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Twelve tips for using the Understanding by Design® curriculum planning framework in Medical Education

Alana D. Newell[a,e], Cara A. Foldes[b], Alison J. Haddock[a,c], Nadia Ismail[a,b], and Nancy P.Moreno[a,d,e]

[a] Department of Education, Innovation and Technology, Baylor College of Medicine, Houston, TX, USA
[b] Department of Medicine, Baylor College of Medicine, Houston, TX, USA
[c] Department of Emergency Medicine, Baylor College of Medicine, Houston, TX, USA
[d] Department of Family and Community Medicine, Baylor College of Medicine, Houston, TX, USA
[e] School of Health Professions, Baylor College of Medicine, Houston, TX, USA

BACKGROUND
Health professions faculty engaged in curriculum planning or redesign can struggle with developing courses or programs that align desired learner outcomes, such as competencies to be applied in a clinical setting, with assessment and instruction.

AIMS
Our medical school implemented the Understanding by Design (UbD) framework to achieve alignment of outcomes, assessments and teaching during the renewal of our four-year curriculum. This article shares our strategies and practices for implementing UbD with teams of faculty curriculum developers.

DESCRIPTION
The UbD framework is a 'backward' approach to curriculum development that begins by identifying learner outcomes, followed by the development of assessments that demonstrate achievement of competencies and concludes with the design of active learning experiences. UbD emphasizes the development of deep understandings that learners can transfer to novel contexts.

CONCLUSIONS
We found UbD to be a flexible, adaptable approach that aligns program and course-level outcomes with learner-centred instruction and principles of competency-based medical education and assessment.

KEYWORDS
Curriculum, planning, management, staff development, management, curriculum infrastructure, outcome-based

CONTACT Alana D. Newell adnewell@bcm.edu One Baylor Plaza, MS:BCM411, Houston, TX, USA

Introduction

Curriculum revision and renewal are a priority in medical education. In 2018, 84% of United States medical schools reported planning, implementing, or having recently completed an undergraduate medical curriculum update (Association of American Medical Colleges 2021). Meeting and assessing learner outcomes (e.g. competencies, milestones) is particularly important in curricular redesign. Additionally, most programs are attempting to align instruction with education best practices through integrated curricula, self-directed learning, a focus on patient-centered care, application of active learning approaches and the inclusion of health systems science (Joyce and McHale 2018; National Academies of Sciences, Engineering, and Medicine 2018).

This emphasis on learner outcomes and learner-centred instruction is consistent with a 'backward design' curriculum development approach. Rather than beginning curriculum creation with a list of topics to cover, 'backward' design begins with identifying and describing desired outcomes, followed by developing assessments and ending with planning learning activities. One framework, Understanding by Design (UbD), differs from general 'backward' approaches because it places explicit emphasis on the ability to transfer learning to new contexts (Wiggins and McTighe 2005). Specifically, knowledge transfer underlies the definition of 'understanding' in the UbD framework.

> To understand is to be able to wisely and effectively use—transfer—what we know, in context: to apply knowledge and skill effectively, in realistic tasks and settings… When we understand, we have a fluent and fluid grasp, not a rigid, formulaic grasp based only on recall and 'plugging in.' (Wiggins and McTighe 2005, p. 7).

UbD encourages designers to identify appropriate, aligned outcomes (desired results), assessments (acceptable evidence of these results), and instruction (learning experiences) that support the development of understanding for transfer (Wiggins and McTighe 2011).

The framework has been applied widely in grades K–12 (e.g. Whitehouse 2014), undergraduate education (e.g. Carlson and Marshall 2009) and, although uncommon, in health professions and graduate medical education programs (e.g. Joyce and McHale 2018). However, there is little documented use of UbD in undergraduate medical education (Min Simpkins et al. 2019). This is surprising because UbD explicitly focuses on assessing evidence of new skills or competencies and the transfer of these skills to new settings even though the UbD framework explicitly focuses on evidence of transfer. In addition, this focus on the measurable application of knowledge aligns well with performance-based recommendations for competency-based medical education (Harris et al. 2010).

Currently, there are few sources of guidance for curriculum design teams seeking to implement UbD in undergraduate medical education. At Baylor College of Medicine (BCM), we applied UbD in multiple courses, programs, workshops, and ultimately curriculum renewal in the School of Medicine, beginning in 2017. Here, we outline relevant aspects of the framework for curriculum design in undergraduate medical education and provide suggestions for its successful implementation.

Tip 1

Conceptualize 'understanding' in the UbD context

'Backward' design curriculum development approaches ask educators to define learner outcomes before crafting learning plans or activities. UbD goes further by focusing explicitly on outcomes that support the transfer of learning to new contexts (i.e. understandings) (Wiggins and McTighe 2005). Identifying these big understandings is central to the UbD framework, but as we began our curriculum renewal process, we found that the process of deciphering what was meant by 'understandings' in the framework and our context was one of the most difficult parts of the process, particularly in a large, interdisciplinary team with members of varying levels of curriculum design experience.

In UbD, understandings represent more than narrowed restatements of content (e.g. 'understanding' causes of a disease process) or a list of facts. Understandings reflect unifying conceptual lenses or inferences central to the discipline. Learners demonstrate understanding when they transfer and apply knowledge or skills to a new context (Wiggins and McTighe 2005). For example, a learner who understands how to conduct motivational interviewing for smoking cessation should be able to transfer this knowledge to conduct a motivational interview to encourage a patient to increase physical activity. A transfer is important because teachers can only provide instruction on a limited number of concepts or applications on any given topic (Wiggins and McTighe 2005), and learners must be able to apply it independently in new contexts in the future.

Although these concepts for transfer are of utmost importance, it was initially difficult for our faculty to think of the curriculum in terms of outcomes (what learners will know and be able to do) rather than lists of individual topics to be covered. In addition, we found that taking the time to discuss and conceptualize the UbD definition of understanding as 'transfer' is a necessary initial step. We suggest emphasizing that the initial focus of the design work will be on broad concepts, not individual objectives or topics, and explicitly outlining the kinds of concepts and contexts for transfer that are relevant at your institution.

The rapid growth of medical knowledge and the need for our learners to access and incorporate new knowledge effectively into their existing knowledge as practising physicians has created a significant demand for the ability to transfer over restatement of facts. The UbD framework enabled us to move our approach to medical education from fact-based recall of content towards a curriculum that emphasizes demonstration by learners of well-defined outcomes.

Tip 2

Start with big ideas to identify and prioritize key understandings

Once the curriculum group recognizes understanding, the next step in the design process is to identify and prioritize the required key understandings that learners will need to be successful. This process can be daunting if the curriculum designers are accustomed to rearranging and rewriting

lists of facts to be covered. We suggest beginning the process of identification and prioritization by examining descriptions of intended competencies or desired outcomes for the explicit or implied 'big ideas' across them (Wiggins and McTighe 2005). A big idea is a single guiding statement that unifies concepts, facts and skills needed to successfully transfer knowledge to new settings and encompasses all the possible combinations of behaviours and contexts for transfer (Wiggins and McTighe 2005). Sometimes, the big idea can be identified by asking, 'What larger concept, issue, or problem underlies…' or connects your course materials or topics (p. 74)? These are learner take-aways, and the standards by which you will drive your course, program or workshop. Identification of 'big ideas' may be familiar to faculty of problem-based learning (PBL) courses, in which big ideas are used to improve transfer, particularly from basic science to clinical applications (Norman 2009).

After a list of big ideas has been identified, it will need to be prioritized. Not every concept in your course should or can be covered; thus, UbD encourages prioritizing content and identifying the essential concepts that support the goals of the curriculum and transfer to the learner's ultimate settings. In the previous motivational interviewing example, the underlying big idea of respectful and empowering communication can be applied in many patient care contexts. At BCM, we ultimately prioritized our new curriculum to focus on the foundational concepts and life skills that our learners can transfer to their future context as practitioners. For example, instead of placing teaching emphasis on the list of drugs that inhibit or induce CYP3A4, the identified big idea is that the liver is an important site of drug metabolism with two general sets of reactions, phase I and phase II (Stringer 2022).

Tip 3

Differentiate between outcomes and objectives and identify the need for your context

Once your team has identified the big idea(s), the next task is to define the specific, aligned outcomes or objectives needed. The terms 'outcome' and 'objective' are frequently used interchangeably (Harden 2002; Prøitz 2010), but we suggest considering objectives as instructor or course-related (e.g. what the course will do), and outcomes as learner-related (e.g. what the learner will know and be able to do). For example, if the session objective is 'prepare learners to apply cardiovascular physiology to measure blood pressure,' the desired learner outcome is 'know and be able to perform the proper steps of taking a person's blood pressure (in a number of settings), taking cardiovascular physiology into account.' Different courses and programs require different kinds of outcomes; some span multiple sessions while others are better suited for single-lesson settings (Yeo 2019). Clarifying differences between outcomes and objectives and standardizing language for your curriculum development team will support consistency across sessions and the ability of the team to work from a shared understanding (Harden 2002). We found that faculty members are not necessarily accustomed to formulating measurable outcomes. Emphasizing

Bloom's (Bloom 1956; Marzano 2001) taxonomy and encouraging educators to start thinking about assessment and transfer early in the planning process was helpful. Thus, providing guidance and practice in how to create objectives or outcomes statements was especially helpful. We engaged a large team of faculty across disciplines that consisted of sub-teams with different starting points. The result of the standardization was consistency across the courses and program years.

Tip 4

Invest in the process and give yourself time to develop quality outcomes

Taking time to develop quality outcomes based on transferable understandings is essential. The volume and complex nature of medical knowledge necessitates a clearly organized, scaffolded approach, which can be implemented through succinct, verb-centered learning outcomes (Taylor and Hamdy 2013). Although it may necessitate multiple rounds of revisions, the process of writing quality outcomes requires thinking deeply about what learners should be able to do after the experience and ultimately provides a solid foundation for quality educational interventions (Webb et al. 2013). However, faculty members often have difficulty with writing outcomes (Aebersold 2019). Accordingly, familiarizing your faculty with Bloom's taxonomy (Bloom 1956; Marzano 2001) and its associated approach to scaffolding outcomes can provide a launching point for the process. These outcomes, when well-written, will drive the planning of assessments and learning activities. While time-consuming, high-quality outcomes help guide the purposeful integration of new information over time, enable benchmarking across years, and produce a robust structure that can guide curricular implementation and adjustments as learning environments and instructors change over time.

Tip 5

Keep outcomes in mind as you prepare for assessment development

After developing outcomes, the next step is assessment, described in UbD as 'evidence' of students' understanding or learning (Whitehouse 2014). The inclusion of multiple assessment approaches is recommended (Wiggins and McTighe 2005). Assessments scaffolded across multiple points (i.e. formative and summative assessments) build evidence of understanding and provide frequent feedback regarding learner progress and areas for improvement, benchmarked against the desired outcomes. This system of assessments aligns well with competency-based medical education, which focuses on desired abilities as outcomes of the educational experience (Frank et al. 2010), as assessments can be designed to prompt learner performances that provide evidence of progress toward each competency (Hurtubise and Roman 2014). This approach supports assessment *for* learning as opposed to the traditional assessment *of* learning.

Tip 6

Think beyond standard approaches when designing assessments

'Students reveal their understandings most effectively when they are provided with complex, authentic opportunities to explain, apply, shift perspective, empathize, and self-assess' (Authentic Education 2015). The UbD multidimensional assessment approach is highly relevant in medical education (McLeod and Steinert 2015) and presents an opportunity for innovation. UbD encourages assessments that are performance-based, thus providing numerous valid, robust approaches for learners to demonstrate knowledge or skill. For example, if an educator wanted to ensure that a learner could interview patients effectively, a simulation might be a reasonable assessment approach. Further, a well-designed scoring rubric would enable detailed and constructive learner feedback on key aspects of the simulation. In our experience at BCM, UbD provided space to innovate and rethink the assessment of outcomes as a way for learners to demonstrate transfer.

Tip 7

Embrace active and learner-centered approaches at the right time in the planning process

The final step in UbD, the design of learning activities, encourages the development of active, student-centered experiences that support learners' progress toward the desired outcomes (Wiggins and McTighe 2005). These approaches already have gained traction in medical education (e.g. Piper 2016). However, as with any learning approach, there are associated pitfalls. Learning experiences must be well-planned—use class time effectively, focus instruction on learner goals, and present content at an appropriate level—to maintain student engagement (White et al. 2014). While it is often tempting to start with 'fun projects' or specific strategies (e.g. role play), postponing the planning of learning experiences until after outcomes and assessments are delineated ensures alignment and, accordingly, course effectiveness. UbD is compatible with multiple modalities of teaching to effectively maximize learning and engagement, such as Team-Based Learning, and can optimize the impact of these approaches (Parmelee and Michaelsen 2010). We found it useful to monitor the work of small planning groups to help teams maintain their focus on the appropriate stage of the UbD framework, and delay their planning of actual class sessions until the appropriate time.

Tip 8

Understand your educational culture and prepare for resistance

Understanding the educational culture and climate at your institution prior to curriculum redesign is paramount, as 'changes that may be made to a curriculum are essentially changes in environments' (Genn 2001). While UbD is a highly suitable approach for medical education, it is not necessarily

intuitive and requires a shift from more traditional approaches, particularly because teaching for transfer ultimately leads to increased learner-centered teaching approaches (Wiggins and McTighe 2005). Your institution's culture will influence how quickly and smoothly changes to curriculum development processes and the curriculum itself are accepted and implemented. Some resistance should be anticipated. Faculty members may feel that new approaches reduce their level of curricular control or represent a negative critique of their current instructional approaches or course design (White et al. 2014). Resistance, misconceptions, and cognitive dissonance can come from students as well, leading to the additional reluctance of faculty to engage in curricular redesign. Resistance may also come from unanticipated stakeholders. We encountered trepidation from residents who completed medical school at BCM and felt defensive of the existing curriculum that had worked well for them, as well as from faculty members seeking academic promotion as educators who feared negative reviews from learners.

Given the multiple layers of hesitancy, we used a multifaceted approach to garner support for the renewal and UbD approach. First, we targeted multiple stakeholder groups. Support from executive leadership was critical, as was support from all students—incoming, as well as current and former because they communicate with each other—and all faculty, even those who may appear to be on the periphery of the education process. The second strategy was persistent and recurrent messaging to each of these groups across time. Multiple presentations and workshops were delivered across the institution, including at grand rounds, Faculty Senate, and the curriculum committee clarifying the reasons behind the changes (McLeod and Steinert 2015) and allowing space for stakeholders to express concerns about the implementation of the new paradigm increased their buy-in. Finally, we provided evidence-based reasoning and data for all proposed and implemented changes (Malik and Malik 2022).

Tip 9

Select appropriate stakeholders to optimize buy-in

Selecting the correct team members to maximize buy-in is necessary (McLeod and Steinert 2015). Blended groups that include students provide perspectives that may be lost if only faculty are involved (Dalrymple et al. 2017), and faculty at different levels of educational expertise can increase interest and engagement (Hagler et al. 2011). As you identify stakeholders, define appropriate roles for each group to provide opportunities for meaningful participation (Bovill et al. 2011). We found that engaging stakeholders broadly during brainstorming and then assigning a leadership team to parse out the essential pieces and present them back to the group kept the processes moving forward, even with varying levels of curriculum development expertise and familiarity with UbD.

To engage groups beyond students and faculty, we held frequent and open discussions with stakeholders – including student affairs, admissions, academic council, faculty development and our clinical affiliates – to share ideas and ensure buy-in and feasibility of different components.

Tip 10

Create a safe environment for experimentation and setbacks

Psychologically safe environments—those in which individuals can freely share ideas, ask questions, and learn without fear of judgement—are important in medical education (Hsiang-Te Tsuei et al. 2019). Psychologically safe teams show increased creativity (Kessel et al. 2012), productivity, and ability to learn from failures (Hirak et al. 2012). Accordingly, curriculum leaders and faculty members must provide an environment in which they can take risks and receive constructive feedback, both from learners and peers. Students may provide negative feedback, particularly related to new instructional approaches, as they do not always immediately embrace active learning despite evidence of its worth (Smith and Cardaciotto 2011). Preparing faculty and learners for changes and providing instruction for actionable feedback may help ease the transition.

To support this environment during the renewal process, all curriculum team members were equal co-creators and colleagues during the development process, referring to each other by first names. Medical students worked side-by-side with faculty and were responsible for presentations, literature searches and task forces among other components. This helped to ensure that the products created through the process benefit students, as well as further support buy-in and psychological safety.

Tip 11

Effective UbD implementation requires educator development

Curriculum development and teaching are different skill sets. Identifying faculty educators and the curriculum team's needs and scaffolding just-in-time professional development accordingly can result in improved curriculum development (Toor et al. 2020) and strengthen other skills. Development workshops with opportunities for practice can increase the team's knowledge of and ability to implement active learning approaches (Houseknecht et al. 2020). Small, collaborative group work is particularly valuable, as it offers opportunities for shared reflection and the development of relevant attitudes, knowledge and skills (Edmunds and Brown 2010).

In our experience, practising UbD in a workshop setting with all members of the development team allowed us to learn and explore the model together and ultimately develop comfort with the approach. To achieve a shared mental model and ensure the quality of the work, we suggest starting slowly by working through agnostic examples that everyone can understand, regardless of their content area or expertise (e.g. develop a set of big ideas, learner outcomes, assessments, and learning plan activities to teach 'how to mow the lawn'). Feedback and interaction enrich the process and lay the foundation for future curriculum planning. This was especially important as curriculum development members were onboarded at various times across the multi-year renewal process, and development workshops kept members on the same page. For faculty who will be implementing the curriculum, we also developed a structured approach to faculty development to ensure that everyone receives the appropriate training for their educational roles.

Tip 12

Foster a continuous quality improvement (CQI) mindset

The emphasis on defining outcomes and assessments—before planning instruction—is one of the most important aspects of UbD. It ensures that adjustments made to learning experiences still point learners toward the intended outcomes. Conversely, changing instruction without being mindful of outcomes or assessment might lead to learning activities that 'miss the mark' in terms of intended knowledge and skills.

UbD permits the collection of clear, sufficient data to measure learner understanding, and a CQI mindset can optimize this learning by permitting updates where needed while maintaining the structure of the course and alignment between the desired outcomes, assessments and learning experiences (Harper and Lattuca 2010).

Conclusions

UbD provides a framework that encourages diverse educator teams to develop curricula aligned with best practices in education. Focusing on transfer and understanding prioritizes content and skills learners will need in clinical contexts. A tight alignment between outcomes and assessments supports frequent opportunities for feedback on progress toward desired competencies and provides opportunities for innovative, learner-centred instruction. While the process requires unlearning traditional approaches to curriculum development, we recommend embracing the initial messiness while remaining disciplined and anchored in the desired outcomes. Although these tips are ordered, we emphasize that UbD is an iterative, not a linear process, as with each new aspect addressed, there may be a need to return to a previous step. Ultimately, our experience using UbD is that the process leads to flexible, high-quality educational experiences that are more interactive, learner-centered and aligned with core competencies than ones produced using a traditional approach to curriculum planning and design.

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Notes on contributors

Alana D. Newell, PhD, is an Assistant Professor in the Baylor College of Medicine Department of Education, Innovation and Technology, Houston, TX.

Cara A. Foldes, MD, MPH, is an Assistant Professor in the Baylor College of Medicine Department of Medicine, Houston, TX.

Alison J. Haddock, MD, is an Assistant Professor in the Baylor College of Medicine Department of Emergency Medicine and the Department of Education, Innovation and Technology, Houston, TX.

Nadia Ismail, MD, MPH, MEd, is an Associate Professor in the Baylor College of Medicine Department of Medicine and the Department of Education, Innovation and Technology, Houston, TX.

Nancy P. Moreno, PhD, is a Professor and Chair of the Baylor College of Medicine Department of Education, Innovation and Technology, Houston, TX.

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