Chapter 9
Curriculum, Course, and Faculty Development for Case-Based Clinical Reasoning

Olle ten Cate and Gaiane Simonia

The current chapter gives a brief overview of the conditions for developing a modern curriculum for medical education to include CBCR and about faculty development for CBCR teachers. The introduction of CBCR is only one element of a full curriculum; yet, just as a complete curriculum, it requires careful planning.

A Brief Introduction to Curriculum Development

"Curriculum," sometimes simply defined as "a planned educational experience" (Thomas et al. 2016), has evolved as a concept to be applied to several levels of education: a macrolevel (requirements defined by a government for an accredited or subsidized course), a meso-level (a plan for a school with university rules and methods of teaching and assessment), and a microlevel (an instrument to guide a classroom teacher in determining content and methods to be used in individual lessons). While this is informative, it still is very general. Janet Grant proposed that a curriculum is "a statement of the intended aims and objectives, content, experiences, outcomes and processes of an educational program, including a description of the training structure and of the expected methods of learning, teaching, feedback and supervision" (Grant 2010). To be even more practical, Mulder and ten Cate, based on extensive experience with curriculum development, constructed a ten-element

O. ten Cate (✉)
Center for Research and Development of Education, University Medical Center Utrecht, Utrecht, The Netherlands
e-mail: T.J.tenCate@umcutrecht.nl

G. Simonia
Tbilisi State Medical University, Tbilisi, Georgia
e-mail: gsimonia@gmail.com

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definition that can guide educators embarking on major curriculum innovation projects (Mulder and ten Cate 2006). A full curriculum description, in this approach, includes a mission statement, objectives, a description of intended learners, an educational philosophy, a general curriculum framework, descriptions of individual units or courses, methods of assessment with rules on student progress and examinations, an organizational and management structure, clear conditions for teaching personnel, finances and facilities, and a quality assurance structure. All of these deserve a much wider elaboration, but for the purpose of this book, we will confine the description to Table 9.1.

These elements comply with international standards for medical curricula (Lindgren 2012). However, it should be realized that a curriculum is a living thing that is only effective in the way it is delivered by teachers and received by students. Authors have distinguished the *planned* curriculum (as exemplified above), the *delivered* curriculum (as understood and carried out by teachers), the *experienced* curriculum (as perceived by students), and even a *hidden* curriculum (not reflected in formal rules and intentions but conveyed implicitly by the unwritten rules and observed behaviors) (Prideaux 2003; Hafferty and Franks 1994). We cannot and should not avoid differences between these "curricula" but must be aware of them and cautious that pathways students follow, even if not designed by curriculum developers, are effective in their learning toward common goals of medical education. There are many "pathways to Rome," and, around the world, there are many routes to the medical degree (Wijnen-Meijer et al. 2013). There is not one "best" curriculum, and the success of a curriculum is very dependent on the students who follow it and the local and national context. Students' motivation to become a doctor can make them just do anything that seems appropriate to get the degree, no matter what curriculum or even in which country or jurisdiction. This individual intrinsic motivation should be valued and stimulated, even with their deviations from a planned path, as long as student creativity is constructive for their own career development (ten Cate et al. 2011).

The Process of Curriculum Development

The curriculum development process for medical education is originally well described by Kern and colleagues from Johns Hopkins University School of Medicine, now revised by Thomas et al (2016). In elaborate and widely used guidelines, the authors recommend to committees embarking on a curriculum development process, to follow "Kern six steps" (slightly adapted):

1. *Problem identification and general needs assessment*: Why is change necessary? What health problems in society have priority in a new curriculum?
2. *Needs assessment of targeted learners*: Curricula will work best if students feel motivated to spend effort in learning, so identify them and query them.

Table 9.1 Ten elements that constitute a curriculum description

	Element	Description
1	Mission statement	This is a carefully stated, well-considered rationale, no longer than one paragraph that summarizes the overall intention of the curriculum.
2	Objectives	An overview is provided of the learning goals of the curriculum, preferably meeting the needs of society on a national level, thus reflecting what graduates must have mastered. Elaborate objective frameworks, such as derived from Bloom can be found on the Internet (Bloom et al. 1956).
3	Intended learners and admission policy	The type of students and their backgrounds that the school desires to attract, including criteria for selection and admission, are described.
4	Educational philosophy	This paragraph shows how the curriculum committee grounds decisions of the practical implementation and may include aspects of educational theory, integration, problem-based approach, and views on clinical teaching.
5	Curriculum framework	Visualization of the curriculum is important to communicate with all faculty and students involved in planning and delivering the curriculum. A chart showing all individual curriculum units, arranged by weeks of the year (vertically) and program years (horizontally) and by color to signify unit types is often used.
6	Individual units	Each unit, sometimes called course or module, must be described as a micro curriculum in itself with objectives and methods of teaching and assessment.
7	Methods of assessment and rules on progress and exams	Assessment approaches can be derived from Miller's pyramid (Miller 1990) and should include written (or electronic) tests, standardized skills assessment, and methods of assessment in the clinical environment. Important are rules for progression of learners, as this is what concerns many students most when they follow a curriculum; these rules should be carefully designed to stimulate learning in the direction of the real goals of education.
8	Governance, coordination, and administration	A powerful curriculum governance structure must be in place to guarantee collaboration of departments, integration where necessary, and quality control. Tasks for program and course directors should be specified. Student and examination data must be efficiently collected and stored. A central medical education unit is highly recommended.
9	Funding and facilities	Conditional for high-quality education is sufficient funding for teaching time and support, and physical facilities, such as suitable classrooms, internet and library access, and a skills lab.
10	Quality assurance and faculty development	Every curriculum must continuously be monitored for its quality and modified if needed. *Plan-do-check-act* is a well-known cycle that can establish the foundation for a curriculum quality assurance procedure. Teachers should be trained and qualified to teach, particularly when the education is not identical to their own education. Understanding the learning process of students is crucial for effective student-centered education (ten Cate et al. 2004). Teachers in medical schools must be provided time to teach and rewarded for high-quality teaching.

3. *Goals and objectives*: Specific and measurable learner objectives, behaviorally formulated, will help to monitor progress of students.
4. *Educational strategies*: Objectives should lead to the choice of suitable methods of teaching to attain these objectives.
5. *Implementation*: Starting a new curriculum involves identifying resources; obtaining support, administrative structures, and communication strategy; anticipating barriers to change, and piloting before full implementation.
6. *Evaluation and feedback*: This includes the identification of users, resources, and issues that circulate, to design procedures and questions, choose or construct measurement instruments, collect and analyze data, and efficiently report results, feeding into a new cycle of quality assurance.

This summary combines a process that may take years to prepare and execute, but all steps are important. Two decades ago Gale and Grant compiled an AMEE Guide that is still extremely helpful in change management for medical curricula (Gale and Grant 1997).

Course Development for CBCR

Introducing just CBCR on top of a medical curriculum that already exists is possible and does not require a major organizational change in infrastructure and a long timeline to fundamentally reform a full undergraduate program. In fact, the introduction of a CBCR course following the format presented in this book can be relatively simple. However, a case-based clinical reasoning course as described in earlier chapters exemplifies many of the characteristic of what has been called a "modern" medical curriculum, since an acronym for that (SPICES) was introduced in the 1980s (Harden et al. 1984): Student centered (particularly through the peer teaching approach), Problem based (clinical problems are the focus), Integrated (its differential diagnostic approach crosses the boundaries of clinical specialties, and applied basic science can be incorporated), Community based (depending on the cases used, this can be a focus), elective (the course is usually mandatory but can be elective), and Systematic (CBCR is an example of a very systematic approach to clinical education). Introducing CBCR in an existing traditional curriculum, as has been done in several Eastern-European countries, can be a first step to a school acquainted with modern approaches to medical education.

In Table 9.2 steps for course development are suggested, with reference to both Kern's six-step approach and the definition of a curriculum given earlier. As CBCR is only a course, the development is simplified.

The implementation of a new CBCR course should be planned well ahead. Particularly the writing of high-quality cases can take much more time than one would initially think or hope. Some clinicians are excellent, naturally born case writers; others need a lot of assistance and editing support. Given the fact that many will do this in spare hours, the planning ahead of a new CBCR course should take at least one full year before the real start.

Table 9.2 Elements of CBCR course development and implementation

1	*Educational needs assessment*
	The school must feel the need to introduce CBCR, so some effort to assess this need is helpful to secure support and a general agreement before starting the course development. This need could be (a) the wish of clinical teachers to see students better prepared when they must take up patient care responsibilities. Clinical reasoning is at the core of health care, and students must be well trained to think like a doctor; (b) just the wish to experiment with curriculum modernization without an early disruption of the full existing curriculum. Introducing CBCR can very well be this first step before a more systematic creation of an integrated curriculum; or (c) a wish from students or science faculty to integrate basic science education more with clinical thinking.
	The needs assessment can be simply carried out by structured interviews or a questionnaire among carefully selected stakeholders (clinicians, basic scientists, students). A clear, concise report may ease the way to a decision by the right body (committee, dean, board) to proceed with the course development.
2	*Content needs assessment andobjectives*
	A content needs assessment gives an answer to the question: *which pathology has the priority to be translated in CBCR cases to be discussed and learned and, more detailed, in which curriculum year*? Basically CBCR can be introduced in the first curriculum year in a very integrated curriculum, but, as prior knowledge is applied in case discussions, students must have relevant prior knowledge. We recommend starting CBCR from the second year or later with cases that can increase in complexity. CBCR is meant as preparation for clinical rotations. Depending on the curriculum, CBCR can extend over the 2nd and 3rd and even 4th and sometimes even 5th year. The nature of a preclinical course will then be adapted, but the format can remain the same.
	Sources of information can be health statistics of the population of the country or of hospitals and practices. Cases for CBCR should reflect a broad range of relevant common medical conditions that have educational value.
3	*Intended learners*
	A decision should be made which students should follow this course and, in addition, how long and when the course is to be scheduled. In most cases it will be a mandatory course for all students, but in an initial pilot phase, it can be offered as an elective course.
4	*General course framework*
	This plan – for a full curriculum, this would be called a blueprint – can be summarized on two pages and should include the general objectives, case titles, number and duration of sessions, the clinical disciplines involved and number of cases per discipline, the origin of the cases (written by own faculty or derived from other sources, such as this book), size and number of student groups, rough scheduling (e.g., one session per 2 weeks at a suitable time), physical requirements (number of small-group class rooms needed), number of teachers (consultants) needed, and from which disciplines.
5	*Method of assessment and examination rules*
	This section of the plan should stipulate how many credits the course offers (in European credits, 5 sessions could be 1 EC, provided that these would include 1 peer teacher assignment), how satisfactory participation is awarded, and how acquired knowledge and skills are tested. Based on our experience, we recommend that 10–15 % of the final score is determined by active participation and 85–90 % on a written (or electronic) test.

(continued)

Table 9.2 (continued)

6	*Coordination and teachers*
	The coordination of the course should reside with a course director or course coordinator, preferably formally appointed by the dean or by a curriculum director. Consultants (teachers) from different clinical departments should be involved. It is a benefit if case writers also act as consultants, as this enables them to see how their case works out in practice and how the case can be improved if necessary. Consultants should be attached to a group for the full course, which means that they will not just guide the group within their own specialty. Given the consultant text version available and their general medical knowledge, preparation for a session is very feasible for nonexpert doctors. UMC Utrecht even has very favorable experience with senior medical students just before graduation acting as CBCR consultants (Zijdenbos et al. 2010). It is advised that the course director has a meeting at least once a year with all consultants.
7	*Funding*
	Funding of courses is organized very differently across schools, but as with any program, teachers should be available for both the course hours and its development and preparation. As a rule of thumb: writing a case should be calculated as 1 full week of work (40 h), updating the case about 6 h per year. A full course of 10 CBCR sessions should be awarded as 40 h per consultant (per session 2 contact hours and 2 preparation hours, which include correspondence and meetings). Preparing, administering, and analyzing exams can be estimated about an hour per student on average. Coordination by the course director may be calculated as 4–6 h per group per year. A quick calculation of the required funding per year for a full 10-session course for 300 students working in groups of 12 would amount to 400 h once and 1,600 h annually. Breakdown:
	- Development of cases: 400 h (only once)
	- Annual case updates: 60 h
	- Annual coordination: 140 h
	- Annual consultant effort: 1,000 h
	- Annual effort preparing, administering, processing exams: 300 h
	- Annual administration (student data, materials, evaluation): 100 h
	In addition, regular course administration printed materials and facilities require a limited budget. The consultant effort clearly requires the biggest funding, comparable with PBL funding. As said, however, junior doctors can be excellent consultants, if provided with high-quality cases and proper guidance, which would significantly lower costs.
8	*Program evaluation*
	A system of continuous course improvement should be devised. This should include the collection of information directly after sessions about case quality (what can be improved?), from both consultants and students, and also student information about teacher quality (how can faculty improve their teaching skills?) and about facilities (rooms, communication, organization). A curriculum program director can have an annual interview with the CBCR course director based on evaluation data and agree upon actions for next year.

The Aim of Faculty Development

Most faculty members of medical schools and medical universities have been trained to be adequate clinicians or scientists or both. Only a minority, although growing, has been trained to be a teacher, and it is odd to realize that as education gets more sophisticated – from grade school to university – fewer requirements apply for teaching skills.

Table 9.3 UMC Utrecht's model of teaching certificates for faculty

	Certificate or diploma	Target group
1	Student teaching certificate	Optional for senior medical students choosing an elective teaching rotation (ten Cate 2007)
2	Teaching certificate	Required for all faculty members
3	Advanced teaching certificate	Required for senior faculty in leadership roles
4	Postgraduate scholarly educator certificate	Optional for senior medical educators who aspire a career in scholarship of education
5	PhD diploma in health professions education research	For those educators aspiring to become researchers of education in the health professions

If teaching would remain identical over the years, teachers could learn the tricks of the trade from their colleagues and remember how they themselves received education. But in a rapidly changing world, education has become quite different by the time students are faculty members themselves and must start teaching students.

Medical educators around the world begin to agree that faculty must be trained before they should be allowed to teach, just as students cannot treat patients if not properly trained. In practice this is too strict a rule, but universities have started requiring new faculty to obtain a basic teaching certificate and an advanced certification for teachers in leadership positions. Table 9.3 shows the model that exists at the University Medical Center Utrecht as an example.

An elaborate framework of teaching competencies for medical educators is provided by Molenaar et al. (2009) and establishes an excellent grounding for faculty development. It distinguishes teaching domains (development, organization, execution, coaching, assessment, and program evaluation) and levels of responsibility (leadership, coordination, and actual teaching – macro-meso-micro), resulting in many detailed teaching competencies that deserve attention in trainings.

Faculty Development for CBCR

Faculty development just for a CBCR course is limited but necessary, and we recommend that it exists of the four components mentioned in Table 9.4.

The following section describes a case study of the introduction of CBCR in a Post-Soviet country. This curriculum and faculty development initiative was part of the EU-Tempus project Modernizing Undergraduate Medical Education in the Eastern Neighboring Area (MUMEENA) of the EU, carried out in the years 2011–2014.

Table 9.4 Components of faculty development for CBCR

1	*Written instructions*
	Written instructions about the background and practicalities of cases-based clinical reasoning education. This book can serve as the resource for this.
2	*Training of case writers*
	One strategy that has been used is to ask writers to make a first draft of a case based on the detailed guidelines in this book, present these drafts before a group of colleague case writers during a workshop, and ask for comments. Group discussions about the level of detail, related to the target group of students, are often very helpful. The session could be one afternoon (3–4 h with a 30 min break), and one case discussion could be 10 mins of presentation, followed by 20 mins of guided discussion in a group of six case writers. Next, multiple writers could be formed to mutually review and edit each other's cases over the course of some weeks to come. One coordinator, preferably a future course director, could be involved in the final editing of the case for consistency across cases.
3	*Training of consultants*
	Several instructional modes have been used. One is the creation and use of a film that shows the process of CBCR from the student perspective. That is quite an investment if done properly, but the result can be very instructive for new faculty members preparing to act as consultants. Another option is to observe a group while actually delivering a CBCR session. What is needed is a room that provides accommodation not only for the group and its consultant but also for an outer ring of observing faculty. It is helpful to have an experienced educator facilitate this process and apply a *time-in time-out* procedure. This means that the group proceeds with a regular CBCR session until the facilitator calls for a time-out, to allow for comments, questions, and answers from the outer ring audience, after which the group continues. Finally, didactic techniques to deal with group dynamic processes may be a topic for the training for all types of small-group teaching, including CBCR. See Fig. 9.1 for an example.
4	*Training of students*
	While strictly not faculty development, the instruction of students is important too. Even students have a teaching role, as they all must act as a peer teacher for multiple sessions. Specifically students who have no experience with open group discussions and those who are afraid to provide wrong answers in classroom sessions must develop a new mindset. Education of students is to help to correct mistakes, and only by asking about things students do *not* know, i.e., disclosing their ignorance, they can be corrected. CBCR is very much student centered and student driven, and this role may be very new for students. Before a first CBCR session and during a first session, there should be much space to discuss the procedural aspects of CBCR.

Case Study: Introducing CBCR at Tbilisi State Medical University, Georgia
As part of a project to modernize medical education in Eastern Europe, in 2011 a 3-year EU-funded project included the introduction of CBCR at six universities in three countries, one of which was Georgia. The following steps were taken:

1. *Introduction of the CBCR rationale and concepts*

   In January 2012, a workshop conducted by educators from UMC Utrecht, The Netherlands, was held at Tbilisi State Medical University (TSMU) to have faculty learn for the first time about this method and its significance for curriculum innovation. Previous evaluations of existing teaching methods had shown that graduates experience serious difficulties in clinical decision-making during residency. The workshop resulted in a proposal to select ten common medical

Fig. 9.1 A faculty development session at the University of Granada School of Medicine (2017) showing the demonstration of a CBCR session conducted by medical students, while faculty members are observing

conditions for elaboration in CBCR cases (swollen legs, cough, breathlessness, abdominal pain, loss of consciousness, arthralgia, urine incontinence, jaundice, tiredness, chest pain). It was also decided to introduce an extracurricular pilot CBCR course for third year students – at the so-called "preclinical" stage.

2. *Training in case writing and demonstration of CBCR*

   In March 2012, 10 active and enthusiastic faculty members, all of them clinicians and considered as prospective CBCR teachers (consultants), were trained during 1 week in CBCR methodology at the University Medical Center Utrecht, The Netherlands. The training focused on case writing and a demonstration of CBCR in practice by Utrecht medical students was given.

3. *Pilot introduction of CBCR and evaluation*

   Preceded by 5 months piloting of 10 CBCR sessions in and following a decision of the TSMU Academic Council, CBCR was included in 2012–2013 for 10 groups (135 students) in the third year of the undergraduate medical curriculum for 2 ECTS credits. The duration of each session, delivered once a week, was 3 h. By the end of each session, questionnaires were provided to all CBCR consultants and students. This showed that 96 % of all consultants valued CBCR as a useful course for learning clinical thinking and helpful to improve students' ability to resolve clinical problems. About 84 % of the students rated the CBCR course as an excellent teaching tool, teaching them the approach and attitude toward patient problems and the methodology of differential diagnosis, and in addition improved their communication and leadership skills.

4. *Formal decision to introduce CBCR*

   Based on this positive feedback, the TSMU Academic Council decided to consider CBCR as a compulsory course for all third year TSMU students from the 2013–2014 academic year, i.e., for 500 Georgian and 250 international third year students.

5. *Spread in other universities*

   Following the successful implementation of CBCR at TSMU, the course was also introduced in partner medical schools in Azerbaijan and Ukraine, likewise supported by workshops in Kiev and Baku.

6. *Lessons learned*

   The introduction of CBCR took 2 years of preparation, negotiation, and faculty development but was clearly successful. With respect to the teaching method, feedback from students revealed, next to general satisfaction, the following points for improvement or attention:

- During CBCR sessions the mere presence of senior clinician consultants can suppress student activity, in particular, communication initiative of peer teachers, clearly a further issue for teacher training.
- Not rarely, consultants tried to unduly interfere with case discussions in the group – another issue for training.
- There were sessions when students were less active, while peer teachers tried to recall previously memorized texts from their written materials – student instruction must stress their roles.
- Due to a yet limited number of CBCR case scenarios, it was not always possible to avoid disclosure of correct answers (i.e., diagnoses) to other students' groups if their session was scheduled at different times; it reveals the anxiety students feel to not know the "right" answer. Students must learn to understand that the reasoning process is just as important as the right answer.
- Several students have suggested to become involved in the CBCR case writing process themselves.

In sum, faculty development is important, but, as this example shows, it can be very successful.

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