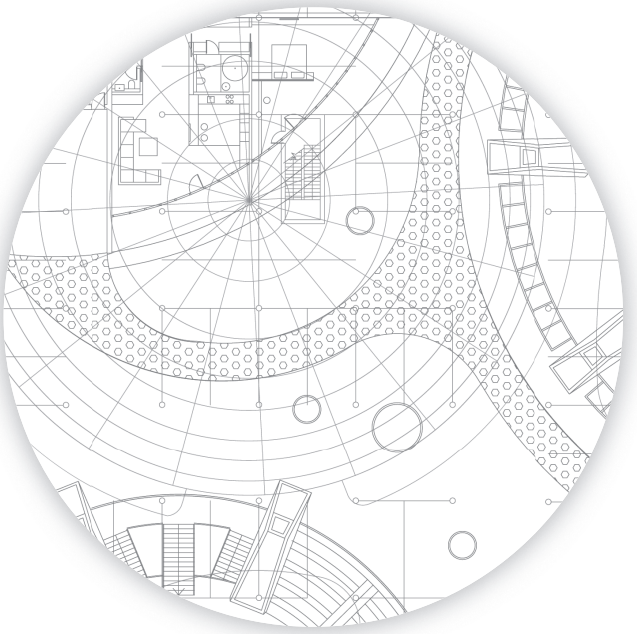
LEADING Modern Learning

SECOND EDITION

A Blueprint for Vision-Driven Schools



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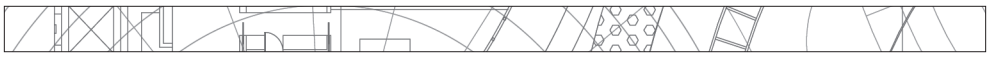


CHAPTER 3

Curriculum for Modern Learning

What are the building blocks for a curriculum that anchors modern learning, and how do we develop them?

The Latin origin of the term *curriculum* translates roughly as *the course to be run* ("Curriculum," n.d.), and it is useful to return to this linguistic root and think of a curriculum as the course or pathway to a destination. In education terms, the learning outcomes we desire for students—both within and beyond traditional academic disciplines—define our destination.

> ***A guaranteed and viable curriculum is the most significant school-level factor impacting student achievement.***
>
> **—Robert Marzano**

In this chapter, we explore our vision of the kind of curriculum necessary to prepare learners for their futures in a modern, yet ever-changing, world. We start by emphasizing the critical principles inherent in a modern curriculum, which includes highlighting the ways in which curriculum mapping has evolved and the challenges inherent in establishing a guaranteed and viable curriculum. We follow these with a curriculum blueprint presented as an analogy related to building construction that describes a framework for operationalizing an educational vision and mission into an impactful curriculum. Along the way, we'll reference the I-O-I and backward design frameworks from chapter 2 and provide a blueprint for crafting a curriculum. We conclude with an introduction to the concept of

cornerstone performance tasks, which provide an essential means to realize a coherent and vertically aligned 21st century curriculum.

Principles of a Modern Curriculum

We propose that a modern curriculum should focus on developing and deepening students' understanding of important ideas and processes to enable them to transfer their learning to new situations. A report from the Committee on Programs for Advanced Study of Mathematics and Science echoes our views in its characterization of a contemporary curriculum (National Research Council, 2002):

> Students presented with vast amounts of content knowledge that is not organized into meaningful patterns are likely to forget what they have learned and to be unable to apply the knowledge to new problems or unfamiliar contexts (Haidar, 1997). Curriculum for understanding provides ample opportunity for students to apply their knowledge in a variety of contexts and conditions. This helps them transfer their learning to new situations and better prepares them for future learning (Bransford and Schwartz, 2000). Providing students with frequent opportunities to apply what they learn in multiple contexts requires a reallocation of instructional time. Allowing time for in-depth learning means decisions must be made about what knowledge is of most worth. For this reason, the curriculum needs to specify clearly the appropriate balance between breadth and depth of coverage in terms of student learning outcomes. (p. 137)

The report goes on to propose a set of principles to guide curriculum design. Although this publication focused on high school mathematics and science, we believe that the principles they advocate are widely applicable and can thus serve as a guide for *all* curriculum design. Here is the committee's set of principles (National Research Council, 2002):

> A curriculum for understanding:
>
> 1. Structures the concepts, factual content, and procedures that constitute the knowledge base of the discipline around the organizing principles (big ideas) of the domain.
> 2. Links new knowledge to what is already known by presenting concepts in a conceptually and logically sequenced order that builds upon previous learning within and across grade levels.
> 3. Focuses on depth of understanding rather than breadth of content coverage by providing students with multiple opportunities to practice and demonstrate what they learn in a variety of contexts.

4. Includes structured learning activities that, in a real or simulated fashion, allow students to experience problem solving and inquiry in situations that are drawn from their personal experiences and real-world applications.
5. Develops students' abilities to make meaningful applications and generalization to new problems and contexts.
6. Incorporates language, procedures, and models of inquiry and truth verification that are consistent with the accepted practice of experts in the domain.
7. Emphasizes interdisciplinary connections and integration and helps students connect learning in school with the issues, problems, and experiences that figure prominently in their lives outside of the classroom. (p. 135)

Using these principles as a guide, let's take a closer look at how we might envision, design, and enact a modern curriculum. This includes examining how curriculum mapping has evolved and how we make a curriculum both guaranteed and viable.

An Evolving Approach to Curriculum Mapping

A modern education deserves a modern curriculum. Our conception of such a curriculum focuses on impacts (assessable student learning outcomes) rather than inputs (what will be taught). With clear long-term outcomes in mind, you can backward plan a curriculum to ensure a guaranteed learning pathway. We begin our description of a modern curriculum by considering curriculum mapping.

Curriculum mapping is a well-established process for ensuring a coherent and vertically aligned curriculum across grades. Unlike a lesson plan that focuses on specific learning objectives for a single session, a curriculum map records curriculum content over time, often for an entire school year. Typically, a curriculum map identifies *content* (what will be taught) as well as *when* it will be taught (and for how long).

We suspect that many readers have had some experience with curriculum mapping. Historically, there have been two major iterations of this process which we briefly describe below, followed by our proposal for the next generation of mapping, which is more suitable to modern learning. Are either or both of these first two approaches familiar to you?

Curriculum Mapping 1.0: Diary Mapping by Teachers

Fenwick W. English (1980) introduced the idea of mapping the curriculum in the late 1970s as a means of revealing what teachers were actually teaching. However, the widespread application of curriculum mapping didn't occur until the late 1990s, when Heidi Hayes Jacobs's (1997) influential book, *Mapping the Big Picture*: *Integrating Curriculum and Assessment K–12*, propelled it forward.

The first generation of curriculum mapping focuses on teachers generating personal *diary maps* of their teaching in which they recorded the unit topics and skills on a calendar map to show *what* they taught, *when* they taught it, and for *how long*. This recording of the actual *taught* curriculum enables teachers to meet in grade-level and department teams to share their individual maps to check for horizontal alignment across a grade or course (such as asking, "Are any important topics or skills being missed?"). Diary mapping also enables a vertical look at the maps across the grades, where teams can look for gaps (such as, "We found that no one is teaching how to write a research paper in high school language arts") as well as unproductive redundancies (such as, "We learned that a unit on dinosaurs is being taught in kindergarten *and* grade 2"). This review and analysis of individual maps ultimately lead to the development of *consensus maps* (Jacobs, 2004), whereby grade-level and department teams agree on the overall curriculum content and sequence to ensure greater consistency across classrooms (horizontal alignment) and across the grades (vertical alignment).

The emergence of software mapping programs such as *Curriculum Mapper*® (https://knowwhatyoutaught.com/software) and *Atlas Rubicon*® (www.rubicon.com) provide educators with electronic tools for entering and storing the maps while enabling a variety of reports to check for alignment. Electronic mapping offers two important advantages over paper printouts in binders: (1) immediate access to the curriculum maps for any teacher, administrator, and parents and students (when appropriate); and, (2) the capacity for quick curriculum updating. Without easy access, the curriculum could become dormant, ending up as a collection of dusty binders lacking the clarity and direction they were intended to provide. We must see curriculum as a living process, especially in a rapidly changing world with an ever-expanding knowledge base. Without the capacity to revise and update on the fly, curriculum documents can quickly become dated.

Curriculum Mapping 2.0: Standards-Based Mapping

In the 1990s, standards-based education became prominent in the United States and Canada. As states and provinces developed standards that they expected teachers to follow, a second generation of curriculum mapping emerged. Although states and provinces do not intend for these standards to be a curriculum, per se, such standards do specify the knowledge and skills that these entities expect students to learn in the various grades and courses. Thus, rather than having individual teachers create their own diary maps of what they teach, curriculum mapping 2.0 describes a group process through which teams of teachers review the adopted standards and *then* decide the scope and sequence for the curriculum accordingly. In larger districts, curriculum committees (rather than individual teachers) often generate the standards-based curriculum maps that all teachers are expected to follow. Some districts and schools went further, coupling the curriculum maps with pacing guides that specified the amount of time teachers should spend on designated topics and skills.

The purpose of second-generation curriculum mapping and pacing guides is to establish a guaranteed curriculum aligned with specific standards. Although well intentioned, we have witnessed an unfortunate effect of curricular pacing guides, especially those that are rigid and prescriptive, such as when a teacher is expected to teach a specific grade-level standard or be on a designated textbook page on a given date. The imposition of a rigidly paced scope and sequence, coupled with the previously mentioned problem of too much content specified by grade-level standards, can unintentionally encourage a coverage approach to teaching and the testing of discrete knowledge and skills. We believe this inevitably leads to superficial, disconnected learning. Moreover, because organizations develop standards primarily for traditional academic disciplines, 21st century skills and other transdisciplinary goals are likely to fall through the cracks of conventional teaching and testing of subject matter. (See Darling-Hammond, 2014a, 2014b; Jacobs, 2014a, 2014b, 2014c, 2014d.)

Curriculum Mapping 3.0: Outcomes Mapping Rather Than Inputs Mapping

To ensure that modern learning and transdisciplinary goals don't slip through the cracks, we propose a third generation of curriculum mapping as an alternative to a

scope-and-sequence map of discrete grade-level standards (knowledge and skills) in traditional subject areas. We recommend mapping the curriculum backward from long-term transfer goals, both disciplinary and transdisciplinary. (*Transfer* refers to the ability to apply learning to new situations, issues, and problems.)

This backward design approach to curriculum mapping shifts the focus from mapping long lists of grade-level content standards (inputs) on a calendar to a focus on outcomes—the long-term transfer goals and the associated performances we seek (impacts). Mapping the curriculum in this way ensures that the mission-related 21st century skills are fused—naturally and appropriately—with the teaching and assessment of academic standards. Ultimately, a modern curriculum should reflect a primary goal of preparing students to apply their learning to the unpredictable opportunities, problems, and challenges they will face.

The Challenge of a Guaranteed and Viable Curriculum

The opening epigraph for this chapter summarizes the findings of a meta-analysis of research (Marzano, 2003), and it underscores the primacy of curriculum in the enterprise of schooling. Moreover, it sets a standard for curriculum design and implementation at the district, school, and program levels. But what exactly does it mean to offer a guaranteed curriculum to all students?

Most modern public-school districts and many independent and international schools expect their teachers to teach according to established national, state, or provincial standards. After all, aren't standards meant to ensure a guaranteed curriculum? Perhaps, but this question leads us to examine the second descriptor in Marzano's (2003) finding—*viable*. His word choice is quite deliberate, reflecting an exhaustive analysis that he and his colleague, John Kendall, conducted at the McREL Regional Educational Laboratory during the first decade of the standards movement in the United States (Kendall & Marzano, 1997). They read and categorized all of the state standards available at the time and concluded that standards simply identified too much content.

Kendall and Marzano (1997) identify "200 separate standards and 3,093 benchmarks in standards documents from 14 content areas at the state and national levels . . . [and] estimated that it would take 15,465 hours for a teacher to cover all of those standards and benchmarks" (p. 104) They also estimate that "there are only 9,042 hours of available instructional time across grades K–12." (Kendall and Marzano, 1997, p. 104).

Kendall and Marzano (1997) conclude that a curriculum *cannot* be viable if a teacher is unable to teach all the listed content well because there is too much of it. Indeed, the problem they identify has led to a familiar characterization of curricula in the United States as being a "mile wide and an inch deep" (Schmidt, 2003). Of course, one could talk faster in class to cover more content, but that only illustrates the critical distinction between *inputs* (what teachers teach) and desired *impacts* (what students actually learn)!

Since then, more iterations of national standards have emerged—including the Common Core State Standards for English language arts and mathematics (National Governors Association Center [NGA] & Council of Chief State School Officers [CCSSO], 2010b), the Next Generation Science Standards (NGSS; NGSS Lead States, 2013), the College, Career and Civic Life (C3) Framework for Social Studies (NCSS; National Council for the Social Studies, 2017), and the National Core Arts Standards (NCAS; n.d.)—and these have influenced revisions to individual state standards. Although this generation of standards has attempted to streamline the volume, nearly every teacher we meet points out that there is *still* too much content jammed into standards-based curriculum!

The casualties of an overcrowded curriculum result in a content-coverage approach in which the implied goal is to teach and assess each of the discrete knowledge and skill objectives listed in grade-level standards. The resulting focus on *inputs* (what is taught) can result in superficial learning and ironically undercut the intended impacts (meaningful learning outcomes). Anticipating this problem, the Kansas State Department of Education (2011) offers an important cautionary note about the purpose and use of standards:

> [Standards can] often result in a checklist of discrete skills and a fostering of skill-and-drill instruction that can fragment and isolate student learning in such a way that conceptual understanding, higher order thinking, cohesion, and synergy are made more difficult. Too often, the process of "unpacking" [standards] is engaged in an attempt to isolate the specific foundational or prerequisite skills necessary to be successful with the ideas conveyed by the overall standard, and is a common precursor to test preparation and reductive teaching. Although this process may be important work in some instances and certainly can be enlightening, it also poses substantial problems if those completing the work never take the time to examine the synergy that can be created when those foundational or prerequisite skills are reassembled into a cohesive whole. Metaphorically speaking, "unpacking" often leads educators to concentrate on the trees at the expense of the forest.

We agree. However, how then might we enact a modern curriculum that honors standards from the academic disciplines (without getting bogged down in trying to cover long lists of grade-level objectives) while also developing transdisciplinary modern skills and dispositions? In light of our recommendations in chapter 2 to distinguish inputs from impact (the I-O-I framework) and to use backward design as a planning process, it will not surprise you to learn that we propose that the key to avoiding an overly discrete and fragmented curriculum is to design *backward* from complex performances that require both content and transdisciplinary outcomes. In other words, educators should frame and develop a modern curriculum in terms of its desired *impact*—what we want learners to *be able to do* with their learning, instead of simply a list of content inputs to be taught.

Let's examine our proposed framework for a modern curriculum, introduced through an architectural and building analogy.

A Curriculum Blueprint

McTighe and Wiggins (2013a) offer a useful analogy for curriculum design: imagine that you are the owner of a construction company that has been contracted to construct a high-rise building. In this scenario, you would not start by just delivering building materials to a job site and telling the workers, "Here is a pile of materials for the third floor, and over here are the materials for the eighth floor, and over there, you'll find the twelfth-floor pile—now get to work." You would begin by consulting an architect who would develop a blueprint—a document that embodies the vision of the desired building and guides its subsequent construction.

We think this analogy also applies to the construction of a curriculum for modern learning. Just as an architectural blueprint offers a complete schema for a high-rise building, so too does a curriculum blueprint provide a macro-organizer; that is, a comprehensive view of the content and learning priorities for preK–12 schooling. Indeed, we need a vision to guide unit and lesson planning (micro level) to ensure that student learning is coherent and connected within and across the grades. A curriculum blueprint is also important to ensure that mission-related outcomes, such as critical thinking, civic engagement, and self-directed learning, won't fall through the cracks during conventional subject-matter instruction and assessment.

The curriculum blueprint we propose has four fundamental purposes.

1. It focuses on important learning outcomes or goals (*impact*), rather than only on knowledge and skills to teach (*inputs*) or curriculum materials (*outputs*).
2. It helps ensure a *guaranteed* and coherent curriculum by identifying the intellectual *through lines* (big ideas and essential questions) that spiral across the grades.
3. It serves as a prioritizing lens to ensure that the curriculum is *viable* and *feasible* to implement in the available time.
4. It systematically and regularly collects evidence of *authentic achievement* and *growth* of the most valued disciplinary and transdisciplinary outcomes.

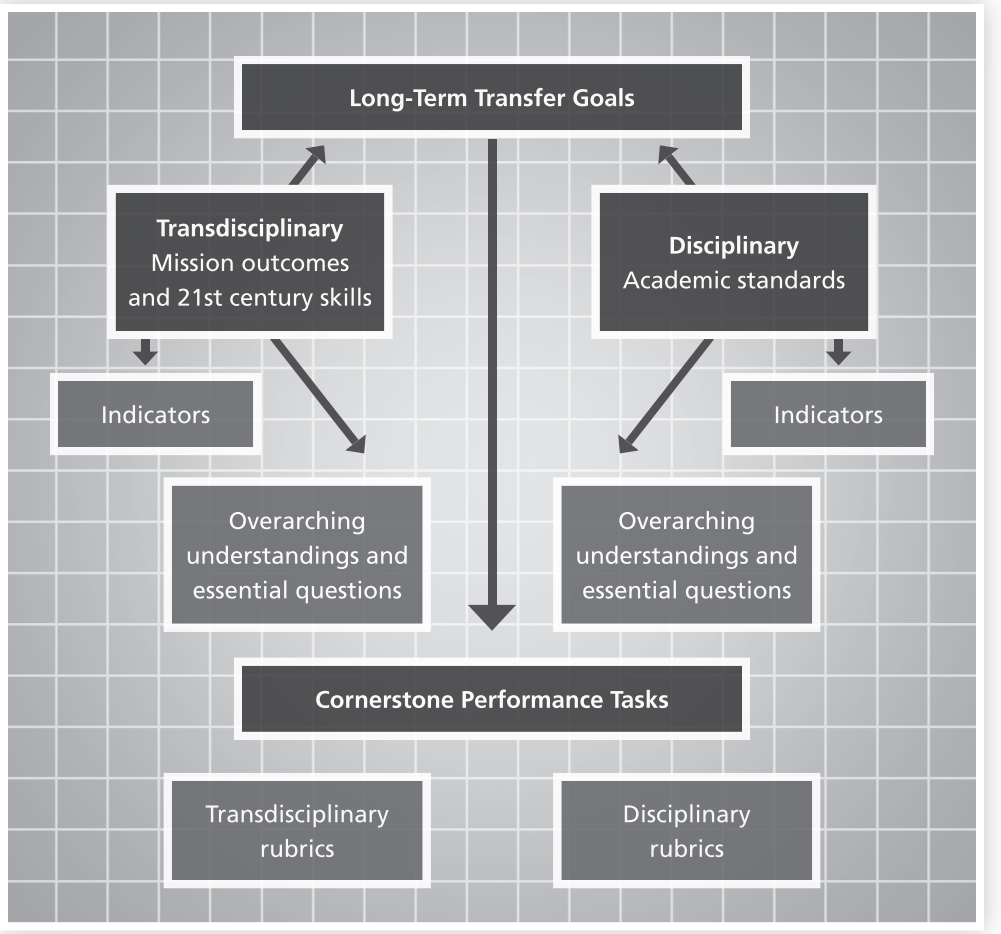
To picture such a curriculum, we start with a bird's-eye view of a high-level curriculum framework for district, school, and program levels. Think of MapQuest (https://hello.mapquest.com) or Google Earth (https://google.com/earth). In picturing a curriculum this way, you'll recognize many of the elements as emanating from the backward design template we introduced in chapter 2 (page XX). Figure 3.1 (page XX) presents a graphic representation of a blueprint that can guide the construction of a modern curriculum that is both guaranteed and viable.

We describe each of the elements in this high-level curriculum blueprint in the following sections.

Planning Backward From Long-Term Transfer Goals

We contend that a modern curriculum should prepare students to transfer their learning. As the name suggests, *transfer* refers to the ability to apply learning to new situations, issues, and problems. The capacity to transfer learning is a crucial ability in a world that is ever-changing and in which new opportunities and challenges abound. It is no longer sufficient for contemporary education to simply equip learners to give back existing knowledge or to learn only in one context.

Moreover, transfer calls for autonomous performance; such as *learners need to be able to apply their learning independently, without prompting, within and across disciplines*. In the world beyond preK–12 classrooms, no professor or boss is likely to guide or direct a student's every action. Transfer requires a person to intelligently, flexibly, and effectively draw from a repertoire of skills, strategies, and tools to independently handle various challenges.



Source: © 2017 by Jay McTighe. Used with permission.

Figure 3.1: A curriculum blueprint.

Acclaimed educational researchers John Hattie and Gregory Donoghue (2016) highlight this goal in their description of learning as "the processes of moving from surface to deep to transfer. Only then will students be able to go beyond the information given to 'figure things out'" (p. 11).

In *Education for Life and Work*: *Developing Transferable Knowledge and Skills in the 21st Century*, the National Research Council (2012) similarly characterizes transfer goals as the essence of 21st century learning:

> We define "deeper learning" as the process through which an individual becomes capable of taking what was learned in one sit-

> uation and applying it to new situations (i.e., transfer). Through deeper learning (which often involves shared learning and interactions with others in a community), the individual develops expertise in a particular domain of knowledge and/or performance. . . . The product of deeper learning is transferable knowledge, including content knowledge in a domain and knowledge of how, why, and when to apply this knowledge to answer questions and solve problems. We refer to this blend of both knowledge and skills as "21st century competencies." (p. 6)

Accordingly, our macro blueprint begins with long-term transfer goals that serve as the destination for a preK–12 curriculum. Transfer goals have four distinguishing characteristics (McTighe and Willis, 2019).

1. They are long term in nature, developing and deepening over time.
2. They are performance-based, requiring application in new situations, not ones previously taught or encountered.
3. They require autonomous transfer, without prompting or excessive teacher hand-holding.
4. They are assessed over time through performances in novel and authentic situations.

Long-term transfer goals can be discipline-specific as well as transdisciplinary. For example, a long-term goal in mathematics is for students to be able to tackle messy, real-world problems using sound mathematical reasoning. A long-term goal in history is for students to apply the lessons of history when considering contemporary issues. Note that some academic disciplines, notably Common Core mathematics (NGA & CCSSO, 2010b) and the Next Generation Science Standards (NGSS Lead States, 2013), include practices such as *model with mathematics* and *analyzing and interpreting data*. Respectively, these are inherently transfer goals. Also, transdisciplinary outcomes, such as *critical thinking*, *creative problem solving*, and *cooperation* are transfer goals since they specify what students will (hopefully) be able to do in a variety of situations—in school and life. Figure 3.2 (page XX) presents examples of long-term transfer goals for various disciplines (McTighe and Willis, 2019, p 51).

Students will be able to independently use their learning to . . .

In economics
Make economically sound and ethical financial decisions

In history
Use knowledge of patterns of history to help understand the present and prepare for the future

In health and physical education
Make healthful choices and decisions throughout their lives

In mathematics
Apply sound mathematical reasoning and strategies to tackle real-world problems

In research
Locate pertinent information from varied sources (print, online; primary, secondary)

In science
Conduct a sound investigation to answer an empirical question

In world language
Effectively communicate with varied audiences and for varied purposes while displaying appropriate cultural understanding

In writing
Write in various genres for various purposes and audiences

Figure 3.2: Examples of long-term transfer goals.

Source: McTighe, 2018.

Notes from the Field

To find disciplinary transfer goals, we often refer to the opening pages of standards documents where the long-term aims are articulated. For example, the Common Core State Standards' college and career readiness anchor standards for English language arts (NGA & CCSSO, 2010a) are transfer goals in that they specify the kinds of performances that, by the end of preK–12

schooling, students will need for success in higher education and the workplace. Here are two examples of these anchor standards (NGA & CCSSO, 2010a). Students should be able to:

- Read closely to determine what the text says explicitly and to make logical inferences from it; cite specific textual evidence when writing or speaking to support conclusions drawn from the text. (CCRA.R.1)
- Write arguments to support claims in an analysis of substantive topics or texts, using valid reasoning and relevant and sufficient evidence. (CCRA.W.1)

Transdisciplinary transfer goals, including 21st century skills and Portrait of a Graduate (see page XX), are often associated with an educational mission. Examples of such outcomes include *critical thinker*, *skilled collaborator*, *engaged citizen*, *creative problem solver*, *effective communicator*, and *self-directed learner*.

Once schools identify long-term transfer goals within and across the disciplines, the goals become the outcomes from which to plan a curriculum backward, from grade 12 to preK. Note that we do *not* expect that all teachers will identify their own transfer goals for every unit they teach. That approach would undercut two primary purposes of generating a curriculum blueprint.

1. Long-term transfer goals support a guaranteed curriculum because all teachers should be working collectively to develop and strengthen these goals across the grades.
2. Long-term transfer goals support a viable curriculum because teachers are encouraged to keep the long-term ends in mind and prioritize the content they teach accordingly.

Clarifying Transdisciplinary and Disciplinary Goals

Although we recommend that districts and schools identify long-term transfer goals, there is often a need for clarification—especially for those that are

transdisciplinary. Such outcomes can be ambiguous, as educators may have their own ideas about what, for example, *creativity*, *global citizen*, *critical thinker*, or *self-directed learner* actually mean. Although universally accepted definitions may not exist, it is essential that you operationally define these transdisciplinary, mission-based outcomes so that they are demonstrable, learnable, teachable, and can be communicated clearly and consistently. Absent clear definition, these larger goals may remain aspirational and elusive.

Furthermore, it is important to undertake this process early to ensure goal clarity from the start. Clearly defined transfer goals are necessary for effective curriculum design, assessment processes, instructional practices, and reliable reporting of students' accomplishments and growth. Figure 3.3 (page XX) presents one example of defining a transdisciplinary outcome.

Transfer goal: Self-directed learner
Definition: A self-directed learner can independently set goals related to learning, plan for the achievement of those goals, independently manage time and effort, and assess the quality of learning and any products that result from the learning experience.

Source: Adapted from Catalina Foothills School District, Tucson, Arizona, 2008.

Figure 3.3: Operational definition of transdisciplinary outcomes.

Establishing a working definition for each of the long-term transfer goals is a necessary first step toward clarity. The next step—identifying performance indicators—ensures greater precision by identifying observable and assessable indicators. Performance indicators answer the question: What would we see or hear in a student who is transferring this skill? Thus, performance indicators provide the specificity necessary to assess the transfer goals. Additionally, they serve as targets for instruction as educators work with students to develop their transfer abilities.

A T-chart offers a practical tool for identifying performance indicators. Figure 3.4 (page XX) illustrates the use of a T-chart for the transdisciplinary transfer goal of a *critical thinker*. Notice that the left side of the chart lists specific traits that characterize an individual who thinks critically, whereas the right side of the chart contains behaviors that illustrate a person who does not demonstrate these behaviors. Developing indicators using a T-chart process not only serves to

clarify meaning but also characterizes the endpoints of a rubric you can use to assess student growth in the targeted outcome. (We write more about rubrics in chapters 4 and 5.)

Transdisciplinary Transfer Goal: Critical Thinker	
Indicators of a Critical Thinker	**Indicators of a Noncritical Thinker**
• Remains skeptical • Asks for reasons and evidence in support of a claim • Questions the accuracy, validity, and reliability of information or evidence • Deliberately seeks different points of view and considers their merits • Identifies personal and cultural biases in self and others • Views issues and problems on a macro and micro level • Recognizes that complex issues are nuanced, containing shades of grey, and can tolerate ambiguity • Identifies his or her position on an issue or situation • Provides sound reasons and relevant evidence to support his or her own position • Uses evidence to evaluate claims • Is willing to change his or her mind when presented with new evidence or compelling reasons	• Does not question • Is gullible • Accepts things at face value • Does not seek other perspectives • Sees only one perspective (is narrow) • Is egocentric • Is unaware that personal and cultural biases may influence his or her thinking • Sees things in isolation • Is uncomfortable with ambiguity; views issues as black or white • Only wants the (one) answer • Does not support his or her position or answer with reasons or evidence (or doesn't know what evidence to use) • Is inflexible and unwilling to change, even in the face of new evidence or compelling reasons

Figure 3.4: A T-chart of performance indicators for a critical thinker.

Again, we recommend beginning this process by starting at the end. That is, think about what a graduate will ideally demonstrate. Once you have identified these exit-level performance indicators, you can plan backward to derive developmentally appropriate versions for students at lower school and grade levels.

We recommend convening a design committee or team to identify and list performance indicators for mission-based outcomes that can include educators, community members, parents, and students. This team should develop a draft

set of performance indicators it can then post (for example, via a Google Doc) for the larger educational community to review and comment. Once your team receives comments and suggestions, it can make necessary revisions and adopt a final set of indicators.

Developing Overarching Understandings and Essential Questions

Based on the long-term transfer goals and performance indicators, the next step in the macro curriculum-design process is to develop overarching understandings and essential questions. Transfer of learning—the ultimate goal of modern schooling—depends on understanding. Rote learning of knowledge and skills is insufficient; it does not transfer. Accordingly, our curriculum blueprint calls for the development of understandings in order to realize transfer goals. Thus, we need to consider this question: What will students need to understand to effectively transfer their learning?

Think of understandings and essential questions as two sides of a coin. By engaging learners in inquiry and exploration through the essential questions, we develop and deepen their understanding of important ideas and processes. We dig deeper into overarching questions and essential questions in the following sections.

Overarching Understandings

Overarching understandings identify the important big ideas and processes that students should come to understand. As part of the high-level curriculum framework, we recommend that curriculum teams identify overarching understandings. We refer to them as *overarching* because they point beyond the specifics of a unit topic to larger, transferrable ideas that spiral through the curriculum—they can be repeated through the grades, disciplines, and units. These understandings can differ in scope. At the unit level (the micro level), a teacher identifies one or more ideas that he or she wants students to understand about a specific topic they are studying.

You can find examples of such overarching understandings in the Next Generation Science Standards (NGSS Lead States, 2013). Known as *crosscutting concepts*, these ideas provide unifying conceptual strands that link across the specific topics, grades, and courses. Here is the rationale for these:

> The Framework identifies seven crosscutting concepts that bridge disciplinary boundaries, uniting core ideas throughout the fields of science and engineering. Their purpose is to help students deepen

> their understanding of the disciplinary core ideas (pp. 2 and 8), and develop a coherent and scientifically based view of the world. (NGSS Lead States, 2013, p. 83.)

Here are three of the seven crosscutting concepts; notice how they are framed as overarching understandings:

1. **Patterns.** Observed patterns of forms and events guide organization and classification, and they prompt questions about relationships and the factors that influence them. . . .
2. **Cause and effect: Mechanism and explanation.** Events have causes, sometimes simple, sometimes multifaceted. A major activity of science is investigating and explaining causal relationships and the mechanisms by which they are mediated. Such mechanisms can then be tested across given contexts and used to predict and explain events in new contexts. . . .
3. **Structure and function.** The way in which an object or living thing is shaped and its substructure determine many of its properties and functions. (NGSS Lead States, 2013, p. 79)

Educators can pair overarching understandings with associated overarching essential questions as we describe in the next section.

Essential Questions

Essential questions are the companions to the overarching understandings. Like understandings, essential questions differ in scope and breadth. Essential questions point beyond the particulars of a lesson or a unit to larger, transferable ideas. When tied to overarching understandings, essential questions can fruitfully recur across grades, spiraling throughout the curriculum to provide conceptual links within and sometimes across disciplines. Topical essential questions, in comparison, are more specific. They guide the exploration of ideas and processes around *particular* topics within a unit or course.

In their book, *Essential Questions*: *Opening Doors to Student Understanding*, McTighe and Wiggins (2013a) characterize essential questions as follows. An essential question:

- Is open-ended and typically will not have a single, correct answer
- Should be intellectually engaging, intended to spark inquiry, higher-order thinking, discussion, and debate
- Points toward important, transferable ideas and processes within and across disciplines

- Raises new questions and sparks further inquiry
- Requires support and justification, not just an answer
- Recurs over time by revisiting the question over and over again

Figure 3.5 (page XX) presents examples of essential questions and overarching understandings linked to corresponding transfer goals in four academic disciplines.

As illustrated in figure 3.1 (page XX), teams can develop overarching understandings and essential questions for transdisciplinary outcomes. Figure 3.6 (page XX) illustrates three such examples.

In sum, overarching understandings and essential questions provide the intellectual through lines necessary for a curriculum to be coherent and directed toward long-term transfer—the desired disciplinary and transdisciplinary outcomes. They are guideposts for constructing a curriculum that spirals around a set of recurring ideas and processes, within and across grades and subject areas. By framing a curriculum in this way, educators can develop and deepen students' understandings and support their capacity to flexibly and independently apply their learning to new problems and situations.

Notes From the Field

In our experience, having sets of essential questions developed at the district, school, or program level supports teachers when they plan curriculum units. Teachers can easily adapt them to create more topical questions suitable for a particular unit, with the recognition that students will likely see the same type of questions in the future that are connected to different topics. Here's an example.

- **Overarching (for English language arts):** How do effective authors hook and hold their readers?
- **Topical (for a unit on biography):** How do biographies hook and hold their readers?
- **Topical (for a unit on argumentation):** How do editorial writers hook and hold their readers while making their argument?

Outcomes	Long-Term Transfer Goals Students will independently . . .	Overarching Understandings	Essential Questions
Mathematics	Use mathematical modeling for descriptive and predictive purposes	Mathematicians create models to interpret and predict the behavior of real-world phenomena. Mathematical models have limits, and sometimes they distort or misrepresent reality.	What is the best way to model this phenomenon? What are the limits of mathematical modeling and representation?
Visual arts	Use various visual media to express ideas and feelings for various purposes and audiences	Visual artists choose to follow or break established conventions in pursuit of expressive goals.	What style and medium should I use to express my ideas and feelings? Why and when should an artist depart from established conventions?
Health	Strive for wellness by making safe and healthful choices throughout one's life	Regularly engaging in healthy behaviors promotes overall health, well-being and quality of life, and reduces the risk of lifestyle-related problems, disorders, and disease.	What does it mean to live a healthy lifestyle? Why do it? How might my healthy lifestyle today be different from a healthy lifestyle in ten years? In twenty years?
History	Apply historical ideas, reasoning, patterns, and sources to understand, respond to, and act in the present	A study of the past informs our ideas about how to understand, respond to, and act in the face of contemporary and future events and circumstances around the world.	Why study history? What can we learn from the past? How is history connected to who I am today?

Figure 3.5: Sample long-term transfer goals, overarching understandings, and essential questions for academic disciplines.

Outcomes	Long-Term Transfer Goals Students will independently . . .	Overarching Understandings	Essential Questions
Critical thinking	Critically appraise information and claims; ask critical questions; deliberately seek differing points of view before reaching a conclusion	A critical thinker does not simply believe whatever he or she reads, hears, or views. He or she remains skeptical, asks critical questions, and seeks alternative points of view.	How do I know what to believe in what I read, hear, and see? Is this a credible and unbiased source? What other perspectives should I consider?
Collaboration and teamwork	Work effectively in groups	The purpose of collaboration is to work together effectively and efficiently to meet a goal. Effective group members are interdependent and take on meaningful roles, which vary according to the task and the group.	What makes a group effective? How will our group work best together? What role should I take to help my group reach our goal? How can I be a good leader?
Self-directed learning	Set goals and pursue them independently, self-assess and adjust, seek feedback to improve their learning and performance	A self-directed learner sets goals and pursues them independently. He or she regularly self-assesses and seeks feedback to improve learning and performance.	What do I want to learn or achieve? How do I take control of my learning? How can I improve my learning and performance?

Figure 3.6: Sample long-term transfer goals, overarching understandings, and essential questions for transdisciplinary outcomes.

Crafting a Curriculum Blueprint: A Sample Case Study

Practically speaking, teams of experienced teachers, with facilitation from content experts, are best suited to undertake this high-level work at the district, school, or department levels. Because the blueprint focuses on the macro level, it is important to have representation from all school divisions (elementary, middle, and high school). For example, in 2009 at the International School of Beijing, Greg Curtis facilitated working sessions to articulate long-term transfer goals and a set of associated, overarching understandings and essential questions for both disciplinary and transdisciplinary outcomes. The sessions brought together teacher leaders from preK–12 for each curriculum area to engage in collaborative discussions about these foundational elements. The process was positive, focused, and productive, resulting in sets of draft transfer goals, overarching understandings, and corresponding essential questions in a relatively short period.

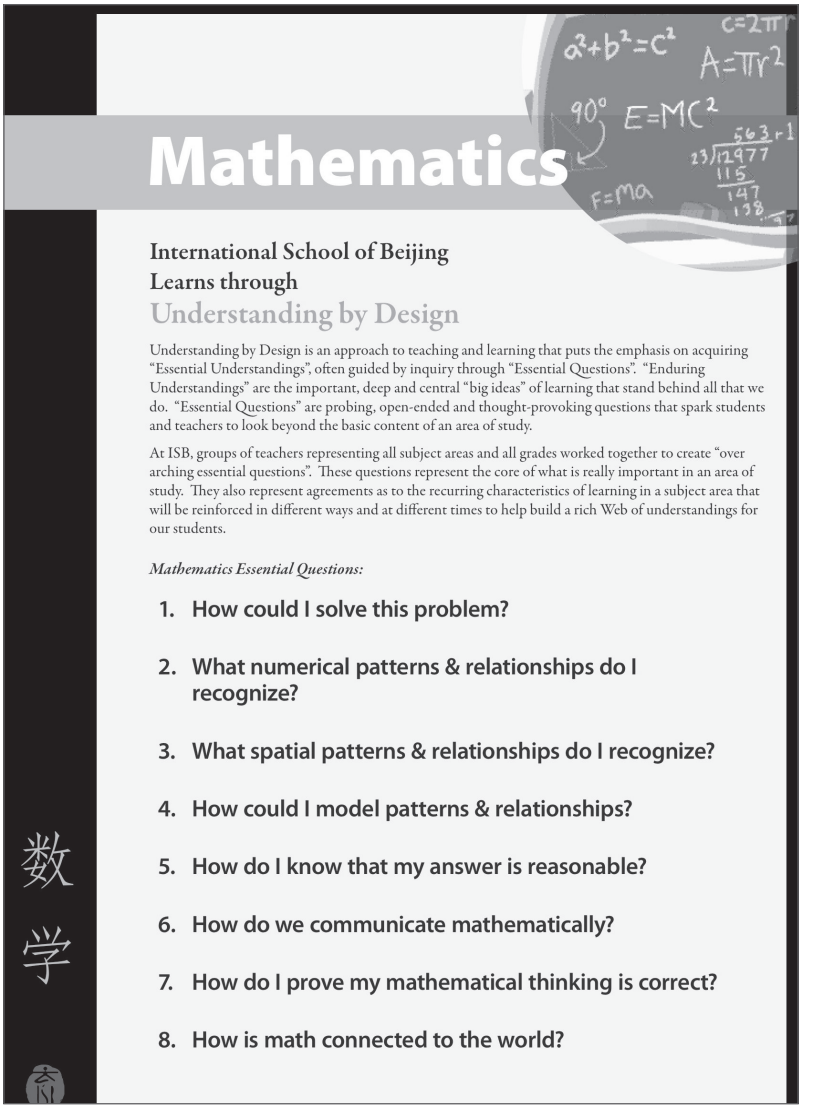
Once the teachers in the working groups drafted these elements, they shared them with their colleagues for feedback and suggestions. The response was largely positive because of the collaborative nature of the process and the ways that these long-term transfer goals resonated with teachers. Moreover, nearly all participants commented on the benefit of working collaboratively with teachers from other divisions.

Once the school adopted the sets of essential questions, it printed attractive posters for displaying them. Figure 3.7 (page XX) shows an example for mathematics.

The school placed the posters prominently in classrooms, hallways, and the faculty room. This public placement highlighted the idea that the curriculum spiraled around a recurring set of important questions and encouraged staff and students to keep considering them across the grades.

Cornerstone Performance Tasks

After you have identified the transfer goals, performance indicators, overarching understandings, and essential questions, the next step is to create cornerstone performance tasks. *Cornerstones* are curriculum-embedded performance tasks based on transfer goals. To invoke the construction analogy again, we can think of these tasks as like a cornerstone on a building; they anchor the curriculum around the most important performances we want learners to be able to do on their own with acquired content knowledge and skills. The tasks engage students in applying their knowledge and skills in an authentic and novel context while operationalizing the



Source: © 2015 by International School of Beijing. Used with permission.

Figure 3.7: Poster showing essential questions for mathematics.

transfer goals by collecting evidence of student growth toward learning outcomes. Cornerstone performance tasks serve as the practical structure for integrating the transdisciplinary outcomes with academic subject matter. In fact, cornerstone performance tasks that are truly authentic will invariably involve one or more transdisciplinary outcomes—for example, critical thinking, creativity, and communication—functioning in tandem with disciplinary knowledge.

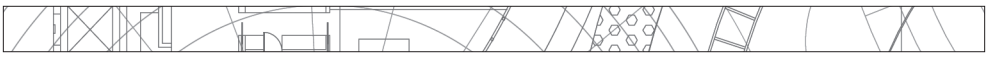
Here is an example:

> You have an idea that you believe will make your school better, and you want to convince school leaders that they should act on your idea. Identify your audience (e.g., principal, PTSA Board, students) and:
>
> - Describe your idea.
> - Explain why & how it will improve the school.
> - Develop a plan for acting on your idea.
>
> Your idea and plan can be communicated to your target audience in a letter, e-mail, blog post, or presentation. (McTighe, 2013b)

We will describe the key characteristics of cornerstone performance tasks and detail a process for developing and implementing them in greater detail in the next chapter.

Conclusion

In this chapter, we described how to use a backward design process to create a curriculum blueprint, which is a framework for designing a guaranteed and viable curriculum that honors the ultimate goal of modern learning. We proposed a modern approach to curriculum mapping that calls for educators to shift their focus from inputs (*what* will be taught and *when*) to outcomes (students transferring their learning), a parallel to the I-O-I structure. In the next chapter, we take a closer look at the role of cornerstone performance tasks for fusing 21st century skills with traditional content and provide a collection of evidence of student progress toward targeted outcomes.



CHAPTER 4

An Assessment System for Modern Learning

How can we assess progress toward both disciplinary and transdisciplinary outcomes?

> ***Are we assessing everything we value or only those things that are easiest to test and grade?***
>
> **—Grant Wiggins**

In the previous chapter, we presented a blueprint outlining the key elements of a curriculum in support of modern learning. In this chapter, we focus more specifically on the assessment system with which to gather evidence of both student achievement (in terms of subject-matter learning) and organizational progress toward broader, mission-driven outcomes. We begin by examining principles of effective assessment of student learning and use these to describe a framework for planning assessment. This starts with assessing existing assessment systems to understanding how the school's goals affect classroom assessments. We then take a more focused look at the performance areas and indicators that make up transdisciplinary outcomes and introduce the idea of *grafting* these outcomes onto disciplinary performance tasks as a means of assessing desired outcomes. Finally, we describe a process of mapping a transdisciplinary curriculum around sets of recurring cornerstone performance tasks as a means for systematically gauging the growth of student performance and obtaining the ongoing feedback necessary for continual improvement.

Principles of Effective Assessment

An effective assessment system at the district, school, and classroom levels requires a set of underlying principles to ground it and guide its design and implementation. We propose the following five principles of effective assessment (McTighe, 2013a; Tomlinson & McTighe, 2006), which we summarize here.

1. **Assessments should serve teaching and enhance learning:** A fundamental purpose of assessment is to inform teaching and deepen learning. As such, we view assessment as a feedback system to provide teachers and students with specific information to enhance teaching and student performance. Assessment practices that enhance learning display the following seven qualities.
    a. They are designed around clear goals (as summarized in the next section).
    b. They include authentic applications of knowledge rather than simply testing for factual recall only.
    c. They include known evaluative criteria (such as rubrics) and models of excellence.
    d. They provide ongoing feedback and opportunities for learners to set new goals based on that feedback.
    e. They allow opportunities for learners to retry and revise.
    f. They provide students with more than one way to demonstrate their learning.
    g. They include opportunities for learners to self-assess and set goals for improvement.

    Of course, assessments also serve an evaluation and grading function, but these purposes should not come at the expense of learning.
2. **Multiple measures provide a richer picture:** Assessment is a process by which educators make inferences about what students know, understand, and can do based on information obtained through assessments. These inferences are more dependable when we include a variety of sources of evidence since all forms of assessment are susceptible to measurement error. Consider a photography analogy.

A photo album typically contains many pictures taken over time in various settings. Thus, the complete album offers a more accurate, complete, and revealing portrait than does any single snapshot. Likewise, multiple assessments (rather than a single measure) reveal a truer representation of student learning and growth, as well as the entire learning organization's progress.

3. **Assessments should align with goals:** Consistent with the logic of backward design, assessments should align with the learning goals. If you are to draw valid inferences from the results of an assessment, that assessment must be aligned to, and provide an appropriate measure of, the targeted goal (or goals). Because there are different types of goals (such as knowledge, 21st century skills, understandings, and transfer), we need a variety of assessments to provide the proper evidence that the goals have been reached. A true representation of student learning and growth reveals itself not only through multiple assessments but also through assessments that align with goal. For instance, educators could use a multiple-choice test to see if students have learned important factual information, a written response to a prompt to assess their understanding of a concept, and a performance task to assess students' ability to transfer their learning to a new situation.
4. **Assessments should measure what matters:** It is essential that teachers assess *all* of the goals they identify. The adages apply here: "We measure what we value," "What gets measured is what gets done," and "It only counts if it counts." If you want students to be able to transfer their learning to new situations, then schools need assessments that call for transfer in authentic situations. For example, if a school is committed to developing self-directed learners who are capable of independently managing new learning, then it needs evidence of their growth as self-directed learners over time. Because most mission-related outcomes, such as 21st century skills or dispositions, do not lend themselves to a moment-in-time test, your district, school, or department needs to be deliberate in collecting evidence over time to gauge students' performance and growth in these valued areas.

5. **Assessments should be fair:** All students must have an equal chance to show what they know, understand, and can do. Standardized tests claim to be fair since the conditions for administering the test, such as strict time limits and uniform scoring procedures, are intended to ensure that all students are assessed in an identical manner. Despite their benefits, standardized assessments have a downside—namely that learners differ in their knowledge and skill levels and in their preferred modes for demonstrating their learning. Thus, a one-size-fits-all approach to assessment may not, in fact, always be fair or appropriate. While external accountability tests must be standardized for comparability purposes, teachers and schools have much greater assessment flexibility for allowing students to demonstrate their learning and performance in varied ways. For example, an English learner might be allowed to show his or her understanding of a science concept visually or through an oral explanation rather than through multiple-choice test items that he or she cannot read. In some cases, it may be appropriate to allow certain students more time to complete a task, especially when competency is the goal rather than speed.

We strongly encourage school leaders to engage staff in discussing and agreeing on a set of assessment principles. You may present the five principles that we offer (or offer ones from other sources) as a basis for conversation, writing, and revision. Alternatively, you can have a representative committee draft a set. Regardless of the starting place, we find that staff understanding, ownership, and application is much more likely when they engage in collaborative dialogue. Once in place, a set of assessment principles can serve as a guiding light when planning and implementing a coherent assessment system.

The process of upgrading a district or school assessment system involves three steps: (1) a thorough examination of the district's or school's current assessment system to identify its strengths and inadequacies; (2) an analysis of how different types of educational goals require different kinds of assessment evidence; and (3) a plan to expand the current measures to more fully assess all valued outcomes. We detail these steps in the following sections.

Examining the Existing Assessment System

The first step in upgrading your assessment system is to review the assessments you're already using. Here's a process: Collect examples of the assessments that

teachers in your school or district are using as the basis for evaluation and grading. Then, present these to a panel for review (such as to educators from another school or district, to parents, or to community members), and ask them the following three questions.

1. "From your review of the assessments, what do you think is the mission of the school? What are the desired learning outcomes for the students?"
2. "Do you see evidence that transfer of learning is valued?"
3. "Do you see evidence that transdisciplinary outcomes and 21st century skills are priorities?"

In our experience, reviewers often detect a mismatch between some stated outcomes and the assessments in use, especially the transdisciplinary outcomes that go beyond traditional academic disciplines. The review process listed here can shed light on whether your current assessment system reflects a fundamental idea of backward design: assessments should align closely with *all* targeted learning goals. In other words, what we assess should signal what we value. If some outcomes are not assessed (such as collaboration, critical thinking, and global citizenship), then students (and some teachers and parents) may regard them as unimportant or peripheral to what counts.

Understanding How Goals Determine Assessment Types

You and your team cannot discuss assessment in any meaningful way without considering the various learning goals or outcomes you need to assess. McTighe (2013, 2018) identifies five qualitatively different types of goals for learning, and their differences are noteworthy. Each requires a somewhat different approach to both assessment and instruction. Here is a summary of the five goal types and their implications for assessment.

1. **Knowledge:** Knowledge goals specify what you want students to know, such as facts (the capital cities of countries or chemical symbols) and basic concepts (different shapes).

   Assessment implications—Typically, knowledge goals have a correct answer, so evaluation is binary—either correct or incorrect. Therefore, you can obtain evidence of attainment of knowledge goals using objective assessments, such as matching, true or false, multiple choice, or teacher questioning.

2. **Skills and processes:** These goals are procedural, identifying what students should be able to do. Skills specify discrete behaviors (such as buttoning a shirt or hitting a ball with a bat), while processes characterize more complex actions requiring multiple steps and composite skills (such as extended writing or scientific investigation).

   Assessment implications—The most appropriate assessment of skills and processes calls for the learner to perform in order to demonstrate his or her competence. Teachers or assessors then use direct observation or an examination of a product or performance (a writing sample) to gauge proficiency. Unlike assessing knowledge for which there is usually a single correct answer, assessing skills and processes best occurs through a continuum of proficiency levels from novice to expert, similar to different colored belts in karate or one's proficiency levels in speaking a world language.

3. **Understandings:** Understanding goals refer to the big ideas that we want students to comprehend at a deep level. Such ideas are conceptual and inherently abstract, such as adaptation or the awareness that form follows function. You can see good examples of understanding-based goals in the crosscutting concepts of the Next Generation Science Standards. For example:

   > Scale, proportion, and quantity: In considering phenomena, it is critical to recognize what is relevant at different measures of size, time, and energy and to recognize how changes in scale, proportion, or quantity affect a system's structure or performance. (NGSS Lead States, 2013)

   Assessment implications—To truly assess understanding, educators must design assessments so that students apply their learning to a new situation and explain or defend their answer and their process for arriving at it. Thus, we advocate the use of performance assessments that require application (ideally in an authentic context) along with explanation (such as showing work, justifying conclusions, and citing text evidence to support interpretations).

4. **Dispositions:** Dispositional goals characterize productive ways of thinking and acting—within and outside of school. Also known as *habits of mind*, these goals are inherently transdisciplinary in nature; they apply within and across subject areas and throughout life. Arthur L. Costa and Bena Kallick (2008) identify sixteen habits of mind

that parents, teachers, and employers recognize as valuable. Their set includes *listening with understanding and empathy*, *thinking flexibly*, *striving for accuracy and clarity*, *managing impulsivity*, *remaining open to continuous learning*, and *thinking about thinking* (metacognition).

Assessment implications—Although educators might give a test or quiz to see if students have learned basic facts, an on-demand assessment of dispositions would be unnatural and inappropriate. Assessing dispositions is based on specific performance indicators: What does it look like when an elementary student is listening with empathy or when a high school student is persevering through a difficult mathematics problem? You can best assess dispositions through a collected-evidence model of observations and student self-assessments, based on defined performance indicators, compiled over time.

5. **Transfer goals:** Transfer goals highlight the effective application of knowledge, skills, understanding, and dispositions. They specify what you want students to be able to do with their learning when they confront new challenges and unpredictable circumstances within and outside of school. In the previous chapter, we characterized transfer goals as exit outcomes toward which teachers collectively work across grade levels. Transfer goals expect autonomous performance, such as *the learner is expected to perform independently without excessive guidance or scaffolding*.

   Assessment implications—Educators assess transfer over time as students increasingly demonstrate their ability to apply (transfer) their learning to increasingly authentic and complex situations and do so with increasing autonomy. We propose that the systematic assessment of transfer can occur through a set of recurring performance tasks, known as *cornerstones*, that we map out across the grades. We describe these in greater detail later in this chapter (see page XX).

Recognizing these different goal types is essential to appropriate assessment of them. Educators can still use conventional assessments (selected response, brief constructed response, and skill checks) to effectively assess knowledge and skill acquisition. However, modern learning calls for students to understand (not just know) how to transfer their learning to new situations and to apply 21st century skills and dispositions. These outcomes require a more robust assessment system.

Identifying Dimensions of Transfer Performance

In chapter 3, we described the value of identifying long-term transfer goals as the endpoints from which you should backward plan a curriculum, grade 12 through preK. We also explained the importance of operationally defining these outcomes, especially those that are transdisciplinary, and further unpacking them in terms of observable and measurable performance indicators.

The T-chart process in figure 3.4 (page XX) provided an example of how to engage teams in the process of unpacking these outcomes. Unpacking the outcome down to performance indicators is essential, because these specify what students will do to provide developmentally appropriate evidence of performance and growth over time. As such, performance indicators are critical for assessment because they point out the particulars to look for when evaluating student performance. The indicators are not only necessary for assessment but also serve as clear targets for learning and instruction.

It is often the case that a group or team working to develop a new assessment system (or refine an existing one) will identify a fairly long list of performance indicators for a transfer goal. Accordingly, it is helpful to categorize the indicators into broader *performance dimensions* that can serve as traits on a rubric. Consider the transdisciplinary transfer goal of *cooperation*. A team could divide this goal into three broad categories, such as the following.

1. Contributes to group goals
2. Adheres to group norms
3. Demonstrates productive interpersonal skills

It would then list more specific performance indicators under the appropriate dimension. You may recognize that such a structure is similar to the way in which disciplines often break down into strands and benchmarks. For example, the Next Generation Science Standards (www.nextgenscience.org) have three strands (disciplinary core ideas, crosscutting concepts, and science and engineering standards) while the National Core Arts Standards (www.nationalartsstandards.org) include the artistic processes of creating; performing, presenting, and producing; responding; and connecting.

Educators identify performance dimensions through either a top-down or bottom-up process. A top-down process involves taking a transfer goal and considering important dimensions of that goal. Once educators identify key

performance dimensions using this top-down method, they can list more specific performance indicators under each. Figure 4.1 (page XX) illustrates a top-down relationship among transdisciplinary transfer goals, overarching understandings and essential questions, dimensions, and performance indicators.

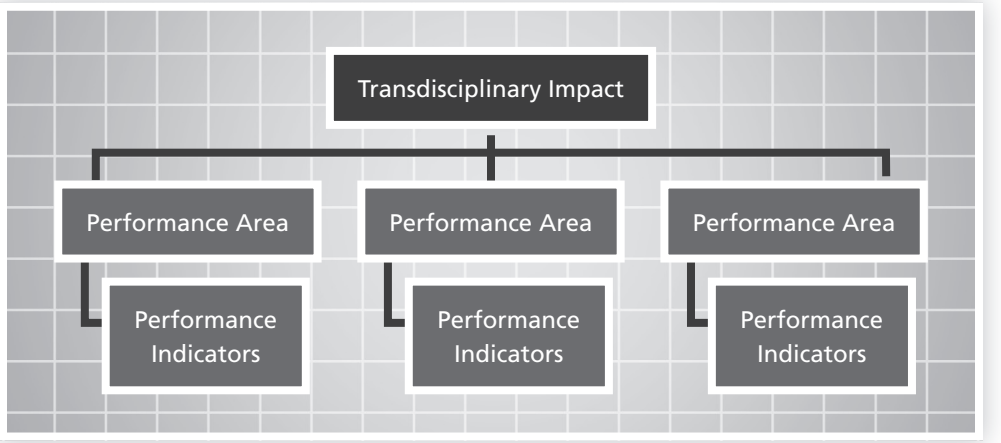


Figure 4.1: Unpacking the layers of a transdisciplinary outcome.

Alternately, a bottom-up process begins with listing performance indicators for a given transdisciplinary outcome. Then, you cluster the indicators into larger performance dimensions. Recall the example of performance indicators generated for *critical thinking* presented in figure 3.4 (page XX). Let's examine how we might group this list into performance dimensions.

A critical thinker might have the following eleven performance indicators.

1. Remains skeptical
2. Asks for reasons and evidence in support of a claim
3. Questions the accuracy, validity, and reliability of information or evidence
4. Deliberately seeks different points of view and considers their merits
5. Identifies personal and cultural biases in self and others
6. Views issues and problems on a macro and micro level
7. Recognizes that complex issues are nuanced, containing shades of grey, and can tolerate ambiguity

8. Identifies his or her position on an issue or situation
9. Provides sound reasons and relevant evidence to support his or her own position
10. Uses evidence to evaluate claims
11. Is willing to change his or her mind when presented with new evidence or compelling reasons

We could cluster these performance indicators (such as 1–3, 4–5, 6–7 and 11, and 8–10) into four performance dimensions for critical thinking, as shown in figure 4.2 (page XX).

Clarifies Issue	Recognizes Perspectives	Evaluates Claims	Supports Position
• Views issues and problems on a macro and micro level • Recognizes that complex issues are nuanced, containing shades of grey, and can tolerate ambiguity • Is willing to change his or her mind when presented with new evidence or compelling reasons	• Deliberately seeks different points of view and considers their merits • Identifies personal and cultural biases in self and others	• Remains skeptical • Asks for reasons and evidence in support of a claim • Questions the accuracy, validity, and reliability of information or evidence	• Identifies his or her position on an issue or situation • Provides sound reasons and relevant evidence to support his or her own position • Uses evidence to evaluate claims

Figure 4.2: Sample performance dimensions and performance indicators for critical thinking.

Regardless of which method you employ, it is important to note—and ensure that team members understand—that you did not design this process

to bring about a comprehensive, polished, and perfect list of indicators on the first attempt. Rather, you designed it to spark thinking about exactly what a student would do to show evidence of growth and attainment of a desired transdisciplinary outcome. Once you and a small development team generate a draft set of performance indicators and dimensions, we strongly recommend that you widely share the drafts for feedback. Invariably you will find yourself fine-tuning the lists over time.

This can seem like a daunting task. The good news is that there are sources that provide good examples as starting points for unpacking transdisciplinary transfer goals, and we include many such examples in appendix A (page XX). You can use this unpacking process for any transdisciplinary outcome embedded in your district, school, or department mission. Once complete, you have a solid conceptual framework for clarifying, communicating, assessing, and teaching transdisciplinary outcomes.

Notes From the Field

We have found that the process of identifying performance indicators and clustering these into various dimensions is especially valuable for transdisciplinary outcomes that may otherwise remain a bit fuzzy. This process yields three benefits: (1) clarifying the meaning of the transfer goal; (2) identifying specific indicators to use in assessment; and (3) providing specific teaching and learning targets. However, it has been our experience that this detailed process is not always necessary for disciplinary outcomes, for which teachers typically have greater clarity and have already developed teaching materials and assessment tools (such as rubrics).

Designing Performance Continua

In the previous chapter, we suggested that you begin your high-level curriculum process by identifying exit-level transfer goals as your long-term outcomes (such as defining a Portrait of a Graduate; see page XX), and then identify associated performance dimensions and indicators. However, it should be evident

that a *single* set of exit-level performance indicators is likely inadequate for assessing transdisciplinary outcomes *across* the developmental spectrum in all grades. Therefore, we recommend planning backward from the exit-level indicators (for use at the high school level) to derive developmentally appropriate versions along a continuum for use with younger students (at the middle school and elementary school levels).

Similar to the developmental continua teachers use in literacy and world languages (such as the American Council on the Teaching of Foreign Languages) to assess students' reading, writing, and speaking progress, a continuum of performance indicators can describe students' progression in reaching transdisciplinary outcomes. We recommend breaking the continuum into grade bands depending on how your district or school organizes grades. For example, your district may organize grade bands by preK–2, 3–5, 6–8, 9–12, or preK–1, 2–4, 5–8, 9–12.

Creating a performance-based continuum for each transdisciplinary transfer goal helps all stakeholders (teachers, students, and parents) to see where students are starting from and what they are building toward. It enables them to assess students' growth and set goals for further development. Figure 4.3 (page XX) provides a sample elementary, middle, and high school continuum of performance indicators for one dimension of a self-directed learner. Recognize that this is not a definitive or complete list of all indicators for all levels but merely an illustrative example.

We suggest that a team of four or five people work on each transdisciplinary outcome. Teams should include representatives from each division of a school or district (elementary, middle, or high school). Although the teams should be composed primarily of teachers, we recommend that administrators also participate, thereby creating a shared understanding of the process and the products of the teams' work together. Some teams may include one or more secondary students, as well. Figure 4.4 (page XX) presents a protocol Greg Curtis used with teams at the International School of Beijing to identify performance indicators and performance dimensions, and then organize them along a continuum. Please note that this is only a sample protocol; you should adapt the process to your setting.

Transdisciplinary outcome: Self-directed learner		
Dimension: Applies learning strategies and tools		
Elementary School Performance Indicators	**Middle School Performance Indicators**	**High School Performance Indicators**
• Tries to apply one or more strategies or tools to achieve an identified learning goal; such as, "I used a story map before I started writing my story." • Describes how the tool or strategy worked for him or her; such as, "The story map helped me get and organize ideas for my story."	• Articulates one or more preferred learning strategies; such as, "I learn better when I can visualize something. I need to see rather than just hear." • Chooses one or more appropriate learning strategies and tools based on the learning goal and their strengths and weaknesses as a learner; such as, "I used a visual mind map to help me learn a new science concept." • Evaluates and explains the effectiveness of their selected strategy or tool in supporting their learning; such as, "The poster of problem-solving strategies is helpful, but drawing a diagram works best for me because . . ."	• Identifies appropriate learning strategies and tools based on the learning goal and their strengths and weaknesses as a learner; such as, "Since this science text contains a number of interrelated, abstract concepts, I will create a concept map to help me see the connections and remember the relationships among these concepts." • Explains why they chose particular strategies or tools; such as, "The argumentation table lays out claim, reasons, and evidence. That really helps me both develop and critique an argument." • Evaluates the effectiveness of their selected strategies or tools in terms of how effective they were in supporting learning based on their strengths and weaknesses as a learner; such as, "The Kahn Academy tutorial really helped me better understand linear equations because the presenter used several real-world examples that were better than the one in our textbook."

Figure 4.3: Sample performance indicators along a continuum.

Actions to take before this process
1. Assemble the teams and communicate (such as via email) the goals, schedule, and plan for the working session. 2. Provide the team (or teams) with overarching understandings and essential questions for review, either in print form or via in an accessible online platform. (You will have developed these materials through the earlier articulation of transdisciplinary outcomes.) 3. Gather examples of rubrics or descriptors for your transdisciplinary outcome from various sources. Many resources are attainable through a simple web search. We include sample performance indicator continua in appendix B (page XX). Important: Keep a list of sources so participants can reference them with the finished product. 4. Distribute examples to the unpacking team members, and ask team members to review them before the working session. Team members should note any themes or common indicators. 5. Print examples, and cut sample performance indicators into individual slips of paper. 6. Prepare a large piece of butcher block or poster paper for each outcome. Prepare the paper as a horizontal continuum by dividing it into columns, using grade-level bands (such as preK–2, 3–5, 6–8, and 9–12) for the column headers and leaving space to write the performance indicators in the row (or rows) below. Have packs of 3 × 5 or 4 × 6 sticky notes available.

Process Phases	Planning Questions
1. A facilitator describes the purpose, protocol, and time frames for the process. (Five minutes)	• What is our goal and through what process will we work to achieve it? • What do the overarching understandings and essential questions tell us about what is involved in achieving this outcome?
2. The team (or teams) meets to discuss previously developed overarching understandings and essential questions for each transdisciplinary outcome. (Ten to fifteen minutes)	• What are the major characteristics of a person who demonstrates this outcome? • What do the rubrics and related resources we have reviewed suggest about important performance areas and indicators?

3. The team first breaks the outcome down into an initial set of a few (two to five) major performance dimensions. (Thirty to forty-five minutes)	• What major performance dimensions are part of demonstrating the outcome?
4. Lay out the large sheet of butcher or poster paper on a central table. Add the performance dimensions generated in the previous step to the row headings. Distribute the sample performance indicators to team members along with glue sticks. Ask team members to take a few indicators and place them appropriately on the butcher paper grid (aligned with the appropriate performance dimensions and developmental stage or division). This should be a quick alignment exercise and not drawn out to create a perfect product at this stage. (Twenty to thirty minutes)	• How do specific performance indicators fit within the identified performance areas? • At what developmental stage could you visualize a student demonstrating this indicator?
5. Team members discuss the developing continuum, paying special attention to the grouping of similar indicators, horizontal flow, whether a student can demonstrate an indicator and a teacher can observe it, and so on. Use sticky notes to fill gaps, and place them in the desired spots on the continuum. (Twenty to thirty minutes)	• Is there a flow across school levels or developmental stages for each performance area (horizontal)? • Is there a flow across all of the performance indicators for school levels or developmental stages (vertical)?

Continued →

Figure 4.4: A protocol for identifying and organizing performance indicators along a developmental continuum.

6. Assuming more than one team is working on more than one transdisciplinary outcome, have the teams rotate to review the work of the others. They can use sticky notes to make notes, offer suggestions, and purpose new indicators on the draft continua. (Twenty to thirty minutes)	• If the flow across school division levels is choppy, how might we bridge those gaps between developmental levels?
7. Team members discuss the output, making minor tweaks until they believe the output is ready for feedback from the larger school staff. (Twenty to thirty minutes)	• How will school staff receive our draft work (output)? • How will we incorporate feedback on, and suggestions for, our draft work?

Actions to take after this process

1. Collect the butcher or poster papers, and recreate the draft continua in digital form for distribution.
2. Present the list of performance indicators and developmental continua as working drafts, and request feedback and suggestions from the rest of the staff. Discuss how and when they will be used.
3. Schedule a day and time for the team to come together to review the feedback and incorporate helpful suggestions into the continua.
4. Share the revised performance indicators and developmental continua with the full staff with directions for classroom trials. Emphasize that you are still in a field-testing phase and that staff should not use these performance indicators for high-stakes evaluation and grading at this time.

The Importance of Assessing Transdisciplinary Outcomes

Most assessments, both large scale and classroom-based, target knowledge and skills in content areas. Such assessments are appropriate if the sole purpose of schooling is for students to learn the basics in traditional subjects. However, when there is a greater emphasis on transdisciplinary outcomes, then our assessment portfolio must expand accordingly. These outcomes emphasize core modern learning skills, such as critical thinking, creativity, collaboration, and communication (commonly known as the four Cs); self-directed learning; and global citizenship.

One way to ensure that your district, school, or department is appropriately assessing transdisciplinary outcomes is by using cornerstone performance tasks, such as those we identified in our curriculum blueprint (figure 3.1, page XX.)

The following sections highlight characteristics of cornerstone performance tasks for assessment, offer ideas for how to design them, and establish ideas for how to reflect targeted outcomes in associated rubrics.

Characteristics of Cornerstone Performance Tasks

As we detailed in chapter 3 (page XX), we propose mapping a curriculum backward from long-term transfer goals. We use the term *cornerstone* metaphorically to suggest that, just as a cornerstone anchors a building, these tasks should anchor the curriculum. Why? Because they engage learners in applying their learning in authentic contexts as a means of providing evidence of their ability to transfer, the ultimate goal of schooling. As such, cornerstone performance tasks are manifestations of the long-term outcomes we seek—within and across subject areas.

Cornerstone performance tasks have the following characteristics.

- They are performance based, calling for the application and transfer of learning.
- They establish authentic contexts for performance.
- They recur across the grades, becoming increasingly sophisticated over time.
- They integrate transdisciplinary outcomes (such as critical thinking, technology use, and teamwork) with disciplinary content.
- They often engage productive dispositions (such as perseverance and flexibility).
- They can be assessments or rich learning activities.
- They include established indicators, rubrics, and performance continua for assessing student growth and achievement.
- They engage students in relevant learning.
- They are accompanied by analytic and developmental rubrics to enable longitudinal tracking of growth as well as learners' self-assessment.
- They provide evidence of achievement for student portfolios so that students graduate with a résumé of demonstrated accomplishments reflecting worthy outcomes.

Once teams select or develop cornerstone performance tasks, we recommend that they become an essential part of the curriculum that teachers are expected to use. In other words, the cornerstone tasks become common assessments; for example, *all fourth-grade students will engage in the same writing task*, or *all students in a biology course will conduct the same investigation*.

There are three reasons why a guaranteed curriculum needs to include a few common (agreed-on) performance tasks at each grade level.

1. They reflect the transfer goals the district, school, or department has committed to develop and toward which all teaching and learning should be directed.
2. They provide evidence that the district, school, or department can systematically track students' growth over time on outcomes that matter most.
3. They help to ensure a guaranteed curriculum, one in which *all* students will have opportunities to develop and demonstrate these goals, regardless of which teacher they have.

Figures 4.5 and 4.6 (page XX and page XX) show two examples of cornerstone performance tasks for upper elementary and high school levels that address the same long-term transfer goal of an *engaged citizen*.

Notice the features of these tasks; they both consist of the following.

- They address the same mission-related goal of *engaged citizen*, albeit in a simpler and more sophisticated manner, respectively.
- They are authentic tasks reflecting a realistic situation and a genuine audience.
- They involve critical thinking and communication, as well as social studies content.
- They allow the student voice and choice in his or her learning.

We provide additional examples of authentic performance tasks throughout the rest of this chapter.

Engaged citizen: Upper elementary or middle school

You have an idea that you believe will make your school better, and you want to convince school leaders that they should act on your idea. Identify your audience (such as the principal, parent-teacher-student association board, or students) and do the following.

1. Describe your idea.
2. Explain why and how your idea will improve the school.
3. Develop a plan for acting on your idea.

You can communicate your idea and plan to your target audience in a letter, email, or presentation.

Figure 4.5: Sample recurring cornerstone performance task.

Engaged citizen: High school

After investigating a current political issue, prepare a position paper or presentation for a public policymaker (such as a congressperson) or group (such as a school board or legislative committee). Assume that the policymaker or group is opposed to your position. Your position statement should provide an analysis of the issue, consider options, present your position, rebut opposing positions, and attempt to persuade the public policy maker or group to vote accordingly. Communicate your position in a policy brief or deliver it as a presentation.

Figure 4.6: Sample high school recurring cornerstone performance task.

Designing Cornerstone Performance Tasks

Although a comprehensive treatment of performance-based assessment is beyond the scope of this book, in this section, we offer three practical approaches or tools for designing school- or district-level cornerstone performance tasks: (1) task frames, (2) task matrices, and (3) grafting. Note that teachers can also use these same tools to design their own unit-based performance tasks.

Task Frames

Task frames use fill-in-the-blank cells to provide a structure to guide the design of performance tasks. They are particularly useful for designing cornerstone performance tasks, because any teacher can use the same template to create successive, increasingly complex tasks across the grade bands. In figure 4.7 (page XX) we share an example of a task frame with three associated tasks.

Functional or Technical Writing

Since you are an accomplished user of _____ (software such as iMovie or Google Docs), you have been asked to develop a user's guide or tutorial to help _____ [target audience] learn to use it. Provide clear, step-by-step directions for using specific features, and include a troubleshooting guide for common problems that beginning users may encounter.

Here are three brief examples of tasks developed from this frame.

1. Write step-by-step directions to help your grandmother set up a social media account.
2. Develop a how-to guide for a younger student to learn how to play the game Clash of Clans.
3. Develop a pictorial manual to guide a budding photographer to use the Layers controls in Photoshop for digital photo editing.

Source: McTighe, 2017.

Figure 4.7: Example of a performance task frame.

The Literacy Design Collaborative (2014) offers an excellent set of generic task frames (it calls them *templates*) educators can use to create cornerstone performance tasks for language arts, science, social studies, and technical subjects. They are well-suited to combining with transdisciplinary outcomes, which we describe in the Grafting section (page XX). Figure 4.8 (page XX) presents examples of two Literacy Design Collective (2014) templates, for *explanation* and *argumentation*, with associated performance tasks. Notice in these examples that both tasks include the transdisciplinary outcomes of technology user, critical thinker, and communicator. The first task also highlights two related dispositions, *determination* and *grit*.

Explanatory Task Template

Question: _____? After reading _____ (literature or informational texts), write a (an) _____ (essay, report, article, or similar) that defines and explains _____ (term or concept). Support your discussion with evidence from the texts. What _____ (conclusions or implications) can you draw?

Task Example

After reading stories about people who faced challenges and struggled to overcome them, write a cartoon story using an online tool (such as Stripgenerator; www.stripgenerator.com) that defines and explains the importance of grit and determination when faced with a challenge. Your story should illustrate your conclusions about the value of determination and grit.

Argumentation Task Template

After researching _____ (informational texts) on _____ (content topic or issue), write a (an) _____ (essay or similar) that argues your position on _____ (topic, issue, or essential question). Support your position with evidence from research. Be sure to cite your sources and acknowledge competing views. Give examples from past or current events issues to illustrate and clarify your position.

Task Example

After researching academic articles on the use of commercial drones (such as for package delivery), write a blog post that argues your position on whether communities should allow commercial drones and, if so, what regulations they should enact. Support your position with evidence from your research. Be sure to cite your sources and acknowledge competing views.

Source: Adapted from Literacy Design Collaborative, 2014.

Figure 4.8: Literacy Design Collaborative task templates and sample tasks.

Task Matrices

A simple content–process matrix offers a valuable tool for use in developing performance tasks. The matrix places key transfer goals (such as mathematical practices, science processes, and 21st century skills) across the horizontal axis of a matrix. The vertical axis establishes the key content topics, concepts, or skills. You can generate ideas for performance tasks by intersecting one or more of the content elements with one or more transfer goals. Indeed, the essence of a performance task is having learners *perform* with knowledge; for example, *applying their learning to a new situation*. Figure 4.9 (page XX) presents such a matrix for mathematics.

Grade 3 Mathematics	Practice Standards							
Content Standards	1. Make sense of problems and persevere in solving them.	2. Reason abstractly and quantitatively.	3. Construct viable arguments and critique the reasoning of others.	4. Model with mathematics.	5. Use appropriate tools strategically.	6.Attend to precision.	7. Look for and make use of structure.	8. Look for and express regularity in repeated reasoning.
Represent and solve problems involving multiplication and division.								
Understand the properties of multiplication and the relationship between multiplication and division.								
Multiply and divide within 100.								
Solve problems involving the four operations, and identify and explain patterns in arithmetic.								
Develop an understanding of fractions as numbers.								

Solve problems involving measurement and estimation of intervals of time, liquid volumes, and masses of objects.								
Represent and interpret data.								
Geometric measurement: Understand concepts of area and relate area to multiplication and to addition.								
Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measure.								
Reason with shapes and their attributes.								

Source for standards: NGA & CCSSO, 2010b.
Source: McTighe, 2018a.

Figure 4.9: Sample content–process matrix for grade 3 mathematics.

Notice that key mathematical content based on grade-level standards is listed on the vertical axis while the horizontal axis contains eight practices based on the Common Core's Mathematical Practices (NGA & CCSSO, 2010b). With these, teachers can generate performance tasks from the fusion of one or more content standards with one or more process (practices) standards. For example, the intersection of content (*Solve problems involving the four operations*, *and identify and explain patterns in arithmetic* and *Represent and interpret data*) and practices (*2. Reason abstractly and quantitatively* and *4. Model with mathematics*) could result in the following performance task:

> *A PTSA committee is planning for the spring fundraising fair and wants to have an ice cream booth. Committee members have asked the third-grade classes to recommend what ice cream flavors it should sell. To make their recommendation, the third-grade students work in pairs to survey other students in the school to find out their favorite ice cream flavors. They compile the data, and then each student prepares a graphic display (such as a bar graph, circle graph, or table) to use in showing the results to the committee and recommending the percentages of various ice cream flavors to make available.*

Teachers can use the same type of matrix to integrate transdisciplinary outcomes with academic content. For example, the matrix could list transdisciplinary, 21st century skills (process) on the horizontal axis, with subject-matter concepts and topics (content) included on the vertical axis. The intersections within cells suggest performance tasks.

Teachers can also use task matrices for mapping out an entire year by a grade level or department team to ensure that students are engaged in applying important processes to content. When viewing these grade-level and course maps vertically, we can more clearly see and coordinate the process through lines necessary for a vertically-aligned, guaranteed curriculum and assessment system.

Grafting

Although teachers may say that transdisciplinary outcomes are already part of their teaching and performance tasks, those outcomes are more typically implied than overtly included. We maintain that if transdisciplinary outcomes are part

of a school mission, then we need to assess them explicitly and integrate them deliberately into the design of performance tasks.

In fact, there is a relatively easy and natural approach for gathering evidence of transdisciplinary outcomes within performance tasks through a process that we call *grafting*. Like the horticultural process of joining parts from two or more plants so that they appear to grow as a single plant, we can purposefully graft one or more transdisciplinary outcomes onto existing academic tasks. For example, nearly any authentic performance task in science, social studies, mathematics, and career and technology education can naturally include the transfer goals of *communication* and *collaboration*.

Figure 4.10 (page XX) presents an example in which a teacher enhances a traditional and familiar task—a book report—by grafting the transdisciplinary outcomes of *technology user*, *critical thinker*, and *communicator* onto it. Note that it preserves the original intent—a basic summary of the book—but rather than being an assessment of knowledge (facts about the story) and a skill (writing a summary), this example presents a more authentic and rigorous performance task by grafting on a critical review for an authentic audience using a technology application.

Traditional task: Write a book report on *A Sick Day for Amos McGee* following the given format.

Grafted task: As a literary critic, you have been asked to submit a book review for *A Sick Day for Amos McGee* on Goodreads (www.goodreads.com). Thousands of students visit this website to find out about books that they might like to read. Your review should summarize the basic plot, discuss the strengths and weaknesses of the writing, and make a recommendation. Before you begin, review other students' book reviews to see what makes an effective review.

Figure 4.10: Sample grafted assessment task.

By systematically grafting transdisciplinary outcomes onto academic tasks across grades, teachers can engage students in applying these skills and dispositions and gathering evidence of their development.

Cornerstone Performance Task Maps

Ideally, you will build a curriculum planned backward from long-term disciplinary and transdisciplinary outcomes around a series of recurring cornerstone performance tasks that increase in complexity over successive grade bands. Beginning in the elementary grades, the tasks are simple and highly scaffolded versions, progressing across the grades to increasingly complex and authentic tasks. If you want students to become prepared for college and careers, it is important for teachers to create tasks that are gradually less teacher directed, allowing students increasingly greater autonomy. Having teachers gradually release responsibility in favor of increasing student ownership is crucial if you want students to become self-directed learners. After all, isn't that what preparation for college and careers requires?

To ensure a coherent progression across the grades, we encourage the development of cornerstone task maps as a means of organizing and connecting cornerstone performance tasks across grade levels and subject areas. Cornerstone task maps lay out a set of recurring performance tasks across the grade levels.

Figure 4.11 (page XX) presents a task map of recurring cornerstone performance tasks for a long-term science transfer goal that Greg Curtis developed with science teachers at the International School of Beijing (2013). The science team constructed the tasks around performance areas that demonstrate developmentally appropriate performances at the grade levels it identified. Figure 4.11 also shows examples of grafting various transdisciplinary outcomes onto these science tasks via performance indicators.

Cornerstone performance tasks for every transfer goal do not usually occur every year. Districts and schools will develop their cornerstone task maps so that the tasks are distributed across grade-levels and subject areas. For example, if a district decided science has three transfer goals (TG1, TG2, and TG3), it might distribute its cornerstone tasks in the following way.

- **TG1:** Prekindergarten, grade 2, grade 5, grade 8, and grade 11
- **TG2:** Kindergarten, grade 3, grade 6, grade 9, and grade 12
- **TG3:** Grade 1, grade 4, grade 7, and grade 10

This arrangement of cornerstone performance tasks also allows teachers to address the learning needs these tasks reveal over time. In other words, if a student is having difficulties with respect to TG1 in grade 2, teachers can specifically address those difficulties in grades 3 and 4 knowing they will be reassessed in

Long-Term Transfer Goal: Students will use scientific approaches and methodologies to investigate phenomena, claims, results, and information.

Associated skills	Asking questions	Proposing hypotheses	Devising tests	Collecting data	Drawing conclusions

Recurring Cornerstone Performance Tasks

Grade Level	Tasks	Transdisciplinary Outcomes and Performance Indicators
Grade 9	**Consumer Science** Students will compare products by devising an appropriate line of scientific inquiry, carrying out research, and interpreting results. They will make a claim about the best product and communicate the inquiry, results, and interpretations of their findings. Others in the class will judge how well students communicate their claims most effectively. (Example: Design and conduct a controlled investigation to determine which diet or health care product has the best scientific backing for its claims and why people should purchase it.)	**Communication** • Clearly states claims and conclusions with convincing references to scientific evidence • Communicates data from sound investigations in a way that communicates claims and conclusions effectively • Uses and integrates a range of digital media (photography, audio, video, web production, digital editing, or presentation slides) to generate compelling and persuasive communication
Grade 7	**Seek and Solve** Students will conduct research and test various potential solutions for sustainability issues in their simulated city by devising an appropriate line of scientific inquiry. They will assess the supporting data and claims for authenticity and make a recommendation based on these results. The students will communicate the inquiry, results, and interpretations of their findings. (Example: Propose a plan and procedure for collecting and recycling cooking oils from area restaurants and food carts to create more sustainable sources of energy.)	**Global Citizen** • Identifies elements of the system that are changing over time and require solutions to maintain sustainability • Explains how actions can create consequences, both wanted and unwanted • Evaluates the effectiveness and implications of existing solutions to issues

Continued →

Figure 4.11: Sample cornerstone task map for science.

Grade 5	**Prove It!** Students will devise and conduct a scientific test that is fair and free of bias. From this experience, students produce a procedure with the clarity and detail for others to replicate. After a peer conducts his or her test, results, and conclusions, students discuss them. (Example: Conduct controlled tests to see which brand of paper towel is most absorbent. Produce a Prove-It Guide so that others can follow the procedure with clarity and accuracy.)	**Communication** • Develops clear procedural guides • Uses appropriate tone and structure for the audience and purpose • Adds effectiveness to communications through the inclusion of graphics, data, and digital elements.
Grade 2	**Create Your Own Experiment** Students will follow the scientific method to answer one of their questions. Questioning, hypothesizing, experimenting, observing, and concluding are each broken down and examined individually. (Example: Observe and predict which objects a magnet will attract.)	**Critical Thinking** • Engages in discovery, exploration, and experimentation • Devises a question and develops a simple methodology to test possible answers • Uses observations to answer questions, construct a reasonable explanation, solve a problem, and create something
PreK	**Fair's Fair** Students will be introduced to the concept of a fair test and will use this to carry out a novel, simple investigation. They learn to ask questions that can be tested and attempt to create fair testing environments with adult support. Findings and conclusions are organized for communication. (Example: Will it float? Investigate the properties of various objects in terms of flotation in water. Develop simple hypotheses as to why some things float and others sink.)	**Critical Thinking** • Makes observations about the immediate environment • Makes simple judgments based on personal experience • Conducts basic tests and evaluations using simple criteria • Draws conclusions with references to personal observations

Source: *© 2013 by International School of Beijing. Used with permission.*

grade 5. This arrangement links student growth in a longitudinal manner across similar performance areas and strands.

A challenge in constructing a map of cornerstone tasks is to achieve a balance among various discipline areas while including transdisciplinary outcomes. Appendix B (page XX) depicts a sample K–12 map of cornerstone performance tasks. You'll notice that we organized the tasks in this map around four prominent academic disciplines, but also note that we grafted various transdisciplinary outcomes (21st century skills) onto each task. We chose to present this example since most schools are still organized around traditional subject areas, and we want to illustrate a possible cornerstone task map. However, schools that have alternate structures (such as teachers and students working in interdisciplinary teams on project-based learning) might organize the task map around transdisciplinary transfer goals and associated tasks or projects.

We recognize that the examples in appendix B (page XX) suggest a somewhat standardized assessment system. However, it is possible to design a cornerstone task map without excessive standardization, in which both teachers and students can have voice and choice within cornerstone tasks in the following three ways.

1. Teachers could offer students choices using task frames such as the example in figure 4.7 (page XX) or those the Literacy Design Collaborative (2014) provides. For example, in argumentation-focused task frame, either teachers or students could choose the *issue*, the *audience* and (or) the *mode of communication* (such as a position paper, a blog post, a podcast, or a letter to the editor).
2. Two teachers might use the *same* task frame, targeting the *same* transfer goal, but allow different content. This is fine, as long as the task provides appropriate evidence of the targeted transfer goal. For example, if the transfer goal is about *research* and *historical analysis* applied to the causes and effects of large-scale migration, the teacher or students might select the *historical period* to study (such as migration from eastern Europe to North America in the early 20th century or current migration from North Africa and the Middle East to Europe).
3. A more personalized approach for students would allow them to propose a task or project through which they could provide evidence

of performance against one or more of the targeted transfer goals. However, to ensure consistency as an assessment, teachers must judge the products or performances they produce according to pre-established performance criteria. We explore the idea of student-provided evidence in greater detail in chapter 6 (page XX).

To summarize, we believe that a systematically developed set of cornerstone performance tasks provides the necessary structure through which a district, school, or department area can collect the assessment evidence necessary to gauge the growth of students' abilities to transfer their learning in authentic situations. This evidence also provides the answer to the fundamental question for districts and schools: Are we delivering on our mission?

Although we advocate for a set of common cornerstone performance tasks to assess transfer of learning and students' progress toward the transdisciplinary and disciplinary transfer goals, these tasks are part of the assessment system. We do not intend for them to replace the more traditional assessments that teachers regularly use (such as tests, quizzes, and skill checks) as checks for students' acquisition of knowledge and skills. Similarly, we do not intend for them to replace the external, standardized assessments—such as state or provincial tests, advanced placement, and International Baccalaureate exams—that provide measures of achievement that allow for comparisons across schools, districts, states, and even nations. As we noted previously, varied assessments have their place in a comprehensive photo album of evidence.

Notes From the Field

We find that when a cornerstone task is set in an authentic context, it is more likely that the task will naturally involve more than a single discipline, as well as one or more transdisciplinary outcomes. In our work with schools, we note that such tasks can provide evidence of student performance on multiple outcomes, both academic and transdisciplinary.

Rubrics

A characteristic of strong cornerstone performance tasks is that they are assessible using established criteria. A rubric is an evaluation tool combining established criteria with a performance scale. Rubrics judge students' responses to open-ended assignments, performance tasks, and projects. Well-developed rubrics have several characteristics, including the following.

- They specify the salient criteria for judging student performance.
- They help clarify instructional goals and serve as targets for teaching and learning.
- They provide specific feedback to learners and teachers.
- They guide students in self-assessment.

Moreover, when grade-level or department teams of teachers use common rubrics, we see improved reliability, such as more consistent evaluation of student performance (Goldberg & Roswell, 2010).

There are many sources of well-developed rubrics for evaluating student products and performances within academic subject areas. However, when assessing broader transdisciplinary outcomes, educators may have to construct their own. Identifying a list of performance indicators is an important first step. They can then incorporate these into an analytic rubric or developmental continuum. Figure 4.12 (page XX) provides an example for the transfer goal of *collaboration*.

For more examples of rubrics for transdisciplinary outcomes, see the following websites (visit **go.SolutionTree.com/leadership** to access live links).

- EdLeader21 (http://www.edleader21.com/order.php)
- Catalina Foothills School District's Rubrics for Deep Learning Proficiencies (https://bit.ly/2GAwAnF)
- West Windsor-Plainsboro's Global Challenge Rubrics (https://bit.ly/2KQOQ19)
- DoDEA21 (https://bit.ly/2UMm1aM)

Although you can access and develop rubrics for transdisciplinary outcomes (21st century skills and habits of mind), we offer a cautionary note about using them. We propose that you can most appropriately use these scoring tools as

Dimensions of Collaboration	Works Toward the Achievement of Group Goals	Demonstrates Effective Interpersonal Skills	Contributes to Group Maintenance	Effectively Performs a Variety of Roles Within a Group
4—Expert	Actively helps identify group goals and works hard to meet them	Actively promotes effective group interaction and the expression of ideas and opinions in a way that is sensitive to the feelings and knowledge base of others	Actively helps the group identify changes or modifications necessary in the group process and works toward carrying out those changes	Expertly performs multiple roles within the group
3—Practitioner	Communicates a commitment to the group goals and effectively carries out assigned roles	Participates in group interaction without prompting and expresses ideas and opinions in a way that is sensitive to the feelings and knowledge base of others	Helps identify changes or modifications necessary in the group process and works toward carrying out those changes	Adequately performs more than a single role within the group
2—Apprentice	Communicates a commitment to the group goals but does not carry out assigned roles	Participates in group interaction with prompting or expresses ideas and opinions without considering the feelings and knowledge base of others	When prompted, helps identify changes or modifications necessary in the group process or is only minimally involved in carrying out those changes	Attempts to perform more than one role within the group but has little success with secondary roles
1—Novice	Does not work toward group goals or actively works against them	Does not participate in group interaction, even with prompting, or expresses ideas and opinions in a way that is insensitive to the feelings and knowledge base of others	Does not attempt to identify changes or modifications necessary in the group process, even when prompted, or refuses to work toward carrying out those changes	Does not attempt to perform a designated role, even when prompted, or refuses to play a supportive role

Source: Adapted from Marzano, Pickering, & McTighe, 1993.

Figure 4.12: Sample analytic rubric for collaboration.

targets for teaching and learning, a means for judging organizational effectiveness (such as asking, "How well are our learners developing these abilities?"), and especially as tools for students to use for self-assessment and goal setting. We do *not* advocate using them for high-stakes evaluation and grading. We will discuss a method that we recommend for assessing and reporting on transdisciplinary outcomes in chapter 6 (page XX).

Conclusion

In this chapter, we explored the elements of a comprehensive system for assessing all our goals—including the broader transfer goals contained in our mission—not just the ones that are easiest to test and grade. When a district, school, or department enacts such a system, it can confidently say that it has a guaranteed and viable curriculum and assessment framework that fully supports its vision and mission. Moreover, we can use the resulting evidence of student performance to check that we are on track toward the modern learning we seek.

In the next chapter, we move to the next stage of backward design to consider the kind of instruction necessary to achieve our mission for modern learning. We also describe the value of identifying an explicit set of learning principles to guide the selection of teaching strategies and resources for modern learning and introduce a framework for aligning teaching methods with our various goals.