Featured Article

Merging Problem-Based Learning and Simulation as an Innovative Pedagogy in Nurse Education

Siobhan Murphy, MSc, BSc, RNT, RGN, Irene Hartigan, MSc, RNT, HDip, BSc, Dip in Nursing, RGN, Nuala Walshe, Dip in Higher Education, RN, MN, Angela V. Flynn, MSc, HDip, Ed, BSc, RGN, Sinéad O’Brien, MSc, BSc, RGN
Catherine McAuley School of Nursing and Midwifery, University College Cork, Ireland

Abstract: Current curriculum models rely heavily on conventional teacher-centered approaches to student learning. Recent literature challenges educators to implement student-centered learning approaches. Health care complexities that confront the future of nursing education, combined with the demands of technologically literate students, challenge educators to be responsive and proactive to advance student-centered learning. Undertaking a scholarly approach to teaching and learning is in keeping with the concept of integrative learning. This article discusses the merger of two active-learning strategies, problem-based learning and simulation, on the basis of a review of recent literature, as well as the scholarly approach undertaken to develop an innovative teaching—learning strategy. Last, it recommends potential pedagogical advantages of combining these strategies in nurse education. This discussion article presents the rationale for merging two well-known teaching strategies for a baccalaureate nursing program at University College Cork, Ireland.


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Introduction

A growing body of literature is questioning how prepared nurse graduates are for practice on completion of baccalaureate nursing education (Hargreaves, 2008; Health Service Executive, 2009; McKinnon, 2009; Newton & McKenna, 2007). The ultimate goal of curricula is to prepare graduates with the ability to interface with the ever-changing challenges of nursing practice. Hegarty, Walsh, Sweeney, and Condon (2009) clearly outlined challenges currently confronting the future of nursing education. They specifically identified these as globalization; changing patient characteristics; science and information technology; increased complexity of health, as well as regulation, policy; and professional standards.

The desired intent of curricula is to deliver theoretical underpinnings of nursing and stimulate intellectual curiosity and critical thinking so that learners engage in the learning experience. Recent teaching—learning strategies have fostered these outcomes from the teacher and student perspectives (Lee, Cho, Yang, Roh, & Lee, 2009; Linder & Pulsipher, 2008; Reilly & Spratt, 2007; Rowan, McCourt, & Beake, 2008). Despite educational advances in undergraduate nursing education, conventional teacher-centered...
strategies predominate internationally; thus educators need to explore new ways of delivering curriculum content by employing innovative pedagogical strategies (Brown, Greer, Matthias, & Swanson, 2009). International organizations such as the Carnegie Foundation in the United States and the Carrick Institute in Australia (2004) focus on advancing the scholarship of teaching and learning in higher education. Such international organizations are committed to supporting diversity, enhancing excellence in teaching and learning, and establishing indicators for quality learning. Integrative learning is one method the Carnegie Foundation promotes to foster students’ learning across courses, over time, and between campus and community life (Huber, Hutchings, Gale, Miller, & Breen, 2007). Thus merging two active-learning strategies both advances scholarship in teaching—learning and was the impetus for combining problem-based learning (PBL) and simulation.

This discussion article presents an overview of pedagogical teaching—learning approaches currently implemented internationally that informed our rationale for merging two well-known teaching—learning strategies. The background provides the rationale for curricular change and introduces PBL and simulation. Then we provide a detailed outline of these strategies to encapsulate learning outcomes and suggest how educators can mimic the cycle to address learning outcomes for all years of study within a baccalaureate nursing program.

**Background**

Recent literature highlights the need to focus curricular content to meet the challenges new graduates encounter (Kelly & Ahern, 2008), new ways of learning (Health Service Executive, 2009), and new ways of actively engaging the learner (Sinclair & Ferguson, 2009). In light of such clinical and educational challenges, curricula should not remain constant and must be responsive to socioeconomic and health care trends (Hegarty et al., 2009). Dalley, Candela, and Benzel-Lindley (2008) encouraged nurse educators to de-crowd the curricular content and integrate innovative learning-centered education. Nursing education needs to move from content-driven curricula to new pedagogies that foster a learning-centered approach to education, as no one teaching approach will address the learning needs of every student (Candela, Dalley, & Benzel-Lindley, 2006; Ironside, 2004; Tanner, 2004). In Europe the Bologna process instigated a change to curricular structures with emphasis on student involvement and lifelong learning (Davies, 2008). More recent trends in curriculum revisions integrate core educational concepts such as learning-centered, evidence-based, and case-based approaches and thus contribute to the aspirations of the Bologna process (Candela et al., 2006; Koivunen, Välimäki, Jakobsson, & Pitkänen, 2008; Reilly & Spratt, 2007).

Established learning theories such as self-efficacy (Bandura, 1971), self-actualization (Rogers, 1983), experiential learning (Kolb, 1984), and adult learning (Knowles, 1990) have traditionally predominated nurse education. According to Paige and Daley (2009), learning cannot be explained using one perspective alone. More recent interpretations of these learning theories focus on knowledge transformation that is relevant to the learners and aims to expand their frame of reference (Entwistle, Skinner, Entwistle, & Orr, 2000; Mezirow, 2000). The concepts that underpin knowledge transformation draw on the everyday experiences of the learner and encapsulate the cognitive and affective domains of learning. Learning-centered education should focus not only on the information currently available but also on means of attaining new information (Beers, 2005). In turn, knowledge will be transformed in an era where information generation will develop dramatically and be available at the click of a button. The implementation of pedagogical approaches increases opportunities for integrative learning (Huber et al., 2007). PBL and simulation adopt pedagogical approaches and are examples of approaches that have a history of being used in health care education.

**PBL**

PBL evolved from the research of Barrows and Tamblyn (1980) and was first introduced in medical education in Canada (Barrett, 2005). PBL enables students to explore what Boud and Feletti (1997) term real-life situations, with the emphasis on problem solving and teamwork. PBL is not just another form of group work, as the problem is presented at the beginning of the learning process, before other curricular inputs. Students engage in aspects of self-directed and lifelong learning, taking greater responsibility for their own learning (Savin-Baden & Wilkie, 2004). Students are presented with a disciplinarily relevant problem and use previous knowledge to begin the PBL process, developing skills in problem solving, critical thinking, and team work (Barrett, 2005). PBL is promising as a pedagogy of integration when applied to the gathering of both internal (class-based) and external (real-world—based) knowledge to solve a shared problem (Huber et al., 2007).

**Simulation**

The concept of simulation as a method of teaching is not a new phenomenon. The literature clearly outlines its origins in other professions such as the military and the aviation industry and more recently in health care (Gaba, 2004). In nursing education, simulation has emerged as...
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a means of promoting experiential learning in various contexts (Alinier & Hunt, 2006). Health care programs incorporating simulation are best embedded in the educational programs of the institution and in partnership with the clinical practice environment (Kneebone, 2003). Simulation is a technique, not a technology, that “replicate[s] aspects of the real world in a fully interactive fashion” (Gaba, 2004, p. i2). This technique promotes a safe, controlled environment that is free from the normal stimuli of the clinical environment (Woolley & Jarvis, 2007). Simulation incorporates several different modalities, such as interactive-learning packages, role players, task trainers, virtual haptic devices, and mid- to high-fidelity manikins. Given the evidence within the published literature, the use of simulation offers an alternative way of learning while giving consideration to patient safety and comfort as well as medicolegal issues (Lane, Slavin, & Ziv, 2001; Sinclair & Ferguson, 2009). Simulation facilitates active application of learning and participation in nursing activities, as well as deeper understanding of concepts of care in a controlled environment (Sinclair & Ferguson, 2009).

Rationale for Integrating PBL and Simulation

In the nursing literature, the theoretical and practical aspects of curricula are still divorced instead of being intertwined as a whole (Ehrenberg & Häggblohm, 2007). According to Sinclair and Ferguson (2009), more active forms of learning are required within nursing curricula to build on student knowledge and skills. Didactic instructional strategies are best known for content delivery; however, the student’s role is passive in achieving understanding of clinical reasoning and decision making (Arundell & Cioffi, 2005).

Student characteristics relating to cognitive and affective domains such as learning styles, intellectual abilities, prior knowledge, motivation, attitudes, and work habits are exercised within these two pedagogical approaches. These support the learner to think aloud; discover knowledge; and engage in active learning, which enables problem solving, creative critical thinking, and clinical reasoning and which guides deep learning and knowledge transformation over time (Barrett, 2005; Linder & Pulsipher, 2008). These factors and the ever-increasing numbers of health care students have affected the availability and standards of clinical placement rotations. This is mirrored across nursing programs globally. In response, the United Kingdom’s nurses’ registration board has approved substitution of 300 clinical placement hours with 300 hours of simulation as a means of providing opportunities for nursing students to achieve learning outcomes (Nursing & Midwifery Council, 2007).

Within health care programs, educators cannot ensure that all students will be exposed to commonly occurring critical situations while on clinical placement rotations. These critical situations can be life threatening for the patient if not managed by a nurse conducting a thorough assessment and following procedure and protocol. Current health care demands in clinical environments include increasing acuity of patients and prioritization of patient care. As a result, students may not have the opportunity to participate in patient care but merely observe the acute event. Learning for the students in such situations is passive and nonparticipatory. As nurse educators, we believe the ideal would be to provide situations in which the inherent learning within the experience can be magnified so that students can apply their theoretical knowledge to critically analyze clinical situations. Our aspiration in merging PBL and simulation is to enable students to think aloud and generate knowledge related to a patient problem in tutorial groups (PBL) and then practice enacting how they would manage that problem in a controlled environment (simulation). In this way, students engage in active learning, and critical situations can be reproduced to meet program learning outcomes, thus ensuring equity within the curricula.

As human error is inevitable, educators need to plan learning activities to safeguard students and patients alike. Providing the opportunities for students to experience factors relating to cognitive and affective domains of learning within a controlled environment enhances their confidence in their abilities to perform real patient care. To achieve learners’ needs and address these shortcomings, a unit of learning was designed that merges two pedagogical approaches. Williams and Beattie (2008) contended that PBL provides a practical clinical teaching approach to guide students in the acquisition of critical reasoning and practical skills. However, this approach alone does not replicate the real-world environment, whereas simulation is the vehicle for translating classroom knowledge into a safe learning environment (Leigh, 2008).

Scholarly Approach Undertaken When Merging PBL and Simulation

Professional education and public safety create increasing complexities for both educators and student learning. Pedagogical approaches reflect robust strategies to prepare graduates for practice. Simulation (Reilly & Spratt, 2007; Sullivan-Mann, Perron, & Fellner, 2009) and PBL (Ehrenberg & Häggblohm, 2007; Rowan et al., 2008; Williams & Beattie, 2008) are discussed and researched extensively as independent pedagogies in the literature but are rarely discussed jointly.

In pursuit of the scholarly approach, we examined recent educational research literature. Maxwell, Mergendoller, and Bellisimo (2004) merged simulation with PBL to enhance student-directed learning for a learning unit in economics at a California university. This unit expanded student ability to apply problem-solving skills by first exposing students to a simulation; thereafter, through PBL, students created knowledge as they recognized the need
to understand relevant concepts or principles. Simulation with PBL contextualized realistic economic dilemmas. The portrayal of simulation by Maxwell et al. was a fictitious market plan, which is very different from simulation as understood in health care, where learning environments are intentionally created to mimic the complexities of real health care in a replicated clinical environment. Within the medical literature, Steadman et al. (2006) conducted a study in which medical students were randomized to either a simulation or a PBL group. Findings indicated that simulation-based learning was superior to PBL for the acquisition of patient assessment and management skills. Clearly adopting active-learning strategies has been successful in disciplines other than nursing.

Within nurse education literature, we examined combined teaching—learning strategies critically to determine how we would create a unit of learning for baccalaureate nursing students that merged PBL and simulation. Posey and Pintz (2006) described online teaching—learning strategies that nurse educators can use to build nursing students’ critical thinking and social skills. This unit of learning used a Web-based method to merge case-based facilitated discussion and cognitive effective hypermedia so that students assessed and synthesized multiple perspectives to resolve problems for which there were no clear-cut solutions. This experience was achieved by anchoring activities to a complex challenge, which empowered learners to develop critical thinking and problem-solving abilities. The combination of these strategies promoted cognitive flexibility, emphasized knowledge construction rather than transmission of information, and triggered advanced thought, which encouraged ownership of learning. Although the article by Posey and Pintz does not outline a clear process, it does provide examples of strategies for improving collaboration and critical thinking in online courses. Thus the combination of pedagogical teaching—learning strategies has been successful in nursing.

In Singapore, 1st-year nursing students \( (N = 33) \) participated in a unit of learning focused on respiratory and cardiovascular disorders (Liaw et al., 2009). This study investigated two strategies: One group of students participated in PBL only, while the second group of students had PBL and simulation. On completion of the unit of learning, students were examined by a knowledge test. Scores of students in the dual-strategy group were higher than those of students who attended PBL only. This study reported that the integration of simulation and PBL provided students with the opportunity to practice clinical skills in a realistic, nonthreatening environment. Thus immersion into the role of the nurse provided valuable insights for student learning. Regrettably, this integration of PBL and simulation was published only as a “brief report,” which is sparse in detail regarding the design and construction of the integration of these strategies.

In Korea a larger study was undertaken by Lee et al. (2009) with 1st-year nursing students \( (N = 283) \) to examine the effects of PBL combined with simulation. This unit of learning addressed basic nursing competence during a 9-week period. The intervention group of students \( (n = 141) \) participated in PBL with simulation while the control group \( (n = 142) \) received traditional methods. The researchers concluded that the intervention group demonstrated an increase in self-driven student learning skills, and students actively engaged in the learning. Although these study results inform our thinking, they may not qualify as pure PBL as 14 hours of didactic lectures were included in the unit presented to the intervention group.

Linder and Pulsipher (2008) described baccalaureate pediatriar nursing students’ learning experiences of simulation in Salt Lake City, Utah. The teaching—learning strategies were strategically planned to implement a “Sim Day.” The Sim Day consisted of 6-hour clinical learning sessions in which students used human patient simulators to learn how to perform pediatric physical assessment techniques, recognize deterioration, and communicate findings in a systematic manner. This occurred when students were on clinical rotation, and the Sim Days were complemented with didactic teaching—learning strategies, as well as case-based learning.

Linder and Pulsipher (2008) hypothesized in this study that students would have opportunities to learn through multisensory media that require students to participate in active-learning strategies. While organizers were planning the Sim Day, they asked students to share their experiences and acute care clinical issues with faculty. The combination of these teaching—learning strategies prepared students to better approach pediatric patients. Linder and Pulsipher offered us insight into the strategic planning required before merging active teaching—learning strategies. Furthermore, the importance of developing learning that focused on issues that are clinically relevant to students was critical to the success of the strategy.

Wong, Cheung, Chung, Chan, and Chan (2008) reported the development of a model incorporating PBL in a simulated clinical environment to support the translation of theoretical knowledge into practical information. This study was part of a larger study aimed at introducing the strategy of PBL into clinical teaching in Hong Kong. Wong et al.’s findings informed the development of a model that an educator can use for adopting PBL in a simulated clinical context. The PBL part of the study consisted of a 3rd-year nursing student, an experienced clinical teacher, and a patient actor who simulated five perioperative patient care issues, each of 45 minutes’ duration. All PBL sessions were recorded by video and audio. Although further research is required to validate the model, the success of this study is based on an isolated event, namely, a patient undergoing appendectomy. However, it serves to inform us in the formulation of learning outcomes. It is essential for learning outcomes to be congruent with both pedagogical approaches as we progress in merging PBL and simulation.
Sinclair and Ferguson (2009) used a mixed method of lectures and simulations to assess 2nd-year nursing students’ perceptions of self-efficacy for practice (N = 250) in Ontario. A modified Baccalaureate Nursing Student Teaching—Learning Self-Efficacy Questionnaire (Goldenberg, Andrusyszyn, & Iwasiw, 2005) was used for measuring student self-efficacy. Despite the labor intensity of delivering the combined method, findings indicate that this method increased student confidence and supported peer learning.

Sinclair and Ferguson prompted our exploration of the barriers to faculty members’ implementing simulation. Lack of time, resources, and technical ability were cited by Kardong-Edgren, Starkweather, and Ward (2008) as the main reasons that faculty members are reluctant to implement simulation. However, study findings (Kardong-Edgren et al., 2008) suggest the experience of simulation for both faculty and students is superior to other modes of learning.

From analysis of findings of preceding recent international studies, it is clear that active-learning strategies are effective in developing higher order critical thinking and synthesis skills in baccalaureate nursing education (Lee et al., 2009; Liaw et al., 2009). It is apparent that learning outcomes must be congruent with teaching—learning strategies and are potentially more successful when emanating from an evidence-based model (Wong et al., 2008). Linder and Pulsipher (2008) stipulated that strategic planning is critical before educators embark on merging strategies such as PBL and simulation. Nurse educators must also consider time and resources, as well as technical abilities of faculty, when implementing new teaching—learning strategies. Nowadays technologically adept students have greater expectations of higher level educational programs, and traditional styles of teaching—learning only partially fulfill learning needs. Educators must ensure the learning process yet have the courage to experiment with strategies that have proven to enhance innovative dynamic ways of learning (Maxwell et al., 2004; Posey & Pintz, 2006; Steadman et al., 2006).

Bringing Together PBL and Simulation

A group of nurse educators who had experience in employing these pedagogies in isolation were eager to explore how student learning could be enhanced by merging two pedagogical approaches, PBL and simulation. Thus an innovative approach to active student-centered learning was designed for a final-year unit of learning within a baccalaureate nursing program.

We have specified the following learning outcomes of the unit for our students:

- demonstrate competence in nursing management of clinical situations
- demonstrate the ability to carry out a competent systematic patient assessment
- recognize, interpret, and respond to alterations in patient status
- apply knowledge to making informed clinical decisions based on individual patient presentations
- select and use appropriate technical equipment to perform clinical nursing skills in context
- communicate effectively and perform professionally
- acknowledge the extent of their own abilities to manage the problem

A research approach was adopted to enhance the scholarship underpinning the strategy of merging PBL and simulation. Firstly, a focus group study (Hartigan et al., 2010) was undertaken with clinical nurses to develop evidence-based yet clinically relevant problems for the PBL tutorials. Identification of practice deficits of newly qualified nurses would inform content of the unit of learning relevant to practice. This content will be presented to students in the format of a series of patient problems. PBL will allow in-depth problem exploration from a theoretical perspective during PBL tutorials. Subsequently the problem would be enacted in corresponding simulations embedded within the cycles of the unit of learning (Figure 1).

As nurse educators, our role will consist of providing instructional support for the learning process (see Table 1). Nurse educators guide learning by supporting students through the process of increasing motivation, promoting initiative, and organizing the use of equipment and technologies. As student learning styles vary, merging these approaches facilitates individual learning by providing a variety of means to understand and solve problems. These
include PBL triggers, online material, debate, and discussion, as well as an array of clinical equipment and resources within the clinical skills simulation center. During the course of a 10-week university teaching term, three cycles of PBL and simulation were provided. Figure 1 demonstrates the process whereby the strategies were merged for each individual cycle, which focuses on one clinical problem.

The learning outcomes are modeled on traits congruent with learning-centered education and supportive of active-learning styles (Posey & Pintz, 2006; Wong et al., 2008). The desired outcome traits for this unit of learning are to stimulate intellectual curiosity, critical thinking, and individual creativity and enhance performance of psychomotor skills. The merging of these pedagogies has potential to overwhelm learners; therefore learning will be directed to activities that will allow students to achieve the learning outcomes within each cycle. Each learning outcome could be achieved through various means within any one cycle and could be revisited in differing contexts in Cycles 2 and 3. As the cycles unfold, the complexity inherent in the problems becomes more intricate, yet the process allows students to revisit and build on prior learning. The unit of learning will embed opportunities for theoretical learning and psychomotor skill acquisition in each cycle presented. Table 1 illustrates how PBL and simulation achieve the learning outcomes, as well as how merging these pedagogies can accommodate different learning styles. It was crucial for the educators to structure and sequence the PBL and simulation so that the learners’ confidence and their critical thinking and problem solving skills can evolve in a coordinated, supported context. The creation of this unit of learning fosters approaches that differ from those of traditional strategies, thereby nurturing knowledge exploration and transformation. In keeping with the pedagogical approach, the assessment would also move beyond factual recall to the application of knowledge and skills in line with the learning outcomes.

**Implications for Nursing Education**

Research into pedagogical approaches to nurse education internationally concurs with integrative scholarly organizations for the development of excellence in teaching and learning. Although PBL and simulation in isolation have educational merit, merging these pedagogies has the scope to link aspects of learning that further enhance and transform knowledge. Together with the necessary resources, merging PBL and simulation is feasible within a variety of curriculum models. Support and partnership between faculty members


**Table 1** How Merging Problem-Based Learning (PBL) and Simulation Matches Learning Outcomes

<table>
<thead>
<tr>
<th>PBL</th>
<th>Simulation</th>
<th>Achievable Learning Outcomes</th>
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*Note. AV = audiovisual; DNA = an integrated digital recording and archiving system; IT = information technology.*
and clinical practitioners are fundamental to the development and enhancement of such learning-centered pedagogies. Although the intent of curricula is to stimulate intellectual curiosity, analytical ability, individual creativity, and critical thinking, educators need to be strategic in order to avoid curricular and disciplinary isolation yet introduce innovative pedagogies. As this is an innovative teaching-learning strategy, it allows faculty members to examine the practicality and feasibility of merging two well-known pedagogies that have potential to be applied to other clinical units of learning. From the implementation of advanced innovative pedagogies, exploration of the students’ learning experience and ability to invest in the process will determine how students transfer this way of learning to graduate practice. Thus the following implications are outlined for nurse educators and students.

**Educators**

- Nurse educators need to integrate learning-centered pedagogies into the philosophy underpinning their instructional methodologies in keeping with the goals of international scholarly organizations.
- Patient safety is further secured with this unit of learning as educators can allow students to explore and rationalize multiple theoretical foundations and practical applications of knowledge and skills to problems.
- Educators using PBL and simulation can guide acute events to ensure that all students will be exposed to commonly occurring critical situations rather than depending on chance during clinical placement rotations.

**Students**

- These participatory approaches to deep learning guide the learner to think aloud, discover knowledge, problem solve, and think critically.
- Group dynamics that develop as the cycles progress in terms of critical discussion and immersion in simulated critical situations will enable students to transform knowledge from multiple sources to functional understanding that will guide future performances.
- The process of PBL and simulation has potential to direct students through a synergy of emotional and cognitive factors in which self-confidence is incrementally achieved in a peer learning situation.
- Student self-confidence is nurtured through the process of effective learning from expert guidance through the theoretical and practical aspects of critical situations.

**Conclusion**

Therapeutic and technical advancements and social, cultural, and political factors have changed, and will continue to rapidly change, the manner and context of nurse education and practice. Traditional styles of teaching and learning are said to be teacher focused. The innovation in merging PBL and simulation suggests a new active teaching—learning strategy. The combination of PBL and simulation offers students a variety of ways of learning and transforms knowledge in different yet controlled and safe environments. The ultimate goal is to challenge students to think for themselves. This merger cultivates an awareness of creative thinking, critical analysis, and decision-making abilities from extrapolating and relating the theoretical and practical knowledge presented in each cycle. PBL and simulation are synthesised to ensure a student-centered curriculum that supports the underlying pedagogical concepts and addresses health care demands. The faculty’s sustained commitment to adopting a scholarly approach when developing student-centered learning has proven to be a challenging but worthwhile process.

**References**


