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Transforming undergraduate nursing curriculum by aligning models of clinical reasoning through simulation

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Whilst clinical reasoning skills are deemed essential in health care professions, undergraduate nursing students often struggle to develop these requisite skills. Teaching nursing students the skills to engage clinical reasoning requires a strategic and systematic approach by educators to make these tacit processes explicit. This paper reports on the design phase of an innovative curriculum re-design for the purpose of enhancing clinical reasoning skills in nursing students through simulation-based learning. Many approaches to simulation-based learning focus on the post-simulation debrief as the forum for engaging students in clinical reasoning. In contrast, this curriculum re-design brought together two existing models of clinical reasoning in order to align the simulation scenario and the post-simulation debrief with a clinical reasoning framework. These models were the Clinical Reasoning Cycle (Levett-Jones & Hoffman, 2013; Levett-Jones, Hoffman, Dempsey, et al., 2010), and Debriefing for Meaningful Learning[©] (Dreifuerst, 2012; 2015). An analysis of the two models revealed the differences in the processes advocated by both works. We argue however that the synergies created by bringing together the two models represented a pedagogically sound approach to simulation design, assisted facilitators to engage students in clinical reasoning through simulation, and reinforced the cognitive and metacognitive processes of clinical reasoning for student nurses.

Keywords: Clinical reasoning, Simulation based learning, Nursing curriculum design

Introduction

Clinical reasoning has been defined as the processes and strategies of thinking nurses undertake to make a judgement or decision, in order to solve problems (Simmons, 2010). As distinct from critical thinking and clinical judgement, clinical reasoning has been described as a complex cognitive process that informs nurses' clinical judgment through the gathering and analysis of patient information, evaluation and consideration of possible alternatives against the evidence, and deciding on the most appropriate action (Tanner, 2006; Simmons, 2010). The need to enhance clinical reasoning skills in undergraduate nursing students is currently a focus of nursing education internationally. Poorly developed clinical reasoning skills can and do result in adverse patient outcomes, often due to failure to detect impending patient deterioration, or through errors of clinical reasoning (Aitken, Clarke, Cheung, Sloane &

Silber, 2003; del Bueno, 2005; Levett-Jones, et al., 2010). Accordingly, newly graduated nurses with well-developed clinical reasoning skills are highly sought after by industry in order to provide quality and safe patient care.

With an anticipated projected shortfall of 109,000 nurses in Australia by 2025 (Health Workforce Australia [HWA], 2012), newly graduated nurses will be expected to competently care for increasingly complex, acutely ill patients in dynamic and highly unpredictable health care environments. Increasingly, the provision of quality and safe patient care will depend upon the capability of newly qualified, inexperienced nurses to accurately identify deviations from a stable health status, initiate actions to manage such deviations individually and collaboratively, using justifiable reasoning processes within an appropriate time-frame (del Bueno, 2005). As such, nursing education is a key determinant for the provision of quality and safe patient care (Aitken et al., 2003; Armstrong, 2009).

Learning clinical reasoning is enhanced by activities that make explicit to students the cognitive and metacognitive processes of clinical reasoning, and are structured and consistent in their approach (Ajjawi & Higgs, 2012; Delany & Golding, 2014; Dreifuerst, 2012; Ericsson, Whyte & Ward, 2007). The development of clinical reasoning skills in undergraduate nursing students may be impeded during the clinical placement due to decreased length of patient admission and greater acuity and complexity of patients. In addition, increasingly large numbers of students being enrolled in Australian nursing programs (Council of Deans of Nursing & Midwifery, 2009; HWA, 2012; 2014; Preston, 2009) has resulted in universities implementing alternative clinical placement models whereby students may be placed one or two days per week (Department of Health, 2011), in contrast to the traditional 'block' placement. These factors have significantly reduced students experiencing continuity of care during the clinical placement, and in-turn, reduced the likelihood of students recognising identifiable patterns of improvement or deterioration that characterise a patient's trajectory of care.

Challenges to enhancing clinical reasoning skills in nursing students through classroom activities include the degree to which educators are equipped to adequately convey to students the application of clinical reasoning to nursing practice (Ajjawi & Higgs, 2012; Smith, Loftus & Levett-Jones, 2013); specifically, making visible to students the rapid, complex and often subconscious processes involved (Higgs & Jones, 2008; Smith, Loftus & Levett-Jones, 2013). In seeking to align learning and teaching activities with industry expectations, nursing education is increasingly turning to simulation-based learning.

This paper contributes to work exploring the development of clinical reasoning in undergraduate nursing students using simulation-based learning. For the last decade studies in this area have shown that simulation-based learning can enhance clinical reasoning in undergraduate nursing students (Dreifuerst, 2012; Forneris et al., 2015; Kuiper, Heinrich, Matthias, Graham, & Bell-Kotwall, 2008; Lapkin, Levett-Jones, Bellchambers, & Fernandez, 2010). The focus of these studies has mainly been on implementing post-simulation debriefing strategies with the aim of positive changes in clinical reasoning skills. This paper provides additional insights into designing simulation for clinical reasoning by considering the cognitive and metacognitive processes of clinical reasoning as they exist in nursing practice, and replicating these processes during the simulation scenario, as well as during the post-simulation debrief. Models exist to guide the development of learning activities to develop clinical reasoning skills in nursing students; for example, written case studies (Levett-Jones, 2013), or post-simulation debriefing (Dreifuerst, 2012; 2015). However,

exploration of the purposeful alignment of simulation scenario and debriefing model with a theoretical perspective of clinical reasoning and how this assists the teaching of clinical reasoning with the aim to enhance clinical reasoning in undergraduate nursing students has not been investigated.

Background: Teaching clinical reasoning

Essential elements of clinical reasoning include cognition (thinking), metacognition (reflection), and discipline-specific knowledge (contextual parameters of the patient and the environment) (Simmons, 2010; Higgs & Jones, 2008). Benner, Sutphen, Leonard & Day (2010) posit that the ability to engage clinical reasoning as a clinical situation unfolds is a defining characteristic of expert nurses. It is, however, important to highlight that these processes of clinical reasoning are not innate and as such need to be learned.

Cognitive processes of clinical reasoning: The dual-processing perspective
As a cognitive process, clinical reasoning has been conceptualised as a 'dual-process' model of thinking (Evans, 2008; Jones, 1995; Norman & Eva, 2010; Simmons, 2010) comprising a slow, deliberate and conscious process of analytic thinking, and the fast, automatic and unconscious process of non-analytic thinking (Norman & Eva, 2010; Evans, 2008). Benner (1984) and Benner & Tanner (1987) assert that non-analytic processing in the form of pattern recognition and intuition are characteristics of an expert nurse.

Whilst there is some debate as to whether analytic processing results in fewer clinical reasoning errors than non-analytic processing (Norman & Eva, 2010), these perspectives highlight two essential considerations for undergraduate nursing education. First, the tacit nature of clinical reasoning as employed by expert nurses renders such skills invisible to nursing students (Benner, et al., 2010; Simmons, 2010). Second, novice nurses lack the experience necessary to develop and employ pattern recognition and intuition required for non-analytic processing. The dual-processing perspective of clinical reasoning highlights the need for learning activities, designed to enhance clinical reasoning in undergraduate nursing students, to make reasoning visible to students.   These factors highlight the need for learning activities, designed to enhance clinical reasoning in undergraduate nursing students, to engage undergraduate nursing students in activities that reveal conscious, structured and systematic processes of clinical reasoning.

Designing for learning clinical reasoning
Literature relating to learning and teaching clinical reasoning emphasises the need for educators to make explicit to students the processes of clinical reasoning, and to engage students in these processes in a structured way (Delaney & Golding, 2014; Dreifuerst, 2012; Forneris et al., 2015; Lapkin, et al., 2010); affording students access to what is otherwise invisible to them (Delany & Golding, 2014). Employing models that make visible the stages of clinical reasoning facilitate the development of these skills in students by providing educators with a structured and consistent way to articulate this tacit, often habitual skill (Delany & Golding, 2014; Smith, Loftus & Levett-Jones, 2013). Two models of clinical reasoning that are well represented in the nursing education literature are the Clinical Reasoning Cycle (CRC) (Levett-Jones & Hoffman, 2013; Levett-Jones, et al., 2010) and the post-simulation debriefing model Debriefing for Meaningful Learning[©] (DML) (Dreifuerst, 2012; 2015).

Whilst a body of research has explored simulation-based learning as a strategy to develop clinical reasoning in nursing students the focus of such exploration has been the post-

simulation debrief and not the simulation scenario itself (Dreifuerst, 2012; 2015; Forneris et al., 2015; Kuiper et al., 2008). In other words, simulation design that purposefully aligns scenario and debriefing with a theoretical perspective of clinical reasoning, assists educators to 'teach' clinical reasoning, and thus, enhance clinical reasoning in undergraduate nursing students has received little attention. In the curriculum re-design presented in this paper, the CRC (Levett-Jones & Hoffman, 2013; Levett-Jones et al., 2010) provided the framework for simulation scenario design and DML (Dreifuerst, 2012; 2015) was used as the debriefing model. These two models are now described.

The Clinical Reasoning Cycle

Based on the work of Hoffman (2007) and informed by Alfaro-LeFevre (2009), Andersen (1991) and Tanner (2006), the CRC (Levett-Jones, et al. 2010) represents the thinking strategies used by expert nurses in everyday practice situations. Clinical reasoning, as proposed by Levett-Jones et al. (2010) is a cyclical process comprising eight distinct stages. These are: consider the patient situation; collect cues and information; process information; identify problems and issues; establish goals; take action; evaluate outcomes; and reflect on process and new learning. These eight stages are illustrated in Figure 1.
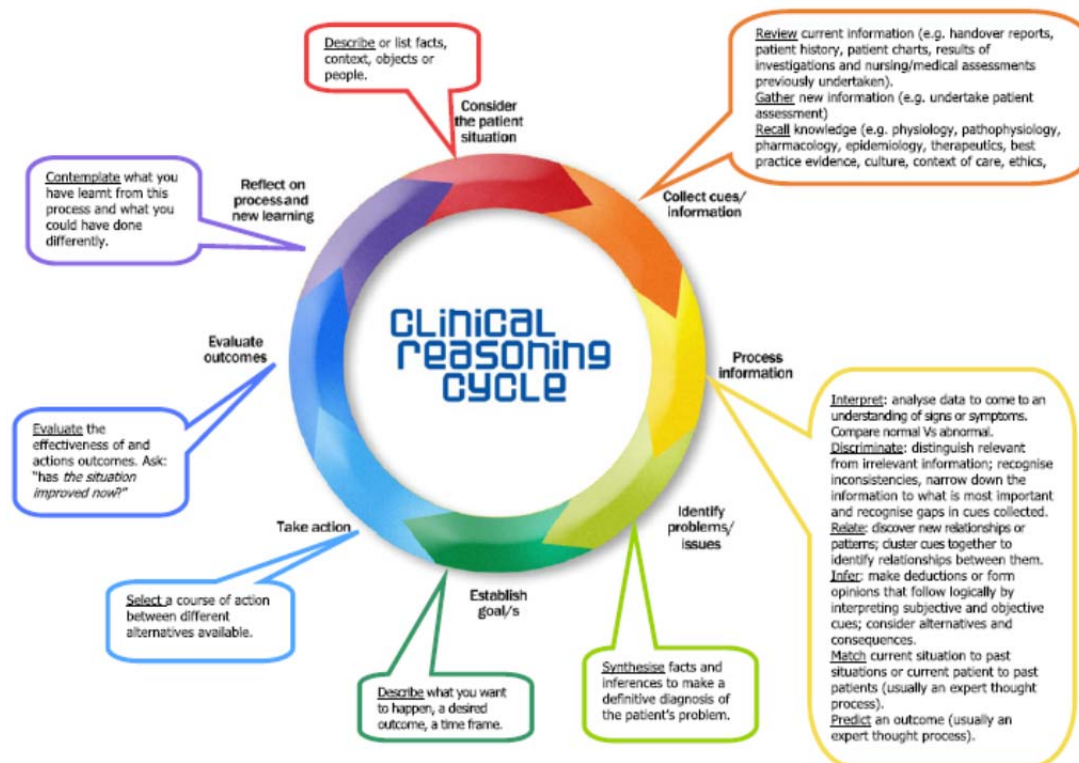

Figure 1. The Clinical Reasoning Cycle (Levett-Jones, et al., 2010)

Levett-Jones et al. (2010) assert clinical reasoning to be a dynamic process, with experienced nurses often combining "one or more phases or move back and forth between them before reaching a decision, taking action, and evaluating outcomes" (p.516). The structured, visual representation of clinical reasoning provided by Levett-Jones et al. (2010) makes the tacit processes of this skill visible, and serves as a cognitive aid for engaging students in the dynamic, non-linear process of this skill. In this curriculum re-design the text Clinical reasoning: Learning to think like a nurse (Levett-Jones, 2013) informed the simulation scenarios in two ways. First, three written case studies from Levett-Jones' (2013) text were

translated into simulation scenarios. Second, the CRC was utilised as a framework to guide the design of one additional simulation activity. It was anticipated that using Levett-Jones' (2013) text as a design framework ensured sufficient information would be available to students to utilise the CRC as a cognitive tool during the simulation scenarios as well as during the post-simulation debrief; an approach designed to replicate the application of clinical reasoning in practice. What the CRC did not offer was a validated debrief model, demonstrated to enhance clinical reasoning skills in undergraduate nursing students. For this reason, the authors selected Dreifuerst's (2012; 2015) DML model of debriefing.

Debriefing for Meaningful Learning©
Debriefing is argued as the essential phase of simulation where meaningful learning occurs (Dreifuerst, 2009; Fanning & Gaba, 2007; Mariani, Cantrell, Meakim et al., 2013; Neill & Wotton, 2011; Shinnick, Woo, Horwich & Steadman, 2011). Whilst approaches and techniques to facilitating debriefing vary greatly (Dreifuerst, 2009; Krogh, Bearman & Nestel, 2016; Neill & Wotton, 2011; Shinnick, et al., 2011), learning appears to be enhanced through structured rather than non-structured approaches (Dreifuerst, 2012; Kuiper, et al., 2008; Mariani, Cantrell, Meakim et al., 2013; Petranek, Corey & Black, 1992; Sawyer, Eppich, Brett-Fleeger, et al., 2016), particularly when the aim is to maintain a high level of analytical thinking (Petranek, et al, 1992).

Dreifuerst (2012) posited that the structured and consistent method of post-simulation debriefing provided by DML enables students to progress "beyond critical thinking toward the higher thinking skills of clinical reasoning" (p.327). This is achieved by engaging in the processes of analysis, evaluation, reflection and anticipation. The DML, model of debriefing involves six phases: engage the participants; explore options by reflecting-in-action; explain decisions, actions and alternatives using deduction, induction and analysis; elaborate through analysis and inferential thinking; evaluate the experience through reflection-on-action; and extend through the processes of inferential and analytic thinking (i.e., reflection beyond-action) (Dreifuerst, 2012). In the context of this study, the intent of the application of this model is that through engaging students in the structured and consistent approach of DML at each simulated stage of the CRC, the facilitator of the debriefing conveys the process of clinical reasoning to students.

Whilst DML has been validated as enhancing clinical reasoning in nursing students (Forneris et al., 2015), there is a paucity of literature which demonstrate purposeful alignment of the pedagogical tenets of clinical reasoning in both simulation scenario design and debriefing model, including DML (Table 1).

Table 2. DML aligned with the Clinical Reasoning Cycle

Synergies	What is known?	Negotiating the key problem	Setting a goal	Taking action	Evaluation	Extending learning through reflection		
Clinical Reasoning Cycle	Consider the patient situation	Process information	Establish goal/s	Take action	Evaluate outcomes	Reflect on process and new learning		
	Collect cues/information	Identify problems/issues						
	Engage Phase	Explore Phase, Explain Phase, Elaborate Phase						Extend
Debriefing for Meaningful Learning©	Patient story	Focused key problem	Desired client outcome (goal)	Nursing interventions and patient responses	What would you do differently and why?	Thinking-in-action	Thinking-on-action	Thinking-beyond-action
				What worked towards the agreed goal?				
				What did not work towards the agreed goal?				

Method

This paper reports on the design phase of a Bachelor of Nursing curriculum re-design at one Australian university, for the purpose of enhancing clinical reasoning skills in final semester undergraduate nursing students using simulation-based learning. The re-design focused on the Bachelor of Nursing capstone unit titled Transition to Professional Practice, and involved 1500 final semester Bachelor of Nursing students, 46 academic staff and 12 technical staff across five campuses located within three Australian states and one territory. Requirements for curriculum implementation necessitated the simulation program be conducted at each campus, at the same time, over a two-week period.

Like many Bachelor of Nursing programs in Australia, simulation activities at this university ranged from task-training, to immersive (high-fidelity) simulations, scaffolded throughout the three-year curriculum. At the time, the focus of immersive simulations was largely high-risk low-frequency events such as cardiac arrests, with an emphasis on manikin-based simulation. Several considerations provided the impetus for the curriculum re-design. First, anecdotal feedback from final-year nursing students indicated they felt underprepared when applying knowledge to patient care during the final clinical placement, and lacking confidence in their clinical reasoning. Second, industry expectations, in the form of professional standards for the registered nurse (Nursing and Midwifery Board of Australia, 2006; 2016) and feedback from clinical nurse educators, highlighted well developed clinical reasoning as an essential skill for new graduate nurses. Third, and importantly, the proposed curriculum re-design was supported by the University School of Nursing executive.

An understanding of the theoretical perspectives of clinical reasoning, as discussed earlier in this paper, raised five key criteria for the design of the simulation program that was the characteristic of this curriculum re-design. First, designing a simulation program that was theoretically-based, and included a rigorous evaluation framework, as a quality approach to simulation practice (Harder, 2009; Kaakinen and Arwood, 2009; Rourke, Schmidt and Garga, 2010). Second, each simulation scenario would be designed according to the stages of clinical reasoning (Levett-Jones & Hoffman, 2013). Third, each scenario would represent 'everyday' low-risk high-frequency situations in contrast to high-risk low-frequency encounters, and utilise a different simulation mode. Fourth, the processes of clinical reasoning would be made visible to students and reinforced during the post-simulation debrief using DML. Fifth, to design a simulation program that facilitators, with varying simulation experience and expertise, could implement in a structured and consistent way.

The curriculum re-design

The re-designed capstone unit was first implemented in 2014, with the simulation program running for two weeks immediately preceding the final clinical placement of the Bachelor of Nursing program. The capstone commenced with two lectures where students were introduced to the delivery mode of the re-designed capstone unit, the relevance of clinical reasoning for newly graduating nurses was explained, and the CRC (Levett-Jones & Hoffman, 2013) was presented.

The simulation program

Each simulation followed the recommended three-phases of pre-simulation brief, scenario and post-simulation debrief (Arthur, Levett-Jones & Kable, 2013; Cant & Cooper, 2010; Jeffries & Rogers, 2012). As a strategy for sustainability, the simulation program needed to align with existing class sizes and staffing. Thus, each simulation involved two lecturers

(facilitators) and accommodated 30 students. Lecturers were allocated one of two roles; the facilitator of the simulation scenario, or the facilitator of the post-simulation debrief.

Pre-simulation brief
Each pre-simulation brief provided the conditions of the simulation, including privacy, confidentiality and expectations of participation including professional conduct. The learning outcomes of the simulation were displayed and students self-selected roles of direct participant (up to two students) and observers (the remainder of the class who would view the simulation from an observation room). Whilst students in direct participant roles were provided with an orientation to the simulation environment, students in observer roles were provided with an orientation to the DML student worksheet (Dreifuerst, 2010; 2015) and copies of the patient documentation for the scenario. The pre-simulation brief concluded with a nursing handover to all participants.

The simulations
The simulation program comprised four simulations. These are outlined in Table 2. Scenarios for Simulations One, Two and Three were adapted from Levett-Jones' (2013) text Clinical reasoning: Learning to think like a nurse. This text also provided the design framework for Simulation Four "Ward for a day". This approach to planning provided confidence to the authors insofar as each simulation containing sufficient, appropriate information to enable students to fully engage in the processes of clinical reasoning both during the scenario, and during the post-simulation debrief. The mode of simulation differed for each scenario, with the choice based on what was perceived most appropriate to achieve the learning outcomes and the desired student experience.

Table 2. Summary of the simulation program

	Simulation One	Simulation Two	Simulation Three	Simulation Four
Learning outcomes	Application of the CRC in the context of: – Interprofessional communication according to ISBAR	Application of the CRC in the context of: – Interpersonal skills – Establishing rapport – Maintaining dignity	Application of the CRC in the context of: –Ethical decision-making	Application of the CRC in the context of: – Patient allocation – Prioritisation – Delegation
Summary of simulation scenario	Fluids and electrolyte imbalance: Recognition and responding to a deteriorating patient.	The "challenging" patient: Employing empathic interpersonal communication.	Refusal of treatment: Maintaining dignity.	"Ward for a day": Prioritisation and delegation.
Simulation mode	Manikin-based	Simulated patient methodology	Video-based	Game-based
Duration	2 hours	2 hours	2 hours	3 hours

Post-simulation debrief
Debriefing immediately followed each simulation according to the DML process as described by Dreifuerst (2015). For the sake of brevity, the processes and rationale of this debriefing model are not fully described, but summarised in the evaluation section of this paper. Fundamental characteristics of DML that aim to make clinical reasoning visible to students,

and engaged both cognitive and social perspectives of clinical reasoning, are: the facilitator's use of Socratic dialogue; the use of the DML student worksheets to guide conceptual mapping and to make visible for students the relationship between assessment, decision-making and actions (Dreifuerst, 2015); and the facilitator using whiteboards or wall-mounted butcher's paper to write important information as identified by students and make thinking visible by revealing relationships. Dreifuerst (2015) claimed these techniques enhance the processes of clinical reasoning as students see their thinking written on whiteboards, and then, have their thinking reinforced as they create their own visual learning resource in the form of the worksheet; a process she termed "double loop visual learning" (p. 270).

An additional strategy for making clinical reasoning visible to students utilised in our simulation program, was to conclude the debrief by asking students to align the eight stages of the CRC with the phases of the DML debrief transcribed on the whiteboard. This innovative approach highlighted for the authors, the synergies created by bringing together these two models.

Findings: Synergies between models

The process of designing simulation scenarios according to the CRC (Levett-Jones & Hoffman, 2013) and aligning this with the DML model of debriefing (Dreifuerst, 2010; 2015) enabled the comparison of these models during the planning and implementation of the program. A significant finding was identifying the synergies between the two different models of clinical reasoning in the design of simulation activity; synergies we hypothesise reinforced the processes of clinical reasoning for nursing students during the simulation program. The following section presents and discusses these synergies under the headings of "what is known?", "negotiating the key problem", "setting a goal", "taking action", "evaluation", and "extending learning through reflection".

What is known?
The first element of both models involves students listing what is known. Stage one and stage two of the CRC asks students to first, "consider the patient situation", and second, "collect cues / information" (Levett-Jones & Hoffman, 2013). This phase is reflected in DML during the "engage phase" and uses student reflection to re-construct the "patient story" (Dreifuerst, 2015). This is achieved through students addressing the first five prompts provided on the DML student worksheet during the first five minutes of the debrief, as well as the facilitated discussion that follows. For both models, reconstructing the patient story provides a point of reference that Levett-Jones and Hoffman (2013) argue can assist students to realise how poor collection of patient data or missed cues can contribute to clinical reasoning errors. In contrast to DML, the CRC makes these processes explicit by systematically guiding students to review, gather and recall when collecting cues and information.

Negotiating the key problem
Negotiating possible and probable problems as a component of clinical reasoning is represented in stage three (process information) and stage four (identify problem / issue) of the CRC. In making this stage of clinical reasoning visible, Levett-Jones and Hoffman (2013) describe processing information as comprising the steps of interpret, discriminate, relate, infer, match, and predict. Similarly, the "explore", "explain" and "elaborate" phases of DML comprise a period of facilitated, active negotiation between student and lecturer, and each other. Negotiation is guided by the facilitator and the DML student worksheet, focussing on possible and probable key problems by exploring the relationship between assessment,

findings, what is known about the person, as well as discipline-specific knowledge. Invariably, different perceptions, assumptions, understandings and experiences ensure a period of rigorous negotiation. Using Socratic dialogue, the facilitator gains insight into students' ability to hypothesis, generalise, synthesize, infer and apply knowledge within the context of the scenario (Dreifuerst, 2015). Further, it is during the "explore phase" where the facilitator begins to uncover mismatches in reasoning, decisions and actions, with the intent to make these visible to students during the subsequent phases of the debrief (Dreifuerst, 2015).

Whilst the focus of both models at this point is on the synthesis of collected cues and information, the CRC presents this component of clinical reasoning as a process comprising six distinct steps in contrast to a more organic approach of DML. However, as a model of debriefing, DML clearly engages students (and the facilitator) in the often challenging and at times confronting process of negotiation.

Setting a goal
An outcome of the previous processes of both models is a mutually agreed key problem or issue. Once identified, the focus of both the CRC (stage five) and DML (explain phase) is to consider priorities of care and set a goal.

Taking action
The actions taken by students (and nurses) are of significance to both the CRC (stage six) and DML. According to Levett-Jones and Hoffman (2013), the focus of this stage is not only what action was taken, but understanding the reasoning processes that inform a course of action; possible alternative actions, people, priorities and timeframes. As a debriefing model, DML facilitates exploration of such reasoning processes through the "explain" and "elaborate" phases. Continuing with Socratic questioning, students engage in a process of uncovering their thinking as they explain and elaborate the actions that were undertaken including assessments, assumptions, interpretations, decisions, actions, responses and outcomes as well as what was expected and what was unexpected (Dreifuerst, 2015).

Evaluation
The evaluation of actions taken is represented in both the CRC (stage seven) and DML "evaluate phase". However, whilst both models make explicit what is to be evaluated, in terms of a re-evaluation of cues and information, through Socratic dialogue that engages students in reflection-on-action (Schön, 1983), DML provides students with an experience of how to evaluate the effectiveness of actions and the clinical reasoning that informed them.
This phase allows students the opportunity to explore the chosen actions and identify alternate options if ineffective. For example, the CRC prompts evaluation by asking "has the situation improved now?" (Levett-Jones & Hoffman, 2013, p.8); a question that may be largely hypothetical without an actual experience of taking action. In contrast, DML, through reflection on actions taken, and the outcomes of these actions, it is possible to evaluate what contributed to achieving the goal, what did not contribute to achieving the goal, and focus learning on correcting critical points for future application.

Extending learning through reflection
The final process of clinical reasoning according to both models focuses on critical review and extending learning through reflection. The CRC (stage eight) presents this process as one of "critical review", with the intent of "refinement, improvement or change" (Levett-Jones & Hoffman, 2013 p.6). Within the DML model, this period of reflection is termed the "extend phase", where students are encouraged to "think-beyond-action" (Dreifuerst, 2015). For both models, extending learning through reflection involves individuals considering what they

have learned about their understanding of why certain choices were made and actions taken in preference of others, and the outcomes of such choices and actions in a specific situation. Furthermore, both models assert that learning through reflection is extended through the use of 'what if' questions, during, for example, a parallel case in which the clinical frame is different (Dreifuerst, 2015). Although the processes of extending learning through reflection are more detailed by Dreifuerst (2015) than Levett-Jones and Hoffman (2013), both models highlight this process as essential to enhancing cognitive and metacognitive skills required for effective clinical reasoning.

Discussion and conclusion

Significant challenges exist to the development of clinical reasoning skills in nursing students. We argue that through purposeful curriculum re-design, whereby two models of clinical reasoning are brought together, aligning simulation scenario and debriefing, represents a pedagogically sound approach to enhancing clinical reasoning in undergraduate nursing students.

As a design framework, the CRC (Levett-Jones & Hoffman, 2013) provided a structured approach to simulation scenario design that clearly conveyed the theoretical stages and steps of clinical reasoning. Whilst this aided scenario design, the CRC also communicated to facilitators a consistent and structured approach to guide students' learning the processes of clinical reasoning. However, as a validated debriefing model, DML provided educators with a structured and consistent process to engage students through worksheets, Socratic dialogue and negotiation that in effect 'teach' this tacit, often habitual skill to students. Employing strategies for consistency in implementation were significant considering 46 lecturers facilitated this program across five university campuses.

As highlighted by Evans (2008) and Higgs and Jones (2008), student and novice nurses may be at increased risk of making errors in clinical reasoning due to engaging non-analytic rather than analytic processing. Combining the CRC and DML promoted analytic thinking in two ways. The first was by making thinking visible. The CRC served as a cognitive tool, making visible the eight distinct stages of clinical reasoning and their respective steps. DML complemented the CRC by engaging students in the process of clinical reasoning through Socratic dialogue and reinforced through double-loop thinking through the use of student worksheets and facilitator notes on the whiteboard. Whilst the CRC enabled students to clearly see movement back and forth between each stages before reaching a decision, taking action, and evaluating outcomes, DML provided an experience engaging students in the processes of explore, explain, elaborate and evaluate; processes which due to their iterative nature (Dreifuerst, 2015), may challenge students to distinguish each phase independently.

A second way analytic thinking was promoted by combining the CRC and DML was the provision of sufficient time for students to engage in clinical reasoning. The six phases of DML provide students with the time required to thoroughly explore the "patient story" in a holistic way, as well as generating curiosity, and explore in-depth, other student's responses. This was a significant consideration for this curriculum re-design, whereby DML actively engaged 30 students for a debrief of on average 60 minutes in duration.

It is important to acknowledge the limitations of this paper. The aim of this exploration was to report on the design phase of an innovative curriculum re-design for the purpose of enhancing clinical reasoning skills in nursing students through simulation-based learning.

Whilst student and facilitator feedback regarding the curriculum re-design was extremely positive, the impact of this approach on enhancing clinical reasoning skills in final semester nursing students is unknown. Exploration of this question is currently underway. Student satisfaction with the program is also being explored. Anecdotal feedback suggests the simulation program empowered students to engage in clinical reasoning during clinical placement. Evidence of learning and teaching strategies that assist students to make connections between the classroom and workplace is highly pertinent to contemporary scholarship of nursing simulation (Harder, 2009; Berragan, 2011). In acknowledging this, we emphasise the need for future research that aligns simulation design, debriefing methodology and application to clinical practice, with theoretical perspectives of clinical reasoning.

Aligning the CRC (Levett-Jones & Hoffman, 2013; Levett-Jones et al., 2010) with DML (Dreifuerst, 2012; 2015) appears to be a logical and theoretically informed approach to simulation design when the aim is to enhance clinical reasoning skills. Comparing the CRC and DML shows that both models comprise almost identical processes of clinical reasoning, yet assist students to understand and engage in these processes in different ways. The approach to simulation design presented in this paper is one way which may provide educators and students with the clarity, consistency and structure required to enhance clinical reasoning skills in new graduate nurses and provides clear impetus and direction for future research.

Acknowledgement

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