

The Clinical Learning Environment and Workplace-Based Assessment Frameworks, Strategies, and Implementation



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KEYWORDS

- Clinical learning environment • Competency-based medical education
- Entrustable professional activities • Mastery learning • Self-regulated learning
- Assessment for learning

KEY POINTS

- Assessments should drive learning by providing a framework for and information to inform trainee goal setting and inquiry.
- A competency-based assessment framework is a key component in transitioning from a normative-based assessment strategy to a criterion-based assessment strategy.
- Entrustable professional activities translate abstract competency domains and milestones into observable activities that are intuitive to trainees and supervisors.
- Programs of assessment should foster self-regulated learning behaviors including goal setting, self-monitoring, and feedback seeking to support the development of intrinsic motivation.
- Supporting learners through advising and coaching for clinical skill and professional development is an essential component of a program of assessment.

THE CLINICAL LEARNING ENVIRONMENT

The clinical learning environment (CLE) can be defined as the “social, cultural, and material context” in which trainees learn while helping to care for patients in the clinical

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workplace.¹ Social theories of learning, particularly those by Lave and Wenger,^{2,3} suggest that the environment, and the learner's interaction with that environment, are critical aspects of learning. When the CLE is functioning well it supports trainees in acquiring knowledge and skill while leading to improved outcomes for patients.⁴ However, in the context of growing demands from patients and payers for more cost-effective and higher-quality care and from health systems for increased clinical productivity, the CLE often is not optimized for learning.⁵

Understanding how trainees learn in the CLE is one essential step toward optimizing the CLE for learning. There is evidence that most of the learning in the CLE occurs through workplace-based activities (eg, conducting rounds, making patient care decisions, interacting with consultants).⁶ In other words, the day-to-day activities of caring for patients in the CLE drive acquisition of knowledge and skills as residents interpret (eg, read the situation, use consultant input, and make reasoned clinical decisions) and construct meaning out of these experiences. A key element of this process is when trainees reflect on these experiences to compare their performance with their own expectations and those of others. This process helps drive additional learning by informing how trainees might need to adjust specific techniques or strategies and/or seek out additional or new experiences to further improve their performance.⁶ Considering that learning in this environment is such a complex entity with many variables that can influence the process, it is not surprising that there are significant challenges in optimizing learning in the CLE.

One group of investigators used a process called Group Concept Mapping to develop a consensus opinion on what are the most important elements for improving learning for residents in the CLE.⁷ Their work identified 10 essential elements of the CLE and identified the barriers that can inhibit learning each of them. **Table 1** summarizes those elements and the barriers they create along with some potential solutions. Among the elements that were rated highest in importance were those that centered on establishing and nurturing connection between residents and senior clinicians and facilitating feedback through those interactions. "Organization and conditions of work" was identified as another important element, which highlights how very busy clinical work environments that focus on efficiency and high throughput can interfere with trainees' ability to reflect on their experiences, assess their own performance, and consolidate knowledge. Other elements of high importance included resident support, time to learn with senior doctors, and interaction and feedback in clinical teams. Aspects of the CLE thought to be easier to modify included clinical experience content, assessment methods and process, faculty supervisor skill and support, and continuity of training experiences.⁷

In summary, the CLE is both a rich and challenging place for learners to acquire knowledge and skills. Competing pressures of productivity and patient care are often in conflict with elements essential to facilitating resident learning, especially time for reflection and interactions with supervising senior clinicians. Understanding how learners use the CLE, and the barriers and facilitators of learning in that environment, can help in the design programs of training and assessment that meet the needs of learners, and foster these critical elements of learning in the workplace and still achieve the goals of efficient, cost-effective, and high-quality patient care. The remainder of this article focuses on using assessment frameworks and strategies to support learning in the CLE.

COMPETENCY FRAMEWORKS: EVOLUTION AND EXAMPLE

History of Competency-Based Medical Education

Medical education is increasingly shifting from a time-based and process-based training system, in which competency was inferred from completing a defined set of

Element	Challenge	Potential Solutions
Organization and conditions of work	Tension between providing clinical service and time for learning, reflection, and knowledge consolidation	<ul style="list-style-type: none"> • Optimize the number and types of patients trainees cover • Provide scheduled, protected time for reflection
Learning from clinical supervisors	Time and productivity pressures limit interactions with senior clinical supervisors	<ul style="list-style-type: none"> • Optimize the number and types of patients trainees cover • Set focused, realistic, and transparent goals for teaching and learning in clinical workplace
Management and facilities	Physical space and workflows often prioritize health care system and delivery needs over training and education	<ul style="list-style-type: none"> • Create and maintain physical space for learning activities
Workplace culture	Trainees, clinical teachers, and learning need to be valued in the clinical workplace	<ul style="list-style-type: none"> • In addition to clinical productivity, incentivize and reward clinical supervisors for high-quality teaching
Development of clinical supervisors	Clinical supervisors need the skills to teach and give feedback in busy clinical workplace	<ul style="list-style-type: none"> • Time-efficient faculty development programs • Realistic adaptation of teaching and feedback methods to clinical workplace • Use trained observers in multiple clinical contexts
Supervision, autonomy, and feedback for trainees on clinical teams	Balancing patient safety, quality, and efficiency with allowing trainees to practice, make decisions, reflect, and gradually gain more independence	<ul style="list-style-type: none"> • Develop clinical supervisor skills in supervision, teaching, and feedback • Develop trainee skills in seeking and processing feedback • Develop and communicate shared mental model about learning goals in each clinical workplace
Content, assessment, and continuity of training	Clinical training activities in a particular clinical workplace need to match goals of assessment, and supervisors need to apply assessments and draw conclusions appropriately	<ul style="list-style-type: none"> • Match assessments to clinical workplace and supervisor skills • Train supervisors in appropriate use of assessment tools • Provide supervisors with ongoing feedback about how they are applying assessments
Motivation and morale	Stress, burnout, and overwork can lead to fatigue and undermine working and learning in the clinical environment	<ul style="list-style-type: none"> • Optimize the number and types of patients trainees cover • Provide backup systems to offload excessive workload • Wellness programs to support trainees, supervisors, and interprofessional team members

(continued on next page)

Element	Challenge	Potential Solutions
Trainee treatment and support in the clinical workplace	Creating a welcoming and respectful environment for trainees who lack knowledge, experience, and relationships with senior clinicians and interprofessional team members who work regularly in the clinical workplace	<ul style="list-style-type: none"> • Provide effective orientation to the clinical workplace • Develop shared mental model among trainees, supervisors, and interprofessional team members about trainee responsibility and roles • Engage interprofessional team members in the training process
The role of patients in the clinical learning environment	Balancing patients' expectations of care with their willingness to support trainee learning	<ul style="list-style-type: none"> • Provide patients with effective orientation learning and supervision in the clinical workplace • Provide opportunities for patients/families to provide guided feedback to trainees

Adapted from Kilty C, Wiese A, Bergin C, et al. A national stakeholder consensus study of challenges and priorities for clinical learning environments in postgraduate medical education. *BMC Med Educ* 2017;17(1). <https://doi.org/10.1186/s12909-017-1065-2>.

clinical experiences over a fixed duration of time, to a competency-based framework that provides explicit sets of skills and behaviors that trainees must demonstrate that they can perform well enough to care for patients independently. Competency frameworks play an essential role in providing a shared understanding, or mental model, between faculty supervisors and trainees about the goals and objectives of training. They also provide the basis for designing curricula (eg, training experiences) and assessment strategies, and a structure for both formative feedback and summative decision making. Beginning in the 1990s with the development of Tomorrow's Doctors in the UK, there has been widespread adoption of competency frameworks internationally for both undergraduate and graduate medical education. Examples include CanMEDS,⁸ Scottish Doctor,⁹ Accreditation Council for Graduate Medication Education (ACGME) Outcomes Project,¹⁰ and the Australian Curriculum Framework for Junior Doctors^{11,12} Although each of these frameworks are different, they all provide an educational and cultural perspective on the qualities and behaviors that are important for being an effective physician. For the purposes of this article, the focus here is on the development and evolution of competency-based medical education (CBME) frameworks for graduate medical education (GME) training in the United States.

Evolution of Competency-Based Medical Education in the United States

In the United States, the ACGME and the American Board of Medical Specialties worked together to develop the Outcomes Project in 1999. In the Outcomes Project, physician competencies were organized into 6 domains: Patient Care, Medical Knowledge, Practice-based Learning and Improvement, Interpersonal and Communication Skills, Professionalism, and Systems-based Practice. In 2009, in an effort to further define these broad competency domains, the Milestones Project began as each specialty developed a set of specialty-specific competencies within each domain and accompanying developmental levels for each competency that defined 4 to 5 levels of performance as residents progress through training.¹³ Twice each academic

year, all ACGME accredited training programs are required to use a Clinical Competency Committee (CCC) to determine the level at which milestone level each trainee in their program is currently performing for a subset of competencies and report those ratings to the ACGME. In Pediatrics there are a total of 21 reporting milestones or competencies representing the 6 domains of competence. For example, in the Patient Care domain, one reported competency (PC4) is to “make informed diagnostic and therapeutic interventions.”^{10,14,15} Theoretically this competency framework with its developmental structure can be used for formative feedback to guide further development toward competence. However, the ACGME Milestones have been criticized as being so detailed and reductionist that they miss the big picture and are not intuitive for faculty supervisors and trainees.^{16,17}

Example of an Evolving Competency Framework: Pediatric Entrustable Professional Activities

Entrustable professional activities (EPAs) are a competency framework that synthesizes and provides clinical context for ACGME Competencies and Milestones. EPAs provide a simplified, more holistic view of a trainee’s progress in learning to perform the common tasks of a particular specialty and allow for more intuitively useful assessment strategies.¹⁸ First proposed in 2005 by ten Cate¹⁹ with further elucidation by ten Cate and Scheele,²⁰ EPAs incorporate competencies into a framework centered around large-scale, observable clinical care and other activities that a physician routinely performs in the CLE. Thus EPAs can be thought of as defining a profession, because they describe the critical activities that a physician practicing a particular specialty or subspecialty must be able to perform without supervision in order to practice independently. Central to the application of EPAs in a training environment is the concept of “trust”—the idea that a trainee is working toward earning the trust of supervisors to perform a given EPA independently, without supervision.

EPAs and competencies are inter-related because to perform an EPA, a trainee must be able to effectively perform multiple competencies. Using this logic, multiple domains of competence (ie, patient care, medical knowledge, professionalism) and individual competencies can be “mapped” to EPAs. In this way, EPAs provide a conceptual model that links the abstract qualities and characteristics of physicians described in the ACGME Milestone Competencies with observable, patient-care-related activities that are recognizable to supervising clinicians and trainees.²¹ One additional advantage of the EPA model is the shift from a normative (eg, how does a trainee do compared with peers or a supervisor’s expectations) to a criterion-based (eg, how much supervision does a trainee require or can a supervisor “trust” them to perform an EPA unsupervised) standard.²² The concept of “trust” or “level of supervision” provides a criterion standard that is intuitive for supervisors and trainees.

Increasingly, the EPA competency model has been embraced in both undergraduate and GME throughout the world. In the United States, this has resulted in the development of EPAs for multiple specialties and some subspecialties. In 2013 the American Board of Pediatrics worked with stakeholders to develop 17 EPAs that “define” the practice of a general pediatrician and could plausibly be assessed to determine when a trainee is ready to practice independently and graduate from residency training. Each EPA carries a description of the key elements of the activity and is parsimoniously mapped to critical ACGME competency domains and individual competencies. For example, EPA 3 (Care for the Well Newborn) incorporated specific competencies related to medical knowledge, patient care, and communication.

Linking Competency Frameworks to Assessment Strategies

Assessment can be viewed through the lens of Miller's Pyramid with the bottom level of "Knows," followed by "Knows How," then "Shows," and finally the highest level of "Does."²³ Assessment strategies for lower levels are relatively straightforward and common. For example, multiple-choice questions can be effective in assessing whether a trainee "knows" something, but assessment of complex tasks that require integration of knowledge, skills, and attitudes, such as those required to care for patients, means focusing on the top 2 levels of Miller's Pyramid. Competency frameworks, such as the ACGME Milestone Competencies or EPAs, provide a shared mental model of the skills, behaviors, and abilities that trainees are trying to learn and supervisors are trying to assess. Miller's Pyramid can help us identify how we should look for it. However, it is important to remember that no single assessment method or tool will be valid for assessing trainee performance in the complex tasks of caring for patients, regardless of competency framework. Effectively determining whether a trainee is ready to practice their intended specialty of medicine independently requires a program of assessment (eg, multiple assessment tools, appropriate sampling strategy) that measures the full range of competencies necessary to practice that discipline. However, the authors consider it equally important that a program of assessment be designed in such a way that it provides useful feedback for trainees such that they can effectively use it to guide their learning.

PROGRAM OF ASSESSMENT FOR LEARNING: A VIEW THROUGH THE LENS OF MOTIVATIONAL THEORIES

Before discussing the specifics of a program of assessment to support CBME, it is worthwhile to discuss the concept of assessment in general, competing purposes of assessment, and underlying educational theories that can be used to help design a program of assessment. In the context of CBME, assessment is commonly thought of as an important component of a summative process in which competence is determined by assessment of what a trainee has learned (ie, assessment of learning). Often this process is heavily informed by high-stakes assessments and comparisons of a trainee's performance to a normative standard.²⁴ More recently, there has been a movement to develop a strategy whereby assessment can be used to provide feedback to learners to inform development of learning goals (ie, assessment for learning). The core principles in this process should emphasize the low-stakes nature of any given assessment, ensure that every assessment provides meaningful feedback to learners to use in their own development, and provide support and coaching for trainees in the context of a safe and trusting relationship with an advisor.²⁵⁻²⁷

Among the more negative effects of high-stakes, normative-based assessment is that it can reinforce a "performance" or "entity" rather than a "mastery" or "incremental" mindset. Goal Orientation Theory, first elucidated by Carol Dweck,²⁸ describes 2 broad orientations, or mindsets, to learning. In a "performance" orientation, learners focus on looking better than others or avoiding the perception of being unintelligent. These learners can be characterized as having an "entity mindset" whereby there is a belief that intelligence and ability are fixed, innate characteristics that cannot change over time. In contrast, learners with an "incremental" mindset focus on the intrinsic value of learning (ie, acquisition of new knowledge or skills). This concept is paired with a belief that intelligence and ability can increase with training.²⁹ Perhaps most applicable to this discussion is that an incremental mindset can be taught, and that randomized controlled trials have shown that learners, when taught about the

malleability of the brain and an incredible capacity for learning, will take on more difficult tasks and persevere even when faced with occasional failures.^{28,29}

Assessment strategies should work to reinforce opportunities for incremental improvement *and* promote and sustain a “mastery” orientation. The concept of mastery learning emphasizes deliberate practice with reflection and coaching within a set of defined and well-articulated learning goals.^{30–32} This can be achieved through the development of a program of assessment *for* learning, which has been defined as “an approach in which routine information about the learner’s competence and progress is continually collected, analyzed and, where needed, complemented with purposefully collected additional assessment information, with the intent to both maximally inform the learner and their mentor and allow for high-stakes decisions at the end of a training phase.”^{26,33} In brief, the concept involves developing targeted assessments that are optimized to the CLE and occur at spaced intervals that allow for the development of a holistic view of the learner. A core principle in this approach is that any single assessment forces a compromise between utility and its quality and that there is no single “silver bullet” for learner assessment.³⁴ A critical additional element to this type of assessment program is support in the form of mentorship and coaching designed to allow learners the opportunity for critical reflection, goal setting, and defining opportunities to seek additional clinical experience and practice to inform iterative improvement toward achieving competence.

Although there are many theories that inform the program of assessment literature, it is useful to consider 2 in more detail: Self-Determination Theory and Self-Regulated Learning. Self-Determination Theory posits that to encourage intrinsic motivation (defined as free engagement in an activity out of interest or inherent satisfaction and the most desirable form of motivation as compared with amotivation or extrinsic motivation), learning environments should promote 3 characteristics: autonomy, competency, and relatedness.^{35–38} Autonomy refers to the ability of the individual to choose what they consider a useful course of action and is supported by creating an environment in which learners are empowered to set their own goals and direct their learning. Competency is embodied in the desire to feel effective in action and performance. Relatedness refers to a sense of interconnectedness, belonging, and engagement in reciprocal caring relationships, for example, incorporation of the learner into the larger professional or clinical group.³⁹ Self-Regulation Theory, originally developed by Zimmerman, characterized self-regulated learning in individuals as an internal desire to achieve mastery through metacognitive, motivational, and behavioral strategies. Such behaviors are highly valued in medicine. One key characteristic of self-regulated learning is intrinsic motivation, whereby learners use strategies to set goals and monitor progress as well as seek activities to enhance progress toward those learning goals. The key behaviors of self-regulated learning are goal setting, feedback seeking, and monitoring of one’s self and abilities to promote intrinsic motivation aimed at performance improvement.^{40–42}

Using the lenses of Self-Determination Theory and Self-Regulation Theory helps illustrate several key points about programmatic assessment. Learners need to demonstrate autonomy by being fully engaged in the process and feel that they have an ability to direct the content and nature of feedback. In addition, learners need to set goals and monitor their own performance relative to those goals and then seek out additional feedback to validate their feelings of growing competence. Finally, learners need to establish relatedness to a trusted individual who can coach them as they regularly review their assessment data and work to revise their learning plans as they progress to competence. In other words assessment should drive feedback, which in turn drives learning by helping trainees identify, create, and

monitor progress toward achieving learning and professional goals and, ultimately, competence.

Table 2 outlines several key elements that are necessary for successful implementation of a program of assessment that supports learning.^{26,27} For example, there are structural elements such as an overarching roadmap that incorporates learning environments and targeted assessments, in essence defining who does what, where, and with whom. Additional structural pieces include a physical means of capturing assessment data, a way to display aggregate data, and a place to record reflection and critique. This involves systems designed to be easily useable and ideally nimble enough to capture feedback and observations (ie, mobile applications) as well as systems designed to aggregate and display these data in user-friendly formats (eg, dashboards, e-portfolios).⁴³ In addition to the structural elements, there are also processes that need to be in place to adequately support reflection and goal setting beyond a physical/electronic system. These processes include ways to facilitate review and

Structural Elements	Processes and Procedures	Faculty/Trainee Development
Overarching assessment plan <ul style="list-style-type: none"> • Roadmap of learning environments and targeted assessments matched to competency framework • Clearly identify who does what, where, and with whom 	Reflection activities <ul style="list-style-type: none"> • Provide protected times for learners to participate in guided reflection experiences, feedback review, and generation of learning plans 	Mentorship/Advising/Coaching <ul style="list-style-type: none"> • Build shared understanding of overarching goals for program of assessment • Enhance understanding of competency framework • Develop skills for trainees to aid processing of feedback and creation of actionable learning goals
Assessment data <ul style="list-style-type: none"> • Outline method to collect, summarize, and display assessment data • Collect written feedback comments to inform learning • Make assessments mobile, easy to use, efficient 	Intermediate summative assessment <ul style="list-style-type: none"> • Perform periodic summative assessments to assess trainee progress toward high-stakes competency decision • Identify trainees who may need additional support/remediation 	Clinical supervisor feedback <ul style="list-style-type: none"> • Build skills of clinical supervisors in giving effective feedback • Build skills in applying appropriate supervision
Dashboard and learning plans <ul style="list-style-type: none"> • Display aggregate data in user-friendly format • Collect and organize learner reflections and coach comments • Create a place to write learning goals, share with advisor, and track progress 	Quality assurance program <ul style="list-style-type: none"> • Create a system to monitor number, timeliness, and quality of assessments • Measure key elements of clinical learning environment to identify areas for continued improvement 	Trainee feedback seeking <ul style="list-style-type: none"> • Enhance trainee skills in initiating or seeking out assessments and helping direct supervisor feedback to align with learning goals • Build trainee skills in processing feedback and converting it into actionable learning goals
Faculty advisors/coaches <ul style="list-style-type: none"> • Develop a cohort of faculty advisors/coaches to guide trainees in processing feedback and creating learning plans 	<ul style="list-style-type: none"> • Implement a program to assess quality/utility of assessment tools/dashboard and revise as required to optimize effectiveness • Provide regular assessment and review of learning plans, advisor/trainee interactions to identify areas for improvement 	

reflection. In addition, it is important to have planned intermediate “certification points” that validate that learners are making adequate progress and to help identify when trainees are struggling or might need remediation. Finally there are human aspects of the program that may require additional faculty and learner development, such as delivering feedback and teaching faculty how to be effective mentors and coach learners in contextualizing feedback and building skills in feedback seeking.^{44,45} Although these factors provide list of key elements for a program of assessment for learning, ultimately individual training programs need to mobilize local resources or modify existing structures to adapt these elements for implementation in their systems and CLE.

COMMON ASSESSMENT STRATEGIES

In designing a program of assessment for learning it can be useful to consider the Hindu parable of the blind men and an elephant, in which the perspective of feeling only a smaller part of the elephant (eg, feeling the tusk, the trunk, the leg) may not necessarily allow each individual to identify what they are feeling as an elephant.⁴⁶ In a similar way, considering only the perspective of a single assessment tool or single assessment encounter is imperfect and unlikely to provide a full picture of how a trainee is progressing toward competency. Fortunately, there is a large and ever-growing toolbox of quality assessment tools that when combined in a thoughtful and planned manner can provide a robust and holistic view of the learner to inform self-regulated, mastery learning for the trainee. The same assessment data, when considered together, can be used by CCCs and training program leadership to make high-stakes competency and advancement decisions. The key to this latter process is to consider the body of low-stakes assessments in its totality and avoid the temptation to place too much weight on a few individual assessments. **Table 3** lists types of workplace-based assessment tools that can be used or adapted for use in a broad range of CLEs. **Table 3** also provides a brief summary of the tools and pros and cons of each, and provides several essential references.

IMPLEMENTATION AND SUSTAINMENT CHALLENGES FOR A PROGRAM OF WORKPLACE-BASED ASSESSMENT FOR LEARNING

Despite the significant improvements that can be gained from conversion to competency-based frameworks, workplace-based assessments, and incorporating a program of assessment for learning, there are significant challenges in implementing and sustaining such a program. These challenges can be grouped into 3 categories: (1) logistical; (2) instrument (or assessment tool) related; and (3) faculty and trainee development.²⁷

In the logistics category there are several simple but key elements that must be addressed. For example, should the program of assessment use a single data management system to collect and collate information, or will users be required to access and manage multiple systems? Ensuring up-to-date enrollment in the system (not a trivial task in complex CLEs) so that trainees and faculty can engage in meaningful assessment and capture that data for later review is also essential. Issues of data management must also be addressed including answering questions such as who inputs data, who manages data, and who has access to what? Finally, it is imperative to provide easy visualization of such large amounts of assessment data in a way that can be understood by trainees, mentors/coaches, and faculty supervisors. Learners and mentor/coaches can and will be quickly overwhelmed by trying to sort through and make sense of an unorganized mound of assessments, regardless of the quality.

Table 3
Examples of workplace-based assessment tools

Tool	Description	Advantages	Limitations	References
Global assessment	<ul style="list-style-type: none"> Based on big picture impressions of trainee performance rather than direct observation of discrete patient encounter Often constructed from elements that directly map to competency framework 	<ul style="list-style-type: none"> Usually understandable to clinical supervisors Can be delivered to and collected from assessors electronically on a large scale Often use numbered rating scales that can be summarized efficiently Can support mastery orientation, depending on design 	<ul style="list-style-type: none"> Rating scales often lack value and utility for learners Context and rater variability can affect reliability, especially if number of assessments is small If used as summative assessment at end of clinical training experience, it will promote performance, rather than mastery, orientation 	51–54
Multisource assessment	<ul style="list-style-type: none"> Provides assessments from individuals with different perspectives (eg, peers, patients, families, nurses, other clinical team members, etc) Can include self-assessment Assessment can be global or discrete patient encounters Can be in the form of checklists with rating scales or free-text comments 	<ul style="list-style-type: none"> Provides information about aspects of behavior and skills not generally seen by faculty Provides information about impacts of behaviors that may not be apparent to trainee Can support mastery orientation, depending on design 	<ul style="list-style-type: none"> Logistical and technical challenges of collecting assessments from diverse group of assessors Requires cooperation and training of multiple assessors with variable investment in the process Trainees often express discomfort in assessing peers 	23,55–57
Structured clinical observation	<ul style="list-style-type: none"> Structured assessment of a discrete or series/sequence of discrete patient encounters Assessment process usually requires observer or rater to assess a structured list of specific behaviors or skills 	<ul style="list-style-type: none"> Some assessments have substantial evidence supporting their validity (eg, mini-CEX) Can be designed to assess a focused activity in a particular clinical environment Can be designed to capture multisource assessment Can support mastery orientation, depending on design 	<ul style="list-style-type: none"> Requires significant investment of time and resources (ie, faculty development and observation) with direct conflict in revenue-generating priorities Checklist-oriented design may not provide the type of feedback that a trainee desires (ie, may not support self-determination and self-regulated learning) 	23,58,59

Direct observation of procedural skills	<ul style="list-style-type: none"> • Observation and assessment of trainee performing a procedure • Can be done in clinical workplace or simulated procedure • Usually asks observer to assess trainee on a structured list of specific behaviors, skills, or steps related to a procedure • Often rated on a yes/no response scale 	<ul style="list-style-type: none"> • Several of these tools have significant validity evidence to support their use • Particularly effective if determining that a trainee can perform the steps to a procedure • Depending on what decisions will be made based on the assessment, can support mastery orientation 	<ul style="list-style-type: none"> • Depending on design, often not as effective in assessing the quality of how well the trainee performed the procedure • Checklist-oriented design may not provide the type of feedback that a trainee desires (ie, may not support self-determination and self-regulated learning) 	60
Chart-stimulated recall	<ul style="list-style-type: none"> • Interview, or oral examination, of trainee based on reviewing a specific case in the medical record (chosen by trainee or assessor) • Similar to a “talk aloud” assessment where trainee explains their approach and decision making in a specific case • Also allows for assessment of trainee’s written documentation in the chart 	<ul style="list-style-type: none"> • Several validated forms exist in a variety of specialties • Case can be chosen to align with trainee learning goals, thus supporting self-determination and self-regulated learning • Can be used to target action plans for improvement around clinical decision making or other specific aspects of competency framework 	<ul style="list-style-type: none"> • Time intensive for assessor and trainee • Requires significant training of assessors • Several threats to validity including inadequate number of cases, bias of assessor, focus of encounter • Usually is a high-stakes assessment, thus tends to foster performance, rather than mastery, orientation 	61,62

In terms of assessment instruments or tools, there should be acknowledgment that many of the tools likely to be used in a workplace-based assessment are inherently subjective, because the complex competencies (regardless of the competency framework) that one is attempting to measure *are* subjective. For example, one system that uses EPA-based assessments uses a supervision-anchored scale whereby faculty supervisors are asked to rate how much supervision they think the trainee they are assessing requires.^{47,48} However, faculty ratings of need for supervision are situated in clinical context, the degree to which a relationship has been fostered between trainee and assessor that promotes trust, time spent in observation, and a faculty supervisor's own expectations, experiences, and bias. In a program of assessment for learning, this type of variability from assessment to assessment is perfectly acceptable because any individual assessment is low-stakes. From an assessment psychometric perspective, this variability evens out by viewing the assessment data not as individual components each with their own validity, but in aggregate with a large number of assessments from many different clinical contexts and different supervisors. Taking this approach, it is possible to make highly valid and reliable decisions about level of competence and advancement through the training program.

Finally, a key area to consider is faculty and trainee development focusing on such topics as: (1) the changing nature of assessment and the idea of workplace-based assessment using criterion-based referents⁴⁹; (2) the roles, responsibilities, and skills necessary for feedback seeking and feedback delivery situated in a competency-based framework⁴⁴; (3) developing self-regulated learning skills such as goal setting and self monitoring⁵⁰; (4) enhancing skills in mentorship/coaching/advising. In short, attention should be paid to not only the framework and content of assessments but also the supporting infrastructure of electronic and human resources that such a program of assessment requires.

SUMMARY

This article has reviewed the concepts of the CLE, the rationale for and examples of CBME frameworks, and the learning theories that support this transition to a new focus of assessment. In addition, it describes how a program of assessment can provide information to the learner to guide intrinsically motivated, self-regulated mastery learning and can be used to inform high-stakes competency and advancement decisions. The key elements to successful workplace-based assessment and the promotion of assessment for learning are:

- Assessments should drive new learning by providing a framework for and information to inform trainee goal setting and inquiry, rather than focusing on testing previously learned material
- A competency-based assessment framework is essential in transitioning from a normative-based assessment strategy (eg, how do I compare with my peers, a gold standard) to a criterion-based assessment strategy (eg, am I ready for independent/unsupervised practice)
- EPAs have the potential to translate abstract competency domains and milestones into observable activities, even at the level of the individual faculty supervisor
- Programs of assessment should foster self-regulated learning behaviors including goal setting, self-monitoring, and feedback seeking to support the development of intrinsic motivation
- No single assessment tool is sufficient to provide a holistic, unbiased view of the learner. Instead multiple, varied, and planned assessments are required to provide a complete picture of a trainee

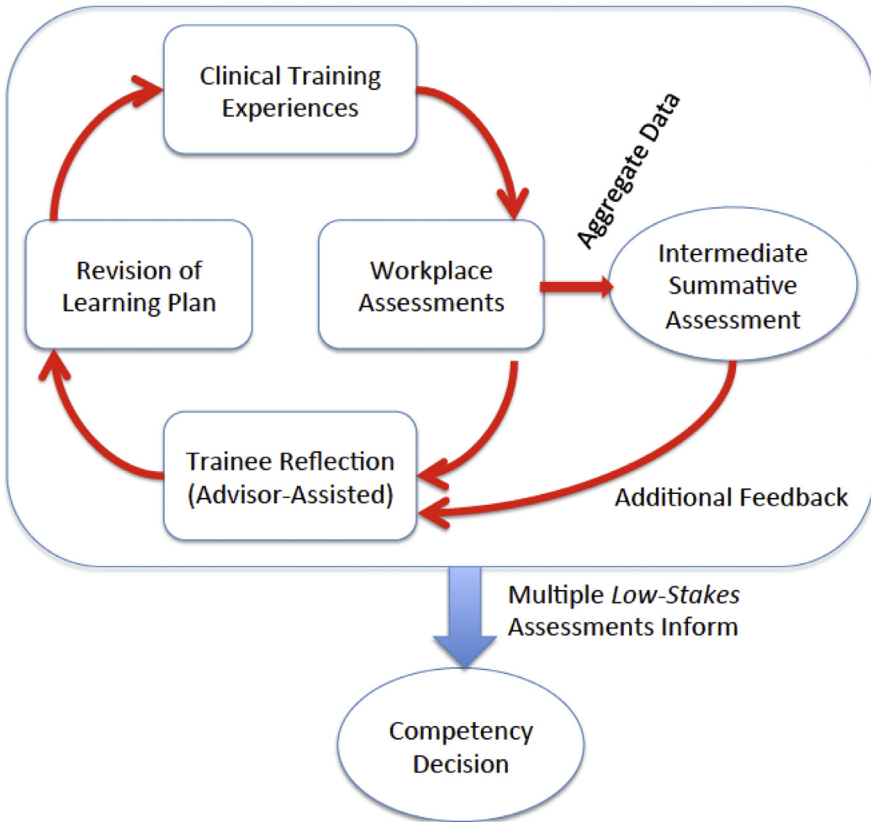


Fig. 1. Program of assessment for learning in the clinical learning environment.

- Supporting the learner through advising and coaching for clinical skill and professional development is an essential component of any program of assessment
- In addition to the structure of assessment (how they happen, when and with whom), attention to the systems and people that support them including development of both learners and faculty in this process is vital

In summary, how a program of assessment might work in an iterative cycle of continuous self-improvement is described (Fig. 1). Through structured assessments and the feedback inherently contained within them, facilitated reflection with trusted advisors, and support and development in goal setting and feedback seeking, learners will not only engage in, but also find reinforcement of their behavior in becoming an intrinsically motivated, self-regulated mastery learner for the rest of their career.

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