

Just-in-time training: A strategy to support perioperative nurses' continued professional education

Sharon M. Higgins, CD, MN, RN, CPN(C)^{1,2}

¹Royal Canadian Medical Service, Canadian Armed Forces, Ottawa, ON, Canada

²Athabasca University, Athabasca, AB, Canada

Address any correspondence to Sharon Higgins at Sharon.Marie.Higgins@gmail.com

Note: The opinions expressed are those of the author and do not represent the Canadian Armed Forces.

Abstract

Continued professional education (CPE) is essential for perioperative nurse competency maintenance. Yet, due to the fundamental nature of the perioperative work environment, with its seemingly endless technological advances and limited access to CPE resources, such as time and funding, accessing competency maintenance activities can prove a challenge. Given the potential for significant negative impacts on patients, organizations, employers, educators, and perioperative nurses, perioperative leaders and nurses must work collaboratively to identify a strategy capable of surmounting the underlying challenges. The just-in-time training (JiTT) pedagogical approach respects adult learning principles and possesses characteristics that are well suited to overcoming recognized barriers. As such, the implementation of JiTT is recommended, as it is an effective strategy to support perioperative nurses' continued professional education and, in turn, improve patient outcomes.

Keywords: just-in-time training, perioperative nurse, continued professional education, competence

Introduction

The perioperative practice environment is continuously evolving due to steady advances in healthcare technology (Beitz, 2019). The remarkable rate at which new equipment, instruments, procedures, and practices are introduced make it challenging for the perioperative nurse to adapt swiftly (Bradley, 2020). Nonetheless, ethical nursing practice requires perioperative nurses to provide safe and competent care (Canadian Nurses Association [CNA], 2017).

Suggested citation: Higgins, S. M. (2024). Just-in-time training: A strategy to support perioperative nurses' continued professional education. *ORNAC Journal*, 41(1), 27–35. <https://doi.org/10.5737/ornac11507>

Competence is defined as the “ability to integrate and apply the knowledge, skills and judgment required to practise safely and ethically in a designated role and practice setting. Competence includes both entry-level and continuing competencies” (Nova Scotia College of Nurses, 2023). The development and maintenance of competence is the responsibility of the perioperative nurse, as well as nursing organizations and employers (CNA, 2024).

The individual nurse commits to life-long learning by way of reflecting on their practice and environment, and incorporating learning (Operating Room Nurses Association of Canada [ORNAC], 2023). Nurse educators employ adult learning principles to provide the education required to meet the needs of the perioperative nurse learner, and the nurse manager facilitates competence development and maintenance by ensuring resources for continued professional education (CPE). New technology also necessitates learning (ORNAC, 2023). These commitments enable perioperative nurses to employ evidence-informed practice in an effort to ensure high-quality patient outcomes, prevent poor practice, and protect the public (CNA, 2004). However, the fast-paced, stressful perioperative environment (O’Neal & Fencl, 2021) challenges timely creation, delivery, and implementation of required learning. Just-in-time training (JiTT), a form of microlearning, is an effective strategy that satisfies the need for immediate, focused education (Tine Health, 2023), by eliminating waste through timely, targeted education (Cheng et al., 2017).

Background

Given the relationship between practitioner competence and CPE, it is prudent to explore what constitutes CPE, along with the commonly identified barriers for perioperative nurses accessing CPE activities. Also worthy of discussion is the potential impact of a diminishment in practitioner competence. Specifically, a lapse in competence invites the risk of skill decay,

which potentiates negative impacts on the patient, as well as job satisfaction for the perioperative nurse (Price & Reichert, 2017).

Continued Professional Education

The American Nurses Association (2010) defines CPE as “systematic professional learning experiences designed to augment the knowledge, skills, and attributes of nurses and therefore enrich the nurses’ contributions to quality health care and their pursuit of professional career goals” (p. 83). Continued professional education encompasses learning facilitated by a nurse, facility, organization or educational institution (CNA, 2004). Such activities can include independent study through e-learning tutorials, reviewing journal articles and answering test questions, employer in-services, webinars, conferences, and academic courses (CNA, 2023). Perioperative nurses recognize the importance of CPE and participate in activities as a component of professional practice (Ahlquist, 2022). They may be motivated by the requirements for licensure or certification, or an intrinsic desire to advance their personal knowledge, skills, and attitudes (Bindon, 2017).

Barriers to Continued Professional Education

A mixed-methods study determined that Canadian perioperative nurses value CPE, yet face barriers for engaging in activities; most notably, time and cost (Ahlquist, 2022), i.e., work or personal time. Factors impacting available work time were based in the fundamental nature of the perioperative environment, exacerbated by staffing challenges (Bindon, 2017); a phenomenon recently compounded by practitioner burnout during the COVID-19 pandemic (Ahlquist, 2022). In terms of cost, memberships to professional organizations, journal subscriptions, conferences, academic courses or programs, as well as professional certifications, all have associated fees. This barrier could intensify in the current post-pandemic landscape of inflation and looming threat of recession.

Potential Impacts

Skill Decay

Skill decay is defined as “the loss or decay of trained or acquired skills (or knowledge) after periods of nonuse” (Arthur et al., 1998, p. 58). There are two types of skill decay identified in the literature: absolute skill decay, a diminishment of skills from baseline; and relative skill decay, a stagnation of skills despite scientific advances (Norman & Eva, 2005). Studies have indicated that skill decay can occur as early as four weeks after learning or practice, peak at six months, and steadily decline thereafter (Maddocks, 2020). The threat of decay is greater for skills and procedures considered to be high-risk (Branzetti et al., 2017), which are characterized as those performed infrequently, under time constraints, or that are critical to patient survival (Wang et al., 2008). This is significant for the perioperative nurse considering that, in general, the perioperative environment is classified as high-risk (Association of periOperative Registered Nurses [AORN], 2022). If CPE is not readily

accessible to the perioperative nurse, it is reasonable to conclude, that given the fast paced, high-risk nature of the practice environment, they are at risk of skill decay and, consequently, of compromised competence.

Patient Safety

It is well established that diminished competence negatively impacts patient safety (Coventry et al., 2015; Price & Reichert, 2017; Weaver et al., 2012). As such, perioperative nurses are ethically obligated to deliver competent care (CNA, 2017). Further, patients rely on perioperative nurses maintaining their competence (Bindon, 2017). Nevertheless, studies have shown that perioperative nurses are failing to participate in CPE activities putting themselves at risk for skill decay, and impeding their ability to provide current evidence-informed practice (Price & Reichert, 2017), which could thwart poor practice, promote high-quality patient outcomes, and safeguard the public (Coventry et al., 2015).

Job Satisfaction

Of interest, access to CPE has been linked to job satisfaction. A Canadian study employed a qualitative descriptive approach with thematic analysis from data collected from eight focus groups across eight provinces, incorporating nurses from the student stage through late-career, identified training and education to be directly linked to career satisfaction (Price & Reichert, 2017). The results indicated that a healthy work environment invests in CPE to ensure competence maintenance and growth, and to provide optimal patient care.

Given the benefits of CPE for the perioperative nurse, and in turn, the patient, it is in the best interest of healthcare organizations, along with perioperative leaders and educators, to prioritize and support CPE activities. While recognizing the barriers of time and cost, strategies should be implemented to identify priority learning needs, along with an effective method for education delivery and uptake that respects adult learning principles. Taking these requirements into consideration, along with the fundamental characteristics of the JiTT approach, JiTT is believed to be the ideal strategy to meet the CPE needs of the perioperative nurse.

Just-in-Time Training

Origin and Definition

Just-in-Time (JiT) originated as a manufacturing philosophy, which was developed and refined in the 1970s by Toyota’s Taiichi Ohno (Institute of Management, n.d.). Initially, JiT referred to the precise production of goods to exactly meet demands in terms of time, quantity, and quality. It has since evolved to represent production with minimal waste, with waste characterized as time, resources, and materials (Institute of Management, n.d.). As it relates to education, it is known as Just-in-Time Teaching, or Training, where the foundational philosophy of JiT was modified to apply to any field of study by centring JiTT

on the post-secondary principles of pedagogical best practice developed by Chickering and Gamson (1987). The result is an educational method that respects adult learning principles by way of eliminating waste through the timely delivery of focused education that is based on the learner's needs (see Table 1).

Table 1 <i>Just-in-Time Training: Strengths and Challenges</i>		
JiTT	Strengths	Challenges
<ul style="list-style-type: none"> • An educational approach that recognizes adult learning principles; • Eliminates waste through the timely delivery of focused education; and • Centres on the learner's specific needs (Gavrin, n.d.) 	<ul style="list-style-type: none"> • Well suited for the clinical setting (Schuller et al., 2015); • Accessible external to the healthcare environment; • Can take many forms, extending its reach: <ul style="list-style-type: none"> ▪ High-tech methods: virtual simulation, mobile device applications QR Codes; and ▪ Low-tech methods: readings, exercises, quizzes (Abersold et al., 2018; Bradley, 2020; Correia, 2018; Helman et al., 2016; Magnum et al., 2017; O'Connell & Weiner, 2017; Serembus et al., 2020); • Reduces cognitive load through targeted learning; and • Complements pre-existing knowledge (Zucco et al., 2022). 	<ul style="list-style-type: none"> • Requires a multi-level collaborative effort; • Negative perceptions regarding the use of mobile devices in the clinical setting; • Potential need for technical support; and • Requirement for access to fast, reliable Internet (Abersold et al., 2018; Jamu et al., 2016)

Adult Learning Principles

Andragogy is an educational approach that focuses on the art and science of teaching the adult learner (Kaufman, 2003). The term was first introduced in 1833 by educator Alexander Kapp, and popularized in the 1970s by Malcolm Knowles (Bouchrika, 2022). Its foundational concept is that adults are independent, self-directed learners, with a goal of becoming competent and competitive within their personal domain of practice.

Additional theory assumptions are that adult learners have a foundation of pre-existing knowledge that can be applied to new experiences, possess a readiness to learn, prefer knowledge immediately applicable to everyday life and that is problem-centred rather than subject-centred learning, and have a desire to know the value of, along with the rationale behind, what they need to know (Kaufman, 2003). It, therefore, focuses on learning beyond that of formal education.

Educational Theories

The JiTT approach draws on three educational theories that align with adult learning principles: constructivism, experiential learning, and cognitive load theory.

Constructivism

The fundamental idea of the constructivism educational approach is that the learner possesses a foundation of knowledge from which the instructor elicits support and builds upon it through personalized, engaging activities (Melrose et al., 2013). The learner continuously constructs knowledge by integrating new information with previous learning. As it relates to JiTT, the theory respects the notion that the learner does not require the comprehensive development and transmission of a concept, but rather the delivery of focused education specific to the learner's needs. This is observed within the nursing profession as the nurse assimilates knowledge and experience, progressing from novice to expert, and advancing their clinical competence and confidence (Peebles et al., 2020; Williams Ware et al., 2021).

Experiential Learning

Experiential learning is commonly understood as learning that results from real-life experiences, as opposed to didactic or formal classroom instruction (Kolb, 2014). An example in the clinical context would be an intervention in the clinical setting. As JiTT continues to be adopted into the clinical environment, it increasingly incorporates experiential learning (Peebles et al., 2020); specifically, by its characteristic targeted, and equally important, timely approach to education. This is achieved through identification and provision of the specific instruction required to carry out a skill immediately prior to its performance in the clinical setting, thus supporting the learning experience.

Cognitive Load Theory

Cognitive load theory supposes that the short-term memory, or working memory, directly impacts one's ability to process and retain information in the long-term memory (Sweller, 1988), where, if the brain receives too much information in a limited amount of time, processing slows and information in the working memory is lost. The JiTT approach acknowledges and addresses this theory by reducing the cognitive load through the delivery targeted instruction specific to learner needs (Serembus et al., 2020). Just-in-time training, therefore, results in smaller, intentional education, that increases the likelihood of information being committed to long-term memory.

Elements of JiTT

The JiTT approach responds to the learner's needs, as it acknowledges that the learner has a base of knowledge and experience from which new learning should be built upon, allowing for education to focus on the specific gaps in knowledge (Gavrin, 2006). Such characteristics make the JiTT approach attractive, as well as beneficial for all stakeholders. The JiTT method can use low- or high-tech elements to achieve a desired outcome; however, combining aspects of each is believed to be most effective (Gavrin, 2006).

Low-Tech Elements

Low-tech refers to learning exchanges that take place between students and educators in the formal classroom setting (Gavrin, 2006). In this application, various forms of learning are completed prior to an educational session. This enables the learners and educators to focus the in-person interactions on the topics or concepts that have been identified as more challenging (Gavrin, 2006). Thus, JiTT in this circumstance refers to adapting a teaching plan to target learner needs “just-in-time” for training (Gavrin, 2006; Schuller et al., 2015).

High-Tech Elements

Originally, the high-tech aspect of JiTT only referred to the employment of the Internet to provide information and improve communications. For example, it functioned as a feedback loop by providing results from learning quizzes prior to the learning session, which would permit the instructor lead time to tailor training to learner needs (Gavrin, 2006). That said, as the digital world continues to expand, so too do technological training solutions (Mangum et al., 2017), such as the use of applications on mobile electronic devices to access evidence-based practice guidelines and literature wherever and whenever it is needed (Serembus et al., 2020).

Strengths of JiTT

Literature on JiTT strongly supports the approach's pedagogical value, including within the healthcare environment (Kent, 2010; Schuller et al., 2015). Its foundational concepts align well with adult learning principles, thus strengthening its suitability as a strategy to support CPE for perioperative nurses. For example, and speaking specifically to relative skill decay, JiTT is viewed as an appropriate method for refresher training, because it is employed to complement existing knowledge (Zucco et al., 2023).

Conducting a search online can be done by just about anyone; the real challenge lies in swiftly digesting the results and identifying what constitutes high quality information (Jamu et al., 2016). The apt employment of JiTT removes the requirement of performing an extensive search which yields endless results that need to be reviewed to find the high-quality information. The JiTT approach eliminates this cognitive load by directly linking the perioperative nurse learner to the desired focused and pertinent educational content.

Through the application of low- and high-tech elements, JiTT can take many forms ranging from pre-session work, by way of readings, exercises, and quizzes; through checklists, videos, simulation, and augmented reality; to mobile device applications and quick response (QR) codes (Aebersold et al., 2018; Bradley, 2020; Correia, 2018; Helman et al., 2016; Magnum et al., 2017; O'Connell & Weiner, 2017; Serembus et al., 2020). Additionally, the continued growth of the high-tech aspects of JiTT extends the global reach of the approach, and provides education in areas where personnel or resources are limited (de Gagne et al., 2019).

JiTT in the Healthcare Environment

As JiTT continues to evolve, an increased presence is seen within the healthcare environment. Studies related to JiTT for high-risk, low-volume procedures, as well as those at the point-of-care, demonstrate various applications of the educational approach that have resulted in positive outcomes and support its employment.

According to the literature, enhanced skill performance, increased confidence, decreased learning time, and a reduction in adverse events have all been associated with the implementation of JiTT (Aebersold et al., 2018; Cheng et al., 2017; Correia, 2018; Helman et al., 2016; Kent, 2010; O'Connell & Weiner, 2017). For example, a systematic review revealed that in five out of eight studies, when JiTT was implemented in the clinical setting immediately before skill performance, the result was an increase in practitioner competence (Braga et al., 2015).

High-Risk, Low-Volume Procedures

A substantial amount of the literature on the employment of JiTT in the clinical setting focuses on high-risk, low-volume procedures—infrequent, complex life-saving or life-sustaining tasks that can significantly impact a patient (Helman et al., 2016). Two separate studies investigated low-tech simulation training as a JiTT strategy for high-risk, low-volume procedures. One, a prospective randomized controlled intervention study that sought to decrease cognitive load by way of providing targeted, learner-focused instruction, determined an improvement in individual and team code performance in comparison to that of the control group (Correia, 2018). The second was a randomized cross-over simulation study, which employed high-fidelity simulation for tracheal intubation of extremely low-weight neonates to determine intubation success rates while using various laryngoscope blades and sizes (O'Connell & Weiner, 2017). While the results of this study did not demonstrate a significant difference regarding time to intubation or success rate, it did suggest that JiTT, by way of simulation immediately prior to employing the skill in the clinical setting, resulted in improved skill performance; this was presumably due to an increase in familiarity with manufacturer nuances between the various instruments.

A different form of low-tech JiTT for high-risk, low-volume procedures described in the literature is through the use of checklists, a concept not foreign to the perioperative nurse, as it is an expectation that the surgical safety checklist is used in all operating rooms in Canada, for all procedures, all of the time (ORNAC, 2023). However, checklists do not have to be limited to serving only this function in the perioperative environment. An example of a checklist as a method of JiTT for high-risk, low-volume procedures is demonstrated in a quality improvement initiative aimed at reducing adverse events carried-out in the cardiac centre of a large, urban, tertiary care pediatric hospital (Helman et al., 2016). The JiTT method required nurses, who would be caring for patients undergoing high-risk procedures, to complete a checklist and achieve a score of 100 percent prior to beginning their shift; nurse educators or procedural experts were available for additional JiTT as required. A year after the checklist was introduced, two high-risk procedures were identified and examined, and indicated a significant 65% to 78% decrease in adverse events (Helman et al., 2006).

Point-of-Care

In the clinical setting, various forms of the JiTT approach can be employed at the point-of-care. A low-tech example of this is simply using a product package insert. In a multi-centre randomized controlled trial testing nurses' confidence and competence in applying an unknown wound dressing, the intervention group was provided JiTT through the provision of the dressing package insert, with the control group being left to rely on their traditional wound care education (Kent, 2010). The results indicated a significant enhancement in performance within the intervention group, where 88% of the participants were successful in accurately applying the dressing; a stark contrast to the control group where no participants were found to have applied the dressing accurately (Kent, 2010).

As technology continues to advance health care, so too do methods of JiTT, such as reading a textbook or viewing a video on a mobile device. A prospective randomized controlled trial pilot determined faster learning times and stronger skills for participants who viewed a brief instructional video over those who took the traditional method of reading a textbook (Cheng et al., 2017). Another intriguing high-tech JiTT method is augmented reality training. A mixed-methods study revealed that nursing students who participated in iPad anatomy augmented virtual simulation training demonstrated a significant increase in skill competence (Aebersold et al., 2018).

Healthcare Practitioners' Perceptions

Several positive findings regarding JiTT have emerged from survey research, for example, that the approach enhances student learning, increases participation, and results in improved retention, confidence, and competence (Helman et al., 2016;

Nelson et al., 2019; Schuller et al., 2015; Williams Ware et al., 2021). Another common finding is that the JiTT approach is very well received. Feedback from medical residents who received supplemental JiTT immediately prior to a busy medical rotation noted the high-yield value of the timely, focused education (Mangum et al., 2017). Similarly, 100% of novice nursing preceptors who received JiTT reported being satisfied with the training in general and expressed an increase in confidence and competence (Nelson et al., 2019). Additional accolades highlighted from a mixed-methods study, praise the student-centredness of the approach, in addition to it recognizing the learner's existing knowledge (Williams Ware et al., 2021). Finally, results from a study that investigated a quality improvement initiative, which requested staff provide their perceptions on the effectiveness of JiTT, indicated a safer work environment and improved patient care (Helman et al., 2016).

Perioperative Environment Application Example

While the JiTT application examples previously described can be tailored to the perioperative environment, the potential for QR codes as a JiTT strategy for the perioperative nurse is quite intriguing. Quick response codes are black and white pixelated squares, which serve as a link to, for example, a website, PDF (Adobe's portable document format), video, and much more (QRcode.com, 2023; see Figure 1 for an example). A recent, and very relatable situation that validates the effectiveness of the strategy was the need for an operational method to deliver the ever-changing clinical guidelines, usage protocols, and surgical care standards throughout the COVID-19 pandemic (Nelson & Rabinowitz, 2020). It was concluded that traditional methods of information dissemination, such as email blasts, were not adequate. The situation required a strategy that would provide timely, specific, and curated information directly to the end-user. The solution was the distribution of QR codes that directly linked perioperative personnel to a tightly

Figure 1

QR Code: Just in Time Training

<https://ornacjournal.ca/index.php/ornac/article/view/11507/8267>



monitored electronic platform, which functioned as a database for clinically current guidelines categorized by activity, for example, airway management, surgical and anesthesia workflow, and donning and doffing of personal protective equipment. The QR code remained the same with the information being updated as required. In a two-month period during the spring of 2020, the resources were accessed more than 1,000 times (Nelson & Rabinowitz, 2020). This is just one compelling example of the effectiveness of QR codes as a JiTT strategy for continued education in the perioperative environment.

Discussion

Perioperative nurses are considered adult learners, as the profession requires training including and beyond post-secondary education (Melrose et al., 2021). In developing CPE for perioperative nurses, adult learning principles should be applied and the characteristics of the adult learner should be respected. It will be important not only to identify what the perioperative nurse's learning needs are, but also to consider their learning interests in order to deliver education that overcomes the recognized barriers of time and cost.

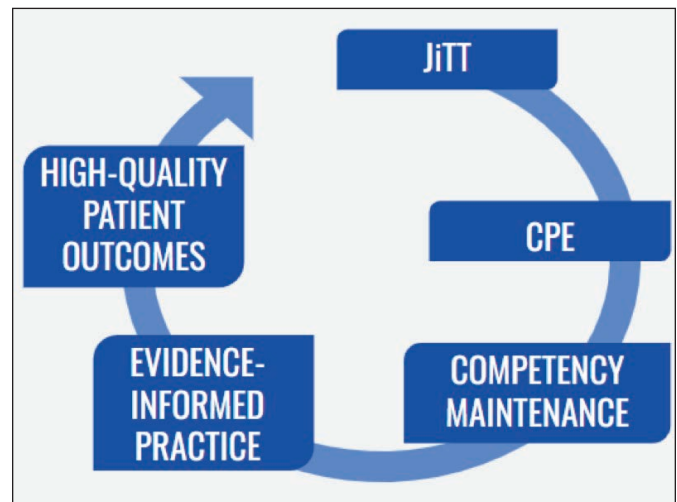
The JiTT pedagogical approach is an ideal strategy for perioperative nurses to achieve their CPE goals and responsibilities. Its theoretical foundations respect the principles of adult learning, offering various low- and high-tech stratagems to facilitate a range of CPE activities for the perioperative nurse, from focused e-learning tutorials, exercises, and quizzes, through checklists, to instructional videos, information, and guidelines, and beyond. Moreover, this strategy would aid in overcoming certain barriers of time, for example, by limiting instructional videos to one-to-two minutes and, depending on the content, eliminating the barrier of cost to the learner, as activities would be free and likely eligible for continuing education credits. That said, the anticipated challenge is in the collaborative effort required at all levels. Management will need to provide the resources for educators to create JiTT content, with educators needing to collaborate with perioperative nurses to identify their specific learning needs. It is suggested that this is the effort required to provide appropriate, targeted learning resources that can be accessed in the clinical setting or external environment.

Beyond the barriers of time and cost, by specifically addressing the identified learning needs of the perioperative nurse, both absolute and relative skill decay can be avoided. The provision of JiTT specific to perioperative high-risk, low-volume procedures, would offer a strategy to combat absolute skill decay. With reference to relative skill decay, by identifying knowledge gaps resulting from technological advances that produce new techniques, products, or practices, JiTT strategies that acknowledge prior experience have the capacity to target the learner's specific needs and facilitate current evidence-informed practice.

Another important consideration is the finding that decreased confidence has a negative impact on competence (D'Angelo et al., 2015; Gawad et al., 2019; Linde et al., 2018). The provision of JiTT to support CPE, which is directly related to competency maintenance (Ahlquist, 2022), would increase practitioner competence and, in turn, have a positive impact on patient safety and outcomes (see Figure 2).

Figure 2

Impact of Just-in-Time Training as a Support for Continued Professional Education



Note. JiTT = just-in-time training; CPE = continued professional education.

Finally, given the current state of health care and the increasing rate of burnout, every effort should be made to improve job satisfaction and retain trained perioperative nurse professionals. With CPE being directly linked to career satisfaction, the provision of easily accessible JiTT has the potential to improve job satisfaction along with perioperative nurse retention.

Gaps in the Literature

The strengths of the JiTT approach support the objectives of providing an educational strategy to overcome the time and cost barriers to CPE, and presumably achieve improved patient outcomes by way of maintaining clinical competence and confidence. However, no hard evidence has been identified that definitively associates JiTT with improved patient outcomes. Given the value of this data, there are future opportunities to explore the association.

In general, the literature has primarily focused on high-risk, low-volume procedures. However, a recent shift has been noted with the JiTT approach now being used across the clinical setting (Cheng et al., 2017; Helman et al., 2016; O'Connell & Weiner, 2017). Health care organizations, facilities,

educational institutions, and workers should continue to investigate broadening its application, including within the perioperative environment.

Finally, identifying which pre-session methods, readings, exercises, and, or quizzes are of most benefit to the learner, is a low-tech area that would benefit from additional studies to focus efforts and optimize method impact (Schuller et al., 2015).

JiTT Implementation Considerations

While many positive findings related to JiTT have been identified and discussed, potential drawbacks also have been noted in the literature. For example, using certain high-tech JiTT strategies in the clinical setting has raised concerns regarding the professionalism of using personal mobile devices in front of patients (Jamu et al., 2016). Additionally, concerns have risen about using certain technology that might need enhanced technical supports, as well as access to fast, reliable internet (Aebersold et al., 2018; Jamu et al., 2016).

Conclusion

The objectives of CPE are to maintain competence, enhance skills, and protect the public (Ahlquist, 2022). However, various barriers, such as time and cost, have been demonstrated to hinder the perioperative nurse's ability to access CPE. With the potential wide-reaching impacts on the perioperative nurse, as well as the patient, it is in the best interest of organizations and employers to establish a strategy that can overcome identified barriers. The method chosen should respect adult learning principles and not compound stressors currently experienced in the perioperative environment. Given the strong support for the JiTT approach throughout the literature, it is suggested as the ideal strategy to support CPE for perioperative nurses, facilitate evidence-informed practice, and promote high-quality patient outcomes.

Author Notes



Sharon Higgins is the Senior Practice Leader for Operating Room Nursing in the Canadian Armed Forces. She has a Bachelor of Science in Nursing from Dalhousie University and a Master of Nursing degree, with a focus in Leadership and Teaching, from Athabasca University. A highlight of her career was an eight-month deployment on Operation IMPACT to Iraq where she was the Surgical Services Nurse Team Lead of the Canadian-led Role 2 Medical Treatment Facility.

Conflicts of Interest

No conflicts of interest exist.

Funding

No funding was received for this research.

Acknowledgements

This article was written while a graduate student at Athabasca University, in the Faculty of Health Disciplines', Master of Nursing: Generalist program.

References

- Aebersold, M., Voepel-Lewis, T., Cherara, L., Weber, M., Khouri, C., Levine, R., & Tait, A. R. (2018). Interactive anatomy-augmented virtual simulation training. *Clinical Simulation in Nursing*, 15, 34–41. <https://doi.org/10.1016/j.ecns.2017.09.008>
- Ahlquist, E. (2022). Canadian perioperative nurses' engagement and perceptions of continuing professional development. *ORNAC Journal*, 40(4), 15–26. https://view.flipdocs.com/?ID=10020446_103368
- American Nurses Association. (2010) *Nursing: Scope and standards of practice* (1st ed.). <https://www.nursingworld.org/nurses-books/nursing-scope-and-standards-of-practice-4th-edit/>
- Arthur, W., Jr., Bennett, W., Stanush, P. L., & McNelly, T. L. (1998). Factors that influence skill decay and retention: A quantitative review and analysis. *Human Performance*, 11(1), 57–101. https://doi.org/10.1207/s15327043hup1101_3
- Association of periOperative Registered Nurses (AORN). (2022). AORN position statement on patient safety. *AORN Journal*, 115(5), 454–457.
- Beitz, J. M. (2019). The perioperative succession crisis: A cross-sectional study of clinical realities and strategies for academic nursing. *Nursing Economic\$,* 37(4), 179–197. <https://www.proquest.com/openview/0f9eca76b5ce61aa7f9957cb4d397b88/1?pq-origsite=gscholar&cbl=307>
- Bindon, S. L. (2017). Professional development strategies to enhance nurses' knowledge and maintain safe practice. *AORN Journal*, 106(2), 99–110. <https://doi.org/10.1016/j.aorn.2017.06.002>
- Bouchrika, I. (2022). The andragogy approach: Knowles' adult learning theory principles. Research.com. Accessed 2023 Feb 3. <https://research.com/education/the-andragogy-approach#2>
- Bradley, K. (2020). Just-in-time learning and QR codes: A must-have tool for nursing professional development specialists. *Journal of Continuing Education in Nursing*, 51(7), 302–303. <https://doi.org/10.3928/00220124-20200611-04>
- Braga, M. S., Tyler, M. D., Rhoads, J. M., Cacchio, M. P., Auerbach, M., Nishisaki, A., & Larson, R. J. (2015). Effect of just-in-time simulation training on provider performance and patient outcomes for clinical procedures: A systematic review. *BMJ Simulation & Technology Enhanced Learning*, 1(3), 94–102. <https://doi.org/10.1136/bmjstel-2015-000058>
- Branzetti, J. B., Adedipe, A. A., Gittinger, M. J., Rosenman, E. D., Broliar, S., Chipman, A. K., Grand, J. A., & Fernandez, R. (2017). Randomised controlled trial to assess the effect of a just-in-time training on procedural performance: A proof-of-concept study to address procedural skill decay. *BMJ Quality & Safety*, 26(11), 881–891. <https://doi.org/10.1136/bmjqs-2017-006656>
- Canadian Nurses Association (CNA). (n.d.). *Renewal by continuous learning*. <https://www.cna-aiic.ca/en/certification/renewing-your-certification/renewal-by-continuous-learning>
- Canadian Nurses Association (CNA). (2004). *Position statement: Promoting continuing competence for registered nurses*. <https://hl-prod-ca-oc-download.s3-ca-central-1.amazonaws.com/CNA/2f975e7e-4a40-45ca-863c-5ebf0a138d5e/UploadedImages/documents/>

- Promoting Continuing Competence for Registered Nurses_ position_statement.pdf
- Canadian Nurses Association (CNA). (2017). *Code of ethics for Registered Nurses* (2017 ed.). <https://www.cna-aici.ca/en/nursing/regulated-nursing-in-canada/nursing-ethics>
- Cheng, Y. T., Liu, D. R., & Wang, V. J. (2017). Teaching splinting techniques using a just-in-time training instructional video. *Pediatric Emergency Care, 33*(3), 166–170. <https://doi.org/10.1097/PEC.0000000000000390>
- Chickering, A., & Gamson, Z. (1987). Seven principles for good practice in undergraduate education. *American Association for Higher Education Bulletin, 39*(7), 3–7. <https://doi.org/10.1002/tl.37219914708>
- Correia, R. (2018, May 24–26). *Just in time training: Lessons from an RCT*. In: Canadian Society of Respiratory Therapists Annual Education Conference, Vancouver, British Columbia, Canada, p. 17–31.
- Coventry, T. H., Maslin-Prothero, S. E., & Smith, G. (2015). Organizational impact of nurse supply and workload on nurses continuing professional development opportunities: An integrative review. *Journal of Advanced Nursing, 71*(12), 2715–2727. <https://doi.org/10.1111/jan.12724>
- D'Angelo, A. L. D., Ray, R. D., Jenewein, C. G., Jones, G. F., & Pugh, C. M. (2015). Residents' perception of skill decay during dedicated research time. *The Journal of Surgical Research, 199*(1), 23–31. <https://pubmed.ncbi.nlm.nih.gov/26197949/>
- de Gagne, J. C., Park, H. K., Hall, K., Woodward, A., Yamane, S., & Kim, S. S. (2019). Microlearning in health professions education: Scoping review. *JMIR Medical Education, 5*(2), e13997. <https://doi.org/10.2196/13997>
- Gavrin, A., (n.d.). Just-in-time teaching. *Open Access Journals at IU Indianapolis*. <https://journals.iupui.edu/index.php/muj/article/view/20284/19877>
- Gawad, N., Allen, M., & Fowler, A. (2019). Decay of competence with extended research absences during residency training: A scoping review. *Cureus, 11*(10), e5971. <https://pubmed.ncbi.nlm.nih.gov/31803553/>
- Helman, S., Lisanti, A. J., Adams, A., Field, C., & Davis, K. F. (2016). Just-in-time training for high-risk low-volume therapies: An approach to ensure patient safety. *Journal of Nursing Care Quality, 31*(1), 33–39. <https://doi.org/10.1097/NCQ.0000000000000131>
- Institute for Management. (n.d.). *JIT just-in-time manufacturing*. University of Cambridge. <https://www.ifm.eng.cam.ac.uk/research/dstools/jit-just-in-time-manufacturing/>
- Jamu, J. T., Lowi-Jones, H., & Mitchell, C. (2016). Just in time? Using QR codes for multi-professional learning in clinical practice. *Nurse Education in Practice, 19*, 107–112. <https://doi.org/10.1016/j.nepr.2016.03.007>
- Kaufman, D. M. (2003). Applying educational theory in practice. *BMJ, 326*(7382), 213–216. <https://www.bmj.com/content/326/7382/213>
- Kent, D. J. (2010). Effects of a just-in-time educational intervention placed on wound dressing packages: A multicenter randomized controlled trial. *Journal of Wound, Ostomy, and Continence Nursing: Official Journal of The Wound, Ostomy, and Continence Nurses Society, 37*(6), 609–614. <https://doi.org/10.1097/WON.0b013e3181f1826b>
- Kolb, D. A. (2014). *Experiential learning: Experience as the source of learning and development* (2nd ed.). FT Press.
- Linde, A. S., Caridha, J., & Kunkler, K. J. (2018). Skills decay in military medical training: A meta-synthesis of research outcomes. *Military Medicine, 183*(1–2), e40–e44. <https://doi.org/10.1093/milmed/usx023>
- Maddocks, W. (2020). Skill fade in military medical training: A literature review of supraglottic airway use in the prehospital environment. *Journal of Military and Veterans' Health, 28*(3). https://doi-ds.org/doi/10.2021-54148286/JMVH_Vol_28_No_3
- Mangum, R., Lazar, J., Rose, M. J., Mahan, J. D., & Reed, S. (2017). Exploring the value of just-in-time teaching as a supplemental tool to traditional resident education on a busy inpatient pediatrics rotation. *Academic Pediatrics, 17*(6), 589–592. <http://dx.doi.org/10.1016/j.acap.2017.04.021>
- Melrose, S., Park, C., & Perry, B. (2013). *Teaching health professionals online: Frameworks and strategies*. Athabasca University Press. <https://doi.org/10.15215/aupress/9781927356654.01>
- Melrose, S., Park, C., & Perry, B. (2021). *Creative clinical teaching in the health professions*. Athabasca University Press. <https://read.aupress.ca/read/creative-clinical-teaching-in-the-health-professions/section/17105b19-3943-45ff-b2fa-8bee37bcff80>
- Nova Scotia College of Nursing. (n.d.) *Glossary*. <https://www.nscn.ca/professional-practice/practice-support/practice-support-tools/glossary/glossary>
- Operating Room Nurses Association of Canada (ORNAC). (2023). *The ORNAC standards for perioperative registered nursing practice* (16th ed.). <https://ornac.ca/standards.phtml>
- O'Neal, J., & Fencl, J. L. (2021) Strategies to implement a competency assessment verification program. *AORN Journal, 113*(5), 455–463. <https://doi.org/10.1002/aorn.13370>
- Tine Health. (2017). *How microlearning and just-in-time training can improve nurse care training*. <https://tinehealth.com/2017/03/13/how-microlearning-and-just-in-time-training-can-improve-nurse-care-training/>
- Price, S., & Reichert, C. (2017). The importance of continuing professional development to career satisfaction and patient care: Meeting the needs of novice to mid- to late-career nurses throughout their career span. *Administrative Sciences, 7*(2), 41–52.
- Nelson, D. F., & Rabinowitz, A. L. (2020). *QR-code based just-in-time platform for perioperative COVID guidelines* [Poster Presentation]. Thomas Jefferson University. <https://jdc.jefferson.edu/cgi/viewcontent.cgi?article=1099&context=patientsafetyconference>
- Nelson, D. M., Joswiak, M. E., & Brake, K. A. (2019). “Just in Time” training for novice preceptors. *Journal for Nurses in Professional Development, 35*(4), 228–231. <https://doi.org/10.1097/NND.0000000000000562>
- Norman, G. R., & Eva, K. W. (2005). Does clinical expertise make up for failure to keep up to date? *BMJ Evidence-Based Medicine, 10*(3), 66–68. <https://doi.org/10.1136/ebm.10.3.66-a>
- O'Connell, J., & Weiner, G. (2017). Intubating extremely premature newborns: A randomised crossover simulation study. *BMJ Paediatrics Open, 1*(1), e000157. <https://doi.org/10.1136/bmjpo-2017-000157>
- Peebles, R. C., Nicholson, I. K., Schlieff, J., Peat, A., & Brewster, D. J. (2020). Nurses' just-in-time training for clinical deterioration: Development, implementation and evaluation. *Nurse Education Today, 84*, 104265. <https://doi.org/10.1016/j.nedt.2019.104265>
- QR Code.com. *History of QR Code*. <https://www.qrcode.com/en/history/>
- Schuller, M. C., Darosa, D. A., & Crandall, M. L. (2015). Using just-in-time teaching and peer instruction in a residency program's core curriculum: Enhancing satisfaction, engagement, and retention. *Academic Medicine: Journal of the Association of American Medical Colleges, 90*(3), 384–391. <https://doi.org/10.1097/ACM.0000000000000578>
- Serembus, J. F., Hunt-Kada, P., Lenahan, K., & Lydon, A. (2020). Internet, apps, and tweets: Enhancing clinical learning through just-in-time training. *Nursing Education Perspectives, 41*(5), E33–E34. <https://doi.org/10.1097/01.NEP.0000000000000486>

- Sweller, J. (1988). Cognitive load during problem solving: Effects on learning. *Cognitive Science*, 12(2), 257–285.
- Wang, E. E., Quinones, J., Fitch, M. T., Dooley-Hash, S., Griswold-Theodorson, S., Medzon, R., Korley, F., Laack, T., Robinett, A., & Clay, L. (2008). Developing technical expertise in emergency medicine – The role of simulation in procedural skill acquisition. *Academic Emergency Medicine: Official Journal of the Society for Academic Emergency Medicine*, 15(11), 1046–1057. <https://doi.org/10.1111/j.1553-2712.2008.00218.x>
- Weaver, S. J., Newman-Toker, D. E., & Rosen, M. A. (2012). Reducing cognitive skill decay and diagnostic error: Theory based practices for continuing education in health care. *Journal of Continuing Education in the Health Professions*, 32(4), 269–278. <https://doi.org/10.1002/chp.21155>
- Williams Ware, K. S., Watts, S. O., & Wang, C.-H. (2021). Student perceptions of a cardiac skills laboratory using a just-in-time teaching approach. *The Journal of Nursing Education*, 60(8) 472–475. <https://doi.org/10.3928/01484834-20210723-02>
- Zucco, L., Chen, M. J., Levy, N., Obeidat, S. S., Needham, M. J., Hyatt, A., Keane, J. R., Pollard, R. J., Mitchell, J. D., & Ramachandran, S. K. (2023). Just-in-time in situ simulation training as a preparedness measure for the perioperative care of COVID-19 patients. *Simulation in Healthcare: Journal of the Society for Simulation in Healthcare*, 18(2), 90–99. <https://doi.org/10.1097/SIH.0000000000000635>