Methods: Phase 1

Nursing student sample

Three of the university partner organisations in two states of Australia recruited 97 final-year nursing student volunteers to a two hour simulation study in their university clinical skill laboratories. All the participants had completed a standard educational program on emergency care within their curriculum.

Simulation exercises

Nursing students, working in teams of three, completed three high-fidelity clinical simulation exercises one after another in which professional actors played standardised patients with medical conditions. Each scenario was based on a common presenting condition: acute myocardial infarction (heart attack), shock (reduced blood circulation) and chronic obstructive pulmonary disease (emphysema). Designed for 'primary responders' to an emergency, the scenarios ran for eight minutes with the patient acutely deteriorating at the mid-point (four minutes). Students worked in teams in a ward-like setting with appropriate medical equipment available (e.g. BP cuffs, ECG machine, oxygen supplies, emergency call button, etc.). For each scenario a different team leader nurse was assigned and student teams were supported by a newly qualified 'doctor'—who was one of the study team acting out the role. The team-based scenarios were developed from previous validated scenarios from related projects[13,14,34].

Figure 2.1. Nursing student team attends to a simulated patent with emphysema in Phase 1

Assessment of learning and feedback loop

Knowledge and skill measures were used as a proxy for learning, with clinical performance as the primary measure. Performance was objectively assessed using standardised assessment techniques (OSCEs) and other approaches that enabled an understanding of performance as students progressed through the program. We filmed student performances and used these records for student self-review in order to produce a realistic perspective and explicit displays of performance[35]. In addition to self-reflection, expert clinical educators gave constructive feedback (debriefing) in order to further develop knowledge and skills[36]. Full details of the assessment instruments and the feedback process are given in Appendix C. These included:

- **Knowledge**: An individual 11-item multiple choice questionnaire (MCQ) administered as a pre-test.
- **Clinical performance**: Video-recorded performance of each scenario was rated by clinical experts using an OSCE checklist: nominal yes/no ratings of key actions or observations (e.g. patient assessment, vital signs, call for assistance, etc.). Scoring related to the teams' overall performance was verified by two clinicians to ensure inter-rater reliability.
- **Non-technical teamwork skills**: Assessed by two clinicians using a previously validated teamwork assessment tool—the Team Emergency Assessment Measure (*TEAM*™)[37] (see: <http://medicalemergencyteam.com/>).
- **Team leader's situation awareness**: Examined using the Situation Awareness Global Assessment Technique (SAGAT) using post-scenario questioning (designed to identify awareness of the patient's physiological state and to ascertain respondents' awareness of the wider situation)[38]. The SA tool incorporates four subscales: i). Physiological Perception; ii). Global Situation Perception; iii). Comprehension; and iv). Projection[39,40].
- **Photo elicitation debriefing and feedback**: Involving the whole student team and led by a facilitator with video records of the simulation exercises to encourage constructive feedback that is designed to elicit an understanding of, and provide feedback on, performance.
- **Evaluation and satisfaction**: Paper-based questionnaires immediately following completion of the simulation exercises.

The total time of involvement for each team was approximately two hours.

Phase 2: Development of a web-based educational package

Informed by previous studies and findings from Phase 1, we developed an interactive web-based educational package with six components. These were: a course handbook; a voice over PowerPoint lecture; two assessment tests—a MCQ and three interactive scenarios (OSCEs); feedback techniques; and finally a course completion certification. The education package was named FIRST^{2}ACTWeb to distinguish it from our previous studies.

Developing an educational model in Phase 2

Teaching and learning activities: A multi-modal program using visual, textual, auditory (voice and sounds), optional choices and feedback mechanisms for access by individuals on the WWW.

Assessment measures: Knowledge; performance scores; perceived improvement in knowledge, competence and confidence.

Feedback techniques: Self-rated satisfaction and feedback surveys.

Methods: Phase 2

A linear step-wise teaching and learning system was designed to trigger learning, enable active participation in the scenarios and provide timely performance-based feedback. Learning was facilitated through a multimedia approach incorporating visual, textual, auditory (voice and sounds), optional choices and feedback mechanisms[25,26].

Translation of Phase 1 OSCEs to web-based interactive video scenarios

In Phase 1, face-to-face high-fidelity simulation was found to be feasible, relevant to students' curriculum, and a valuable teaching and learning approach. The original three scenarios were professionally filmed (videoed), once again using simulated patients: professional actors who portrayed each of the deteriorating patients. As in Phase 1, the actors were in a hospital setting and showed symptoms of a medical condition. At four minutes of an eight-minute scenario, their condition rapidly deteriorated.

Students' learning was facilitated through a set of screen-based visual and action choices:

- Central video recordings of a patient deteriorating whilst at bed rest in a hospital setting (see Figure 2.2).
- A range of interactive clinical tasks (based on 'mouse-over' clicks that generate pop-up videos) e.g. taking a BP and ECG (Figure 2.3).
- A range of 'pop-up' patient responses to questions about pain, previous medical history and presenting condition etc. (Figures 2.4, 2.5).
- Timed performance to create a sense of urgency, over eight minutes with acute deterioration at the four minute mark.

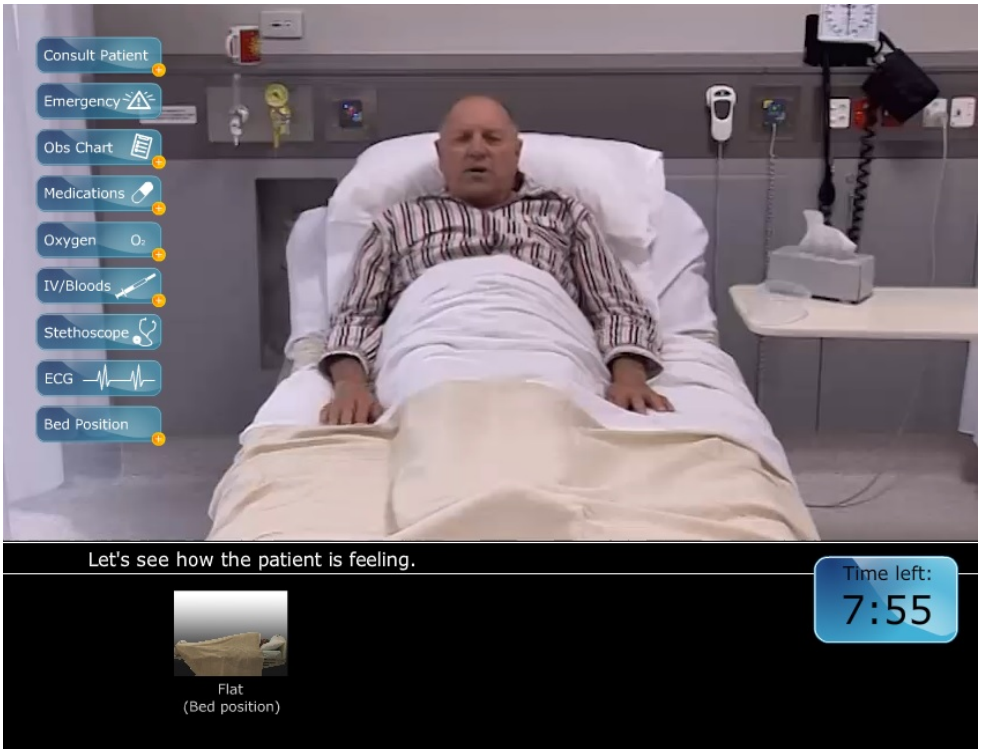

Figure 2.2. Screen shot from FIRST^{2}ACTWeb: initial screen with optional intervention tabs and timer counting down, commencing at 8 minutes

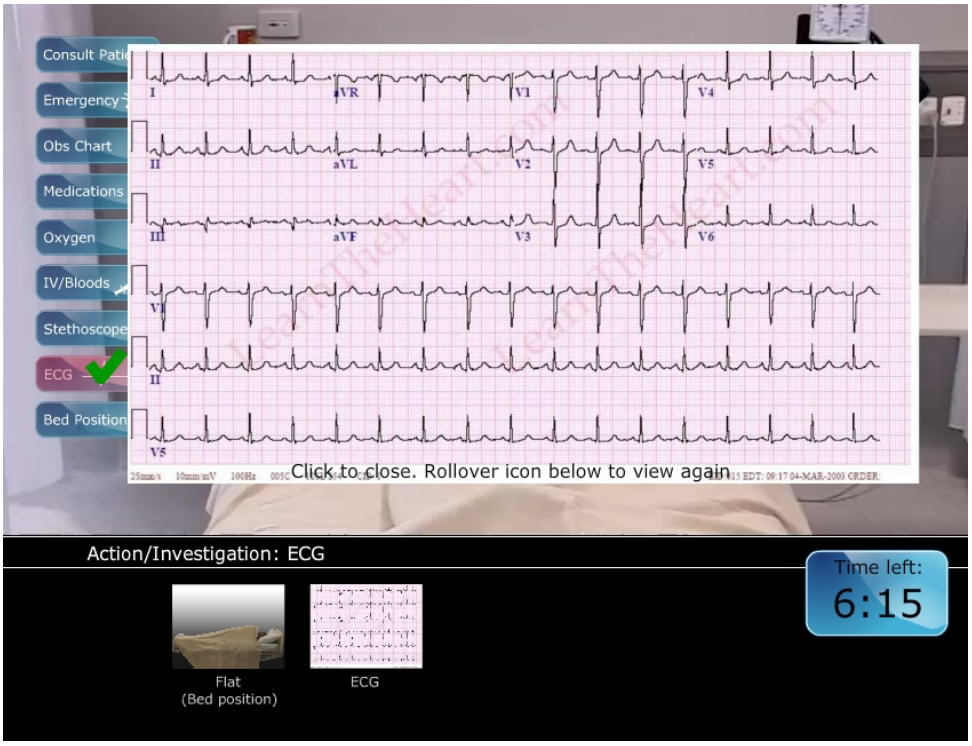

Figure 2.3. Visual reading of requested ECG

Technical issues were of prime consideration when translating scenarios into interactive video scenarios with accompanying educational information. Some technical developmental aspects of the website are described below. During development the program was tested by members of the project team in several iterations.

Table 2.1. Technical aspects of website development

The on-line program FIRST^{2}ACTWeb^{TM} is hosted on a server that has provision to enable a large number of users to log into the system at the same time, allowing for class/group access for training situations, as well as multiple users connecting to the system at the same time.

- Cloud hosting: The server use is monitored and supported through cloud hosting which automatically scales up and down as the number of users requiring access increases and falls. This gives the hosting the ability to scale to the changing needs.
- Adobe® Flash®: Each scenario was developed in Adobe® Flash® –providing a secure, stable and self-contained system that presents each scenario in an identical manor. Adobe® Flash® requires only a plug-in to be installed in the browser, in order to present each scenario in exactly the same visual format on all browsers. Some devices do not allow for Adobe® Flash® to be installed, such as iPads™ and iPhones™. The program is best designed for screens no smaller than a tablet.
- Video accessibility: Although all video Internet delivery services are compromised when Internet bandwidth is low, the video has been compressed to reduce the impact this may have. Unfortunately there is a limit, as the quality of the video needs to remain high enough for users to correctly assess the images and engage with the experience. Video is streamed, rather than downloaded as this provides the most agreeable experience to most users as any video segment that is not required is not downloaded.
- User ID code: Users are asked to log onto the system using an email address as the only identifying detail. This is required as students need to access their results, and some form of communication is required for a range of technical issues, such as password recovery. All other information can be anonymous, as the user can choose to enter more or less information, as they need. No personal information is collected other than emails.
- Linked data collection: Data is collected at several points and each set (surveys, scenarios, feedback) is linked in order for each set of data to be compared. The data is stored on the server, in mySQL and backed up locally at regular intervals.
- Confidentiality: Users can access their own data results via a dashboard available to them when they are logged in; they cannot see any other person's data.
- Click data: Data is collected about scenario performance, which includes the users score, but also which buttons they have clicked and when. This is to assist in understanding user habits, whether they are clicking the same action a number of times, and when they are commonly performing certain actions. It may help to understand user patterns in general.
- Analytical data is also collected from the website in general (through Google Analytics), this includes pages clicked, country of access, time spent on site. This data is anonymous.

Figure 2.4. Options for re-positioning the patient in the bed

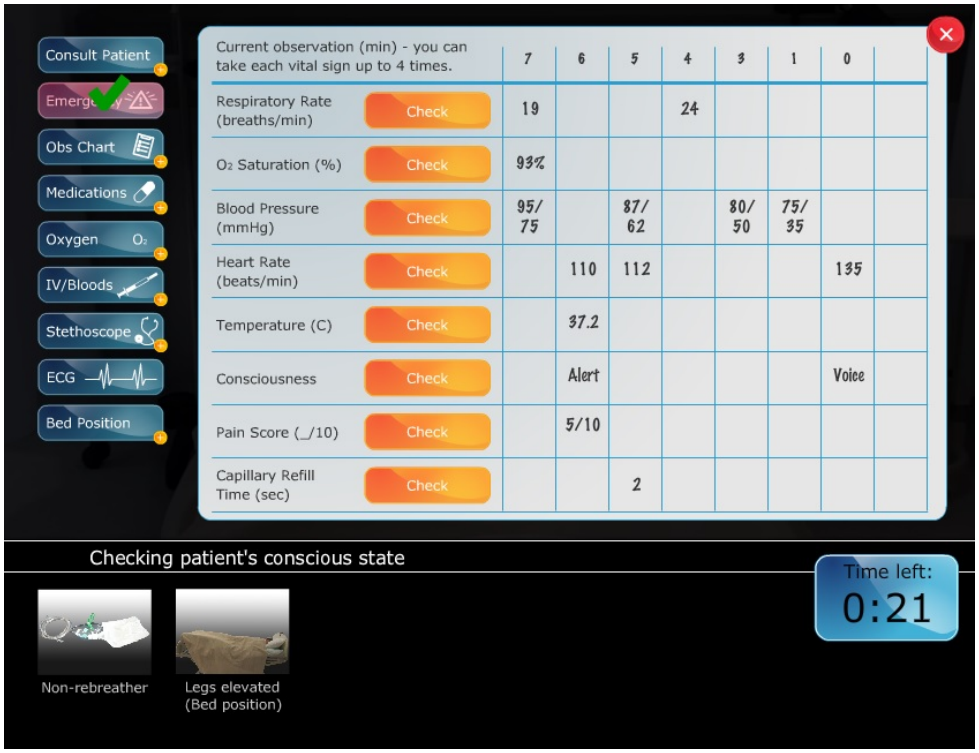

Figure 2.5. Options for rechecking vital signs or observations—only 21 seconds left to complete the nursing tasks

Phase 3: Live program implementation (testing)

The 'live' website with the interactive online educational package was trialled with nursing students and faculty staff during a three-month implementation phase. Twenty faculty members and 409 students participated.

Research question to be answered in Phase 3

What impact does the web-based learning program FIRST^{2}ACTWeb have on students and their learning?

Assessment: Knowledge, performance scores, perceived improvement in knowledge, competence and confidence.

Feedback methods: Self-rated satisfaction and feedback surveys.

During this trial and 'trouble shooting' stage, essential updates were made to the program when problems were encountered. For example, video streaming issues were noted when participants were using Internet Explorer to access the Internet.

Methods: Phase 3

Trial population

Students at nine campuses were involved (two TAFE colleges, and three universities with seven campuses). Whole-of-course final-year student populations were invited to participate. All the sites ran generic units/modules in acute care and the FIRST^{2}ACTWeb program acted as a learning supplement to those who had completed or were undertaking an acute care study unit.

The trial recruited 409 students from a population of 483 (85%). This total was 20% less than the proposed sample owing to unforseen delays in website preparation and reduced availability of students in the later semesters. Lecturers who were not associated with the project at each campus were asked to recruit students and, in Phase 4, were recruited to test the transferability of the material. In this trial stage, assessment outcomes from web-based FIRST^{2}ACT^{TM} did not directly influence the students' final unit/module assessment outcomes.

Using their institutional email accounts, participating students individually accessed the program on the Internet, with an estimated program completion time of up to 1.5 hours. In total the program was available for a period of nine months with each cohort's access restricted to approximately four weeks. Most students completed the program individually, and at home, however the first and last cohorts attended a computer laboratory to enable the developers to view and test the program in action.

Performance and outcome data that were collected included:

- participant demographics (e.g. age, first language, and institution);
- pre- and post-test MCQ results;
- simulation performance including total score and 'click' data in each scenario;
- self-reported, retrospective pre-post confidence and competence ratings; and
- a course evaluation survey.

Analysis: Phase 1 and Phases 3, 4

For Phases 1 and 3–4, data analysis was based on a triangulated convergent design where separate quantitative and qualitative analysis was performed and then compared with matrices of the findings. For example, in relation to team performance in Phase 1, we analysed quantitative outcomes based on the ratings from the TEAM™ tool and compared these with qualitative reviews of video records to form a matrix of outcomes. Data for individual participants across all sites was pooled and entered into IBM SPSS[41] for analysis. A significance level of 0.05 was determined for all descriptive and inferential tests.

Scores for knowledge, clinical performance, teamwork and situation awareness (MCQ, OSCE, TEAM™ and SAGAT instruments respectively) were summed and analyzed as continuous variables in the first instance, and the descriptive summary statistics were reported. Inferential statistics were employed to test associations between variables. For example, performance scores from Phase 1 designed to further explore student success were dichotomized according to determined cut points[42,43] and MCQ knowledge scores were divided into quartiles to enable subsequent bi-variate analysis of categorical variables[43]. In Phase 3, multiple regression analysis was used to indicate predictors of performance.

Phase 4: Evaluation of learning

An evaluation framework based on Kirkpatrick's[44] and Clarke's[45] models for educational evaluation was developed based upon the described before-and-after program measures (pre-post quasi-experimental) and qualitative evaluations (stakeholder focus groups). Both models describe the need to evaluate programs across the spectrum from personal impact on participants, to the impact on society or, in this case the likely clinical impact. In line with these approaches student satisfaction, knowledge, skill gain and workplace (clinical placement) impact would be identified as shown in Figure 2.6.

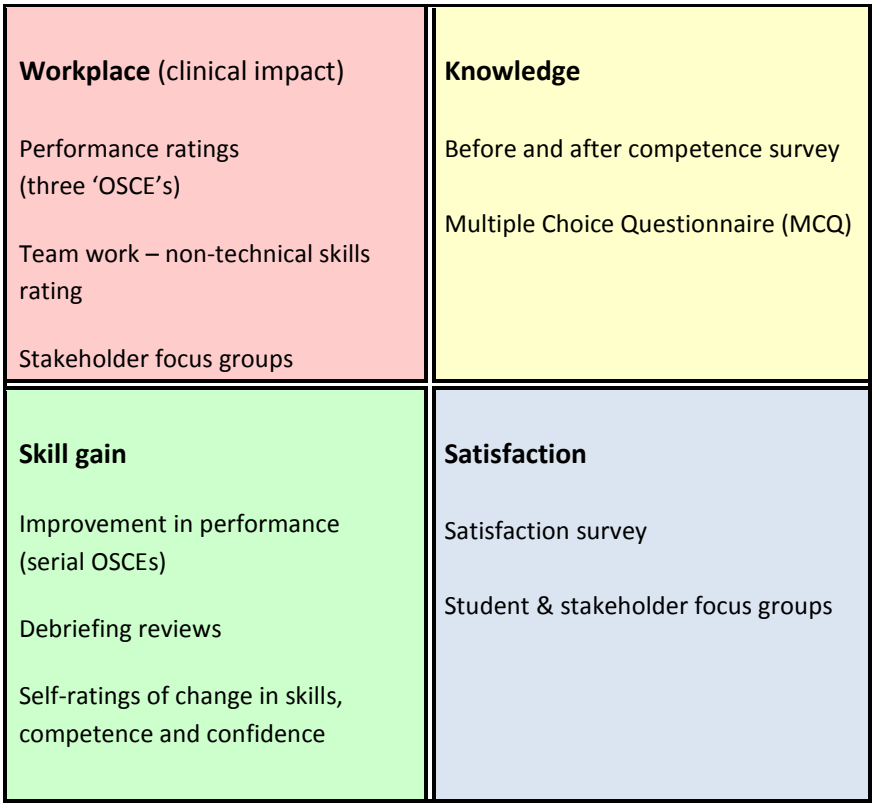

Figure 2.6. Model of evaluation of learning in the FIRST^{2}ACTWeb project

The following components were included in the evaluation process:

1. At the commencement of the study phase we developed a 'project logic' to indicate how the intervention would work. We involved stakeholders (project team, reference group, lecturers at trial sites, clinical placement coordinators and practice educators) in order to focus on the context and objectives of the evaluation e.g. the impact of FIRST^{2}ACTWeb on learning and teaching. Outcomes from these discussions guided the evaluation methods which included the following approaches.

2. Analysis of outcome data including:
   (i). MCQ scores pre-post course with applicable inferential analysis;
   (ii). Student evaluations of the course including relevance, applicability, interest, delivery mode, and descriptive outcomes together with reflective self-reports of confidence and competence levels pre-post course; and
   (iii). Eight *stakeholder focus groups*, based on a stratified sample (six in Victoria and two in Queensland) to identify the perceived impact of the program. The core themes and outcomes were identified using content analysis.

3. Based on outcomes from these evaluations, we were able to update and adapt FIRST^{2}ACTWeb to meet learning and teaching requirements.

Methods: Phase 4 – Evaluation

All students who had completed FIRST^{2}ACTWeb in full evaluated the program (*n* = 367/409). The 42 who did not complete the evaluation dropped out at an earlier stage, sometimes due to Internet link problems, video freezing and for other unknown reasons. Video lag and freezing was improved throughout the study with only the occasional remaining issue where we concluded Internet connections were poor and/or Internet Explorer was used as opposed to using Google Chrome, Firefox or Safari (the search engines of choice). Data analysis included the aforementioned quantitative approaches, whilst thematic analysis techniques[46] were used to generate key themes from stakeholder focus groups (student participants' as well as academics').

Independent evaluation

The academic partnership included Monash University (Victoria), Deakin University (Victoria), The University of Queensland (Brisbane), GippsTAFE and Chisholm Institute of TAFE in Victoria. However, a Reference Group made up of clinicians, academics and educators also informed the development of the project. The project was formally evaluated by an internal evaluator (Professor Ruth Endacott, Monash University) and an externally contracted evaluator (Professor Leanne Aitken, Griffith University, Queensland).

The methods of dissemination are described in later sections of this report.

3 Outcomes from Phase 1

This chapter reports the results of the first project phase: *Understanding team work and decision making***.** Student participants working in teams attended a simulation centre for two hours to complete a series of questionnaires and three video-recorded scenarios. A detailed description of the methods was given in Chapter 2.

Outcomes

The overall outcomes from Phase 1 of the project are summarised in Figure 3.1 and are described in detail below.

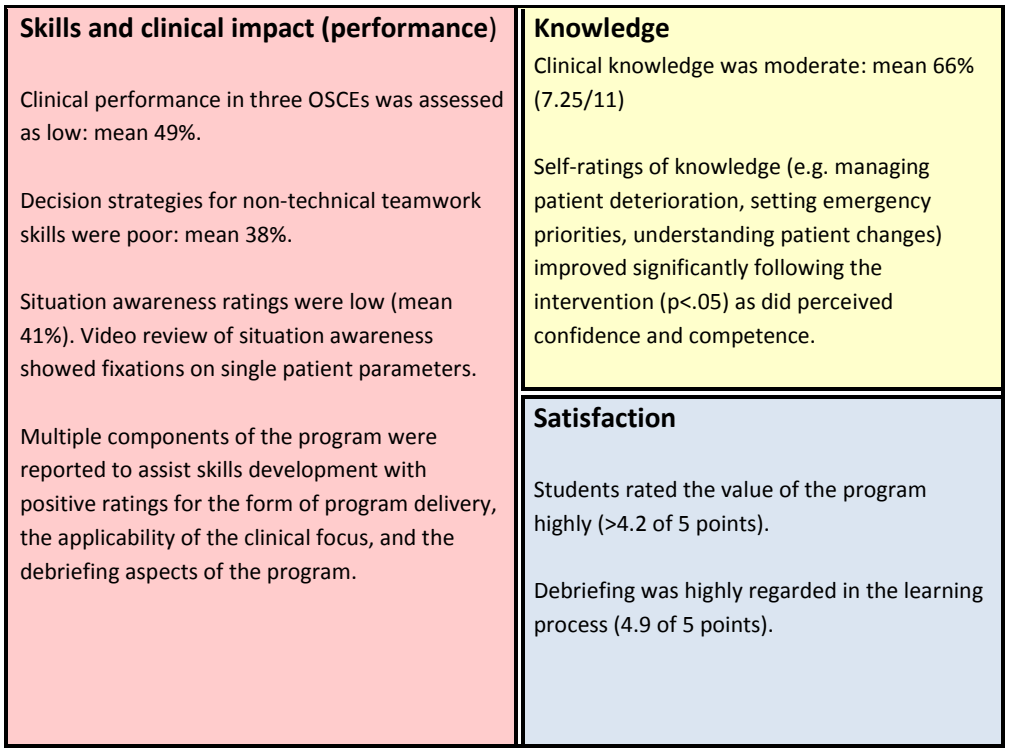

Figure 3.1. Outcomes from FIRST^{2}ACT™ team-based scenarios in Phase 1

Dissemination

The outcomes from Phase 1 are reported in three scholarly articles in nursing journals (see inset box). Conference presentations are listed in Appendix B.

Journal publications arising from Phase 1:

- Quantitative results: face-to-face team-based simulation exercises
  Citation: Bogossian F, Cooper S, Cant R, Beauchamp A, Porter J, Kain V, Bucknall T, Phillips NM, The FIRST2ACT™ Research Team. Undergraduate nursing students' performance in recognising and responding to sudden patient deterioration in high fidelity simulated environments: Quantitative results from an Australian multi-centre study. *Nurse Education Today* 2013. DOI: 10.1016/j.nedt.2013.09.015

- Situation awareness in undergraduate nursing students
  Citation: McKenna l, Missen K, Cooper S, Bogossian F, Bucknall T, Cant R. Situation awareness in undergraduate nursing students during a simulated patient deterioration scenario. *Nurse Education Today* [In review]

- Comparison of student versus RN teamwork competence
  Citation: Endacott R, Bogossian F, Cooper S, Young S, Forbes H, King V, Porter J. Leadership and teamwork in medical emergency performance of nursing students and registered nurses in simulated patient scenarios. *Journal of Clinical Nursing* [in review]

Participant characteristics

Ninety-seven final-year nursing students participated in the study; 34 from university one, 32 from university two and 31 from university three. All were enrolled in a degree leading to registration as a nurse, with 92% in the third year of their course (n= 6 were in 4th year and 1 was in 2nd year). Most were female (93%) and the median age was 21 years (range 18–52). There was no significant difference in age by university of enrolment.

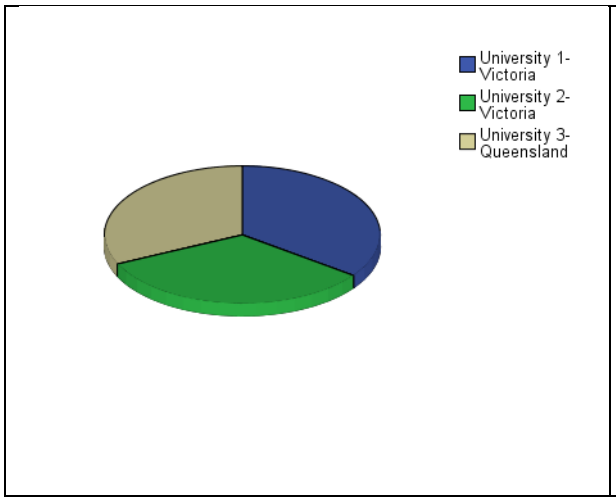

Figure 3.2. Phase 1- sample by university and state of origin (*n* = 97)

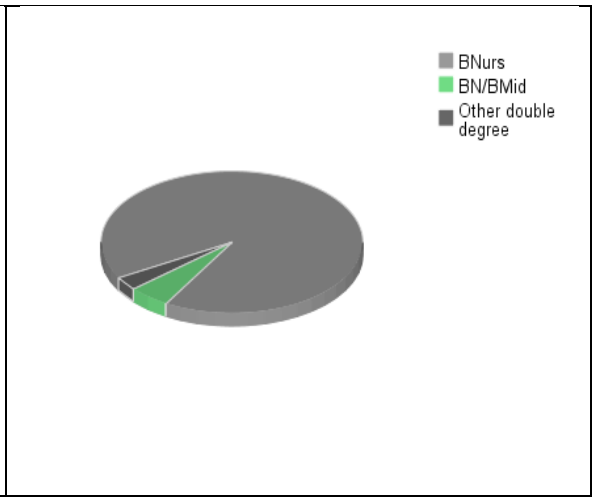

Figure 3.3. Phase 1- course of university study (*n* = 97)

Nearly all students (95%) had experienced at least three clinical placement units, commonly including general wards and mental health. In addition, half the students (50; 51.5%) reported prior clinical experience whilst employed in a healthcare-related position such as a personal care attendant or nursing assistant.

Results: Knowledge of deterioration management

An 11-item MCQ on clinical knowledge was administered to participants prior to the simulation exercises. (See Appendix C for the question items.) Results revealed a range of scores from 4 to 10 with a mean score of 7.25 (66%).

Clinical skills performance

Using a standardised OSCE rating form, each teams' performance was calculated for each of the 8-minute scenarios. The overall average score for the 97 simulation exercises was 49% (Table 3.1).

Table 3.1. Performance ratings for three clinical scenarios

Scenario (*n* = teams)	Score %	Mean /SD	Confidence interval
Cardiac scenario (*n* = 35)	45%	12.65 ± 2.83	11.68–13.63
Shock scenario (*n* = 32)	49%	12.66 ± 3.34	11.45–13.86
Respiratory scenario (*n* = 30)	54%	12.96 ± 2.61	11.99–13.91

Indicative pass marks were established for each OSCE assessment by an expert clinical team using the Modified Angoff technique[42]. They set the pass mark for the Cardiac scenario at 59%; the Shock scenario at 70% and the Respiratory scenario at 67%. Based on this, only 9 (9%) student teams passed any OSCE, clearly indicating a training deficit and a need for repetitive high-fidelity simulation to enhance performance.

Situation awareness (SA)

Using a structured checklist (see example in Appendix C), each lead student's level of situation awareness was measured immediately after each scenario. Situation awareness scores were low overall with an average score of 41%. When the four SA component ratings (summed item scores) were examined, average awareness ratings for the first three subscales were also low: 26%, 32% and 44%. However, students were better at forecasting the likely medical consequences with a projection rating of 59%. The findings indicate that students lacked awareness of the presenting condition but were able to anticipate further deterioration, again indicating a need for repetitive practice in high-fidelity situations.

Non-technical teamwork skills

The non-technical skills of each team were assessed using the *TEAM*™ instrument to rate leadership, teamwork and task management. The average total score for the 11 items was 38% and the average Global 'overall' rating 37%. Such outcomes illustrate the need for additional practice in team-based events.

Experience and knowledge in relation to performance

Knowledge as measured by MCQ was significantly positively associated (p = <0.05) with teamwork (the *TEAM*™ score), total situation awareness and clinical performance in the cardiac and shock scenarios. Prior experience of caring for a deteriorating patient was also associated with overall teamwork performance (p = <0.05). Teamwork performance was further correlated with clinical performance in each of the scenarios (p = <0.05). Such results indicate that **clinical knowledge may be a critical precursor to clinical performance and decision making.**

Evaluation outcomes

Participants provided written feedback on the value of the program using a rating scale of 1 to 5 (where five indicated their needs were met 'to a large extent'). Students rated the simulation program highly overall (Mean 4.7/5) and thought the simulations 'Provided effective feedback' (M: 4.9); they were 'Encouraged to think through a clinical problem' (M: 4.9) and thought the session was 'Relevant' to their needs (M: 4.8). They were also satisfied with the simulation environment, rating it as: 'Challenging without being threatening' (M: 4.6), and 'Appropriate' to their level (M: 4.5). We conclude therefore that participants **valued the experience with perceived educational benefits.**

Change in knowledge and skill

Participants were asked to retrospectively rate their level of knowledge and skill (based on seven criteria), and their confidence and competence prior to and then after the simulation training. All ratings improved significantly (p <0.001) suggesting improvements in these domains (Table 3.2).

Table 3.2. Self-rated knowledge, confidence and competence pre and post the simulation training (retrospectively rated) (n = 97)

Knowledge and skill	Pre-test Mean/SD	Post-test Mean/SD
Managing patient deterioration	2.66 ± 0.65	4.04 ± 0.61*
Setting emergency priorities	2.76 ± 0.71	4.03 ± 0.66*
Key emergency observations	2.93 ± 0.70	4.13 ± 0.77*
Pressures of an emergency situation	2.78 ± 1.00	4.22 ± 0.70*
Understanding patient changes	2.78 ± 0.76	4.06 ± 0.63*
Specific emergencies tested	2.65 ± 0.73	4.09 ± 0.65*
Working as a team member	3.53 ± 0.78	4.57 ± 0.56*
Confidence	2.36 ± 0.76	3.67 ± 0.71*
Competence	2.53 ± 0.77	3.67 ± 0.71*

**Significant difference p < 0.001*

Debriefing evaluation

Debriefing is regarded as one of the most important learning facilitation techniques, enabling participants to reflect on, and learn from their performance. A validated 18-item debriefing evaluation questionnaire[47] which used a 5-point Likert scale on 'achievement of learning' (1 = not achieved, 5 = achieved) was selected. Participants reported positive benefits of video debriefing with a mean (average) total score of 83% and for 17 of the 18 items the mean score was 4.6 to 4.9 of 5 (Table3.3).

Table 3.3. Self-rated satisfaction with the debriefing session and with learning Phase 1 (*n* = 97)

This session as a whole-	Mean	SD
Having a group debriefing session enhanced my learning	4.9	0.3
Strategies and ideas for improvement were raised	4.9	0.3
I was motivated to be actively engaged in reflection and constructive critique	4.8	0.5
Content was clarified when misunderstanding or confusion occurred	4.8	0.5
I identified how learning could be applied to daily practice	4.8	0.5
My questions and comments were addressed	4.8	0.4
I was able to assess factors that enabled or impeded me	4.7	0.6
I identified specific intentions or ways to improve future performance	4.7	0.5
Rapport established prior to DB	4.7	0.5
The use of video effectively enhanced my learning	4.7	0.6
I was encouraged to solve questions and problems	4.7	0.5
Open-ended questions used to facilitate appropriate problem solving and divergent thinking	4.7	0.4
Allocated time and planned use of time was clear	4.6	0.6
Structure and process of debriefing was clear	4.6	0.6
The purpose and objectives of the process were clear	4.6	0.6
The session proceeded at an appropriate pace	4.6	0.5
I revisited important points or asked follow up questions to ensure that learning was achieved	4.6	0.5
I discussed ways in which the training could be conducted more effectively	4.2	0.9

Positive perceptions of the debriefing process included: 'Group debriefing session enhanced my learning' (mean 4.9) and 'I identified specific intentions or ways to improve future performance (mean 4.7). **Overall positive feedback suggests that the students thought the debriefing process had a strong impact on their learning.**

Feedback (Open-ended comments)

Student participants were asked to comment on positive aspects of the course and how it could be improved. The majority of comments were positive, ranging from 'Not a whole lot to improve really'; 'Session was done well and everything explained clearly'; to 'Have another session in a few months' time to see how we improve' and 'All nursing students should get the opportunity to participate'.

Suggestions for improvement included 'Orientate the students around the environment so they have an idea as to where equipment is' and 'Have a better doctor'. This latter comment related to the doctor-actor role where an educator had intentionally played an inexperienced doctor in order to avoid 'leading' participants. **Where possible, suggestions for improvement were incorporated into the subsequent phases of the project**.

Phase 1 Summary: Objectives related to outcomes

We posed the question: **In emergency situations how do undergraduate nursing students perform and what are their decision strategies in primary response teams?** In relation to this question, the program objective and outcomes are described below.

> **Objective**: To examine participants' ability to recognise patient deterioration in a simulated environment and establish which clinical cues are most commonly identified and/or missed as signs of deterioration.

As shown in Table 3.1, 'clinical performance' ratings by OSCEs, SA, and *TEAM*™ were low, with less than expected 'pass' or performance rates. Final-year nursing students lacked the knowledge, clinical skills, teamwork and situation awareness required to competently manage a deteriorating patient, either as first response leaders or team members. Only a small proportion of student groups performed to the clinical standard determined by expert clinicians.

> **Objective:** To identify the relationship between knowledge and skills in the recognition of physiological changes in a simulated environment.

Knowledge as measured by MCQ scores was significantly associated (p = <0.05) with total teamwork, total situation awareness and clinical performance in the cardiac and shock scenarios. Previous care of a patient who had suddenly deteriorated was associated with overall teamwork performance. Teamwork performance was also correlated with clinical performance in each of the scenarios. Level of clinical knowledge and experience is therefore a key precursor to clinical performance.

> **Objective**: To develop an understanding of decision-making processes through student reflection.

Based upon the combined quantitative and qualiative data including the videotaped reflective interviews, it was clear that students were developing their perceptions of how to make sense of clinical cues. Emerging themes included: (i) leadership versus followership behaviours; (ii) the timing of help-seeking; (iii) reliance on prevous experience; (iv) fixation on a single detail; and (v) available team support. For example, from video analyses it was clear that the better performing teams included a member who was willing to speak out. Situation awareness is also identified in the literature as a precursor to decision making, enabling individuals to understand a situation and predict what will occur. Low SA scores in this study (41%) and fixation on single elements suggest that students did not perceive many of the elements in the environment that would give meaning and direction to their decisions.

Conclusions

Results from Phase 1 indicate that participants (final-year nursing students) demonstrated significant performance deficits when managing deteriorating patients. There may be many contributory factors to these outcomes, including insufficient opportunity to apply knowledge in realistic settings and insufficient practice and feedback that would help to reduce the high levels of anxiety portrayed in this study. However, participants reported significant benefits from attendance including a high regard for the program and the debriefing elements, and reported benefits to skills, knowledge, confidence and competence.

Whilst these outcomes are not direct measures of clinical impact, we know from our previous studies with similar interventions that they do translate into direct improvements in clinical performance[13].

In conclusion, there is a need to increase opportunities for students to integrate knowledge and skills in holistic simulated settings, and to make rehearsals of first response and team management of emergencies a key component of clinical education. However, the limiting factor in such an approach is its feasibility—face-to-face simulation-based programs are resource intensive, hence the need for a web-based resource used in combination with face-to-face approaches that will reduce the time it takes students to reach a proficient level of competency.

4 Phases 3 and 4: Web-based program implementation and evaluation

Building on the experiences of student teams and the educational findings from Phase 1, Phase 2 included the development of the web-based version of FIRST^{2}ACT™ (described in Chapter 2). In this chapter we report on the outcomes from the FIRST^{2}ACTWeb trial (Phase 3) and Phase 4 focus group evaluations. Our central research question in these phases was:

> **Research question**:
>
> What impact does the web-based learning program have on student learning and on their clinical activity?

Outcomes

The outcomes from Phases 3 and 4 are summarised in Figure 4.1.

Skills and clinical impact (performance)

Overall clinical performance in the three OSCEs was assessed as moderate: mean 69%.

Clinical performance improved significantly by 15% between the first and third scenarios (p<.001).

As in Phase 1 multiple components of the program were reported to assist skills development with positive ratings for the form of program delivery, the applicability of the clinical focus, and debriefing aspects of the program.

The post-program online evaluation indicated positive views of skill development.

Focus group analyses indicated potential positive impacts on clinical performance.

Knowledge

Knowledge was identified as a critical precursor to clinical performance with positive correlations to all OSCEs (p<.05).

Knowledge improved significantly following the intervention (69% to 79%; p< .001).

Self-ratings of knowledge (managing patient deterioration, setting emergency priorities, understanding patient changes) improved significantly (p<.001) as did perceived confidence and perceived competence.

Satisfaction

Post-test surveys reported strong agreement about the positive value of the program (mean 4.56/5).

Learning was facilitated through independent practice and clinical decision making in 'realistic' cases depicting common medical conditions.

Students recommended the program be included in all nursing courses.

Figure 4.1. Phases 3–4 outcomes of evaluation of FIRST^{2}ACTWeb

Dissemination

Results from Phases 3–4 (completed in the final stages of this 2013 study) have been disseminated through conference presentations as listed in Appendix B. Three papers are in preparation for scholarly journals. Details of Phases 3 and 4 including comprehensive evaluation are given below.

Phase 3 Recruitment

A population sample of 489 final-year nursing students who were studying for qualification as a Registered Nurse in three universities and as an Enrolled Nurse at two vocational TAFE colleges received an invitation to participate. Across sites, the recruitment rate varied between 37% and 100%, averaging 83%. Of 409 students who commenced the program, 91% (*n* = 367) completed the three scenarios and were included in the analysis.

The Webmaster identified the final dataset to be downloaded for analysis. Some cases were lost to the study owing to intentional or unintentional non-completion of the program and/or Internet access problems such as video freezing. (These 'streaming' issues were resolved by the end of the trial apart from some occasional problems where Internet access was slow or variable.)

Characteristics of nursing student participants

The final sample included 330 university nursing students from three universities at seven campuses and 37 students who were studying for qualification as an Enrolled Nurse at two vocational TAFE colleges.

Most participants (88.5%) were female. The overall median age was 23 years (range: 18–60), with no significant difference in age between the college and university groups. The diploma students were in year two (the final year) of an 18-month course and constituted 10 percent of the sample (*n* = 37). The degree students were in their final course year which equated to either year two, three or four. Most of these students (263; 72%) were studying for a three year bachelor degree, however there were also pre-registration graduate-entrants (*n* = 23: 6.2%), and 32 students (8.7%) from 4-year nursing-midwifery degrees (see Figures 4.2 and 4.3).

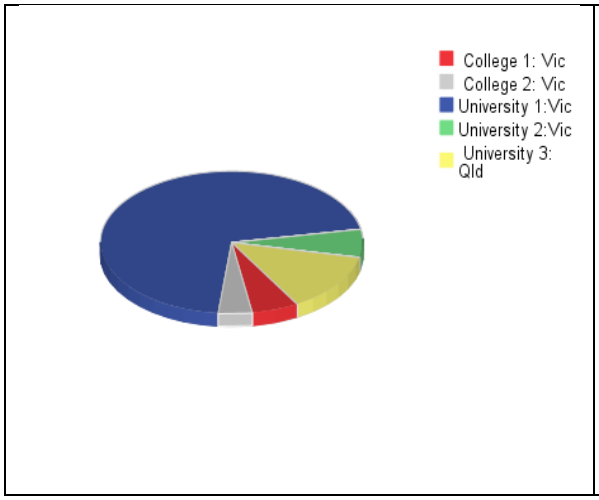

Figure 4.2. Phase 3 sample by university and vocational college and by state (*n* = 367)

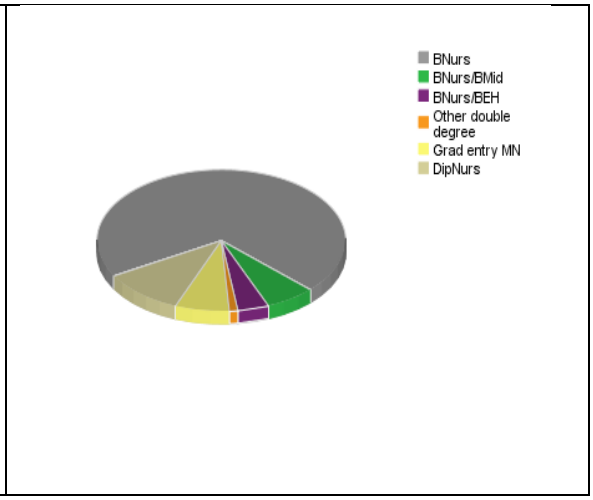

Figure 4.3. Phase 3 courses (*n* = 367)

Participants were questioned about their clinical experience including their employment status, clinical placements and experience in managing acutely deteriorating patients. Most (88%) had experienced a placement in acute wards and 87% in mental health. Half (55%) had experience as an Enrolled Nurse and one-quarter (28%) as a Personal Care Assistant or Nursing Assistant. University students had significantly greater healthcare experience than college students (p = 0.01) with half having worked in healthcare and greater experience of caring for a deteriorating patient (p = 0.01).

Results: Web-based scenario performance

Participants' scores for the three screen-based scenarios averaged 69% (Cardiac case mean: 62%; Respiratory case 77%; Shock case 68%). There was no significant difference between university and college students when the three OSCE scores were summed.

Performance progression

The scenarios were run in the order of Cardiac-Respiratory-Shock. Both cardiac and shock were rated out of a possible 30 points. The 'cardiac' initial mean score was 18.59, and the final 'shock' mean score 20.24. A paired t-test showed a significant improvement in students' performance between the first and last scenarios (t = –8.037, df 366, CI –2.048–
–1.243; p = 0.000). An independent between-subjects t-test showed that the effect size was small (Cohen's d –0.44; effect size r = 0.22).

Knowledge: MCQ test and retest (pre-post)

Students completed the 11-item MCQ before the online intervention (the pre-test) and the same test immediately after they had completed the third scenario. The mean initial knowledge score was 7.63 (SD 1.52) which improved significantly to 8.68 (SD 1.50) in the post test (t = 15.845, df 366, CI –1.185– –.124; p = 0.000). This equated to a moderate effect size (r = 0.33). Most individual items that rated less than 95% correct at pre-test showed a significant improvement after training (Table 4.1); however, there was no improvement in responses to question 8 which asked when a 14–16 gauge needle should be used.

Table 4.1. Association of repeated MCQ knowledge scores (*n* = 367)

Item Correctly identified …	**Pre-test Mean**	**Post-test Mean**
A patient who is in hypovolaemic shock will have:	0.98 ± 0.13	0.98 ± 0.13
A patient with hypoxia …	0.96 ± 0.19	0.96 ± 0.19
Slow capillary refill …	0.93 ± 0.26	0.96 ± 0.20*
The pulse can be palpated ...	0.44 ± 0.50	0.60 ± 0.49*
A normal heart rate for an adult at rest is:	0.77 ± 0.42	0.90 ± 0.30*
Pulse oximeters may be unreliable when which of these conditions are true?	0.77 ± 0.42	0.84 ± 0.36*
When assessing a patient's breathing, which of the following is true?	0.30 ± 0.46	0.40 ± 0.49*
A 14–16 gauge needle is most likely to be used for:	0.75 ± 0.43	0.70 ± 0.43
Which of the following is NEVER compatible with a cardiac output:	0.55 ± 0.50	0.65 ± 0.48*
A.V.P.U. stands for?	0.79 ± 0.41	0.88 ± 0.32*
When using a non-rebreath mask:	0.38 ± 0.49	0.75 ± 0.43*
TOTAL	7.63 ± 1.51	8.68 ± 1.50*

** Significant difference (ratings: 0 = incorrect; 1 = correct)*

Knowledge in relation to university and college groups

Students' knowledge was explored by enrolment category: 'university' versus 'college' groups. There was a significant difference in initial MCQ scores between college and university students (t = 4.491, df 365, p = 0.000; uni: 7.75, SD 1.47; college 6.59 SD 1.57) but with a small effect size (Cohens' d = 0.47, r = 0.23). The difference remained at post-test (t = 2.362, df 365, p = -.019; uni: 8.75, SD 1.46; college 8.14, SD 1.75) although the difference had narrowed and the effect size was reduced further (Cohen's d = 0.25; r = 0.12).

Demographic influences and performance correlations

Pearson correlation co-efficients indicated that non-native English speakers performed less well in each OSCE (p = 0.000) and in the pre-test MCQ (p = 0.04). Employment in the healthcare field lacked any association with outcomes, as did student category (being a domestic or international student).

Performance in the pre-test MCQ was strongly correlated with performance in the post-test MCQ (p = 0.643, p = 0.000) and performance in the pre-test MCQ was weakly correlated with performance in the OSCEs: (p = 0.000) and with the total of the three OSCE scores.

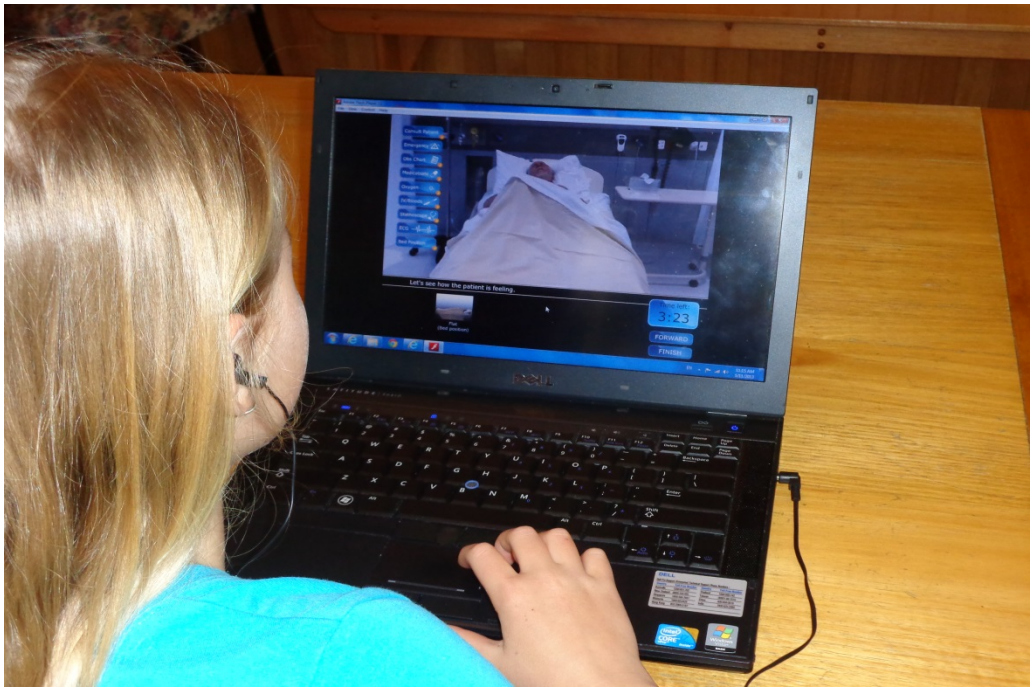

Figure 4.4. "Let's see how the patient is feeling"; Interaction with FIRST^{2}ACTWeb live

Performance in relation to screen-based 'clicks'

- **Initial actions -slow to collect data:** The final scenario (Shock) included 32 different click options/actions which were compared with eight objectively prescribed actions (from the OSCE instrument: history, RR, oxygen saturation, BP, HR, Temperature, Pain score, CRT in the first four minutes). Students were slow to collect these observations/vital signs, performing around half of the key tasks (mean 5.4) in their first 10 clicks and never all eight tasks in the first four minutes.
- **Priority observations/vital signs:** In the first four minutes of the shock scenario students prioritised oxygen saturation, BP, and Pain score. Repeated assessments are key to tracking the patient's medical condition and within the first four minutes oxygen saturation was conducted an average of 1.3 times by one-third of students, with BP and pain score averaging 1.2 times.
- **Three initial prescribed interventions** were poorly performed within the first four minutes of the Shock scenario. While almost all students gave oxygen (91%), only around one-third performed actions such as increasing IV fluids (36.5%), and auscultating the abdomen (36.5%).
- **In the second four minutes** of the Shock scenario, oxygen saturation and BP were checked by all students at least once, and were collected 1.25 and 1.05 times on average. Other required click options were not universally performed. One-third (34%) called for assistance; 55% gave oxygen via the non-re-breath mask (a total of 79% 'gave' oxygen in some form); 56% increased IV fluids; 18% positioned the patient correctly in the flat or semi-upright position, and 14% ensured IV cannulation.
- **Clicks analytics overall performance**: At the end of eight minutes 96% of participants had clicked on pain relief (give morphine), 93% had increased fluids and 79% had auscultated the abdomen. At the end of eight minutes, six of seven required observations and vital signs had

been assessed by all participants, as had the presenting complaint information.

- **Emergency calling**: Almost all students (94%) had made a call for emergency assistance by the end of eight minutes.

The overall results indicated a lack of compliance with best practice; **students lacked a systematic approach to assessment and would benefit from repeated practice.**

Program feedback: Evaluation

A 7-item online satisfaction survey enabled students to provide feedback on the web-based program. The overall total score was 33/35 (91.3%) with a median score of 5 on all items, indicating strong consensus on the positive value of the program (Table 4.2).

Table 4.2. Satisfaction survey (*n* = 367)

The FIRST^{2}ACTWeb program:	Mean	SD
Was relevant to my needs	4.62	0.66
Was appropriate to my level of training	4.62	0.65
Provided effective feedback	4.43	0.83
Was challenging without being threatening	4.44	0.71
Enabled me to integrate theory into practice	4.58	0.68
Stimulated my interest in the topic	4.61	0.65
Encouraged me to think through a clinical problem	4.65	0.66

Ratings: 1 (low) to 5 (high)

Repeated measures: Self-rated knowledge/skills, confidence and competence

Upon program completion, participants also retrospectively rated their knowledge and skills, together with their confidence and competence. Ratings indicated that students perceived significant improvements (all: p = <0.001) (Table 4.3).

Table 4.3. Self-rated knowledge and skills (*n* = 367)

Knowledge and skills	Pre-test M/SD	Post-test M/SD
1. Recognising a deteriorating patient	3.5 ± 0.81	4.37 ± 0.58*
2. Managing emergency priorities	3.21 ± 0.81	4.14 ± 0.66*
3. Performing emergency tasks	3.29 ± 0.89	4.10 ± 0.74*
4. My confidence	2.94 ± 0.84	3.99 ± 0.65*
5. My competence	3.14 ± 0.77	3.98 ± 0.66*

**Significant difference (<0.001) in Z value (2-tailed)*

Open-ended responses to questions about the value of the program were given by 164 respondents (45%) describing mostly positive feedback, and some suggestions for improvement (Table 4.4).

Table 4.4. Evaluation open-ended responses

Positive aspects of the FIRST^{2}ACTWeb program	Concerns and suggestions for improvement
It is a great program for students to enhance their clinical skills in critical situations and enable for their transition to graduate nurse. It made me to feel as I was really attending the patient. It was very helpful to become aware that nerves take over me a little bit during situations like this. Great program. Very user friendly and straightforward. We need to do a lot of these before going on placement. I feel I can prioritise much more quickly and accurately. Fantastic program, non-threatening but challenging. Learnt a lot, and my performance improved with each scenario.	It would be good to see the patient respond to the medication or intervention (i.e. a change in their behaviour, etc.). Is it possible to be talking to patient while completing a task as you lose a lot of time just asking questions? I felt like I was repeating the same tasks whereas in a real situation, there would be others around … to provide guidance as to what to do next. It seemed the patient continued to deteriorate regardless of the treatment given. … could be improved and made more real by allowing for multitasking to save time, and by simple things like leaving the pulse oximeter attached and blood pressure cuff in-situ. The program can be improved by giving an explanation of how the final score was achieved.

Focus group feedback: Phase 4

Description of focus groups

Focus groups provided further feedback from participating students and faculty about the web-based program. Between April and June 2013, six mixed staff/student focus groups and two staff focus groups were conducted with 20 students and 14 faculty from three universities. (Faculty who attended completed the program prior to the discussions.) Each group discussion was audio-recorded and transcribed in full for further analysis.

Emerging themes

Focus group feedback centred around:

(i). web program access, instructions and mastery of the interactive options;
(ii). aspects of the program they liked or disliked; and
(iii). suitability of the program for nursing curricula.

See Appendix A for details of summary points and the participants' practical suggestions for scenario improvement.

Based on the online evaluations and the focus group suggestions we made changes (where possible) to aspects of the program. For example, the 'taking blood pressure' and 'oxygen saturation' clips were reduced in length for second and subsequent recordings and additional buttons were added to enable users to 'ask the patient about their current condition'. Some suggestions were not applicable because it was felt important to mimic action in real time. It was not possible to program the software to make changes to the patients' condition dependent on students' action/treatment—however the education team did not feel that this was a limitation as in the clinical setting treatment takes some time and conditions do worsen despite applicable interventions.

Summary of findings: Phases 3 and 4

The key findings were:

- **Initial** k**nowledge of deterioration management:** The overall mean initial knowledge score was 69% which concurred with the same test in Phase 1 (66%). College (TAFE) students' pre-test knowledge scores were significantly lower than those of university students (p = 0.000).
- **Knowledge improvement**: Overall MCQ scores improved to 79% at post-test (p = 0.000). Scores of both university and college groups improved significantly (p = 0.000) with a small effect on university students (r = 0.22) and a medium effect on college students (r = 0.33).
- **Skill development:** Overall clinical performance ('OSCE') scores for the three scenarios were Cardiac 62%; Respiratory 77%; and Shock 68% with no significant difference between university and college students in the summed three OSCE scores. Overall, students' average performance improved significantly between the first scenario (Cardiac) and the third (Shock) scenario (p = 0.000). The effect size was small (r = 0.215) amounting to ~15% improvement.
- **Knowledge and skill relationship**: The pre-test MCQ of all students was weakly correlated with performance in OSCEs: (r = 0.17 to 0.22; p = 0.000). [Multiple linear regression analysis showed that knowledge (measured by MCQ) was the main predictor of clinical performance

(Shock scenario score) however this only accounted for <10% of the variance in the dependent variable.]

- **Critical decision making in relation to 'click data':** Based on the last timed 8-minute Shock scenario in-depth analyses of participants' mouse clicks indicated critical thinking and clinical decision making ability. Sequential click data showed a general trend in prioritisation with a strong initial focus on patient history, followed by vital sign recordings within the first 4 minutes, then, to a lesser extent, interventions such as IV fluids and medications. However participants were rarely systematic in their approach and none completed all the required actions.

Conclusion

In summary, Phase 3 outcomes include significant quantitative improvements in participants' knowledge and skill and positive qualitative reviews following completion of FIRST^{2}ACTWeb. Summative feedback from students and faculty in Phase 3 and in Phase 4 were exceedingly positive with reports indicating significant improvements in the management of deteriorating patients and enhanced knowledge, confidence and competence.

We conclude that FIRST^{2}ACTWeb has a significant impact on students' learning and on the development of clinical skills in a simulated setting.

Independent evaluation of the program

An independent evaluation of the program and its progress was made by a team of two Professors of Nursing. The evaluation process included an initial assessment of the project plan, risk assessment, and regular project outcome and risk reviews. Early in the project a number of potential risks were identified and where possible addressed by the project team. The program was found to lack the teamwork focus identified in Phase 1 (bar inclusion of a chapter on teamwork in the course manual) but was found to be sufficiently robust to work in different settings, sustainable beyond the initial funding period, and with the potential to enhance learning and teaching. The report can be found in Appendix D.

5 Discussion and recommendations

Core outcomes

Previous chapters have described how the face-to-face simulation-based program regarding patient deterioration management revealed significant deficits in students' performance although positive learning outcomes. The feasibility of such intensive programs of learning is questionable and led to the development of a similar web-based interactive program which was named FIRST^{2}ACTWeb. When tested, this also revealed deficits in performance but likewise significant improvements in learning. Based on feedback from this trial, the final program was updated and is currently available online and free of charge to the international community.

> http://first2actweb.com/
>
> **FIRST^{2}ACTWeb™**
>
> Open access at the above site

As such, subject to Internet access, the program is amenable to implementation by any individual or institution anywhere in the world. Users can access the program on single or multiple occasions from the link above.

Figure 5.1. The front page of FIRST^{2}ACTWeb that is now trademarked (™)

Project objectives

In this study we aimed to identify how students' managed deteriorating patients and to develop an understanding of their decision processes. Based on these outcomes our objective was to produce a practical web-based learning program that had an impact on learning and teaching. The project uses and advances existing knowledge in relation to OLT objectives through alignment with the priority of 'Innovation and development in learning and teaching, including in relation to the role of new technologies', but also covers issues in relation to 'assessment and promotion of student learning'. The project also meets ALTC Threshold Learning Outcomes[31] number two (assess health status and implement management plans); number five (deliver safe and effective collaborative healthcare); and number six (reflection and planning for personal development).

Key linkages

This project is aligned with other OLT/ALTC projects including an examination of the impact of simulated patients and IT on clinical reasoning skills[48]; a program on communication skills and video analyses[49]; standardised assessment of skills in physiotherapy[50]; and new technologies and pedagogies in teaching and learning[51]. Also of note were the disciplinary and interdisciplinary links forged throughout the project. These included:

- links with nursing leaders across the sector including close associations between the project team members at the three university and two colleges (TAFEs);
- core links with disciplinary leaders including those in the reference group, evaluation team and Deans of Nursing (see dissemination below);
- inter-disciplinary links with the Monash University IT department enabling development of the electronic resources and employment of part-time staff members; and
- all video material being produced and edited by IT students at Monash University as part of a unit of study. One student was then employed part time for the remainder of the project.

Factors key to successful project development

A number of factors were thought to be ***critical to the success of the project*** including:

- selection of project team members with a mix of skills (some with expertise in the clinical topic and others with teaching expertise, IT skills and research skills);
- adequate funding to employ a project coordinator/administrator enabling the project to proceed through all phases in an orderly manner;
- a single clearly defined leader who drove the project through the various phases to completion;
- a collaborative team who regularly shared and contributed to key project phases;
- a software programmer who was committed to and enthusiastic about the program;
- creation of a program that was feasible, relevant, varied, stimulating and challenging;
- creation of a program that collected and collated a range of quantitative learning outcomes through the Webmaster;
- the available support of references group members, who in this project were contacted individually for advice and support; and

- a two-person evaluation team (one internal and one external to the project) who developed an in-depth review of the project from the start (e.g. SWOT analyses) and met on conclusion of each stage of the project to analyse progress and advise on developments.

However ***a number of factors impeded project development*** including:

- Loss of key team members, highlighting the importance of succession planning. A project coordinator left for new employment after the first 12 months of the project and was replaced by an existing team member. In addition, the first software programmer commenced work but with little progress for the first four months of the programming phase. This individual was replaced with a team member who made up much of the time but with residual impacts on the data collection schedule.

- Initial problems with software especially when used with Internet Explorer leading to video freezing and sequencing issues. In addition, the interactive component of the program was designed with Flash® software limiting the program to PCs (i.e. not iPads™, etc.).

Project dissemination

1. **The core and central outcome from the project is the freely available project material on the website**. Users are required to obtain a password after which they can access the program as many times as they wish. Core outcomes are collected by the system (e.g. demographic profiles, knowledge, skills performance and evaluation data) and will be used in anonymous reports at a later date. Such data will enable the applicability of the program to be tested in groups other than students—for example it is likely that the material will be used for continuous professional development by nurses and other health professionals. The website also includes material and publications on previous patient deterioration studies indicating 'best practice' guidance on face-to-face programs for students and instructors. Our original intention was to produce a web-based instructor forum, however, in the end this was not required as the program can be completed independent of additional instruction, although advice and guidance is available for the project team at any time.

2. **The final report** will be made available to stakeholders and library depositories and the eight publications in Appendix B are either available (or near completion) in a range of peer-reviewed journals.

3. **Dissemination:** To date, ten conference presentations and workshops have been presented in a range of national and international conferences (including in Italy, USA, Hong Kong and the UK). This process has enabled access to leaders in the field including the Deans of Nursing in Australia and educators throughout the sector. See Appendix B for details.

4. **A program of publicity** relating to the availability and access to the program will continue into the near future. A list of key nursing educators in the university and college sector is being collated in order to distribute publicity material.

Finally, a comment in regard to early uptake. Dissemination included a 'Launch' of the live FIRST^{2}ACTWeb™ as an open access program at an international emergency nurses' conference in October 2013. As a result of this and various other publicity, the package has been promoted through Facebook notifications both in Australia and internationally. In the first weeks after release (7–17 October 2013) the site was visited by 675 individuals. The program access will continue to be

tracked through Google Analytics by the Webmaster, and we will be able to report on a number of participant variables and performance outcomes.

Overall conclusion

In summary, this two year project has identified performance deficits in student nurses' management of deteriorating patients. However, both face-to-face and web-based interventions demonstrated benefits to learning and teaching. Results indicate the need to increase opportunities to integrate knowledge and skills in holistic simulation settings and to make such practice a mandatory process of clinical education. In the aircraft industry, pilots are required to pass annual flight simulator assessments to be licensed to fly. To ensure patient safety a similar process of assessment for healthcare staff is essential.

In arguing that 'multiple methods of teaching are the best methods of teaching' it is likely that face-to-face options supported by web-based programs such as FIRST^{2}ACTWeb^{TM} will be an effective way to enhance students' autonomy, purpose, and mastery of patient deterioration management.

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Appendices

Appendix A: Supplementary data from Phase 1 and Phases 3–4

Phase 1: Student participants' characteristics (*n* = 367)

Participants' characteristics		***n* (%)**
Sex	Female	90 (92.9)
	Male	7 (7.1))
Course of study	Bachelor of Nursing or Bachelor of Nursing Practice	89 (91.8)
	Bachelor of Nursing/B Mid	5 (5.2)
	Other BN/Double degree:	3 (3.0)
Year of course	Year 2	1 (1.0)
	Year 3	90 (92.8)
	Year 4	6 (6.2)
Ever employed in healthcare-related position	Yes	50 (51.5)
Ever cared for a rapidly deteriorating patient	Yes	47 (48.5)
		Mean (SD)
Age by university	University A	23.91 (7.9)
	University B	22.22 (4.3)
	University C	21.69 (2.4)

Phase 3: Summary of student participants' additional characteristics (*n* = 367)

Participants' additional characteristics		***n* (%)**
Sex	Female	325 (88.5)
	Male	42 (11.5)
Age range	Up to 20 years	24 (6.5)
	21–30 years	196 (53.40
	31–40 years	43 (11.8)
	41–50 years	41 (11.2)
	51–60 years	12 (3.3)
Tertiary education category	Vocational college University	37 (10.1) 330 (89.9)
Language spoken at home	English alone	297 (82.8)
	Other language	69 (17.2)
Enrolment category	Domestic	336 (91.5)
	International	31 (8.5)
Course of study	Bachelor of Nursing or Bachelor of Nursing Practice	263 (71.6)
	Diploma of Nursing	39 (10.6)
	Bachelor of Nursing/B Mid	32 (8.7)
	Graduate entry: Master of Nursing Practice/ Master of Nursing Studies	23 (6.2)
	Bachelor of Nursing/ Bachelor of Emergency Health (Paramedic)	15 (4.1)
	Double degree: BN/ Applied Science (Psych) or Public Health	3 (0.8)
	Masters – other	3 (0.8)
Year of course	Year 2	63 (17.2)
	Year 3	270 (73.6)
	Year 4	34 (9.3)
Current course semester/trimester	Semester 1	300 (81.7)
	Semester 2	24 (6.5)
	Trimester 1	15 (4.1)
	Trimester 2	2 (0.5)
	Trimester 3	26 (7.1)

Phase 4: FIRST^{2}ACTWeb feedback – Summary points from student and staff focus groups

Positive aspects

The program overall

'It gives a good systematic approach to how we would do that. I thought it was really nicely put together and easy to understand.'

The scenarios

'I'm just so happy to do these scenarios … I felt like after I'd done three I was like great: "Give me 10 more". This is like, right, this is kind of mobilising stuff in a structured way.'

The manual

'I had a very good look at it and I think it's a great resource and really comprehensive.'

The certificate

'I don't know that I knew that I was going to get a certificate, but when I did I was pretty excited because I think it was really important for me to do.'

Summary

'My recommendation at the end was it should be brought into the curriculum ... like, I feel more confident now to be at least some sort of help in a real scenario …'

Summarised points for improvement

PowerPoint presentation

Talk slower

Scenarios

Introduction – Needs changing to an interactive talk through (with a moving mouse icon – 'if you click on this - this will happen' etc.).

The scenarios themselves

Main issue – patient's condition does not change – possible solutions:

1. A 'check patient's condition' button with either a brief written pop-up 'despite your actions the patient is still not doing well – keep going'
2. Or, perhaps better, record some voiceovers from the actors, for first 4 mins 'oh nurse thanks for your help but I'm still not feeling right' – then for the last 4 mins a similar response but with applicable moans and groans etc.

'O2 Sats needs to stay on after first recording.'

'BP cuff needs to stay on after first recording.'

'Ask patient about their condition' – re-word to 'ask patient about their presenting condition'.

Emergency button – give feedback – 'staff are with another emergency and will be with you as soon as they can'.

Summary points

'It gives a good systematic approach to how we would do that. I thought it was really nicely put together and easy to understand.'

'I think it's exciting. I think it's … the first little brief was really well put together and I think it's a really important initiative. … I think it's value laden for health care professionals and I think it's fabulous.'

'I think it's got potential to be quite useful. I think you just need to – you'd need to tweak it so that it was more realistic.'

'Yeah, no I think it's great. I think quality of it – having done a few of them over the years – the quality of the video and the questions and everything.'

'It's great.'

Appendix B: List of project outputs and publications

1. Website		
	The education package: FIRST^{2}ACTWeb <first2actweb.com>	
2. Facebook		
Facebook (Impacted Nurse)	<www.facebook.com/permalink.php?id=253568074686083&story_fbid=614501611926059>	
3. Published or in-press refereed articles		
Citation	**Topic**	**Status**
Cooper S, Beauchamp A, Bogossian F, Bucknall T, Cant R, DeVries B, Endacott R, Forbes H, Hill R, Kinsman L, Kane VJ, McKenna L, Porter J, Phillips N, Young S. Managing patient deterioration: A protocol for enhancing student nurses' competence through web-based simulation and feedback techniques. BMC Nursing 2012; 11: art 18.	Project protocol	**Published**
Bogossian F, Cooper S, Cant R, Beauchamp A, Porter J, Kain V, Bucknall T, Phillips NM, The FIRST2ACT™ Research Team. Undergraduate nursing students' performance in recognising and responding to sudden patient deterioration in high fidelity simulated environments: Quantitative results from an Australian multi-centre study. Nurse Education Today 2013. DOI: 10.1016/j.nedt.2013.09.015	Quantitative results: face-to-face team-based simulation exercises	**Published**
Endacott R, Bogossian F, Cooper S, Young S, Forbes H, King V, Porter J. Leadership and teamwork in medical emergency performance of nursing students and registered nurses in simulated patient scenarios. Journal of Clinical Nursing	Comparison of students' Phase 1 performance versus RNs' teamwork competence	Oct 2013: In second review
McKenna l, Missen K, Cooper S, Bogossian F, Bucknall T, Forbes H, Cant R. The human factors: Teaching situation awareness in undergraduate nursing students managing simulated patient deterioration. Nurse Education Today	Situation awareness in undergraduate nursing students	Oct 2013: In second review
4. Refereed papers In development		
Analysis of decision strategies from Phase 1 video and interview data	Tracey Bucknall NF, HF, VK, JP, RE, FB	Draft available by end 2013
'Click' data – Phase 3 evaluation	Simon Cooper, RC, JP (and TBC)	Ongoing for 2014
Quantitative outcomes – Web data – Phase 3	Fiona Bogossian SC, JP (and TBC)	Ongoing for 2013/4
Evaluation of face to face teaching compared with web-based learning in university nursing students.	Simon Cooper RC, JP (and TBC)	Ongoing for 2013
Descriptive paper on reported student satisfaction with learning from Phase 3 evaluations and phase 4 focus groups/evaluations.	Robyn Cant JP, SY, LK, SC	Ongoing for 2013

(continued)

5. Conference presentations		
Conference details	**Speaker**	**Content of presentation**
ICN 25th Quadrennial Congress 2013: 18–23 May, Melbourne	Simon Cooper, Helen Forbes, Fiona Bogossian	40 minute skills workshop related to development of FIRST^{2}ACT™ website.
ICN 25th Quadrennial Congress 2013: 18–23 May, Melbourne	Fiona Bogossian	Presentation "Who will be the First 2 Act to recognise and treat the deteriorating patient?"
International Clinical Skills Conference 2013: 19–22 May Prato, Italy.	Joanne Porter	Development of a web-based patient deterioration simulation training program to enhance competence.
12th Annual International Nursing Simulation Conference 2013: June 13–15, Las Vegas USA.	Simon Cooper	Early outcomes and presentation of software
12 July 2013 Meeting of the Council of Deans of Nursing & Midwifery (Australia), Brisbane	Fiona Bogossian	Presentation:FIRST^{2}ACT ™ -Implications for Schools of Nursing & Midwifery
IIR conference series- Managing the deteriorating patient, Royal College of Nursing 2013: 17–18 September, Melbourne.	Joanne Porter	40 minute workshop on development of FIRST^{2}ACT™ website; taking simulation from the live lab to an interactive online web site.
The University of Hong Kong 2013: 12–13 September, Hong Kong.	Simon Cooper	2 day workshop, F2A – train the trainer F2A, TEAM™ tool, face to face scenario teaching.
Monash University – post graduate Masters simulation course 2013: 23 September, Monash University Clayton, Vic.	Joanne Porter	2 hour workshop on First2ActWeb: development of the evaluation tools, scenario writing, TEAM™ tool/use of simulation in undergraduate education.
11th International Conference for Emergency Nursing (CENA) 2013: 9–12 October, Melbourne.	Simon Cooper	Key note speaker, showcasing FIRST^{2}ACTWeb™ active site and international launch.
University of Brighton 2013: 29th October, United Kingdom.	Simon Cooper	2 hour workshop on First2ActWeb™ development.

Appendix C: Instruments and examples of checklists used in the project

Participant Demographic Survey (Students)

Participant No.: ..... Date: ..... Study Centre: ……..

Participant demographic form			
Your sex? (please tick one)	☐ Female ☐ Male		
Your age?	……..Years		
Your course of university of study? (Please tick one)	☐ Bachelor of Nursing ☐ Bachelor of Nursing/Bachelor of Midwifery ☐ Bachelor of Nursing/Bachelor of Public Health and Health Promotion ☐ Bachelor of Nursing/Bachelor of Applied Science (Psychology) ☐ Bachelor of Nursing/Bachelor of Commerce ☐ Diploma of Nursing ☐ Other (please name): ……		
What year of your course are you currently studying?	☐ Year 1 ☐ Year 2 ☐ Year 3 ☐ Year 4	In which semester or trimester are you currently enrolled? (please tick one)	☐ Semester 1 ☐ Semester 2 ☐ Trimester 1 ☐ Trimester 2 ☐ Trimester 3
Have you ever worked as an employee in a nursing or healthcare related field (eg., EN, PCA)	☐ No ☐ Yes – <u>If yes</u>, what was your role and how many years did you work in that role? …… ……..		

(continued)

<table>
<tr><td rowspan="5">Where have your clinical placements been during your nursing education? (please tick any)</td><td>Aged care</td><td></td><td>General wards</td><td></td></tr>
<tr><td>Community</td><td></td><td>Mental Health</td><td></td></tr>
<tr><td>Critical / intensive care</td><td></td><td>Operating Theatre</td><td></td></tr>
<tr><td>Emergency</td><td></td><td>Rehabilitation</td><td></td></tr>
<tr><td>Other (please specify)</td><td colspan="3"></td></tr>
<tr><td>Have you ever cared for a patient whose condition suddenly deteriorated such that a medical emergency or Medical Emergency Team (MET) was called?</td><td colspan="4">☐ No
☐ Yes –If yes, what was your role?
☐ Observer ☐ Recorder/scribe
☐ First responder ☐ Calling MET
☐ None
Comments ……</td></tr>
</table>

[ANSWER SHEET]: **Candidate number .....**

Questionnaire for nursing students (MCQ)

Date: ……

Please complete the following multiple choice questionnaire by circling the best answer for each question. Each question has only one correct answer. You have 10 minutes.

Q 1.	**A patient who is in hypovolaemic shock will have:**	
	a.	Normal capillary refill
Correct	b.	Cold clammy skin
	c.	Facial flushing
	d.	Warm dry hands

Q 2.	**A patient with hypoxia is likely to be:**	
Correct	a.	Confused
	b.	Pink
	c.	Happy
	d.	Hot

Q 3	**Slow capillary refill is a sign of:**	
Correct	a.	Vasoconstriction and poor peripheral perfusion
	b.	Malnutrition and dehydration
	c.	Warm hands and feet
	d.	Reduced concentrations of oxyhaemoglobin

Q 4	**The pulse can be palpated:**	
	a.	Every time the atria contacts.
	b.	When a vein is close to the surface of the skin.
	c.	Every time the left ventricle contacts.
Correct	d.	When an artery is close to the surface of the skin

Q 5	**A normal heart rate for an adult at rest is:**	
	a.	60-80 bpm
Correct	b.	60-100 bpm
	c.	60-90 bpm
	d.	60-110 bpm

(continued)

Q 6	**Pulse oximeters may be unreliable when:** (CHOOSE the correct answer from a, b, c, or d below)	
		1. tissue perfusion is poor 2. the patient is wearing nail varnish 3. haemoglobin is 100% saturated 4. measured on the ear lobe 5. the patient has a cold 6. haemoglobin levels are low 7. digits are cold **8.** the patient is elderly
Correct	a.	1,2 & 7
	b.	2, 3 & 6
	c.	1, 4 & 8
	d.	*2, 5 & 7*

Q 7.	**When assessing a patient's breathing:** (CHOOSE the correct answer from a, b, c, or d below)	
		1. Assess for 30 seconds 2. Look for chest movements 3. Use a mirror to check for exhaled air 4. Listen for breath sounds 5. Feel for exhaled air on your cheek 6. Always remove dentures
	a.	**1, 2 & 4**
	b.	**2, 3 & 5**
Correct	**c.**	**2, 4 & 5**
	d.	**1, 4 & 6**

Q 8	**A 14-16 gauge needle is most likely to be used for:**	
	a.	Elderly patients
	b.	Paediatric patients
	c.	Inserting in the back of the hand
Correct	d.	Trauma or burns patients

Q 9	**Which of the following is NEVER compatible with a cardiac output**?	
	a.	Supraventricular tachycardia
	b.	Ventricular tachycardia
	c.	Atrial fibrillation
Correct	d.	Ventricular fibrillation

(continued)

Q 10	**A.V.P.U. stands for?**	
	a.	Alert, Visual, Peripheral, Unconscious
	b.	Altered, Verbal, Pain, Unresponsive
	c.	Anxious, Violent, Paranoid Unsettled
Correct	d.	Alert, Voice, Pain, Unresponsive

Q 11	**When using a non-rebreath mask:**	
	a.	40% O_2 is delivered to the patient
	b.	100% O_2 is delivered to the patient
	c.	The reservoir bag should not be inflated prior to placing on the patient's face
Correct	d.	O_2 flow rates of approximately 15 litres a minute are required in adults

Cardiovascular System Scenario

Research staff:

- Participants should be asked to arrive dressed as they would for clinical placement. That is, in uniform, hair and jewellery appropriate, note pad, pen, watch, stethoscope, etc.
- Ask participant not to discuss the scenarios with their colleagues until study is complete.
- Ensure demographics form is completed.
- Ensure MCQ test is completed.
- Ensure microphone/video is correctly placed over the patient actor.
- Ask SA questions at the end of the scenario.
- Simplify room and monitoring with BP, O^2 Sats available.
- Have an ECG machine available.
- Brief 'newly qualified doctor' to support appropriately but not to prompt, i.e. they can give drugs and increase infusion rate if requested.
- Run through scenario with participants and ask them to repeat it back.
- Emphasise the need to record observations regularly and verbalise thoughts and actions.

Briefing notes

Nursing student: You are just starting your shift. There are two other Registered Nurses working on the ward who you can call on for assistance if needed. You also have the support of a junior doctor who will assist and support as required. As your 'patient' is an actor you are required to take observations as per normal but results will be revealed by your doctor. The patient is in a quiet side ward.

The patient: John is 65 years of age and was admitted a few days ago with cellulitis of his leg for which a course of IV antibiotics has been completed. The IV cannula has been removed and he is due for discharge to home this afternoon. He has just rung the patient call bell. You respond and enter his room. He tells you he has chest pain and points to the centre of his chest. You are the first to respond.

The scenario will be run in 'real time'. There will therefore be gaps in activity, *(this does not mean you are doing anything wrong).* An observation chart is available for you to document your observation findings. Talk out loud about what you are thinking and doing. You can ask for the patient's status at any point and you can expose him down to his underwear.

At the end of the simulation you will be stopped and asked about specific aspects of the situation, as you perceive them, at that time. The questions should be answered as rapidly as possible – it is Ok to use your instinct.

Supporting Doctor – role
DO NOT PROMPT at any point. Give information as requested after an applicable action, i.e. only indicate the BP or HR after it has been taken. Please rate performance on the following scale during or immediately after each scenario.

Provide the participant with the Inferior acute myocardial infarction ECG after one has been done.

Patient scenario:

You are Mr John Edwards a 65-year-old retired accountant.

Moulage – Cyanosis – i.e. pale/sweaty lips (does the actor have the correct make up?)

Presenting condition (If asked)

You were admitted a few days ago for cellulitis of the leg and have been treated successfully with IV antibiotics. About 20 minutes ago you got severe chest pain and you rang the patient buzzer for a nurse.

- Chest pains and breathlessness.
- The pain came on gradually and is currently approx 5/10.
- The onset of pain was AT REST. You did not have indigestion.
- The pain was across the front of your chest. It did not radiate anywhere else.
- The pain was accompanied by you feeling generally unwell and breathless. You still feel your breathing is 'a bit tight'.
- You have had this pain in the past. It does feel similar to your angina pain.
- Usually you need to use your GTN approx once every month or so and you have not seen your GP about your angina for the last 8–9 months.

You are anxious and agitated but not aggressive. Your wife is out shopping with her sister and you have been unable to contact them so far.

Past medical history

- You are known to have high BP for which you take medication.
- You had a blood test to check your cholesterol last year which was 5.4
- You have had angina for the last 3 years

Drug history

- Metoprolol 50mg twice a day (for your BP and angina – you think)
- Aspirin 100mg daily
- Pravastatin 40mg at night (for your high cholesterol)
- GTN spray prn (for your angina when you need it)

Social history

- You drink 4 glasses of red wine per day.
- You eat 'healthily'.
- You smoked 20 cigarettes per day for 25 years but have recently given up
- You have gained about 6kg in weight over the last 6 months.
- Married to Grace, also retired, with four adult children.
- You don't exercise specifically but you take your dog for a walk twice a day

Family history

- Your father died aged 48 years of a heart attack which is adding to your concerns.

Decline at 4 minutes (halfway point of scenario)

- Rapid increase in chest pains (9/10) and breathlessness (rapid shallow breaths)
- The pain is crushing central chest pain right across the front of your chest. It did not radiate anywhere else.
- You are anxious, agitated and very frightened.

Objective Structured Clinical Examination Checklist/Scoresheet

CVS Chest Pain (Scenario 1)				
Approx Time (mins)	Observations	Action	Correct/ incorrect	*Points at debrief*
On arrival 1-4		**Obtain immediate history**	**Y/N**	
	5/10	**Pain assessment**	**Y/N**	**PQRST (**Provoke/Palliation, Quality, Radiates, Severity, Time**)**
		Record/request obs		
	BP 150/95		**Y/N**	
	HR 110 *(if palpated)*		**Y/N**	
	RR 20		**Y/N**	
	CRT – 2 secs		**Y/N**	
	O^2 Sats 95%		**Y/N**	
	Temp 36.8		**Y/N**	
		Investigate current medication usage	**Y/N**	**Prescription, over counter, recreational**
		Identify other symptoms	**Y/N**	**Dyspnoea, nausea, diaphoresis, neck vein extension**
		Consider non-cardiac causes of chest pain	**Y/N**	**Aortic aneurysm, oesophageal reflux, pneumothorax, musculoskeletal**
		Aspirin (sub-lingual)	**Y/N**	
		Performed a 12 lead ECG	**Y/N**	

(continued)

Patient rapidly deteriorates **Rapid increase in chest pains (9/10) and breathlessness (rapid shallow breaths)**				
4-7.5	**9/10** **BP 170/95** **HR 140** **RR 32** **CRT – 2 secs** **O^2 Sats 89%** ***(despite O^2 if on)***	**Pain assessment** **Nitrates** **Record/request Obs.**	**Y/N** **Y/N** **Y/N** **Y/N** **Y/N** **Y/N**	**Emphasise systematic ABCs. Time critical**
		Call for Assistance **Nurses** **Doctor** **Met call** **Position appropriately** **Administer O_2** (non-rebreath) **Ensure IV cannulation** **Blood specimens** **Morphine** **Assigns tasks to nurses during scenario**	 **Y/N** **Y/N** **Y/N** **Y/N** **Y/N** **Y/N** **Y/N** **Y/N**	**Upright or Semi-recumbent.** MONA **– M**orphine, O**xygen,** N**itrates,** A**sprin** **Allocates tasks to nurses, ECG, Vital signs.**
7.5 -8 mins?	**BP 140/80** **HR 120** **RR 25** **CRT – 2 secs** **O2 Sats 93%**	Instructor Note**:** **Unless majority of above have been missed indicate these observations and initial stabilisation.**		**Stabilisation may be temporary**
End scenario with SA questions				

Situation awareness (SA)

Process for development of SA questions

(Wright et al. 2004: Objective measures of SA in a simulated medical environment)

Goal Task Analysis (Cardiac)

Key Goal
Resuscitation

Sub Goal
Primary Stabilisation/Resuscitation (first 8 minutes)

Key Decisions
What is the patients' status (observations)?
Is assistance required?
What is the differential diagnosis?
What equipment is required?
What responses are required to the observations?
How should the patient be stabilised?

SA Requirements
Visual assessment (e.g. RR & LOC)?
Physiological monitoring (BP, HR, Temp, CRT, $SpO^{2,}$)?
Awareness of the need for assistance?
Observation/indicators of pain?
Awareness of heart rythm?
Awareness of equipment requirements?
Awareness of applicable actions (e3.g. analgesia)?
Awareness of requirements for patient stabilisation (e.g. MONA)?

SAGAT Queries

Physiological Perception
What is the BP at the moment?
What is the HR at the moment?
What is the RR at the moment?

Global Situation Perception
Is suction available?
What's on the patient's wrist?
What was on the wall near the patient?

Comprehension
Is the patient adequately oxygenated?
What is wrong with this patient?

Projection
If condition does not improve, what will happen to the HR?
If condition does not improve, what will happen to the BP?
What investigations may be required?
What medications may be required?

Situation Awareness Checklist

Cardiac Scenario

Question	Answer	Right	Wrong
What medications may be required?	**2 of- Morphine, Nitrates, Asprin**		
What is the HR at the moment?	**140 or 120**		
Is the patient adequately oxygenated/sats?	**NO - 89% - 93%**		
What is on the patient's wrist?	**A friendship band**		
What investigations may be required?	**2 of -12 lead ECG, Bloods (cardiac enzymes), CXR**		
What was on the wall near the patient?	**Childs drawing**		
If condition does not improve, what will happen to the HR initially?	**Increase**		
What is wrong with the patient	**MI**		
What is the BP at the moment?	**170/95 or 140/80**		
What is the respiratory rate at the moment?	**32 or 25**		
Is suction available?	**Yes**		
If condition does not improve, what will happen to the BP initially?	**Increase then decrease**		

Rating: correct = 1; incorrect =0

Photo elicitation schedule

Key points for feedback following photo elicitation

Use beefburger technique:

- Good points – points for improvement – finish with good points
- You will have 15 minutes only for the feedback (please do not overrun)

As you work through the scenario with the student (photo – elicitation) make notes on a spare rating form. You will see that this form has key points for feedback:

In cardiac scenario these are:

- PQRST – pain assessment
- Current medication usage
- Key symptoms
- Non-cardiac causes of chest pain
- Patient positioning
- MONA

In the respiratory scenario these are:

- Discuss summarise 'blue bloater'
- Current medication usage
- Key symptoms
- Patient positioning
- Drugs required
- O_2 levels – hypoxic drive issues – aim for 90% sats – but GIVE lots lots of o_2 in this emergency

In the hypovolemic scenario these are:

- Importance of ongoing assessment of circulation – Central and peripheral
- Fluid resuscitation - IV access (2 large bore cannula)
- Key symptoms
- Patient positioning

<u>General take-home points:</u>

- Highlight the need to watch trends
- Need to record respiratory rates (the missed observation)
- Call for help early
- Increase frequency of observations when necessary
- Importance of vital signs being attended overnight
- Check urine outputs, blood sugar, level of consciousness, pain scores.
- Importance of taking Vital Signs overnight

Debriefing evaluation questionnaire

Candidate number ..... Date .....

Debriefing evaluation

The debriefing session was the one you have just attended, where you were given performance feedback, after you had finished watching/commenting on the video

Please read the following statements carefully and follow the scale below to record your answers.

At the beginning of the debriefing session, to what extent was each of the following achieved?	**Not achieved** **1**	**2**	**3**	**4**	**Achieved** **5**
The purpose and objectives of the debriefing session were clear.	**1**	2	**3**	**4**	**5**
The structure and process of the session was clear.	**1**	**2**	**3**	**4**	**5**
The allocated time and planned use of time was clear.	**1**	**2**	**3**	**4**	**5**
Rapport was established prior to initiating the debriefing discussion.	**1**	**2**	**3**	**4**	**5**
My questions and comments were addressed.	**1**	**2**	**3**	**4**	**5**
Throughout the debriefing discussion, to what extent was each of the following achieved?	**Not achieved** **1**	**2**	**3**	**4**	**Achieved** **5**
I was motivated to be actively engaged in reflection and constructive critique.	**1**	**2**	**3**	**4**	5
The use of video effectively enhanced my learning.	1	**2**	**3**	**4**	**5**
Strategies and ideas for improvement were raised.	**1**	**2**	3	**4**	**5**
Open-ended questions were used to facilitate appropriate problem solving and divergent thinking.	**1**	**2**	3	**4**	**5**
Content was clarified when misunderstanding or confusion occurred.	**1**	**2**	3	**4**	**5**
I was encouraged to solve questions and problems.	**1**	**2**	3	**4**	**5**
The session proceeded at an appropriate pace (i.e., not too fast or too slow).	**1**	**2**	**3**	4	**5**
Having a group debriefing session enhanced my learning	**1**	**2**	**3**	4	**5**
I was able to assess factors that enabled or impeded me.	**1**	**2**	**3**	4	**5**

(continued)

I discussed ways in which the training could be conducted more effectively.	**1**	**2**	**3**	**4**	5
I revisited important points or asked follow-up questions to ensure that learning was achieved.	**1**	**2**	**3**	4	**5**
I identified specific intentions or ways to improve future performance using knowledge/skills targeted by the session.	**1**	2	**3**	**4**	**5**
I identified how learning could be applied to daily practice.	**1**	2	**3**	**4**	**5**

Adapted from: Gururaja et al, Examining the Effectiveness of Debriefing at the Point of Care in Simulation-Based Operating Room Team Training. [report] Available at: ahrq.gov

Satisfaction survey (FIRST Evaluation: Phase 1)

This session as a whole	**Not at all**				**To a large extent**
Was relevant to my needs	1	2	3	4	5
Was appropriate to my level	1	2	3	4	5
Provided effective feedback	1	2	3	4	5
Was challenging without being threatening	1	2	3	4	5
Helped me integrate theory into practice	1	2	3	4	5
Stimulated my interest in the topic area	1	2	3	4	5
Encouraged me to think through a clinical problem	1	2	3	4	5
Encouraged me to consider my leadership and teamwork skills	1	2	3	4	5
Was realistic (in relation to clinical practice)	1	2	3	4	5

Adapted from: Wiseman & Snell (2008) The deteriorating patient: a realistic but 'low-tech' simulation of emergency Decision-making. The clinical teacher. 5. 93-97

My knowledge of	**Before this session**					**After this session**				
	Not at all				To a large extent	Not at all				To a large extent
Patient deterioration management	1	2	3	4	5	1	2	3	4	5
Setting emergency priorities	1	2	3	4	5	1	2	3	4	5
Key emergency observations	1	2	3	4	5	1	2	3	4	5
The pressures of an emergency situation	1	2	3	4	5	1	2	3	4	5
Understanding of patient changes	1	2	3	4	5	1	2	3	4	5
The specific emergencies of this session	1	2	3	4	5	1	2	3	4	5
Working as a member of a team	1	2	3	4	5	1	2	3	4	5

	Before this session					**After this session**				
My confidence level:	1	2	3	4	5	1	2	3	4	5
My competence level:	1	2	3	4	5	1	2	3	4	5

Please turn over page

Please add any other comments or suggestions
For example - what were the key things you learnt from this session? How could this session be improved?

Team Emergency Assessment Measure (TEAM)

Introduction

This non- technical skills questionnaire has been designed as an observational rating score for valid, reliable and feasible ratings of emergency medical teams (e.g. resuscitation and trauma teams. The questionnaire should be completed by expert clinicians to enable accurate performance rating and feedback of leadership, team work, situation awareness and task management. Rating prompts are included where applicable. The following scale should be used for each rating:

Never/hardly ever	seldom	About as often as not	Often	Always/ nearly always
0	1	2	3	4

Team Identification

Date: **Time:** **Place:**
Team Leader: **Team:**

Leadership: it is assumed that the leader is either designated, has emerged or is the most senior-if no leader emerges allocate a '0' to question 1 and 2.	0 1 2 3 4
1.The leader let the team know what was expected of them through direction and command	☐ ☐ ☐ ☐ ☐
2. The team leader maintained a global perspective ***Prompts: Monitoring clinical procedures and the environment? Remaining 'hands-off' as applicable? Appropriate delegation.***	☐ ☐ ☐ ☐ ☐
Team Work: ratings should include the team as a hole i.e. the leader and the team as a collective (to a greater or lesser extent).	0 1 2 3 4
3. the team communicated effectively ***Prompts: Verbal, non-verbal and written forms of communication?***	☐ ☐ ☐ ☐ ☐
4. the team worked together to complete the tasks in a timely manner	☐ ☐ ☐ ☐ ☐
5. the team acted to changing situations ***Prompts: Applicable emotions? Conflict management issues?***	☐ ☐ ☐ ☐ ☐
6. the team moral was positive ***Prompts: Appropriate support, confidence, spirit, optimism, determination?***	☐ ☐ ☐ ☐ ☐
7. the team adapted to changing situations ***Prompts: Adaptation within the roles of their profession?*** ***Situation changes: patient deterioration? Team changes?***	☐ ☐ ☐ ☐ ☐
8. the team monitored and reassessed the situation	☐ ☐ ☐ ☐ ☐
9. the team anticipated potential actions ***Prompts: Preparation of defibrillator, drugs, airway equipment?***	☐ ☐ ☐ ☐ ☐
Task Management:	0 1 2 3 4
10. The team prioritised tasks	☐ ☐ ☐ ☐ ☐
11.The team followed approved standards and guidelines ***Prompt: Some deviation may be appropriate?***	☐ ☐ ☐ ☐ ☐
Overall:	0 1 2 3 4 5 6 7 8 9 10
12. on a scale of 1-10 give your global rating of the teams non-technical performance	☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐ ☐

(continued)

Comments:_____

_____

_____

_____

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Citation: Cooper S, Cant R, Sellick K, Porter J, Somers G, Kinsman L, Nestel D. Rating medical emergency teamwork performance: Development of the Team Emergency Assessment Measure (TEAM). Resuscitation 2010; 81: 446-52.

Appendix D: Managing Patient Deterioration: Project Evaluation Report

Internal Assessor: Professor Ruth Endacott
External Assessor: Professor Leanne Aitken

CONTENTS

A. Overview

Management of deteriorating patients is poor and when left untreated leads to expensive and often unsuccessful resuscitation procedure. Strategies to improve identification of deteriorating patients, followed by appropriate, early intervention are urgently needed.
A team composed of a partnership between Monash University, Deakin University, University of Queensland (UQ) and GippsTAFE (MODE-UQGT) was created to conduct this project. The specific plans for the project included:

- Phase 1: Develop an understanding of *team* work and decision making through student testing of knowledge and skills at Monash University, Deakin University and University of Queensland.
- Phase 2: Develop a web based electronic educational package using interactive multimedia (FIRST^{2}ACTWeb) including a series of three video-recorded scenarios depicting 'patients' (professional actors) who were deteriorating. Outcomes will be derived from student decisions requiring differing management pathways of patient deterioration/improvement to be built into each scenario.
- Phase 3: Implement the program across four cohorts of final-year student nurses at Monash University, Deakin University, University of Queensland and at GippsTAFE.
- Phase 4: Evaluate learning outcomes including review of satisfaction, knowledge, skill gain, workplace (clinical placement) impact.

The project team met in person and via electronic means on a regular basis. Communication with the External Assessor (Professor Leanne Aitken) was primarily via the Internal Assessor (Professor Ruth Endacott) with occasional communication from the Team Leader (Associate Professor Simon Cooper).

B. Evaluation process

A plan for the evaluation of the 'Managing Patient Deterioration' project was developed jointly by the Internal and External Assessor, with consultation with the Team Leader. The broad elements of the evaluation were to include:

1. Initial assessment of the project plan, including consideration of potential risk, planned outcomes and strategies to be used by the project team
2. Conduct of a risk assessment
3. Review of project progression on a regular basis
4. Review of project outcomes, including participant and stakeholder evaluation.
5. Review of the original risks, evaluating the extent to which these were realised during the project

Initial assessment

A meeting between the Internal Assessor and the External Assessor took place in February 2012. The following questions were identified to guide development of the risk assessment and associated discussions at this time, and throughout the project evaluation:

a) What contingency plans have been put in place to mitigate risks?
b) What processes were planned and what were actually put in place for the project?
c) Were there any variations from the original intended processes, and if so, why?
d) How might the project be improved?
e) What were the observable short-term outcomes?
f) To what extent have the intended outcomes been achieved?

g) Were there any unintended outcomes?
h) What factors helped and hindered in the achievement of the outcomes?
i) What measures, if any, have been put in place to promote sustainability of the project's focus and outcomes?
j) What lessons have been learned from this project and how might these be of assistance to other institutions?

Risk assessment

An initial risk assessment was undertaken by the Internal and External Assessor (Table 1). The purpose was to highlight potential risks to the project, to consider the likelihood and potential impact of those risks and to prompt the research team to consider the strategies that could be implemented throughout the project to mitigate any risks. This risk assessment was reviewed by the project team, with refinement of the project plan accordingly (see Table 1).

C. Project details

The two phases of most relevance to the evaluation are Phase 1, during which evidence was collected for development of the simulation package, and Phase 3, where the package was tested with a wider student population. To avoid repeating findings reported in the project report, evaluation focuses on these two phases and specifically on the appropriateness of the sampling strategy and quality of the outputs.

Phase 1 participants

Phase 1 was limited to a cohort size of 100 students, with a planned approximately equal number of participants from each participating university. Ninety-seven of a possible 570 students were recruited:

- University A 34/120 = 28% response rate
- University B 32/350 = 9% response rate
- University C 31/100 = 31% response rate

The reporting of response rates in this context is misleading given the planned cohort size that was identified *a priori* and the process of discontinuing recruitment once the target recruitment had been achieved in each site. However given issues of generalisability it was important to examine the alignment of the characteristics of those students in the sample with those in the wider student cohort. Characteristics of the Phase 1 sample were generally reflective of the wider student nurse population:

- 92% BN program enrolment
- 93% female
- Median age 21 years (mean 22.59 ± 5.47, range 18-52)
- 95% had >3 clinical placements

Table 1 Process for Risk Assessment by project Phase

Risk	**Likelihood (L/M/H)**	**Impact (L/M/H)**	***Action/strategy for mediating*** *(as discussed with Project Team 13 Feb 2012)*
PT nature of RF post	PT to assess	H	*Additional time safeguarded (0.4)*
Timeline and description of phases not consistent	M	L	*Addressed*
Unanticipated impeding factors	unknown	H	*Regular reports and communication*
Project and product lack credibility with stakeholders	M	M	*Communication strategies*
Phase 1			
Lack of recruitment	L (past experience)	H	*Project Team agree that this is unlikely*
Over-recruitment (potential cost escalation/inequity)	H	H (budget)	*If volunteers exceed required sample size, participants to be randomly selected.*
Technology failures	L (past experience)	H	*Backup plans in place*
Inequity of student experience across sites - OSCEs - Clinical placements - Theory input - Reflective review	PT to assess	H (on quality of data for publication) M (development of resource – other sites compensate)	*Clear rationale for selection of sites/student cohorts to be articulated.*
Expertise of staff in conducting review and feedback (and potential for variability within and across sites)	PT to assess	H & M as above	*Roving team from Monash to collect data in all sites*
Reductionist approach to qual data (Matrix approach to qual data analysis)	L/M	L/M	*This will be monitored by Reference Team member Prof Scholes*
Students don't articulate decision making processes honestly or in manner expected (Aim 1c)	M	H	*Skill of research team in the photo-elicitation (roving team to ensure consistency)*
Tight timeframe for data collection and analysis (and publication)	M	H	*Dates established for data collection; roving team will ease the workload at each site*
Phase 2			
Reliance on single team member for IT development	L	H	*Backup plan in place*
Lack of experience of the PT in online resource development	H (tight timeframe)	H	*Resolved: preparation in place for key members of the Project Team*

The detailed assessment, using a range of methods, has provided evidence of student performance. The modified Angoff technique used (Ricker, 2006) allowed development of performance standards.

As well as providing evidence for the development of the web-based program, findings from Phase 1 emphasised the need to make high fidelity simulation experience more readily available for all students. This evidence will be useful for the further promotion of the web-based simulation package.

Phase 3 participants

Participants for Phase 3 comprised 330 University nursing and nursing-midwifery (double degree) students at 3 universities (7 campuses), along with 37 Diploma of Nursing students in two vocational (TAFE) colleges (2 campuses). Response rate over all campuses was 83% (possible recruitment n=409) and retention through to completion of the entire program of three scenarios was 91%. These data indicate considerable interest in the student body for this type of resource, and the program developed by the Project Team maintained the students' interest.

The sample included international students (n=31, 8.5 %) but a total of 69 (17.2%) reported that the language spoken at home was not English. Analysis revealed that student status (domestic or international) had no impact on knowledge scores or performance; however, students from a non-English speaking background did perform less well in each scenario (reflected in the OSCE scores) and the pre-test knowledge score. Hence, whilst the numbers in these categories were small, it was a useful strategy to include non-native English speaking and international students in the recruitment for Phase 3. These findings point to the need for further investigation in this area, particularly important given the trend towards more internet-based education provision in health-related education programs.

Given that the purpose of this phase was to test the use of the software package, one would expect identified problems requiring improvement to be flagged and attended to. The ability of the team to respond as required, and flexibility built into the resource to accommodate such changes, are indicators of quality when developing technology for educational use (see footnote 1). It was noted by the Project Team that some students were exiting the online program early because of technical problems, such as computer freeze or program download failure. These problems had been resolved through improvements to video upload/website design by the end of the Phase 4 trial.

Project outputs and dissemination

The project has resulted in 7 conference presentations (4 completed in the US, Europe, Australia and 3 to be completed) to date. This represents excellent dissemination. and was probably achieved in part due to the strong track record of the team. The dissemination achieved to date includes two key peak bodies: the International Council of Nurses and the Australasian Council of Deans of Nursing and Midwifery. Three publications have been submitted to international journals and are under review. A further 3 publications are under development. Again this represents excellent outputs from a study of this size.

D. Evaluation

Evaluation of the FIRST^2 ACT package was undertaken by the project team (see main report section 5); the evaluators reviewed the processes and outcomes of the project. Most of the issues raised by students related to practical matters; Project Team meeting notes indicate that these were acted on as they arose.

Processes

The risks identified by the evaluators at the beginning of the project were again reviewed with the project team, to ascertain whether they had an impact on the Project.

1. *Project personnel: PT nature of the Research Fellow (RF) position*

   This had no impact on delivery of the project; the original RF (project manager) left the University about midway through the project and was replaced by another member of the team, again with no detrimental impact. The experience of the RF was highlighted as key to making the part time role work to good effect.

2. *Phase 1: inequity of student experience across sites*

   The statistical analysis revealed no association between student personal demographics and situation awareness scores. The video recording of the scenarios made it possible to review whether there were any differences in the way that students from different sites reacted to the scenarios during the OSCEs, or their response during the interviews. The Project Team noted that students on one site were not used to learning and being assessed through OSCEs hence the simulated scenarios were a new experience for them. On review of the video data, there was no obvious difference in the way these students behaved during the scenarios or interviews. However, there were differences in knowledge and performance.
   There were a small number of double degree students who found the adult patient scenarios difficult; these students were later excluded from the dataset.

3. *Phase 1: low response rate (9-31%) – [how] did this impact on the study? Any particular reasons for the low response?*

   As noted earlier, the reporting of response rates is misleading as the Phase 1 sample size was limited to 100. The delay from semester II in one year to semester I in the following year (due to delays with software development and testing) seems to have impacted on the cohort that could be recruited from one of the sites resulting in a cohort with quite different characteristics.

4. *Phase 1: potential variability of staff in conducting review and feedback across sites.*

   The same 'review team', who were experienced in the method, conducted the review and feedback across all sites, removing the risk of variability. Faculty members at the sites were also given the opportunity to observe the team conducting the photo-elicitation interviews. The same patient actor was also used at all sites. Although this is a strength in regard to the conduct of this project, the issue of generalizability into routine practice should be considered.

5. *Phase 1: when conducting the interviews were students able to articulate their decision-making processes? If not, how was this handled?*

   The skill of the 'review team' in getting students to articulate decision-making was highlighted by other members of the Project Team. One Project Team member commented that 'the interviewer prompted students'; this is the usual process with photo-elicitation techniques but this feedback indicates that the process possibly needs fuller explanation.

6. *Phase 1: was the timeframe for data collection and analysis too tight?*

   The Project Team members who conducted the review and feedback (the 'review team') felt that the tight timeframe kept the momentum going and did not impinge on conduct of the scenarios or data collection. Key milestones were met.

7. *Phase 2: did the lack of experience of the project team in developing online resources have any impact?*

   Some time was lost changing between software developers; however, this risk was identified early and managed well by the team. The team did not have previous experience of online development, hence recruiting the specialist skills of a software developer. The team therefore at times had expectations that were not realistic, such as wanting multiple videos for the same intervention (depicting slightly different approaches). The entire Project Team were consulted regularly and given the opportunity to try out early prototypes of the software.

8. *Did the lack of TAFE involvement in the earlier phases have any impact?*

   Key staff members who had contributed to the original grant submission and subsequent development of the project were no longer in post at the relevant stage in the project. The project was also occurring at a time of redevelopment in the TAFE sector hence there were delays, with the decision taken to recruit a second TAFE in order to meet the project deadlines. This unforeseen change in circumstances was handled efficiently by the project team with a reformulated plan put into place when the scope of the difficulty became clear.

Outcomes

Following the flashlight approach[1] for reviewing technology-based education interventions, we also evaluated the project according to a number of additional criteria:

1. Robustness

   We examined the extent to which the web-based approach to simulation works in different settings. It was not as easy to engage the TAFE sector as was originally conceived, due to a number of factors; however, it was worth persisting as the analysis from these sites demonstrated comparable outcomes, indicating that the simulation resource is sufficiently robust to work in both University and TAFE settings. The program can also be sequenced with other educational materials in varying ways to suit different student needs. However, Phase 3 results did demonstrate poorer performance with international students hence further work is needed to test the resource with students whose first language is not English.

2. Sustainability

   We examined the likely sustainability of the web program. Given the feedback from students and level of interest generated during the conference presentations, it is highly likely that its' use will continue after initial funding/purchase and enthusiasm fades. The only threat to sustainability is the need to review and update the scenarios as clinical practice and associated guidelines for managing the types of patients depicted in the scenarios change.

[1] http://tltgroup.org/Flashlight/Handbook/flashlight_approach.pdf

3. Scalability
   We explored the extent to which its use can be expanded while (at minimum) not diminishing its effectiveness or outgrowing its supply lines. For this type of web-based resource, if demand increases then supply can increase without affecting the goal of the program.

4. Capacity to generate innovation
   Feedback from the students indicates that the program has stimulated its users to try a learning approach that they might not otherwise have tried. Discussion generated through international conference presentation also indicates that curriculum developers are considering creative and innovative ways of integrated the resource into a range of education programs.

Any evaluation should consider not just the gains but also the losses; the most obvious loss if students use the FIRST2ACT web-based program is the opportunity to develop team work skills. This was identified as a key outcome from the quantitative and qualitative data in the Phase 1 findings (used to construct the web-based scenarios) and has been a key component of international approaches to managing the deteriorating patient, for example rapid response teams. This was addressed in part by including a chapter on teamwork in the course manual. While the potential to use the web-based program as a team, rather than as an individual, was beyond the scope of this project it should be explored in future studies. The most likely target market is academics responsible for curriculum development, who should seek other ways to address teamwork based learning outcomes in the curriculum. The loss of interactivity and team work is more than compensated for by the 'gain' of a program that provides multiple opportunities for rehearsal of skills.

Summary

Management of the deteriorating patient has been recognised around the world as an area needing urgent and sustained attention. A web-based learning program was developed and tested in this four phase project as one strategy to improve recognition and response to the deteriorating patient. This project has been conducted using a systematic and logical process that achieved important outcomes, including development of a web-based learning program, positive review by student participants and academics, and some evidence of impact of this learning resource on outcomes. A number of points continue to require consideration by the project team and the wider academic and health care community as the results of this project inform subsequent projects and are translated to practice. These considerations include:

- development of specific web-based learning resources such as the one examined in this project needs to be consistent with the overarching program of study so that students do not consider the resource as something different or additional, but consider each resource to be a valuable and essential component of the program of study;
- the above point also relates to any assessment that is associated with the learning resource; in the current project one of the participating universities did not use OSCE although the students who participated in this project were required to undertake an OSCE; this inconsistency in generic learning activities may have affected results of the study and should also be considered in future activities;
- assessment of student improvement in the OSCEs in this project has been undertaken by two team members specifically trained for the project; issues of generalisability to the broader educational practice environment need to be considered;

- one component of evaluation in Phase 3 involved asking the students to retrospectively rate their level of knowledge, skill, confidence and competence prior to and after simulation training; retrospective assessment of these characteristics is likely to be prone to bias and should be interpreted with caution;
- the technical skills of the personnel employed to develop learning resources were no doubt important to the success of this project however personnel with such skills are not necessarily readily available and therefore replication of learning resource development addressing other learning needs must take into account the capability and availability of staff with these technical skills.

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Reference: Ricker K. Setting cut scores: A critical review of the Angoff and Modified Angoff methods. Alberta Journal of Educational Research 2006; 52: 53-63.