

Practice-based simulation model: a curriculum innovation to enhance the critical thinking skills of nursing students

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KEY WORDS

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ABSTRACT

Objective

The purpose of this paper is to describe the Practice-Based Simulation Model (PBSM) as a pedagogical framework that enables the integration of simulation in a way that ensures critical thinking skills are explicitly taught as part of the processes and outcomes of students' learning.

Setting

The PBSM is an innovative pedagogical strategy that offers greater flexibility; one that can be applied to various types of educational contexts and delivery modes, while simultaneously ensuring desired learning outcomes.

Primary argument

The use of simulation has been gaining popularity because of its capacity to provide effective experiential learning as a method of enhancing learners' critical thinking skills. Despite ample literature that highlights the need for the integration of simulation into nursing curricula, there are few papers demonstrating simulated learning experiences that are underpinned by sound pedagogy. This paper asserts that simulated learning experiences need to be integrated into a curriculum underpinned by sound pedagogy, such as the PBSM, in order to ensure that learning facilitates the development of the critical thinking abilities deemed essential for nursing.

Conclusion

The PBSM demonstrates an example of effective integration of simulation into a curriculum, and highlights the importance of the integral relationship of simulation as a key component of curriculum.

INTRODUCTION

Contemporary health care environments require nurses to possess critical thinking abilities in order to tackle the complexities of practice – which can often be compounded by increasing patient acuity – advancing technologies and a growing consumer demand for quality of care (Fero et al 2010). In Australia, as elsewhere, the importance of critical thinking abilities for registered nurses has been well supported (ANMC 2005). The National Nursing Competency Standards endorsed by the Australian Nursing and Midwifery Council (ANMC) includes as one of its four main domains of national nursing competencies, “critical thinking and analysis”; in addition to “professional practice provision”, “coordination of care”, and “collaborative and therapeutic practice” (ANMC 2005, p.2). Competency for the purpose of this curriculum reform was defined as “an attribute of a person which results in effective performance” (Australian Nursing Council 2002, p.1). Since education providers are obligated to demonstrate that intended graduate outcomes are in line with the ANMC National Competency Standards (Ryan 2009), Australian nursing curricula must be structured in such a way as to elicit and make explicit critical thinking behaviours. The challenge is to develop a curriculum model based on sound pedagogy which results in clinical competency augmented by the ability to think critically in clinical decision-making and problem-solving processes.

Contemporary approaches in simulation are centred on its capacity to provide effective experiential learning as a method of enhancing learners’ critical thinking skills (Fero et al 2010; Brannan et al 2008; Rush et al 2008). Despite recent calls for the integration of simulation into nursing curricula, there is little in the literature that demonstrates simulated learning experiences underpinned by a sound pedagogy (Parker and Myrick 2009). This paper describes the main features of the PBSM as a pedagogical framework that enables the integration of simulation in a way that ensures critical thinking skills are explicitly taught as part of the processes and outcomes of students’ learning.

Critical Thinking and Simulation

Martin’s (2002) definition of critical thinking, the “thought process used by nurses for clinical decision-making” (p. 243) is utilised for the purpose of this curriculum model development. While it is necessary to acknowledge that critical thinking is needed for problem-solving and complex decision-making, it is also essential to recognise that critical thinking is not an independent skill, but rather one that develops in the context of domain knowledge. Learners’ abilities in decision-making and problem-solving are best improved through repeated experiences, or practice with thinking as it relates to specific knowledge domains (Rush et al 2008).

Although clinical placement provides the best opportunity for students in repeated exposure to practice, the efficacy of current approaches to clinical education has been frequently questioned. It is acknowledged that given the increasing dynamics of health settings, the likelihood that student nurses develop competence and critical thinking skills for practice in those environments is limited (Lunney 2008; Jeffries 2007; Watson et al 2002). Simulation, on other hand, enables the repetition of clinical experiences that are considered infrequent but critical, or events where students are unable to participate due to patient safety concerns. Simulation as an educational method provides an opportunity to structure learning systematically to help students acquire deep content knowledge and to facilitate the development of critical thinking processes (Brannan et al, 2008; Schumacher 2004). Simulation contextualises various types of clinical practice situations, the most common being to provide an opportunity to present patients with deteriorating conditions. This requires learners to recognise, interpret and integrate new information with their previous knowledge so as to make decisions about the course(s) of action to follow (Liaw et al 2011; Watson et al 2002). Following the simulation, debriefing allows learners to be challenged and to critically review their decision-making processes and performances

and to identify further learning needs. Therefore, it is argued that simulation learning experiences encourage the development of critical thinking skills and help learners become more competent in the care of patients and complex conditions (Decker et al 2011; McGaghie et al 2010).

Despite the overwhelming expectation of simulation effects on learners' critical thinking skills, the evidence to support this expectation seems insufficient. Recent experimental studies (Massias 2010; Brown and Chronister 2009; Ravert 2008) have failed to prove whether simulation-assisted learning is more effective than non-simulation-assisted learning in improving learners' critical thinking skills. Lapkin et al (2010), in their systematic review of the literature, also report mixed findings. This current literature review found only two experimental studies (Howard 2007; Schumacher 2004) which showed significant improvement in the critical thinking abilities of nursing students after exposure to simulation activities. Another study, by Fero et al (2010) examined the relationship between critical thinking skills and simulation-based performance using videotaped vignettes and a high-tech patient simulator. This study employed the California Critical Thinking Disposition Inventory and the California Critical Thinking Skills Test, and reported a statistically significant correlation between performance in simulation and overall critical thinking disposition scores. Despite these recent studies suggesting a positive correlation, the methodological limitations of these studies, such as small sample size and use of convenience sampling, has resulted in insufficient evidence to support a concrete correlation between the uses of simulation and improved critical thinking skills. The difficult task of demonstrating the effectiveness of simulation in improving critical thinking skills with significant randomised sample sizes has been deemed impractical (Lapkin et al 2010). In addition, designing experimental studies that require extensive periods of time and allow sufficient exposure to simulation before testing is challenged by the difficulty related to meeting ethical underpinnings of research and those principles of assessment that centre on equity for all students.

This paper argues that simulation, when incorporated into structured learning, creates an opportunity for educators to provide a framework to enable students to develop a full suite of skills; to be team players, to work collaboratively with others, to engage in determining solutions in particularly challenging situations, to make decisions based on sound judgments, and to develop critical thinking in a safe supportive environment. However, it is important to note that as not all experiences lead to meaningful learning, and that learners' exposure to simulation does not always result in the desired learning outcomes, including critical thinking skills. Critical thinking is best developed through repeated exposures to practice where learners' thinking processes are supported by integrated contextual knowledge, skills, and behaviours (Helsdingenet al 2011; Simpson and Courtney 2002). Simulation, therefore, that is integrated into a curriculum based on sound pedagogy will ensure that learning facilitates the development of the critical thinking abilities.

There is a dearth of literature demonstrating the integration of simulated learning experiences in nursing curricula underpinned by a pedagogy (Schlairet 2011; Parker and Myrick 2009). A number of authors have suggested merging simulation into an integrated Problem Based Learning (PBL) curriculum (Murphy et al 2010; Park et al 2009; Wong et al 2008). PBL has long been recognised as a mechanism to provide an integrated approach to acquiring the knowledge, skills, and behaviours required for effective clinical practice, and therefore having the potential to enhance critical thinking skills (Oja 2011); however, many models of PBL do not achieve this outcome (Hmelo-Silver et al 2007). A totally integrated PBL curriculum, focusing mainly on the classroom activities is impractical, particularly when considering the competing challenges associated with the shortage of nursing academics and increasing student enrolment, challenges which have driven an emphasis on cost-effectiveness in educational delivery and an emerging on-line presence (Howard et al 2011). Therefore, there is a need for an innovative pedagogical strategy that offers greater flexibility; one that can be applied to various types of educational contexts and delivery modes, while simultaneously ensuring desired learning outcomes.

The Practice-Based Simulation Model (PBSM)

The Practice-Based Simulation Model was initially conceptualised by the first author, drawing both on the literature and professional expertise gained through leading the development, implementation and evaluation of the Simulation-Problem Based Learning (S-PBL) curriculum in Korea (Park et al 2009). The PBSM was then further refined through an action based project involving a series of trials and modification of the model during 2009-2010 by the authors at one Australian university. The PBSM is currently employed in five undergraduate courses in a Bachelor of Nursing program, and within two postgraduate nursing programs. The results of the evaluation study of the PBSM implementation is being prepared for later publication.

The PBSM is based on constructivist learning theory which asserts that knowledge is not passively transferred from educator to learner, but constructed by the individual learner through the processing of experiences and interactions with their environment (Parker and Myrick 2009). Constructivist learning theory is operationalised through valuing concepts of active learning, authentic or situated learning, and collaborative learning (Pritchard and Woollard 2010).

The PBSM is a learner-centred curriculum model that was developed with the aim of achieving effective simulation integration, and to clearly demonstrate the integral relationship of simulation as a potentially key component of curriculum. The learning of critical thinking skills is explicit to the PBSM as linked to the process of planning, implementation and evaluation of curriculum in order to achieve these skills as part of the desired outcomes.

Elements of the Practice-Based Simulation Model

The PBSM as a curriculum model is composed of a series of learning modules. Each learning module is organised around one practice situation, which is carefully selected to represent a cluster of key learning concepts. One or two learning modules collectively form a subject and these are mapped out to reflect achievement of the desired outcomes of the entire curriculum. The PBSM has five elements: practice situation, simulation, structured learning, inquiry process, and assessment. All of these elements are interlinked and work together, as shown in figure 1, to systematically guide and effectively drive the learners' knowledge construction. This section provides the rationale for each element and elaborates their role within the Practice-Based Simulation Model.

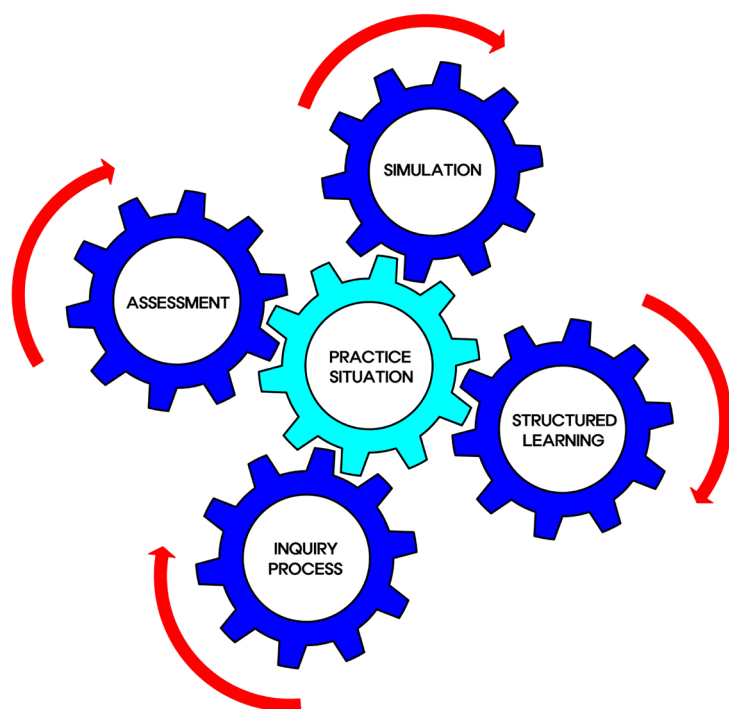


Figure 1:
The interlinking of elements in the Practice-Based Simulation Model.

Practice Situation

The practice situation is the core of curriculum design and the main thread holding each of the elements together. It provides the focus for learning and assures the clear integration of learning concepts within the framework of nursing professional practice (Conway et al 2000). To develop an effective PBSM learning module, a quality practice situation must be designed and integrated into the curriculum. The quality design of practice situation and aligned simulation learning experiences 'integrate thinking and doing' during learning processes and inform action-oriented decision-making by learners. The materials replicating practice situations should: be authentic and reflect real world practices; provide specificity and direction for learners around time, place and role; include social, political, and ethical components; and recognise the potential for multimedia to enhance the fidelity of simulation (PROBLARC 2000).

A practice situation is often referred to as a case and involves a 'problem', a 'patient case', or a 'scenario' depicting various people and/or situations. In the PBSM, the term 'practice situation' is used to emphasise the point that the stimulus material should not merely be a patient case, but should include practice context surroundings in which the patient and the nurse are physically, socially, and emotionally located (Fero et al 2009). Even a quality practice situation taken from real-world practice often requires re-structuring to guide the learning process. This re-structuring includes situation descriptions, formulation of relevant cues, and their effect on priorities. During this process, clinicians' involvement is critical to ensure the similarity to real-world situations in content, importance, and direction of the relationships (Chiarella et al 2008).

Simulation

Although various types of simulation technologies are employed in the clinical laboratory sessions, simulation as an element of this model refers to a form of immersive simulation where learners are required to take the role of a clinician within a replication of real practice situation. The learners are required to analyse the clinical situation, to formulate appropriate care, to prioritise and to deliver the care within the real-time practice environment. Simulation in this model, therefore, provides a venue for training learners' ability to think critically and engage in clinical reasoning.

The "practice situation" in the PBSM provides a full description of a nurse-patient encounter, while the simulation scenario represents a snap shot of a particular portion of that situation. Depending upon the purpose of the learning module, one or a series of snap shots can be taken and employed as simulation scenarios in a learning module. The scenarios are usually sequential in order to imitate the changing, contingent situations of a nurse-patient encounter. These sequential multiple encounters enable and reinforce learners' ability to recall previous knowledge and to apply this to new experiences. This allows learners to construct a deeper level of processing, therefore improving their clinical reasoning skills (Hoffman et al 2011).

A typical immersive simulation session within this model includes a process of 10-15 minutes of pre-briefing, 10-15 minutes of simulation encounter, and 20-30 minutes of debriefing. A remedial follow-up is arranged when considered necessary. Debriefing allows a venue for the teaching of critical thinking skills in the context of specific subject matter (Dreifuerst 2010). The debriefing process involves a learner's critical review and discussion of the decision-making process within the simulation encounter and a reflection of the learners' own cognitive strategy. This is considered as a typical, but very effective mode for the instruction of critical thinking skills (Helsdingen et al 2011).

The PBSM suggests that various forms of debriefing be used, according to the learner's level of preparation, and in order to meet the objectives of the learning module. A facilitator guided debriefing is useful for beginners to be trained in learning from reflection. The debriefing facilitator encourages learners to collaboratively engage in constructive processing by redirecting their attention, pushing them to think deeply, and modelling the

clinical reasoning process that clinicians would perform in real practice (Dreifuerst 2010; Hmelo-Silver et al 2007). Peer debriefing in the PBSM is used to promote learners' engagement in structured observation, to critically evaluate, and to provide peer feedback, in a professionally appropriate manner. A written form of debriefing is particularly useful in providing learners with time to reflect on their performances and emotions. This allows educators to have access to the individual learner's perceived learning through the simulation (Petranek 2000).

Practice situation and simulation are the elements of the PBSM emphasising the goals of authenticity. The PBSM employs real-world practice situations as the focal point of all learning and assessment strategies, and further reinforces authenticity through the use of immersive simulation. This approach then locates learners' performance within a realistic encounter with an imitated practice situation. Therefore, the PBSM increases the chance of transferability of on-campus learning to clinical settings.

Structured Learning

Structured learning in this model refers to that element concerned with the way the learning of the essential content of a curriculum is achieved. It is important that educators achieve a consensus on the essential learning content of the profession and how this can be best transferred to their learners. The PBSM includes regular, structured learning sessions such as lectures, tutorials, clinical skill labs, and web-based interactive learning sessions. One criticism of constructivist learning approaches, such as PBL and Inquiry Based Learning (IBL), has been that certain models used by these approaches place too much emphasis on the discovery journey of learning, but provide minimal instructional support. Such an approach has been reported to be less effective and efficient than conventional instructional approaches that provide sufficient guidance to student learning process (Kirschner et al 2006). While the importance of learners being engaged in the self-directed and collaborative construction of knowledge is still valued, the PBSM endeavours to reduce excessive cognitive loading for the learners by providing a more focused approach through the use of various types of direct and indirect instructions. The PBSM supports the inclusion of direct instruction such as regular lecture sessions, but these must be provided in a timely manner; generally once learners have identified their learning gaps and understand the relevance of the information through analysing the practice situation.

Indirect instruction is presented during tutorials, clinical laboratory sessions, and online interactive activities, as a type of scaffolding activity. For example, clinical laboratory sessions in the PBSM are designed to foster collaborative learning environment using vignettes and multimedia content. The educator acts as a facilitator to discuss a vignette – often one that directly relates to the practice situation – so that skills are taught within the context of the practice situation. Ideally learners will have access to computers to retrieve relevant information and to learn collaboratively with their peers. The facilitator assists learners' understanding and development by prompting learners to explain or identify the limits of their knowledge and skills. Direct skill demonstration is given once the collaborative learning is undertaken and considered necessary to articulate complicated procedures. Such timely direct and indirect instruction promotes knowledge construction in a way that makes knowledge available for future use in relevant contexts (Edelson 2001). Structured learning sessions in the PBSM aim to encourage learners to move beyond their limitations and engage in complex tasks that would otherwise be beyond their current abilities (Hmelo-Silver et al 2007).

Inquiry Process

Concurring with Facione's (2011) views on critical thinking as a vital tool for inquiry, the inquiry process in this model is an element which focuses on enhancing learners' critical thinking skills and preparing them to be life-long learners. The strategies to promote learners' inquiry processes are distributed in each element of the PBSM and across the curriculum, so as to focus on gradual improvement in learners' critical thinking

skills. For example, the choice of appropriate debriefing method directly relates to elements of the inquiry process. The selection and design of inquiry process strategies are guided by a set of core critical thinking skills and sub-skills identified by an international group of experts in critical thinking through a Delphi study conducted by Facione (Facione 2011, 1990); this is outlined in table 1.

Table 1: Core Critical Thinking Skills and Sub-skills, adapted from Facione (2011)

Core critical thinking skills	Sub-skills
Interpretation	Categorise, decode significance and clarify meaning
Analysis	Examine ideas, identify arguments, and identify reasons and claims
Inference	Query evidence, conjecture alternatives, and draw conclusion using inductive or deductive reasoning
Explanation	State results, justify procedures, and present arguments
Self-regulation	Self-monitor and self-correct

One of the main features of the PBSM model is its use of pre- and post-concept mapping as a mean to aid learners' self-evaluation of their learning needs and outcomes. Concept mapping has been reported as an effective tool in helping learners develop problem solving and critical thinking skills (Hsu and Hsieh 2005; Wheeler and Collins 2003). Pre-concept mapping assists learners in the engagement of cognitive processes such as organising, categorising, analysing, evaluating, and reasoning critically (Taylor and Wros 2007; Rafferty and Fleschner 1993). During pre-concept mapping, learners' decisions are based on the recognition of aspects of the practice situation, matching recognised aspects with previous knowledge and experiences. The learners are required to formulate set of care decisions to manage the situation. These decisions are often incomplete or inconsistent because of missing information, insufficient evidence, and unproven assumptions (Helsdingen et al 2011). The result of pre-concept mapping therefore reinforces learners' impetus towards identifying their learning needs and motivates their seeking for further information. Pre-concept mapping aims to foster the core critical thinking skills of interpretation, analysis, and inferences (table 1).

Post concept mapping aims to promote learners' self-reflection on 'knowing' and the 'process of knowing' by allowing learners to revisit the practice situation and compare their pre- and post-concept maps. This process allows learners to engage in the core critical thinking skill of explanation (table 1). A 'reflective summary' – an individual written assignment – replaces the post-concept mapping for experienced learners. Towards the close of a module, following an immersive simulation and debriefing, learners are required to revisit the practice situation and reflect upon their decisions, decision making processes and performances, and to rationalise or critique their decisions based on scientific evidence. Therefore, a reflective summary aims to foster learners' self-reflection on 'knowing and doing' and provides opportunities to learn the core critical skill of self-regulation (table 1). The authors suggest that educators make explicit the objectives of the strategies to learners during the implementation of inquiry process, so that the value of the activities is well-accepted in order to motivate learners' participation, particularly when the strategies are not incorporated as part of formal assessment.

Assessment

Assessment as one of the five elements of the PBSM displays close links to the practice situation so learning is re-directed to the specific context. Assessment, and assessment strategies that direct students' learning, must be congruent with the goal of the curriculum (which in the case of undergraduate nursing education is most often the achievement of professional competency as provided by the registration body) (Ryan 2009). Competency builds on a foundation of basic clinical skills, scientific knowledge, moral development, and cognitive functions, such as critical thinking (Epstein 2007). As Epstein (2007) emphasises, it is vital to have

multiple methods of assessment to cover all dimensions of competency, particularly by using a longitudinal approach within a curriculum and so avoid excessive testing at any one point in time. This will allow educators to monitor gradual improvement of learning outcomes and learners' knowledge base, and assess improvements in levels of skill against criteria informed by statements and standards within a suite of nursing competencies.

The PBSM advocates the use of simulation in assessing the clinical component of the curriculum as it allows educators to formatively assess in ways that are consistent with the knowledge, skills, and attitudes underpinning competent performance. Epstein and Hundert (2002) argue that conventional methods of assessment may "underemphasise some important domains of professional practice, including interpersonal skills, life-long learning, professionalism, and integration of core knowledge into clinical practice" (p. 226). Most on-campus assessment methods in health professional education still evaluate a single dimension of competency, such as knowledge or skills, rather than integrating both and explicitly assessing the processes which underpin them (Epstein 2007; Epstein and Hundert 2002). Simulation has been recognised as a desirable method for assessing competency as it allows for the evaluation of learners' performance in real-time and in a realistic practice situation (Decker et al 2011; Scalese et al 2008). Simulation-based assessment allows educators to simultaneously examine numerous learners, all exposed to identical scenario conditions, that can be reproduced over time and are highly realistic; thereby creating fairer grounds for assessment, while at the same time eliminating threats to patient safety (Spunt 2007; Boulet et al 2003).

Although simulation has been reported as an effective way of assessing learners' practical skills and other non-vocational qualities, scepticism towards using clinical simulation in learner assessment still exists (Donoghue et al 2009; Ryan 2009; Brannan et al 2008). Boulet et al (2003) criticise the reliability of simulation assessment as being strongly influenced by the types and number of simulation encounters. Thus, in the PBSM it is advocated that accommodations be made for multiple simulated encounters to encompass a broader range of practice domains in order to effectively and accurately assess learners' abilities in clinical settings. Although the PBSM actively utilises various forms of simulation for formative assessment and feedback for students across the curriculum, the use of immersive simulation as a summative assessment is recommended only in the final year of a program. This is to ensure that learners have had sufficient exposure to simulation and spent adequate time to prepare for a fair and accurate appraisal of their readiness for transition to the workforce. It is also essential to create reasonable expectations about the demands of these assessment tasks for both educators and learners.

There is an ongoing need for staff development in all aspects of the PBSM, but particular emphasis needs to be focused on assessing the processes that learners develop during a program. Unless nurse educators are able to agree on behaviours that reflect critical thinking and to design assessment activities that elicit both the process of developing critical thinking and the outcomes of its application to nursing practice, the evidence that nurses can and do think critically will continue to be questioned. In times of diminishing resources within universities there has been a tendency to rationalise assessment methods to product-oriented, summative assessment, such as written assignments or essays, knowledge tests, or observation of performance of clinical procedures. Those involved in nurse education need to develop valid, reliable, efficient, and effective tools for assessing critical thinking as a process integral to both practice and learning.

CONCLUSION

In summary, the Practice-Based Simulation Model is an innovative curriculum model underpinned by constructivist pedagogy that is designed in such a way as to ensure critical thinking skills are explicitly

taught as part of the processes and outcomes of students' learning. The interlinking of five elements of this model – practice situation, simulation, structured learning, inquiry process, and assessment – provides a framework for educators to use in the process of design, implementation and evaluation of a curriculum and to systematically assist knowledge construction of learners.

The PBSM demonstrates an example of effective integration of simulation into a curriculum, and highlights the importance of the integral relationship of simulation as a key component of curriculum. The authors assert that simulated learning experiences need to be integrated into a curriculum underpinned by sound pedagogy, such as the PBSM, in order to ensure that learning facilitates the development of the critical thinking abilities deemed essential for nursing.

One of the critical features of this model is its flexibility to be applied into various types of educational contexts and delivery modes. Since its development in 2010, the PBSM has been utilised for various courses and programs of undergraduate, postgraduate, and clinical education. The informal and formal evaluations of these efforts strongly support its value and usefulness for simulation integrated teaching and learning practice. A longitudinal study examining the effect of the PBSM is needed to support the correlation between the use of simulation and enhanced learners' critical thinking skills.

REFERENCES

- ANMC. 2011. National competency standards for the Registered Nurse 2005 [cited September 24 2011]. Available from http://www.anmc.org.au/docs/Competency_standards_RN.pdf.
- Australian Nursing Council. 2002. Principles for the assessment of national competency standards for registered and enrolled nurses. Canberra: Australian Nursing Council.
- Boulet, J.R., Murray, D., Kras, J., Woodhouse, J., McAllister, J. and Ziv, A. 2003. Reliability and validity of a simulation-based acute care skills assessment for medical students and residents. *Anesthesiology* 99(6):1270.
- Brannan, J.D., White, A. and Bezanson, J.L. 2008. Simulator effects on cognitive skills and confidence levels. *Journal of Nursing Education* 47(11):495.
- Brown, D. and Chronister, C. 2009. The effect of simulation learning on critical thinking and self-confidence when incorporated into an electrocardiogram nursing course. *Clinical Simulation in Nursing* 5(1):e45-e52.
- Chiarella, M., Thoms, D., Lau, C. and McInnes, E. 2008. An overview of the competency movement in nursing and midwifery. *Collegian: Journal of the Royal College of Nursing Australia* 15(2):45-53.
- Conway, J., Jeffries, M. and Chen, S. E. 2000. Assessment of professional competence in problem-based learning settings: Two case studies. *Implementing Problem-Based Learning*. Hong Kong: University of Hong Kong.
- Decker, S., Utterback, V.A., Thomas M.B., Mitchell, M. and Sportsman, S. 2011. Assessing continued competency through simulation: A call for stringent action. *Nursing Education Perspectives* 32(2):120-125.
- Donoghue, A.J., Durbin, D.R., Nadel, F.M., Stryjowski, G.R., Kost, S.I. and Nadkarni, V.M. 2009. Effect of high-fidelity simulation on pediatric advanced life support training in pediatric house staff: A randomized trial. *Pediatric Emergency Care* 25(3):139.
- Dreifuerst, K.T. 2010. Debriefing for meaningful learning: Forstering development of clinical reasoning through simulation. PhD thesis, School of Nursing, Indiana university.
- Edelson, D.C. 2001. Learning-for-use: A framework for the design of technology-supported inquiry activities. *Journal of Research in Science Teaching* 38(3):355-385.
- Epstein, R.M. 2007. Assessment in medical education. *New England Journal Medicine* 356(4):387-96.
- Epstein, R.M., and Hundert, E.M. 2002. Defining and assessing professional competence. *JAMA: The Journal of the American Medical Association* 287(2):226.
- Facione, P.A. 1990. Critical thinking: A statement of expert consensus for purposes of educational assessment and instruction. Research findings and recommendations. Newark: American Philosophical Association.
- Facione, P.A. 2011. Critical thinking: What it is and why it counts 2011 [cited July 22 2011]. Available from <http://www.insightassessment.com/content/download/1176/7580/file/what&why2010.pdf>.
- Fero, L.J., O'Donnell, J.M., Zullo, T.G., Dabbs, A.D.V., Kitutu, J., Samosky, J.T. and Hoffman, L.A. 2010. Critical thinking skills in nursing students: Comparison of simulation based performance with metrics. *Journal of Advanced Nursing* 66(10):2182-2193.
- Fero, L.J., Witsberger, C.M., Wesmiller, S.W., Zullo, T.G. and Hoffman L.A. 2009. Critical thinking ability of new graduate and experienced nurses. *Journal of Advanced Nursing* 65(1):139.

- Helsdingen, A., Van Gog, T. and Van Merriënboer, J. 2011. The effects of practice schedule and critical thinking prompts on learning and transfer of a complex judgment task. *Journal of Educational Psychology* 103(2):383.
- Hmelo-Silver, C.E., Duncan, R.G. and Chinn, C.A. 2007. Scaffolding and achievement in problem-based and inquiry learning: A response to Kirschner, Sweller, and Clark (2006). *Educational Psychologist* 42(2):99-107.
- Hoffman, K., Dempsey, J., Levett-Jones, T., Noble, D., Hickey, N., Jeong, S., Hunter, S. and Norton, C. 2011. The design and implementation of an interactive computerised decision support framework (ICDSF) as a strategy to improve nursing students' clinical reasoning skills. *Nurse Education Today* 31(6):587-594.
- Howard, V. M. 2007. A comparison of educational strategies for the acquisition of medical-surgical nursing knowledge and critical thinking skills: Human patient simulator vs. the interactive case study approach. PhD thesis, School of education, University of Pittsburgh.
- Howard, V.M., Englert, N., Kameg, K. and Perozzi, K. 2011. Integration of simulation across the undergraduate curriculum: Student and faculty perspectives. *Clinical Simulation in Nursing* 7(1):e1-e10.
- Hsu, L., and Hsieh, S.I. 2005. Concept maps as an assessment tool in a nursing course. *Journal of Professional Nursing* 21(3):141-149.
- Jeffries, P.R. 2007. Clinical simulation in nursing education: Valuing and adopting an experiential clinical model. *Create the Future* (7), http://www.nursingsociety.org/Publications/Newsletter/Documents/CTF_V4_7.pdf.
- Kirschner, P.A., Sweller, J. and Clark, R.E. 2006. Why minimal guidance during instruction does not work: An analysis of the failure of constructivist, discovery, problem-based, experiential, and inquiry-based teaching. *Educational Psychologist* 41(2):75-86.
- Lapkin, S., Levett-Jones, T., Bellchambers, H. and Fernandez, R. 2010. The effectiveness of using human patient simulation manikins in the teaching of clinical reasoning skills to undergraduate nursing students: A systematic review *Clinical Simulation in Nursing*:e1-e16.
- Liaw, S.Y., Scherpbier, A., Klainin-Yobas, P. and Rethans, J.J. 2011. Rescuing a patient in deteriorating situations (RAPIDS): An evaluation tool for assessing simulation performance on clinical deterioration. *Resuscitation*.
- Lunney, M. 2008. Current knowledge related to intelligence and thinking with implications for the development and use of case studies. *International Journal of Nursing Terminologies and Classifications* 19(4):158-162.
- Martin, C. 2002. The theory of critical thinking of nursing. *Nursing Education Perspectives* 23(5):243.
- Massias, L.A. 2010. Influencing critical thinking in nursing education: Comparing high-fidelity simulations and traditional clinical training. Doctoral dissertation, Education, University of Phoenix, Arizona.
- McGaghie, W.C., Issenberg, S.B., Petrusa, E.R. and Scalese, R.J. 2010. A critical review of simulation based medical education research: 2003-2009. *Medical Education* 44(1):50-63.
- Murphy, S., Hartigan, I., Walshe, N., Flynn, A.V. and O'Brien, S. 2010. Merging problem-based learning and simulation as an innovative pedagogy in nurse education. *Clinical Simulation in Nursing* 7(4):e141-e148.
- Oja, K.J. 2011. Using problem-based learning in the clinical setting to improve nursing students' critical thinking: An evidence review. *Journal of Nursing Education* 50(3):145-145-151.
- Park, M.Y., McMillan, M., Little, P., Park, C.S. and Park, H.O. 2009. Simulation-PBL (Problem Based Learning): An evaluation of the implementation of learning modules in the Korean nursing context. In *International Meeting on Simulation in Healthcare*. Lake Buena Vista, FL: Society for Simulation in Healthcare.
- Parker, B.C., and Myrick, F. 2009. A critical examination of high-fidelity human patient simulation within the context of nursing pedagogy. *Nurse Education Today* 29(3):322-329.
- Petraneck, C.F. 2000. Written debriefing: The next vital step in learning with simulations. *Simulation & Gaming* 31(1):108.
- Pritchard, A. and Woollard, J. 2010. *Psychology for the classroom: Constructivism and social learning*. Hoboken: Routledge. <http://RMIT.eblib.com.au/patron/FullRecord.aspx?p=515360> (accessed 28.09.11).
- PROBLARC. 2000. *Criteria for learning events* Newcastle, Australia: University of Newcastle.
- Rafferty, C.D. and Fleschner, L.K. 1993. Concept mapping: A viable alternative to objective and essay exams. *Reading and Research Instruction* 32(3):25-34.
- Ravert, P. 2008. Patient simulator sessions and critical thinking. *Journal of Nursing Education* 47(12):557.
- Rush, K.L., Dyches, C.E., Waldrop, S. and Davis, A. 2008. Critical thinking among RN-to-BSN distance students participating in human patient simulation. *Journal of Nursing Education* 47 (11):501.
- Ryan, D. 2011. Standards and criteria for the accreditation of nursing and midwifery course leading to registration, enrolment, endorsement and authorisation in Australia-with evidence guide: Registered nurses. Australian Nursing and Midwifery Council 2009 [cited September 24 2011]. Available from [http://www.anmc.org.au/userfiles/file/ANMC_Registered_Nurse\(1\).pdf](http://www.anmc.org.au/userfiles/file/ANMC_Registered_Nurse(1).pdf).
- Scalese, R.J., Obeso, V.T. and Issenberg, S.B. 2008. Simulation technology for skills training and competency assessment in medical education. *Journal of General Internal Medicine* 23:46-49.
- Schlairet, M.C. 2011. Simulation in an undergraduate nursing curriculum: Implementation and impact evaluation. *The Journal of Nursing Education* 50(10):561-568.
- Schumacher, L. 2004. The impact of using high-fidelity computer simulation on critical thinking abilities and learning outcomes in undergraduate nursing students. *Dissertation Abstracts International* 65.

Simpson, E. and Courtney, M. 2002. Critical thinking in nursing education: Literature review. *International Journal of Nursing Practice* 8(2):89-98.

Spunt, D. 2007. Setting up a simulation laboratory. In *Simulation in Nursing Education: From Conceptualisation to Evaluation*, edited by P. R. Jeffries. New York: NLN.

Taylor, J., and Wros, P. 2007. Concept mapping: A nursing model for care planning. *The Journal of Nursing Education* 46(5):211.

Watson, R., Stimpson, A., Topping, A. and Porock, D. 2002. Clinical competence assessment in nursing: A systematic review of the literature. *Journal of Advanced Nursing* 39(5):421-431.

Wheeler, L.A. and Collins, S.K.R. 2003. The influence of concept mapping on critical thinking in baccalaureate nursing students. *Journal of Professional Nursing* 19(6):339-346.

Wong, F.K., Cheung, S., Chung, L., Chan, K., Chan, A., To, T. and Wong, M. 2008. Framework for adopting a problem-based learning approach in a simulated clinical setting. *The Journal of Nursing Education* 47(11):508.