Competency-Based Medical Education: The Wave of the Future

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Abstract

Competency-based medical education (CBME) is a new educational paradigm that will enable the medical education community to meet societal, patient, and learner needs of the 21st century. CBME offers a renewed commitment to both clinical and educational outcomes, a new focus on assessment and developmental milestones, a mechanism to promote a true continuum of medical education, and a method to promote learner-centred curricula in the context of accountability. Accountability is central to CBME, ensuring that graduating practitioners are well-rounded and competent to provide safe and effective patient care.

The structure of CBME in obstetrics and gynaecology must be rooted in, and reflect, Canadian practice. Its development and implementation require an understanding of the principles that are the foundation of CBME, along with the involvement of the entire community of obstetricians and gynaecologists and other maternity care providers.

We provide here an overview of the basic principles of teaching and learning and the theories underpinning CBME.

Résumé

La formation médicale axée sur les compétences (FMAC) est un nouveau paradigme pédagogique qui permettra à la communauté de la formation médicale de répondre aux besoins de la société, des patients et des apprenants du 21e siècle. La FMAC offre un engagement renouvelé envers les issues tant cliniques que pédagogiques, un nouvel accent sur l'évaluation et les jalons du développement, un mécanisme visant à promouvoir un réel continuum de formation médicale, ainsi qu'une méthode permettant de promouvoir un curriculum axé sur l'apprenant dans le contexte de la responsabilité. La responsabilité est au cœur de la FMAC, ce qui permet d'assurer l'obtention de diplômés épanouis et compétents qui seront en mesure d'offrir des soins sûrs et efficaces aux patients.

Dans le domaine de l'obstétrique-gynécologie, la structure de la FMAC doit être fondée sur la pratique canadienne et la refléter. Son élaboration et sa mise en œuvre nécessitent une compréhension des principes qui étayent la FMAC, en plus de solliciter la participation de l'ensemble de la communauté des obstétriciens-gynécologues et celle d'autres fournisseurs de soins de maternité.

Nous offrons ici un aperçu des principes de base de l'enseignement et de l'apprentissage, et des théories qui sous-tendent la FMAC.

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INTRODUCTION

The Royal College of Physicians and Surgeons of Canada has embarked on a major shift in medical education. Competency-based medical education (CBME) is central to its new competence by design framework.[1,2] CBME is an integrated, longitudinal, trainee-focused approach "to preparing physicians for practice that is fundamentally oriented to graduate outcome abilities and organized around competencies derived from an analysis of societal and patient needs. It deemphasizes time-based training and promises greater accountability, flexibility, and learner centeredness."[3]

TEACHING AND LEARNING

CBME is based on essential principles of teaching and learning. Learning is an active process; teachers cannot simply transfer knowledge, but must enable the construction of knowledge and meaning by the learner. Elements of effective teaching include:

a) a positive learning environment that provides an appropriate level of challenge;

b) interactive teaching, which is contextual and builds on prior knowledge and experience; and

c) enthusiastic, engaged teachers who are sensitive to different learning needs and styles.

Experiential and contextual learning are approaches that allow learners to process their experiences, produce constructs based on contexts, and build on prior knowledge. Learner-centred goals support engagement. Knowledge retention is significantly improved if the learning can be placed in an organized context. Interaction and timely formative feedback, paired with self-reflective practice, embed and guide learning while engaging the learner.

Bandura, through social learning theory, has argued that people also learn within a social context, acquiring new information and behaviours by watching others.[4] This observational learning, or modelling, emphasizes how modelled behaviour (the desired result of our teaching) is dependent on factors that are innate in the learner and also in the learning environment. The interactions between the modelled behaviour, the learning environment, and the innate characteristics of the learner can either enhance or impede learning.

Learning is best facilitated in a safe and supportive environment that allows learners to make mistakes with minimal consequences, in order to gradually expand their envelope of skills and knowledge. At each stage of the learning process, skills build on previously acquired skills as confidence and mastery increases. Appropriately timed "letting go" allows trainees to expand their current skills. Four factors affect the timing of a reduction in supervision:

a) the ability of the trainee,

b) the personality of the supervisor,

c) the environment and circumstances, and

d) the nature and complexity of the activity.[5]

There may also be medico-legal guidelines regarding learners' supervision and their scope of practice which affect the teacher's ability to allow trainees to act independently in the clinical environment. However, an important concept for learning is "constructive" or "cognitive" friction, which involves allowing learners to attempt the performance of a task just beyond their zone of competence.[6] The learning environment must place trainees in their cognitive friction zone in order for them to increase their competence.

The cognitive load of a trainee is composed of germane, intrinsic, and extraneous components.[7] The germane load refers to the mental energy spent processing and developing a framework for thinking about something. The intrinsic load represents the mental energy required due to the inherent difficulty and complexity of the material. The extraneous load refers to the mental energy required as a result of the way the material is presented to the learner. Both intrinsic and extraneous loads are case-specific, with their impact decreasing as learners develop coping mechanisms.[8] Early learners face heavy germane loads.[9] Learning increases with workload until the point at which the learner is overwhelmed and is no longer able to process further learning, developing a state of cognitive overload. Hence, continuing workload reaches a point at which learning begins to decrease. The workload at which each trainee optimizes their learning increases as competence is gained.[8] However, the optimum workload is also affected by external influences such as fatigue and other stressors, and teachers need to learn to identify situations in which learners are at risk for this cognitive overload.[6]

Good clinical teaching is a layered process, requiring effective direct observation, feedback on clinical performance, and directed teaching. During any clinical encounter, there should be direct observation of communication, collaboration, technical skills, diagnostic skills, decision-making, and judgement. Feedback can be given on these components and clinical "pearls" can be added. Direct observation and feedback on clinical performance set the stage for directed teaching, which can include formal teaching of both technical and non-technical skills, diagnosis, treatment planning, and use of collaborative resources. Clinical teaching can be implicit—teaching inferred from what is done or said in a clinical encounter—or explicit, including a discussion of what has been said and done to make a point. An important part of directed teaching is for the teacher to reflect on the salient points of the implicit role modelling with the learner to make those points explicit in the teaching encounter.

This cycle of direct observation followed by feedback on clinical performance followed by directed teaching, becomes an iterative process. Each episode of directed teaching provides a context into which the next direct observation is placed, and is followed by further feedback on clinical performance and directed teaching. In a setting of mentorship, longitudinal assessment, and teaching, the competency-building process is composed of successive cycles of the above to produce a competent practitioner, ultimately transforming a novice into an expert.

NOVICE TO EXPERT

To become an expert, one of the key skills a novice needs to acquire is clinical reasoning.[10] Learners must translate their clinical reasoning skills at each stage of development into formed behaviours. Clinical reasoning is dependent on two processes: the analytic method and the non-analytic method, or pattern-based recognition. The importance of the content and context (setting and circumstances), as well as personal influences (beliefs and attitudes) in creating these

relationships makes each pattern unique to the individual case. More experienced learners or experts rely on pattern recognition, which appears to others as "intuition."

The progression from novice to expert can be summarized in the Dreyfus Model, as outlined by Carraccio et al.[10] Novices are rule driven, using analytic reasoning and rules to link cause and effect. Their ability to synthesize information is limited, and the ability to generate the "big picture" is imperfect. In essence, novices don't know that they don't know. The novice must be given both knowledge and the appropriate modelling of desired behaviour in order to progress to the advanced beginner phase.

Advanced beginners know what they don't know and can begin to practise skills under full supervision. The advanced beginner is able to:

a) sort through rules and information to decide what is relevant on the basis of past experience,
b) use both analytic reasoning and pattern recognition to solve problems, and
c) abstract from concrete and specific information to more general aspects of the problem.

The competent trainee is able to perform the tasks and roles of the discipline, but with restricted breadth and depth. At the competent stage, the trainee demonstrates an increasing sense of responsibility for patient care. The process of clinical reasoning shifts from methodical and analytic to a more readily identifiable recognition of patterns, so that competent practitioners are able to see the big picture in the case of common clinical problems. Complex or uncommon problems still require more reliance on analytic reasoning.

Proficient trainees, performing at the next level of competency, are consistent and efficient in the performance of their tasks and roles. Proficient practitioners know what they know and what they don't know. At the proficient stage, a practitioner's breadth of past experience allows reliance on pattern recognition of the presentation of an illness, so that clinical problem-solving seems intuitive. However, proficient practitioners still rely on methodical and analytic reasoning for managing problems, as they have less comprehensive experience in management than in illness recognition because of the exhaustive number of permutations and responses within management. They are comfortable with evolving situations because they are able to extrapolate from a known situation to an unknown situation, and are more comfortable with ambiguity.

An expert has in-depth knowledge of the discipline, much of which is rule-based. They know what they know. Their thoughts, feelings, and actions align to intuitive problem recognition, and intuitive situational responses and management. They are open to noticing the unexpected, and often welcome the attendant challenges. They are able to perceive discriminating features that do not fit in a recognizable pattern.

At the pinnacle is a master, an expert who thrives with, and in, situations that break the rules and whom experts look to for advice and assistance. The master exercises practical wisdom and transcends the "big picture" to appreciate the even larger picture of the culture and context of each situation. A master is intensely motivated to pursue ongoing learning and improvement, and habitually reflects "in, on and for action."

The development of expertise is from unconscious incompetence to conscious incompetence, then to conscious competence and to unconscious competence; this transforms the novice through reflective practice to expert.[11]

CONSTRUCTION OF COMPETENCY

At the heart of the development of competency is the concept of deliberate practice.[12] Deliberate practice refers to the process whereby learners begin with an intention to improve some aspect of their performance or well-defined task, and after performing the task receive immediate detailed feedback, intended to improve the subsequent performance of the same or similar tasks. This process is repeated until competence is achieved.

There is a significant association between reflection and deep learning.[13] A sustained, disciplined approach to learning and deliberate practice requires motivation and self-regulation.[14] Motivation provides a general energizing force to engage, while self-regulation is the process by which people organize and manage their capacities.[15] Goals drive improvement. Specified attainable goals are associated with learners exerting greater effort, spending more time, and persisting longer with learning tasks.[11] Underlying success is self-efficacy or the belief that one has the capabilities to succeed or accomplish a task. This belief is associated with motivation and self-regulation and, not surprisingly, is more marked in experts than non-experts.[16]

Competency development requires specific conditions. Learners need to observe models and exemplars that illustrate the "to-be-learned" processes and outcomes.[14] They then need to be allowed to perform focused practice and rehearse specific skills, whilst receiving immediate and informative feedback in a defined setting. They should then be encouraged to perform these skills in diverse settings. To complete the loop, they must reflect on their performance.[14] Central to the development of competency

Comparison of the current system of structure and process-based assessment with competency-based assessment

Variable	Structure and process-based	Competency-based
Driving force for curriculum	Content—knowledge acquisition	Outcome—knowledge application
Driving force for process	Teacher	Learner
Path of learning	Hierarchical	Non-hierarchical
Responsibility for content	Teacher	Student and teacher
Goal of educational encounter	Knowledge acquisition	Knowledge application
Typical assessment	Single subjective measure	Multiple objective measures ("assessment portfolio")
Assessment tool	Proxy	Authentic (mimics real task of profession)
Setting for assessment	Removed (Gestalt)	"In the trenches" (direct observation)
Assessment	Norm-referenced	Criterion-referenced
Timing of assessment	Emphasis on summative	Emphasis on formative
Program completion	Fixed time	Variable time

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is the process of longitudinal direct observation with scaffolding, during which teachers provide successive levels of temporary support that enable learners to attain successively higher levels of comprehension and skill acquisition.[17]

ASSESSMENT IN COMPETENCY-BASED MEDICAL EDUCATION

Our current assessment systems rely heavily on traditional limited methods, such as examinations, ward assessments, and in-training evaluation reports, with minimal direct observation in the clinical setting and little assessment that is formative. A summative assessment usually encompasses the familiar 1 to 5 Likert scales for abstract "competencies." This system leads to assessors improbably rating almost all learners as above average and using comments such as "A pleasure to work with . . .," rather than rating and commenting on observable and measurable behaviours.

The CBME assessment model proposed by the Royal College of Physicians and Surgeons of Canada is an integrated, longitudinal, learner-centred assessment system that promotes residents' acquisition of skills in multiple domains. The model facilitates assessment of tasks that residents actually perform in practice, relying on direct observation that allows formative feedback.[3] Effective teaching in CBME is guided by continual assessment of learners' progress.

Carraccio et al.[18,19] have provided a detailed comparison of the current system of structure and process-based assessment with the competency-based assessment required for CBME (Table). The driving force for curriculum development shifts both from content and knowledge acquisition to outcome and knowledge application and from teacher to learner. The learning path progresses from hierarchical to non-hierarchical, as the responsibility for content becomes shared between the student and the teacher. Learner-centredness is promoted as trainees are encouraged to take responsibility for their progress and development. The typical assessment is no longer a single subjective measure, but now consists of multiple objective measures, which are authentic, i.e., mimicking real tasks of the profession. The assessment setting is "in the trenches," with direct observation in the clinical setting, and is no longer remote. Evaluation becomes criterion-referenced rather than norm-referenced. The emphasis is on formative rather than summative assessment. Program completion time moves from fixed to variable, with the length dependent on the progress of the learner.

CBME is outcome-based rather than process-based. The focus is on the acquisition of multiple competencies, ensuring every graduate is prepared for practice. The benefits of CBME are manifold.[3] It offers a new paradigm of competence with a renewed commitment to outcomes, a new focus on assessment and developmental milestones, a mechanism to promote a true continuum of medical education, and a method to promote learner-centred curricula. CBME allows standardization of assessment, enabling the potential for portability of training. Transitioning to this completely different paradigm will certainly create significant upheaval, so we must seek to reduce logistical chaos. There is the potential for a loss of the authenticity that exists within our current training programs, including mentoring. There will most certainly be a need for new educational technologies, appropriate resources, and faculty development. Some of the greatest challenges will arise from systemic and individual inertia.

DISCUSSION

The shift to CBME is already taking place in both North America and Europe, and CBME lies at the heart of CanMEDS 2015.[2] There is an underlying supposition that CBME will enable us to guide the training of our learners so that upon graduation they will demonstrate competence in the multiple domains of practice required to meet the health care demands of the 21st century, but this has not yet been proven. However, as clinician-teachers and educators in obstetrics and gynaecology, we have a duty of care to the women and children of the future to produce competent, caring, and well-rounded practitioners. As CBME brings an increased emphasis on accountability and assessment, and is rooted in sound educational principles, it provides a sound foundation on which to base curricular reform. Under the aegis of the Academic Professionals in Obstetrics and Gynecology, CBME initiatives have been launched in academic departments across Canada. One example is a CBME assessment pilot in the maternal–fetal medicine and reproductive endocrinology and infertility rotations at the University of Toronto.[20] Other initiatives are being launched in Canadian residency programs, many of which are being shared through Academic Professionals in Obstetrics and Gynecology Postgraduate Committee and website. For those seeking additional information about CBME, an annotated bibliography[21] and an emodule[22] are available online.

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*To extract the emodule, click on the zipped module folder and open with Windows Explorer then click on "Launch Presentation" and it will ask you to extract embedded files. Reply "Yes" and choose an appropriate folder to place the extracted files. Open that folder and click on "Launch Presentation" in the unzipped folder and it will run. Unfortunately this module can only be unzipped in Windows but once extracted can be copied to a Mac and run there.