Synergistic Integration of Concept Mapping and Cause and Effect Diagramming Into Simulated Experiences

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Abstract: The ability to demonstrate clinical judgment while applying critical and reflective thinking skills is mandatory for nurses (American Association of Colleges of Nursing, 1998; National League for Nursing, 2003). Yet research has demonstrated that new nursing graduates have difficulty transferring knowledge and skills to the clinical setting (Clarke & Aiken, 2003; Del Bueno, 2005). Simulation provides faculty an innovative strategy to promote meaningful learning and facilitate the development of safe, effective, and competent graduates. This article discusses the integration of concept mapping and cause-and-effect diagramming as components of a simulated experience in an effort to facilitate the development of critical and reflective thinking.


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Introduction

The ability to demonstrate clinical judgment while applying critical and reflective thinking skills is mandatory for nurses (American Association of Colleges of Nursing, 1998; National League for Nursing, 2003). Today’s nursing graduates are faced with a dynamic, technically advanced work environment (Shultz, 2009). To provide safe practice in this environment, Del Bueno (2005) stated, nurses are required to accurately gather, analyze, synthesize, and apply patient clinical data. When a nurse does not have the knowledge and skills to complete this process, a patient could be placed at risk for injury.

Research has demonstrated that new nursing graduates have difficulty transferring knowledge and skills to the clinical setting (Clarke & Aiken, 2003; Del Bueno, 2005). Therefore, faculty are challenged to use innovative educational strategies that are evidence based (Institute of Medicine & Kohn, 2004). These strategies must incorporate experiential learning to promote meaningful learning and facilitate the development of safe, effective, and competent graduates. Simulation, according to Bambini, Washburn, and Perkins (2009), provides a safe environment in which students can apply theoretical principles while participating in a realistic patient care situation.

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Literature Review

Dewey (1910) described the relationship between learning and experience by defining learning as “not learning things, but the meaning of things” (p. 176). We define meaningful learning as a process of integrating and assimilating new knowledge gained from experience. As a building process, meaningful learning creates the opportunity to assimilate and apply acquired knowledge, competencies, and critical thinking to future situations.

As a recognized core competency for the nursing graduate, critical thinking was described by the American Association of Colleges of Nursing (1998) as the foundation for “independent and interdependent decision making” and “includes questioning, analysis, synthesis, interpretation, inference, inductive and deductive reasoning, intuition, application, and creativity” (p. 9). Brookfield (1987) described critical thinking as a dynamic process (not an outcome) involving “alternating phases of analysis and action” (p. 23). Critical thinking, according to Brookfield, integrated cognitive skills, logical reasoning, emotions, and reflective thinking. According to Brookfield, critical thinking has a dynamic relationship with experiential learning (exploring alternatives) and reflective thinking (reflective analysis). Reflective thinking (reflection), based on Dewey (1933), is defined as the active process of self-monitoring, occurring during or after an experience. Furthermore, reflective thinking, an essential component of experiential learning, promotes insightfulness leading to the discovery of new knowledge with the intent of applying such knowledge to future situations (Decker, 2007).

Simulation integrates theory into practical application while promoting critical thinking (Bambini, Washburn, & Perkins, 2009; Jeffries & Rizzolo, 2006). Additionally, the integration of reflective thinking facilitates the link between theory and practice, increases the student’s ability to synthesize knowledge, and promotes development of insight (National Council of State Boards of Nursing, 2005). According to Decker (2007), learning supported through simulation enhances the development of both critical and reflective thinking skills.

When using simulation as an integral component of education, students are exposed to situations which can be manipulated in a variety of ways. Simulation allows faculty to adjust the scenario according to the student’s response to the situation. Simulation scenarios allow the student to gain experience with multiple real-life problems in a realistic environment (Jeffries, 2005). We believe the student is then able to transfer the essential thought process and clinical competencies from the simulated setting to actual patient care. As the student progresses through the curriculum, the simulated experiences should become more complex. We view difficulties encountered in the provision of care during a scenario as enriching experiences. Texas Tech University Health Sciences Center (TTUHSC) nursing faculty use the debriefing component of simulated experiences to assist the student in the process of self-reflection. Faculty members believe experience alone does not guarantee learning, but the integration of reflection promotes deep understanding from experience and promotes application of theory to the clinical setting (Lockwood, Walker, & Tilley, 2009; National Council of State Boards of Nursing, 2005). This belief is supported by Dewey (1938), who stated that a learner who makes his or her own discoveries, even if disappointed, is more likely to acknowledge these discoveries than if they are merely pointed out. According to Jeffries (2005), debriefing “reinforces the positive aspects of the experience and encourages reflective learning, which allows the participant to link theory to practice and research, think critically, and discuss how to intervene professionally in very complex situations” (p. 101).

Reflective Thinking

Various techniques are posed to facilitate the development of reflective thinking. TTUHSC has elected to incorporate either debriefing using the plus (alpha)-delta method or guided reflection into the simulated experiences. As discussed by Fanning and Gaba (2007), the plus-delta technique involves a two-column design, with the columns labeled plus (alpha) and delta. In the plus column, examples of competent actions are listed. Actions the learners...
identify as needing improvement, including recommendations for modifications, were listed in the delta column. Initially, faculty remained in the room while students completed the plus (alpha)-delta tool. The faculty elected to modify this process because the students continuously sought faculty approval for their actions. Faculty therefore (a) designated the “family or observer” as the group facilitator, (b) provided specific instructions related to the plus (alpha)-delta format, and (c) left the room. After 15 minutes, the faculty members returned, listened to the group’s presentation, and facilitated the group analysis. Finally, the faculty members provided feedback if any errors or deficiencies were not identified by the learners during the group process.

Johns (2004) stressed that because reflection can produce negative thoughts, a guide (faculty) needs to support the practitioner throughout the process. Johns (1995) developed a model for structured or guided reflection to provide questions based on Carper’s four ways of knowing: empirical, aesthetic, personal, and moral-ethical (Carper, 1978). Modifications to Johns’s model were initiated and validated through research (Decker, 2007). The outcomes of these modifications are presented in Figure 1 and are used to facilitate reflective thinking sessions integrated at strategic points.

### Table 1: Student Comments Related to Integration of Concept Mapping With Simulation

<table>
<thead>
<tr>
<th>Comment</th>
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<tr>
<td>“I did enjoy working as a group together to incorporate our interventions into our pathophysiology of our disease.”</td>
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<tr>
<td>“Students first linked the disease process, clinical manifestations and lab work by drawing a map….They were asked to work with SimMan based on the provided information….It was very helpful.”</td>
</tr>
<tr>
<td>“I also enjoyed doing our concept maps together….because I am a visual learner and seeing the pathophysiology and how it correlates with the signs and symptoms helps me understand the disease process a lot easier than just talking about it.”</td>
</tr>
<tr>
<td>“I like how we started the day by making a concept map together….I feel like it made us less nervous and more comfortable with the scenarios.”</td>
</tr>
<tr>
<td>“Doing a concept map right before taking care of SimMan/Baby was helpful to refresh our memory on the pathophysiology. Overall this was a very useful learning experience to have with a group.”</td>
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### Figure 1: Sample questions used for the guided reflection sessions.

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<tr>
<td>1. “What was I trying to achieve and did I respond effectively”</td>
<td>1. “Discuss your main goal during this the simulated experience?”</td>
</tr>
<tr>
<td>2. “How did this experience connect with previous experiences?”</td>
<td>2. “Talk to me about past experiences including previous knowledge and skills that influenced your actions during the simulated experience.”</td>
</tr>
<tr>
<td>3. “How might I respond more effectively given this situation again?”</td>
<td>3. “Tell me what would you do differently if you were able to repeat the simulated experience right now?”</td>
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### Figure 2: Integrating concept mapping into simulation.
Guided reflection took place at the end of the simulated experiences discussed in this article.

**Integration Into Curricula**

We suggest the nursing student needs to experience a continuum of simulated and actual clinical experiences throughout the nursing curriculum. The student needs to be given the opportunity to react to these experiences and take accountability for the outcomes resulting from his or her actions. Furthermore, we believe that without planned simulated and actual clinical experiences, a graduate may have the book knowledge of anticipated actions and still lack the reasoning to react appropriately. Hence, we believe simulation should be integrated strategically throughout the curricula to facilitate increased competency.

Students at TTUHSC have been exposed to simulated experiences using advanced patient simulators since the fall of 2003. These simulated experiences have been strategically integrated throughout the curricula based on research findings. Our research identified a need for specific essential constructs to be incorporated into simulated experiences. The essential constructs currently identified include patient safety, communication, situation awareness, therapeutic interventions, resource allocation, assessment, and critical thinking. Additionally, to facilitate the development of critical and reflective thinking while promoting clinical competence, two unique strategies (concept mapping and cause-and-effect diagramming) were integrated into simulated learning experiences.

**Integration of Concept Mapping**

Concept mapping has demonstrated an ability to promote knowledge development leading to enhanced critical thinking (Arhin & Cormier, 2007). Additionally, a literature review demonstrated that concept mapping increased students’ knowledge integration and promoted confidence, which led to meaningful learning (Hill, 2007; St. Cyr & All, 2009). Because concept mapping provides a schematic representation of key concepts in the provision of patient care, and the nursing process could be integrated into this diagrammatic representation, we proposed that concept mapping should promote meaningful learning. Therefore, we hypothesized that the integration of concept mapping into a simulated experience would have a synergistic effect.

Concept mapping was first integrated into a simulated learning experience at the TTUHSC School of Nursing in the fall of 2006. The course chosen as the pilot for this distinctive approach was the second-semester medical–surgical course. During this course, each student was required to complete two 8-hour simulated learning experiences in lieu of one adult and one pediatric hospital clinical day.

Students in this course were randomly assigned to attend the simulated experience in groups of 10. On arrival at the Clinical Simulation Center, the students were separated into groups of five to complete either three adult or three pediatric simulated learning experiences.
pediatric scenarios. During the 2nd simulation day, the students completed the alternate scenarios.

After dividing the students into two groups (adult and pediatric scenarios), the faculty assigned each group three disease processes to initiate the pathophysiology component of the concept map. After 1 hour, the faculty reviewed the concept maps with the students to ensure comprehension of the disease processes. The students were then randomly assigned roles, which included two nurses, a family member, and two observer—evaluators. Next, the students participated in a 20-minute simulated experience. On completion of the scenario, students returned to the debriefing room. During the next 20 minutes, the students completed the concept map by integrating the patient assessment, the implemented nursing interventions (Figure 2), and patient outcomes. Additionally, during this time frame, the students conducted their self-debriefing, using the plus (alpha)-delta tool and reflected their conclusions on a white marker board. The session ended with faculty facilitating the student-led peer review and critique. This entire process was repeated for each of the two remaining scenarios. The day concluded with guided reflection to facilitate the process of reflective thinking.

Overall, inclusion of concept mapping within the simulation case scenarios improved student satisfaction within the simulated learning experience. By integrating debriefing, guided reflection, reflective journaling, and concept mapping into a simulated learning experience, the students enhanced their thoughtful practice and improved their critical thinking skills. Student evaluations from TTUHSC School of Nursing concurred (Table 1).

### Integrating Cause-and-Effect Diagramming

To enhance learning experiences, a modification of concept mapping was implemented in an advanced pharmacology course. This modification was based on three premises. First, the top sentinel events according to the Joint Commission include medication errors and problems arising from treatment delays (Joint Commission Resources, 2007). According to the Institute of Medicine, adverse drug events are costly in terms of both dollars and patient injury or death (Institute of Medicine, Aspden, Wolcott, Bootman, & Cronenwett, 2007). The Agency for Healthcare Research and Quality (2001) indicated medication errors occur throughout the medication process, from ordering (39%–49%), transcribing (11%–12%), and dispensing (11%–14%) to administration (26%–38%).

Second, Finkleman and Kenner (2007) proposed that cause-and-effect diagrams could help students understand the implications of the entire medication administration process. To appreciate the total effect of the medication administration process, students must understand the interconnectivity of pathophysiology, symptomatology, and implemented treatment modalities. The medication process as defined by Finkleman and Kenner includes prescribing, dispensing, administering, monitoring, and management. Other strategies recommended included simulation scenarios with multiple drug orders, requiring students to identify drug interactions, calculate appropriate dosages, and administer the medication safely.
The third premise recognized by the faculty is that students incorporate multiple learning styles to effectively transfer knowledge. According to Fleming and Mills (1992), VARK is a questionnaire that identifies four types of preferred learning styles: visual (V), or a preference for information depicted as diagrams; aural/auditory (A), or a preference for information that is heard or spoken; read/write (R), or a preference for information displayed as text; and kinesthetic (K), or a preference for experience and practice. Experiential learning incorporates all four learning styles identified by Fleming. Although the questionnaire was not administered to students, faculty believed it was important to address different learning styles in the simulation experience. Additionally, experiential learning theory, introduced by David Kolb in the early 1970s, embraces earlier theories postulated by John Dewey, Kurt Lewin, Carl Rogers, and others (Shreeve, 2008). Major principles of experiential learning theory are that (a) learning is a process instead of a focus on outcomes, (b) within the process, an experience must occur, and (c) knowledge is acquired by assimilating the experience. Therefore, integration of a cause-and-effect diagram as a component of a simulated learning experience should promote meaningful learning while maximizing all types of learning.

Building on these premises, we created the student assessment model (SAM), which integrates root, impression, outcome, and treatment (RIOT) to assist students in the conceptualization of medication cause and effect (Figure 3). RIOT requires students to (a) identify the root cause of the pathology, (b) state their anticipated impression of the patient on assessment, (c) recognize patient outcomes after nursing care is implemented, and correlate treatment modalities that result in the previously identified outcomes. An impetus for this unique diagrammatic tool was the acknowledgment that current methods for teaching pharmacology did not achieve the desired level of competence. Integrating the SAM RIOT diagram allowed students to incorporate the cause-and-effect process while creating a holistic picture of the patient.

A typical simulated experience that incorporated SAM RIOT would begin with the students’ receiving a scenario. The students illustrated the pathophysiology, which included the etiology of the disease (R) and the impressions of the patient (I) on the SAM RIOT diagram. Initially, when asked to complete the diagram independently, some students were hesitant to illustrate their thoughts on paper. To address this problem, we modified the process from an independent learning activity to an active collaborative approach. To facilitate group dynamics, the diagram evolved from a simple computer-generated figure to a white marker board illustration to a realistic 6-foot drawing (Figure 4). Students became more engaged in the activity with each progressive modification.

One case scenario involved a patient with a diagnosis of congestive heart failure. The root causes of congestive heart failure identified by the students included hypertension, myocardial infarction, and dysrhythmias. The students’ impressions included both objective and subjective signs and symptoms and consisted of decreased level of consciousness, increased blood pressure, apical impulse shifted to the left, wheezes, peripheral edema, and decreased urinary output. The students then participated in the high-fidelity simulation. Expectations for the students included demonstration of efficient time management, prioritization, evaluation of nursing care, and intra- and interprofessional communication. Following the simulated experience, the students returned to the debriefing room to discuss the actual patient outcomes resulting from the treatment they had initiated. Finally, the group depicted the interconnectivity of the final outcomes and determined whether these interactions were an agonist or antagonist (Figure 5).

On completion of the pictorial representation of SAM RIOT, a debriefing session provided the opportunity to discuss the efficacy of care. The faculty-facilitated debriefing session was conducted with the plus (alpha)-delta format. The faculty noted that when using the plus (alpha)-delta format, students were able to effectively identify and verbally correct deficiencies with minimal faculty guidance. This correlates with Dewey’s (1938) belief that when learners discover and self-correct, there is a greater opportunity for them to embrace their learning (see Table 2).

Conclusion

Nurse educators are challenged to prepare students who can think critically and provide safe, effective care in today’s complex practice environment. To meet this challenge, faculty must explore and implement innovative teaching modalities based on evidence in an effort to promote the science of nursing education. One innovative strategy that integrates concept mapping and SAM RIOT diagramming into a simulated experience proved to be an effective teaching pedagogy. Faculty have taken this concept and expanded the innovation, such as by integrating interactive whiteboard technology, which combines the simplicity of a white marker board with computer technology that projects, saves, and stores images and words. Today’s students expect faculty to be proficient in the use of technology for delivery of course concepts and application of clinical skills. Therefore, future immersive technology will require educators to acknowledge the importance of constant change and acquisition of new competencies. These attributes are required for educators to foster the development of clinical judgment needed to provide safe, effective patient care in the dynamic health care environment.

References


