Abstract

High-fidelity patient simulation is a method of education increasingly utilised by educators of nursing to provide authentic learning experiences. Fidelity and authenticity, however, are not conceptually equivalent. Whilst fidelity is important when striving to replicate a life experience such as clinical practice, authenticity can be produced with low fidelity. A challenge for educators of undergraduate nursing is to ensure authentic representation of the clinical situation is a core component for potential success. What is less clear is the relationship between fidelity and authenticity in the context of simulation based learning. Authenticity does not automatically follow fidelity and as a result, educators of nursing cannot assume that embracing the latest technology-based educational tools will in isolation provide a learning environment perceived authentic by the learner. As nursing education programmes increasingly adopt simulators that offer the possibility of representing authentic real world situations, there is an urgency to better articulate and understand the terms fidelity and authenticity. Without such understanding there is a real danger that simulation as a teaching and learning resource in nurse education will never reach its potential and be misunderstood, creating a potential barrier to learning. This paper examines current literature to promote discussion within nurse education, concluding that authenticity in the context of simulation-based learning is complex, relying on far more than engineered fidelity.

Introduction

Authenticity was identified by Bland et al (2011) as a critical attribute of simulation in undergraduate nurse education. Conceptually, authenticity was clearly evident from the analysis but upon reflection I would suggest what is understood by its meaning in the context of simulation-based learning has become blurred and unclear. This lack of clarity is particularly evident when authenticity is considered in relation to fidelity as these terms are often used synonymously within simulation-based nursing literature. For example, fidelity refers to how authentic or life-like the manikin and/or simulation experience is (Lapkin and Levett-Jones 2011). Nursing students can learn within authentic environments either in clinical practice or via carefully constructed high-fidelity simulated scenarios with manikins exhibiting authentic physiological properties (Onda, 2011). Interpretation of such and other accounts indicate an implicit assumption that fidelity and authenticity are interchangeable. Bland et al (2011) argue however that authenticity and fidelity are not conceptually equivalent with Rystedt and Sjoblom (2012) adding that authenticity is often treated as unproblematic following automatically from particular designs. Fidelity is a term profoundly represented within the simulation-based literature with authenticity playing catch up. This is problematic because whilst there appears to be a better understanding of what fidelity is there is less clarity regarding what authenticity is, how it is achieved or contributes to learning. Exploration and understanding of how authenticity and fidelity are used within the context of simulation-based learning is lacking yet timely and relevant given that Rystedt and Sjoblom (2012) identify that mimicking reality through fidelity is the prevailing movement towards authenticity increasingly seen as the central premise for learning in simulation.

Fidelity and Authenticity

The quest for realism has clearly been at the forefront of high fidelity simulator design and such resemblance with real patients that breathe and talk is geared towards authenticity. But authenticity is often considered as an effect of the simulator and not as an object of inquiry in its own right (Rystedt and Sjoblom, 2012) a concern prompting their study to explore the requirements needed to establish and maintain simulations as authentic. Simply increasing fidelity through technology does not necessarily increase authenticity. Although fidelity is important when seeking to match the appearance and behaviour of the real situation (Kinney and Henderson, 2008) authenticity can be reproduced with low fidelity. Fidelity in the context of simulation-based learning is considered as a close as is possible reproduction of an object reality whereas authenticity may be considered as a subjective interpretation / response to a constructed situation in which the student interacts with context, other students, facilitators and technology with varying degrees of fidelity. Splitter (2009) indicates perceptions of similarity are highly subjective and contextually relative as what counts as authentic for one person may be far from authentic for another. Interpretation of authenticity is individual which

is highly relevant for educators of nursing to consider when presenting students with the latest high-fidelity human patient simulator. Rystedt and Sjoblom (2012) identify from the work of Petraglia (1998) that authenticity often stands out as a kind of desideratum rather than something that actually characterises the learner's experience. This observation raises concern in that as we become receptive to the developments of new and more capable simulation technologies there is increasing potential to assume that the fidelity will inevitably lead to authentic learning opportunities. Educators need to understand the fundamental differences between fidelity and authenticity and look at what else is going on in the learning environment if we are to provide effective learning opportunities in simulation-based education.

Background

Simulation is recognised as an innovative pedagogical approach gaining international popularity (Moule, 2011) and as such requires educators to become familiar with its attributes in the context of learning. Simulation in nursing education attempts to replicate essential aspects of a clinical situation (Buckley et al, 2011) and as an educational strategy, "replaces or amplifies experiences that replicate aspects of the real world in an interactive fashion" (Gaba, 2004, pi2). Many Universities have developed simulation centres that represent actual ward areas (Berragan, 2011) and purchased simulators that respond realistically using advanced computer technology which have contributed to recent interest within nurse education. Other reasons may include the increasing expectation that higher education institutions mirror clinical practice agencies commitment to provide high quality patient care in a safe environment (Miller and Bull, 2013). To ensure students receive strategies that compliment traditional education with actual patients, educators strive to replicate practice as closely as possible becoming receptive to the possibilities simulation may offer including technology that attempts to replicate clinical situations through increasing fidelity. Despite the well documented use and perceived benefits of simulation in nursing, little evidence exists regarding how nurse academics regard the use of simulation as a teaching strategy (Miller and Bull, 2013). Parker and Myrick (2009) identifying a lack of research into a pedagogy or educational philosophy to guide the technology-based learning tool of high-fidelity simulation. It may be prudent for educators to question whether there has been a rush to include simulation without fully understanding the mechanisms of learning which underpin it. Berragan (2011) found from an influential literature review that concern exists that we may be overtaken and seduced by developing technology that substitutes real patients, denying the student nurse opportunities for realistic interaction. When new technologies are introduced to academics, focusing on the technology in isolation and not on the context of education may occur (Hixon and Buckenmeyer, 2009; Alexander, 2009). Dewey (1938) cautioned curriculum development lacking sound philosophical foundation leaves educators at the mercy of the latest educational and technological fads without any depth of thought as to why it is appropriate to the teaching and learning process. Kaakinen and Arwood ((2009) found from a systematic review of nursing simulation literature regarding use of learning theory that most nursing educators approach simulation from a teaching rather than a learning paradigm and may benefit from reflecting on the purpose of the simulation. Simulation technology may fuel this focus on teaching rather than the learning as there is potential to concentrate on reproducing objective reality through high-fidelity with the aim of producing authentic learning experiences. Houghton et al (2012) identifying the clinical skills laboratory should provide an authentic learning environment. However authenticity may be interpreted individually, hence a challenge for some students to deal with less than perfect fidelity may obscure and create a barrier to potential learning if considered in isolation particularly if the focus is on learning the complexities of clinical practice and social interactions. As clinical practice is often regarded as complex there is a need to better understand the conceptual tensions of fidelity and authenticity and how they contribute to learning in simulation-based nurse education.

Methodology

This paper is a discussion paper based on a focused scholarly review of existing literature. The papers identified (Appendix 1) following a rigorous search process were appraised and

considered influential in developing the discussion. Other literature of less specific significance to the aims of the review but relevant to the developing discussion can be identified within the reference list. A literature search for papers concerning simulation-based education was conducted using combinations of the terms, 'simulation' with 'education', 'learning', 'nursing education', 'fidelity', 'high-fidelity', 'authenticity' and 'authentic learning' and entered into Google scholar, limiting to papers published in English between 2003 and 2013. A second search utilising the data bases CINAHL, Medline, PubMed, Cochrane and ERIC through a portal – Summon was conducted with the same limitations. The reference lists of the retrieved papers were hand searched to increase the potential of identifying all relevant studies (Kable et al, 2012). Initially 371 articles resulted from the searches described above for initial review. To assess for relevance each abstract was read and the full paper was screened for appropriateness resulting in a total of 25 published papers which are documented in a summary table (Appendix 1) and form the basis of this discussion paper. Inclusion criteria for this review included literature reviews, discussion papers and original research studies that reported fidelity, realism, authenticity or authentic learning in simulation-based learning / education in health care and nursing education. Papers were excluded if they did not specifically detail the critical attributes fidelity, realism, authenticity or authentic learning in simulation-based learning/education. Although this discussion paper focuses on nursing education, papers that related to other healthcare disciplines or non-healthcare industry were not excluded if their content added to the understanding of authenticity and fidelity in relation to learning in simulation-based education. It is not the purpose of this paper to present a detailed process of the review itself but to identify key issues from the reviewed literature to help raise awareness and stimulate debate regarding authenticity and fidelity and their contribution to the learning within simulation-based education. It would appear that current simulation literature lacks robust research to substantiate process and effectiveness of simulation–based education. There is a tendency to utilise methods akin to participant satisfaction and product evaluation rather than educational research.

Fidelity and Simulation

Fidelity is associated with realism and the extent to which simulation mimics reality through fidelity is the essence of successful simulation (Jeffries, 2007). Such accounts indicate realism is at the heart of fidelity construction, which is increasingly utilising technology to simulate clinical situations. Stayt (2012) recognises many manifestations of clinical simulation in nurse education frequently described as low, medium and high fidelity. The use of low to high fidelity manikins are recognised methods in teaching clinical simulation (Jarzemsky and McGrath, 2008) with high fidelity referring to activities most accurately reproducing life-like situations and low fidelity less life-like (Warland, 2010). The assumption being with increasing fidelity the potential for the simulation to be real is increased. Buykx, et al (2011) found from an evaluative study that learners place emphasis on the importance of the simulation being realistic to facilitate their learning, a realistic scene being essential to legitimise the learning activity (Paige and Daley, 2009). Such accounts have inevitably led nursing educators being drawn to the possibilities high-fidelity simulators can offer. Technological advancements have provided more exposure to realistic, interactive clinically focused learning strategies since the advent of medium and high-fidelity patient simulators (Solnick and Weiss, 2007). High-fidelity simulators are designed to engage student's senses as they palpate, listen, observe and synthesise what they see, hear and feel linking with underpinning theoretical concepts (Clark, 2007). Simulated wounds and fake blood can be applied to the manikin or actor, simulators can be programmed to bleed, moan, sweat and cry to increase the vivid reality of the clinical situation (Roberts and Green, 2010). Such efforts to increase realism is referred to as engineered fidelity with Maran and Glavin (2003) identifying the difference between engineering fidelity (how realistic the simulated setting is compared to the real setting) and psychological fidelity (how authentically the learner associates simulated setting with the real setting). Fidelity can take on the aspects of environmental or psychological fidelity (Paige and Daley, 2009). When environmental fidelity is high the environment closely matches the real world (Beaubien and Baker, 2004) with psychological fidelity reflecting emotional connection of the learner to the simulation (McCallum, 2006). As fidelity can be engineered by the educator, there is potential to assume what the learner perceives as real. Petraglia (1998) has criticised such assumptions, calling it 'the real world on a short leash` (p.53) with Gulikers

et al (2005; p 512-23) stating; …` it cannot be automatically assumed that an environment that is designed by educational developers as an authentic environment is also experienced as authentic by students'. This questions whether learners can associate authenticity with engineered fidelity that may be perceived authentic in the eyes of the educator but not necessarily the student. The implications of which could result in the potential loss of psychological fidelity affecting how the student responds to a simulated learning experience.

Limitations with Fidelity and its contribution to Authenticity

Even high fidelity simulation has its limitations in terms of authenticity (Lasater 2007; McCaughey and Traynor, 2010). Ricketts (2010) found from a literature review some students do not find simulated scenarios lifelike, experiencing difficulty in associating or relating the simulated setting to real life, questioning the usefulness of clinical simulation (Pike and O'Donnell, 2010). McKenna et al (2011) identified from a qualitative study that perceived low levels of realism in educational models limited the utilisation of simulation with the feel of models being particularly problematic. Hravnak et al (2007) supports this view in that simulators do not have realistic eyes or skin limiting physical examination skills. Such evidence is important to consider when studies suggest learners place emphasis on the importance of realism to facilitate their learning in a simulation experience and educators need to be receptive to learners that may have difficulty engaging with less than perfect engineered fidelity. A lack of realism may occur if learning experiences become predictable with Leigh (2008) discussing the notion of students anticipating something is going to happen reducing the authenticity of the experience. The complexity and unpredictability of real patients in real clinical settings ensures making a truly authentic simulated experience a difficult prospect (Maran and Glavin, 2003). Strategies such as scenario teaching to make learning 'situated' (Lave and Wenger, 1991) adding realism by enabling the unpredictable nature of the real clinical setting and use of actors may increase authenticity in the simulated setting (Pike and O'Donnell, 2010). Attempts have been made to simulate realistic patients by educators wearing commercially prepared masks and hand gloves to teach clinical skills. An exploratory study by Reid-Searl et al, (2011) found such masks can enhance student learning by simulating very realistic situations. They also found that students made an important clarification in that it was important to have the right person inside the mask which Reid-Searl et al (2011) identified as realism of the character and skill of the teacher. Although a small study, such findings are influential in raising awareness of realism and authenticity and could be interpreted as the mask provides the engineered fidelity or realism with the skill of the teacher inside the mask contributing to the authenticity. Arthur, Kable and Levett-Jones (2011) found fidelity being dependent not only on the type of high-fidelity simulator but authenticity of the scenario and skill of the facilitator. Fidelity and authenticity are inextricably linked but interestingly studies have investigated student experiences of comparing high fidelity with low fidelity (Butler et al, 2009) or low fidelity with no simulation (Gore et al, 2010) but not specifically the juxta positioning of fidelity and authenticity. This is particularly relevant when considering that Pike and O'Donnell (2010) report the transfer of learning to the real clinical setting is reliant upon the authenticity of the simulation experience.

Authenticity and Authentic Learning

Authenticity is defined in the Oxford English Dictionary (2012) as the quality of being what is professed in origin and being genuine, as being real. Authentic defined with similar terms such as being original (Oxford English Dictionary, 2012). Authenticity in learning or making learning authentic is a key issue in education (Roth, 1995) and traditionally viewed from the perspective of making classroom learning as authentic as possible by mirroring processes evident in actual professional communities, where communities are considered "real" and classrooms "pseudo" (Hung et al, 2007). Authenticity is increasingly regarded as a central premise for learning in simulations with much prior research concentrating on technical aspects of simulators (Rystedt and Sjoblom, 2012). A clear distinction has to be made between authenticity that is concerned with realism or fidelity and authentic learning which according to Lombardi (2007) brings into play multiple disciplines, perspectives, ways of working, habits of mind and communities. Chang et al (2010) discusses a pedagogical concept named authentic learning proposed by Herrington and Oliver (2000) inspired by situated learning theory relating to real world complex problems and their solutions, using

activities and participation in virtual communities of practice. Such descriptions go beyond educational pre-authentication of learning materials and environments corresponding to concepts of the real world indicating the need for educationalists to foster learners with the ability to interact with it (Petraglia, 1998). In nurse education the development of clinical competency necessitates hands-on practice in an authentic clinical environment (Onda, 2011) and it would seem logical to develop simulated environments that mimic reality providing authentic replication for learners to engage with naturally. Gulikers et al (2005, p. 509) explain; 'An authentic learning environment provides a context that reflects the way knowledge and skills will be used in real life. This includes a physical or virtual environment that resembles the real-world complexity and limitations'. The focus of high-fidelity human patient simulators has been to replicate as many of the physiological and physical properties of human patients as possible based on the assumption that similarity itself is crucial for learning (Rystedt and Sjoblom, 2012). Students can wear clinical dress in an environment crafted to replicate 'real' clinical practice with equipment such as cardiac monitors, simulators that exhibit authentic breath and heart sounds, blink, cry and talk. However technical features of simulators that represent such dynamic systems do not according to Rystedt and Sjoblom (2012) determine the degree of authenticity or professional relevance. Consequently the design of learning technologies cannot be considered in isolation from other human interactions (Hung et al, 2007) including the emotional content of learning which Berragan (2011) argues, receives less attention than cognitive issues when considering the theory of skills acquisition.

Authenticity in the context of simulated learning is associated with realism of which fidelity is a potential attribute. Authenticity, however, may bring realism even if the learning environment is unrealistic and fidelity is low. Whereas authentic learning is concerned with the processes of learning within the reality of the simulation experience, (how the equipment is used for example) and is far more than fidelity or pre-authenticating content. It is about multiple perspectives including emotion, participation, communities and key to meaningful learning opportunities. Barab, Squire and Dueber (2000) claim that authenticity occurs `not in the learner, the task, or the environment but in the dynamic interactions among these various components…authenticity is manifest in the flow itself and not in the objective feature of any one component in isolation` (p.38). A key consideration is that authenticity cannot always be achieved nor should be at the expense of developing other attributes associated with the learning experience (Ricketts, 2010).

Authenticity and Learning

Some learning theories have moved from individual learning towards social learning from studying learner interaction. Berragan (2011) identifies that traditional models of learning focusing upon knowledge and skill acquisition (Dreyfus and Dreyfus, 1980; Benner, 1984) are being challenged by models of learning emphasising social participation and communities of practice (Lave and Wenger, 1991., Wenger, 1998; Bleakley, 2006)). This move from individual learning to social learning, repositions learning from a passive, receptive and content driven process to one which is dynamic, active and requires reflexivity (Berragan, 2011). For Lave and Wenger (1991) a primary focus is learning through active social participation and in the construction of identity through participation in communities. Learning through engagement in activities that are perceived authentic demands location in and interaction with a socio-cultural context; resonant with the theory of 'situated cognition' or 'situated learning' (Brown et al, 1989). Situated learning is based on the premise that learning (cognition) is influenced by the situation in which it occurs (Lave and Wenger, 1991) and that learning should be embedded in authentic activities that aid transformation of knowledge from the abstract and theoretical to the practical (Onda, 2011). Context becomes crucial for learning to be effective and authenticity is crucial for context. Simulation deliberately places the learner's needs at the centre of attention providing the potential to create conditions of best practice for teaching which is in contrast to real clinical settings, where the healthcare needs of the patient take priority over the educational needs of the student (Berragan, 2011). Creating such conditions is however challenging and places emphasis on developing realism thought to be essential in order to legitimise the learning activity (Paige and Daley, 2009). According to situated learning theory, learners participate in experiences that reflect real life with authentic contexts being the cornerstone of the theory and for situated learning to be

effective, the learning environment should reflect the way in which the knowledge will be used (Onda, 2011). What is less clear from literature is the detail regarding the construction of fidelity and the learning environment to enhance the authenticity and situate the learner within an authentic representation of reality.   As educators increasingly turn to fidelity for operationalizing authenticity caution is required particularly with evidence indicating that some students do not find the high-fidelity simulator authentic. The pursuit of ever increasing fidelity is unlikely to produce authenticity but may contribute with the equipment being less fundamental to learning than the authenticity of the simulation experience, authenticity bringing realism even if the learning environment is unrealistic and of low fidelity. Levett-Jones et al (2011) found simulation being highly valued by students, irrespective of the level of fidelity. Developing technology that focuses upon authenticating learning experiences is beginning to dominate simulation–based nurse education and although the pursuit of authenticity may be a key to meaningful learning opportunities, how authenticity is understood and achieved requires the academy to research extensively.

Conclusion

Simulation based education requires substantial capital and investment which develops considerable pressure to then use it (Miller and Bull, 2013). This may lead to premature utilisation of equipment without fully understanding its potential or to evaluate its effectiveness.   Many simulators are designed to mimic and replicate physiological characteristics of real patients and although such technology is welcome, educators have to be fully aware of the limitations even the most technologically sophisticated high-fidelity simulators have in relation to authenticity and the learning experience. Educators cannot assume that just because a simulator breathes students will perceive this to be authentic and engage fully in learning. Ashton (2010) found a lack of curiosity in existing studies regarding how authentic learning emerges within inauthentic learning contexts as low levels of authenticity should give rise to inauthenticity-in-learning. With the rise in simulation based education in nursing and the rapid development of low, medium and high-fidelity simulators to support learning and education, understanding the relationship between fidelity, authenticity and learning is crucial if we are to improve the effectiveness of simulation based education. We should embrace evolving simulation technology for its contribution in developing authentic learning contexts but be also fully aware of its limitations in providing authenticity in isolation of other key factors and not fall into the trap of assuming that authenticity automatically increases with increasing fidelity.

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Appendix 1

Summary of papers reviewed after meeting the inclusion criteria and considered influential in developing the discussion paper. Other literature found in the reference list was referred to following the development of the focus of the paper derived from appraisal of the papers included in this table.

	Author (year) Country	Design of Paper / Study (Discussion Paper/Literature Review/Original Research)	Sample Size – If Original Research	Comments / Key Findings
1	McKenna, L., Bogossian, F., Hall, H., Brady, S., Fox-Young, S., Cooper, S (2011). Is simulation a substitute for real life clinical experience in midwifery. A qualitative examination of educational leaders. Nurse Education Today 31 (2011) 682-686. Australia.	Qualitative design using focus groups audio-taped and transcribed. Data was analysed using thematic analysis.	46 midwifery academics in 11 focus groups across Australia.	Three main themes emerged – simulation is used extensively in Australia, lack of realism limits potential for further use and some elements of midwifery may be impossible to simulate.
2	Buykx, P., Kinsman, L., Cooper, S., McConnell-Henry, T., Cant, R., Endacott, R., Scholes, J (2011). First2Act: Educating nurses to identify patient deterioration – A theory-based model for best practice simulation education. Nurse Education Today 31 (2011) 687-693. Australia & UK.	Discussion paper reviewing and evaluating FIRST2ACT simulation model, an evidenced based model simulation model designed to improve clinical assessment of patient deterioration.	Participant self – review facilitated by open-ended video review. 51 student nurses, 35 student midwifes and 34 registered nurses in Australia.	Simulated targeted education can improve delayed detection and mismanagement. Simulation needs to be made more realistic.
3	Bland, A.J., Topping, A., Wood, B (2011). A concept analysis of simulation as a learning strategy in the education of undergraduate nursing students. Nurse Education Today 31 (2011) 664-670. UK.	A concept analysis review of literature guided by a systematic process of studying a concept.	Analysis sought to identify how concept of simulation is interpreted in English printed literature.	Identified 5 critical attributes of which authentic representation was one constitute of the phenonema and the definition of simulation as a learning strategy developed from the analysis.
4	Buckley, T., Gordon, C (2011). The effectiveness of high fidelity simulation on medical-surgical registered nurses ability to recognise and respond to clinical emergencies. Nurses Education Today, Vol 31, Issue 7, Oct 11, 716-721. Australia.	Qualitative follow up survey design whereby participants reported on the usefulness of various aspects of simulation in their ability to respond to real patient emergencies.	38 medical-surgical graduate nurses following immersive high fidelity simulation education.	Skills practiced in simulation were highly relevant to real practice.
5	Rystedt, H., Sjoblom, B (2012). Realism, authenticity, and learning in healthcare simulations: rules and irrelevance as interactive achievements. Instructional Science. Springer Science+Business Media B.V.2012. Sweden.	Comparison of 2 different simulators to explore requirements needed to establish and maintain simulations as authentic representations of practice using principles of ethnomethodology.	Empirical cases in study are based on video data from 2 prior studies each involving qualified nurses. Sample sizes not specified.	Goal of creating simulations to be authentic instances of clinical practice presupposes that participants continuously orient to what aspects are relevant or not. Learning to simulate is key.
6	Warland, J (2010). Using simulation to promote nursing students learning of work organisation and people management skills: A case-study. Nurse Education in Practice (2010), doi:10.1016/j.nepr.2010.08.007. Australia.	Case-study of use of a simulation exercise designed to develop nursing students work organisation and people management skills and evaluation of a simulation exercise.	125 undergraduate nursing students in Australia.	10% of students do not "buy in or suspend disbelief" indicating a lack of realism in the simulation. Skills obtained from simulation are transferable to clinical placements.
7	Miller, A., Bull, R.M (2013). Do you want to play? Factors influencing nurse academics adoption of simulation in their teaching practices. Nurse Education Today 33 (2013) 241-246. Australia.	Exploratory research design using semi-structured interviews. Thematic analysis was conducted utilising a cross comparative approach.	7 academic members of School of Nursing and Midwifery in Australia.	Findings indicate factors influencing nurse academics attitudes and choices around simulation must be understood and addressed to increase success. Pressure to provide realistic contexts for students was a

			raised concern.
8	Paige, J.B; Daley, B.J; (2009). Situated Cognition: A Learning Framework to Support and Guide High-Fidelity Simulation. Clinical Simulation in Nursing 5, 97-103. USA.	Discussion paper providing overview of situated cognition and illustration of how a high-fidelity simulation case scenario principles relate to a learning framework.	N/A	Use of high-fidelity simulation within the situated cognition framework relocates learning from decontextualized traditional teaching paradigm to real-world human activity paradigm which includes complex ingredients such as authenticity, realism and interaction.
9	Parker, B.C., Myrick, F (2009). A critical examination of high-fidelity human patient simulation within the context of nursing pedagogy. Nurse Education Today (2009) 29, 322-329. Canada.	Critical examination of the application of pedagogy to high-fidelity scenario-based simulation.	Literature based study.	High-fidelity simulation requires educators in nursing to grasp educational philosophy to inform nursing pedagogy and how that influences the use of technology.
10	McCaughey, C.S & Traynor M (2010). The role of simulation in nurse education. Nurse Education Today 30 (2010) 827-832. UK.	Descriptive survey design using quantitative and qualitative data to evaluate medium to high-fidelity simulation in the preparation for clinical nursing practice.	153 Adult Branch undergraduate nursing students in Ireland, UK.	Whilst acknowledging limitations to the realism of high-fidelity simulators, the majority considered simulation as an authentic learning experience.
11	Onda, E.L (2011). Situated Cognition: Its Relationship to Simulation in Nursing Education. Clinical Simulation in Nursing (2011), e1-e8. USA.	Discussion paper addressing the relationship of situated cognition to the use of simulation in nursing education.	Literature based discussion.	Situated cognition readily lends itself to assisting novice nurses in development. A balance must be struck between explicitly teaching the cognitive base and providing authentic learning contexts.
12	Pike, T., O'Donnell, V (2010). The impact of clinical simulation on learner self-efficacy in pre-registration nursing education. Nurse Education Today 30 (2010) 405-410. UK.	Thematic content analysis from a qualitative questionnaire based on a preliminary pre-test post-test design to measure learner self-efficacy before and after a clinical simulation.	Focus group interview with a convenient sample of 9 pre-registration nurses.	Students highlighted need for simulation learning experiences to be more authentic to improve the theory-practice gap.
13	Arthur, K., Kable, A., Levett-Jones (2011). Human Patient Simulation Manikins and Information Communication Technology Use in Australian Schools of Nursing: A Cross-Sectional Survey. Clinical Simulation in Nursing. November 2011 (Vol.7) No6, pe219-e227. Australia.	Cross-sectional survey design to explore the use and types of simulation and information communication technologies in Australian schools of nursing.	24 schools of nursing participated in the descriptive survey.	Achieving fidelity is dependent upon the realism of the environment, the clinical authenticity of the scenario and skill of facilitator, not just the type of simulator.
14	Roberts, D., Greene, L (2010). The theatre of high-fidelity simulation education. Nurse Education Today (2010), doi:10.1016/j.nedt.2010.06.003. UK.	Discussion paper demystifying the roles, responsibilities and underpinning pedagogy of high-fidelity simulation by introducing simulation as an analogy of theatre.	N/A. Review of literature.	It is important that the pedagogy leads the use of high-fidelity simulation rather than the technology.
15	Ricketts, B (2010). The role of simulation for learning within pre-registration nursing education – A literature review. Nurse Education Today (2010), doi:10.1016/j.nedt.2010.10.029. UK.	Literature review to appraise current thinking regarding the worth of teaching psychomotor skills in a simulated setting as some sources question its value in terms of experience.	N/A. Literature review.	Further evaluation of current learning methods within simulation may offer appraisal of the preparation of students for clinical practice. Realism and authenticity of learning environment / simulation was explored as part of the literature exploration.
16	Berragan, L (2011). Simulation: An effective pedagogical approach for	Literature review focusing upon the operational concerns of	N/A. Literature review.	Simulation can only provide part of the learning

	nursing? Nurse Education Today (2011), doi:10.1016/j.nedt.2011.01.019. UK.	simulation, considering the theoretical positioning and understanding of simulation as a teaching and learning approach.		experience and should not be dominated by technology as learning clinical skills shifts from real life to simulation.
17	Reid-Searl,K., Eaton,A., Vieth,L., Happell,B (2011). The educator inside the patient: student's insights into the use of high fidelity silicone patient simulation. Journal of Clinical Nursing, 20, 2752-2760. Australia.	Focus group interviews following high-fidelity simulation participation. Thematic analysis identified main areas of interest.	21 nursing students and first year graduates.	Two main themes of 'realism of the character' and 'skills of the teacher / facilitator' were identified. Having a realistic character presented to the students increased engagement in learning.
18	Stayt, L.C (2012). Clinical simulation: A sine qua non of nurse education or a white elephant? Nurse Education Today 32 (2012) e23-e27. UK.	Examination of the learning theory that underpins clinical simulation by using an existing theoretical framework.	N/A. Literature-based discussion.	Philosophical conflict exists between the different learning approaches required to meet all the expected learning outcomes which would benefit from future research endeavours.
19	Lapkin, S., Levett-Jones, T (2011). A cost-utility analysis of medium vs. high-fidelity human patient simulation manikins in nursing education. Journal of Clinical Nursing, 20, 3543-3552. Australia.	Cost-utility analysis from a quasi-experimental study to arrive at an overall cost utility comparing medium and high-fidelity human patient simulation manikins in nursing education.	268 second-year and 84 third-year nursing students.	Results indicate effective simulation sessions do not always require high-fidelity manikins and depending on the learning objectives, similar outcomes can be achieved with less fidelity.
20	Kaakinen, J., Arwood, E (2009). Systematic review of nursing simulation literature for use of learning theory. International Journal of Nursing Education Scholarship 6 (1), Article 16. USA.	Systematic Review of Nursing Simulation Literature for Use of Learning Theory.	120 articles were reduced to 16 that used a learning type of foundation.	Nursing faculty approach simulation from a teaching rather than a learning paradigm. There needs to be research on how to shift simulation design which can foe example include fidelity / authenticity to a learning paradigm.
21	Butler, KW., Veltre, DE & Brady, D (2009). Implementation of active learning pedagogy comparing low-fidelity simulation versus high-fidelity simulation in pediatric nursing education. Clinical Simulation in Nursing, 5(4), e129-e136. USA.	Randomized, two- group experimental design pilot study comparing the implementation of active learning pedagogy using low and high-fidelity human patient simulators.	31 nursing students participated in a randomized 2 group (paediatric simulators) experimental design.	Multiple types of clinical experiences may be used to prepare students in practical and interpersonal skills with high-fidelity simulators rating the most highly effective by students of which being more realistic and authentic a contributing factor.
22	Kinney, S., Henderson, D (2008). Comparison of Low Fidelity Simulation Learning Strategy with Traditional Lecture. Clinical Simulation in Nursing (2008) 4, 15-18. USA.	A randomized two-group experimental design to compare low-fidelity simulation with a traditional lecture on medicine administration.	4 associate degree nursing students participated.	Replication and further study on maximizing use of low-fidelity strategies recommended.
23	Parker, B.C., Myrick, F (2009). A critical examination of high-fidelity human patient simulation within the context of nursing pedagogy. Nurse Education Today (2009) 29, 322-329. Canada.	Critical examination of the application of behaviourist and constructivist pedagogy to high-fidelity scenario-based simulation.	N/A. Discussion paper – literature based.	The nurse educator may blend both educational philosophies to best meet the learners needs. Technology being embraced as a learning tool with little guiding philosophy.
24	Levett-Jones., McCoy, M., Lapkin, S., Noble, D., Hoffman, K., Dempsey, J., Arthur, C., Roche, J (2011). The development and psychometric testing of the Satisfaction with Simulation Experience Scale. Nurse Education Today 31(2011) 705-710. Australia.	Mixed method design capturing quantitative and qualitative data with 4 distinct phases to the study including development of satisfaction with simulation experience scale (phase 1) which was tested in phase 2.	Instrument was tested with 268 second year and 76 third year nursing students.	Simulation was highly valued by students irrespective of the level of fidelity but does not address issues of authenticity merely objective reality through levels of fidelity.
25	Houghton, C.E., Casey, D., Shaw,D., Murphy, K (2012). Staff and students perceptions and experiences of	Qualitative multiple case study design using semi-structured interviews over 5 study sites in	28 student and newly qualified nurses, 15	Clinical skills laboratories should provide an authentic environment with

| | teaching and assessment in Clinical Skills Laboratories: Interview findings from a multiple case study. Nurse Education Today 32 (12) e29-e34.UK. | Ireland UK. | | academic staff and 15 clinical staff, n=58. | appropriate use of teaching strategies. |