Chapter 13
Critical Care Educational Modeling

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The first established intensive care unit (ICU) can be traced back to 1953 in Copenhagen, Denmark [1]. The integration of knowledge, skills, attitudes, and behaviors with a sound ethical and profession framework has led to groundbreaking advancements in patient-centered outcomes over the past 66 years. The modern critical care service model now finds itself in a new era of significant growth by specialty, technology, complexity, and acuity. This must be met with an educational model that is both systematic and adaptive in its effort to compliment novel services, new training program requirements, and alternative staffing models.

Critical care training and education varies worldwide in context, content, assessment, and duration. Whether you practice in an academic teaching program or in a community medical center, there are parallels drawn between the quality of care provided and the quality of education available. Providing teaching that is measurable and translatable to staff, trainees, patients, and caregivers is more challenging now than ever before. Success can be found in building a systematic approach to a learner-centered model, with competency-based training, compassionate coaching, and performance review.

Staff Education in the Modern Training Environment (Learner-Centered Model)

ICU education is designed to provide a comprehensive understanding of topics delivered and reinforced through visual, verbal, and tactile educational modalities.

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Learners

1. ICU Staff Physicians
2. Critical Care Trainees
3. Advanced Practice Providers
4. Nursing

Educational Modalities

Bedside Rounding
Curriculum-Based Lecturing
Targeting Teaching/Small Group Huddles
Simulation Training
Research and Study Design
E-Learning (Podcasts and Web Series)
Professional Development

Teaching responsibilities have grown outside the comfort zone of the ICU. We feel the pressure to deliver a more personalized experience. This experience not only includes medical trainees but other colleagues, advanced practice providers, and patients and their caregivers. Targeting a universal curriculum and distributing education through various education modalities alone do not ensure that concepts are translatable and provide the tangible understanding, professional growth, practical application, and improved patient outcomes we strive for.

Traditionally, the framework for medical education and training has been time-based, and learners are assessed periodically to determine a specific grade. In this model, equal weight was given to both the process and the outcome of the learning [2]. Emphasis was placed on understanding a concept or principle, and skills were evaluated globally [2, 3]. Transitioning to a competency-based approach is believed to provide more individualized and flexible training with transparent standards and an increased public accountability [4].

Building a collective educational program that is sharable for learners at different levels is not unrealistic. The multidisciplinary critical care team is comprised of learners from different backgrounds and varying levels of experience and expertise. Defining competencies, providing compassionate coaching, and delivering a workplace-based assessment of competence are applicable to each type of learner regardless of background. This learner-centered model allows for both the learners and teachers to exchange expectations and actively take responsibility for the learning process (Fig. 13.1).

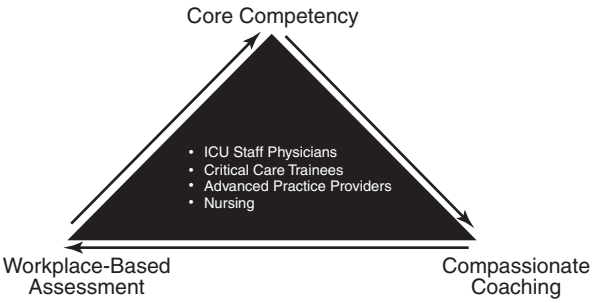

Fig. 13.1 Standardized approach to staff education

Competency-Based Training

Competency-based medical training is a method for describing the knowledge, skills, attitudes, and behavior expected from a care provider [4]. Medical education has begun to modify its training programs from syllabus-based and examination-driven systems to programs built around competencies assessed in the workplace [5].

Applicable competencies can be identified and implemented in several ways. In critical care medicine, the CoBaTrICE project has been a widely accepted platform for provider competencies [4, 6]. CoBaTrICE is an international partnership of professional organizations and critical care clinicians working together to enhance training in intensive care medicine worldwide [7]. The CoBaTrICE project featured consensus techniques comprised of an extensive international consultation process using a modified online Delphi involving more than 500 clinicians in more than 50 countries. Also included was an eight-country postal survey of patients and relatives and an expert nominal group to define the core competencies required of a specialist in the ICU [4].

There are practical concerns surrounding competency-based training. A list of competencies provides a summary of capable tasks but does not guarantee a provider's ability to synthesize these competencies to deliver comprehensive care. Practical concerns also exist in determining core competencies for continued professional growth. With advancements in technology and an evolving scope of practice, attending physicians are required to show competency in core skills while being pressured to rapidly acquire new skills (ECMO training, point-of-care ultrasonography). Practices should customize competencies that complement the needs of their individual learners as well as their critical care service line.

A key advantage to competency training is placing the focus on the ability to "perform tasks" rather than receiving credit for "time served" [4]. This allows learners to progress at their own pace. One must remain aware that these competencies need to be acquired within a fixed training period and to remain mindful of the "learning process" so that medical education does not give way solely to "medical training" [2].

Compassionate Coaching

Critical care education has long been cemented in Socratic methodologies. ICU teaching is often comprised of argumentative dialogue through which we ask and answer questions in an effort to stimulate critical thinking and work to identify knowledge deficits. Although this may be effective in identifying knowledge deficits, the psychophysiological effect is thought to be equally detrimental in leadership development and professional growth [8]. A platform for the development of future ICU leaders can be found by utilizing a more holistic approach through compassionate coaching [8].

Coaching with compassion requires a caring relationship between the teacher and the learner. Compassionate coaching emphasizes empathy of the learner and requires a willingness to act in response to a learner's needs in an effort to achieve the desired educational goal [5]. A coach takes on the role of teacher, mentor, and friend in order to achieve a desired educational goal for his/her learner. Coaching with compassion may require training staff to retool their role, perspectives, and attitudes [5]. Coaching with compassion is felt to be a more powerful methodology in engaging the learner, stimulating independent thought, cementing competencies, and building emotionally developed future leaders [5].

Workplace-Based Assessment

Historically too much emphasis has been placed on learner's ability to show knowledge and pass some forms of examination. There is too little emphasis on whether they can perform in their expected role [7]. Objective structured clinical examinations (OSCEs) have been widely utilized in medical education but can limit the provider-patient encounter by isolating aspects of the clinical encounter along with the type of cases that can be simulated. OSCEs also lack the universal applicability to patients and caregivers who do not share a common clinical background [7].

Workplace-based assessments can be used to validate the teaching curriculum, teaching methodology, clinical context, application, and impact on patient care. Assessments can be customized to a specific learner to validate a competency goal. For example, a learner's ability to interact with a patient, build a care plan, or carry out the difficult conversation is traditionally assessed through a one-on-one evaluation by a faculty member tasked with overseeing that learner's time in the ICU. This "traditional" form of feedback provides the learner with insight into an observed behavior or procedural skill set and offers the opportunity for improvement. Unfortunately, it is one-dimensional. One-dimensional feedback may lack the diversity of experience and practice we seek to impart on the ICU learner to best shape a core competency. In contrast to "traditional feedback," Multisource Feedback (MSF) in an example of a workplace-based assessment that compiles

Table 13.1 Workplace-based assessmt tools

Assessment tool	Design	Advantages
Direct Observation of Procedural Skills (*DOPS*)	Direct observation of the learner performing diagnostic and interventional procedures during clinical practice	Assessment during everyday work in real-life scenarios Observes technical ability as well as professional interactions and behaviors
Mini-Clinical Evaluation Exercise (*Mini-CEX*)	15–20-minute snapshot of a clinical encounter designed to assess clinical skills, attitudes, and behaviors essential to the provision of a desired competency	Can be used in different clinical settings depending on the target learner Easy to design around specific clinical competencies Short interactions provide the ability to be done repeatedly over a fixed teaching period
Case-Based Discussion (*CbD*)	Discussions between the learner and the educator about how a clinical case or scenario was managed Provide real-time feedback	Detail into decision-making and competency application Tests higher-order thinking and synthesis within the framework of actual practice
Multisource Feedback (*MSF*)	Patients' or colleagues' interpretation of the learner's professionalism, knowledge, and procedural skills	Real-time feedback obtained from a perspective external to that of the clinical educator

feedback from multidisciplinary providers (ICU physicians, consultants, nurses, and other trainees) as well as the patients and their families. Pooling experience and perspective to develop multidimensional feedback allows the ICU learners more opportunities to shape goal competencies and comply with best practices. MSF and other workplace-based assessments are outlined in Table 13.1.

Medical education is moving away from cumulative marks and moving toward gathering evidence of conceptualization, clinical competence, and professional behavior. Common workplace-based assessments include Direct Observation of Procedural Skills (DOPS), Mini-Clinical Evaluation Exercise (mini-CEX), Case-Based Discussion (CbD), and Multisource Feedback (MSF) [4].

Patient and Caregiver Education (Family-Centered Model)

Learners

1. The Patient
2. The Caregiver

Educational Modalities

Bedside Rounding
Printable Educational Materials
Digital/Web-Based Content
Multidisciplinary Meetings

In an effort to maximize patient outcomes, providers must use their acquired competencies to match the needs and individual characteristics of the critically ill patient and their caregivers. *The Society of Critical Care Medicine*, as part of its family-centered care program, has recommended that family education programs be included as part of the clinical care [9]. Family presence at the bedside enhances engagement, and when coupled with an educational program, it has been shown to improve outcomes [10]. Family education programs have also demonstrated beneficial effects for family members in the ICU by reducing anxiety, depression, post-traumatic stress, and generalized stress while improving family satisfaction with care [9, 11].

A patient's care team, support devices, and clinical condition can change minute by minute in the ICU. Implementing educational content that provides a patient and caregiver with the knowledge to remain engaged with each other, make the best informed decisions, and feel satisfied with care can be very challenging. Similar to a learner-centered model, the patient-centered model should start by identifying core competencies or concepts that every patient or family member can accomplish during their stay. Competencies may vary from institution to institution depending on the clinical expertise of that unit and its patient population. Collective competencies that prove to be translatable across ICU specialties, as described by the AACN, are competencies related to ICU arrival, ICU understanding and partnership in care, and ICU transitions (Fig. 13.2) [11].

Competencies

Learning validation and the assessment of educational demonstrations, diagrams, reinforcements, reviews, electronic resources, and support systems is critical. Providers must use tools to anticipate the needs of the patient and family based on cultural, cognitive, and physical differences [11]. Family-centered educational assessments are often obtained in real time by learner teach-back or through unit-based surveys. These assessment tools help the care providers realign modalities to best target a competency-based strategy [9, 11].

Simulation Training

I hear and I forget; I see and I remember; I do and I understand. –Confucius, circa 450BC

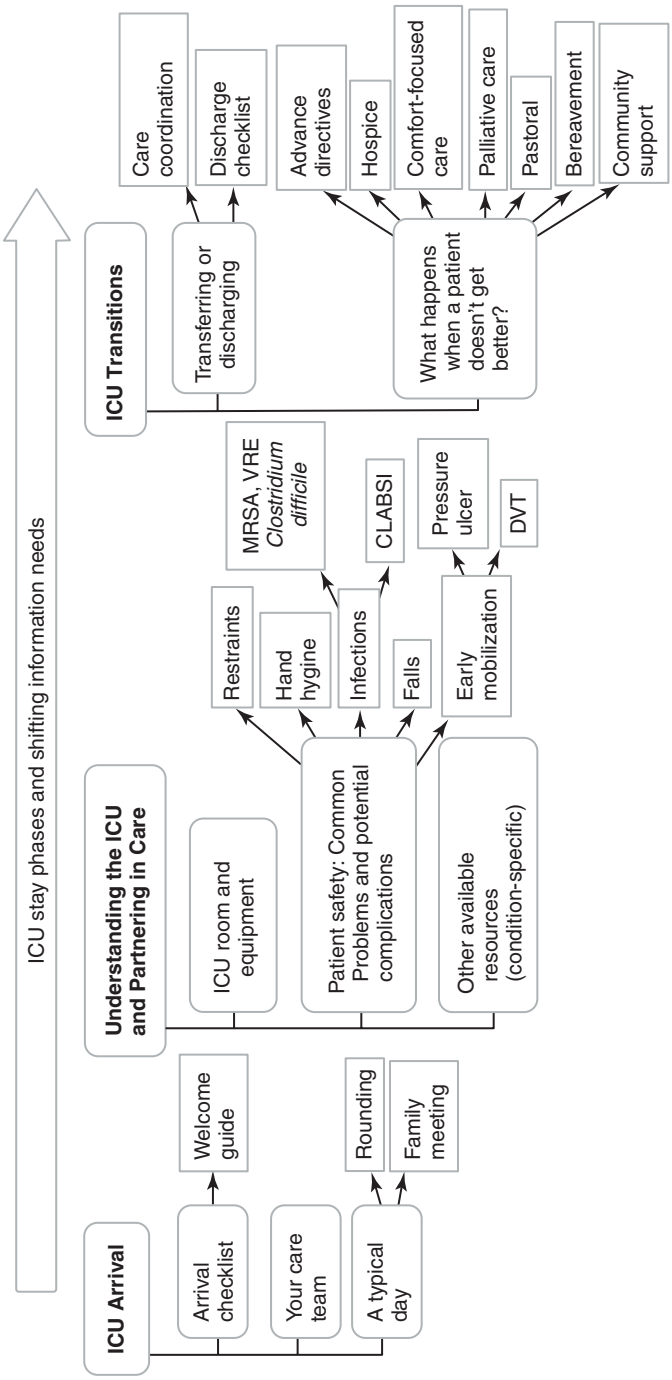

Fig. 13.2 Competencies and information pathway. (Adapted from Schnock et al. [11]. Copyright 2017)

Learners

1. ICU Staff Physicians
2. Critical Care Trainees
3. Advanced Practice Providers
4. Nursing

Outline

1. Select a category of learner
2. Identify an educational objective
3. Choose an appropriate fidelity
4. Build the scenario
5. Debrief and evaluate the experience

Simulation refers to the artificial (and almost always simplified) representation of a complex real-world process with sufficient fidelity to achieve a particular goal [12]. Simulated clinical environments have been documented throughout historical texts, dating back to the birthing phantoms of ancient Rome and continuing through the use of vivisection to advance surgical techniques in the nineteenth century [4]. Patient care and family interactions carry the expectation of perfection. However, many of these interfaces do not occur with the regularity to ensure competency and are carried out within the confines of an imperfect system. Additionally, health care is now regarded as an industry with greater emphasis on accountability, transparency, and quality assurance [12, 13].

Experience-based training in clinical emergencies and acute pathology is difficult due to the fact that many of these encounters are rare or do not warrant a delay in management to allow for teaching. Emphasis must be placed on repeated protocol-based training practices in the appropriate management of a clinical situation. This aims at reducing the margin of error for an unexpected emergency. Simulation training in the critical care environment affords us the opportunity to "fail for success": training toward competency and proficiency while at the same time identifying system errors and providing safe and timely care for all.

The use of simulation is growing rapidly; the Society for Simulation in Healthcare (SSH), the largest academic society for simulation, has experienced a 16-fold increase in membership since its inception in 2004 and an average annual growth of 25% in the past 5 years. The Agency for Healthcare Research and Quality has allocated more than $9 million in support of simulation research [13]. Results from a survey of program directors in emergency medicine demonstrated 91% of responding programs in 2008 used simulation in their training programs [13]. Teaching hospitals throughout the USA use simulation to teach, assess, and evaluate core competencies in medical education. Emphasis is

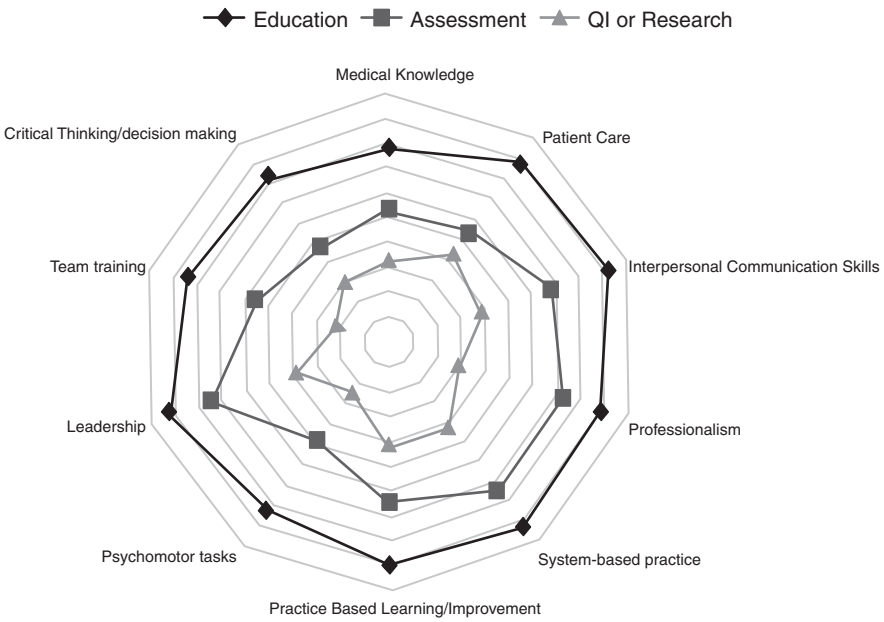

Fig. 13.3 Core competencies for simulation training. (Adapted from Huang et al. [13]. December 2012)

placed on multifaceted domains of leadership, system-based practice, and practice-based learning/improvement (Fig. 13.3) [13].

The aim for ICU educator is to facilitate learning through immersion, reflection, and feedback [12, 13]. Fidelity is a common industry term used in simulation to describe the degree of realism and technical complexity for a chosen scenario. Low-fidelity models can be developed and updated rapidly in contrast to high-fidelity models which offer added flexibility but cost significantly more to engineer and maintain [12]. Higher-fidelity modeling is not always necessary. Educators should tailor the fidelity of their simulation to the degree of immersion necessary to highlight a desired competency and deliver impactful learning (Tables 13.2 and 13.3) .

Failing in a simulated learning environment is failing in a safe environment and learning in the process. The capacity to fail through complex clinical scenarios or high-risk patient encounters and improve through feedback provides immersive and impactful learning which reduces the likelihood of future errors.

Teaching at the Bedside and During ICU Rounds

Teaching during ICU rounds is challenging due to time pressure and distraction (both warranted distraction related to the illness being dealt with and frequent interruption). Carlos et al. offer the CARE framework as a method to incorporate ICU

Table 13.2 Classification of simulators as per type

Simulation types	Specifications	Examples
Educator driven	Task trainers replicating a particular part of the anatomy Varying levels of sophistication are used to practice specific procedures or interventions	Intravenous-insertion arms, central line insertion mannequins, urinary catheter trainers, airway management heads Store-bought animal anatomy such as pig tracheas or cricothyroidotomy training and pig feet for suturing
Event driven		
Standardized patients	Trained actors, role-play, history taking, physical exam, communication skills	Situational simulation, mock emergencies and disasters
Hybrid simulation	Combination of standardized patients and part-task trainers	
Computer-based simulators	Mouse-and-keyboard navigation for multiple pharmaco-physiological models	

Adapted from Datta [12]. April 2012

Table 13.3 Classification of simulator by fidelity

Classification of simulator by fidelity	
Low-fidelity simulators	
Screen-based text simulators	Create scenarios with user selecting one of several responses User choice results in a new text narrative with more management choices *For example*, scenario involving a patient with chest pain; the user may be offered the options of selecting pain medication or obtaining an ECG
Static mannequins	Used for hands-on practice *For example*, intubating airway mannequin
Medium-fidelity simulators	
Screen-based graphical simulators	Demonstrating physiological modeling and pharmaco-kinetic and dynamic processes associated with drug administration *For example*, ACLS Training Center®
Mannequins with mechanical movement	Mannequin and software which can simulate the interaction between a student and teacher *For example*, AMBU® Man CPR trainer
High-fidelity simulators	
Non-physiologic (static) programming	Manually set parameters dependent on an operator
	Parameters reset after each intervention *For example*, ventilator connected to a test lung
Physiologic programming	Parameters change from baseline dependent on intervention and independent of the operator
	Automatic generation of appropriate physiological responses to treatment interventions *For example*, SimMan®

Adapted from Datta [12]. April 2012

teaching at the bedside [14]. This methodology includes *C*limate (setting patient/family expectations and seek permission, set learner expectations, avoid one-upmanship), *A*ttention (plan in advance, remain focused on the moment, keep content relevant for all members of the rounding team, be democratic as to leadership style), *R*easoning (encourage hypothesis-driven examination, avoid "read my mind" questions, give formative feedback), and *E*valuation (avoid individual criticism, provide feedback). We would also refer the reader to a manuscript on practical tips for ICU bedside teaching by Santhosh et al. that includes discussion of the CARE approach as well as other bedside teaching methodologies [15].

Summary

Critical care education aims to build better multimodal critical care service lines targeting the best practices and outcomes for those patients who are the sickest. With evolution in critical care service and staffing models, we have been asked to provide measurable and translatable education experiences which promote professional growth, improve patient outcomes, enhance family engagement, and engender patient satisfaction. By taking a systematic approach to a learner-centered and a family-centered educational model, with immersion though simulation training, we can provide a framework on which to construct comprehensive educational experiences for all learners.

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