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Classroom Activity Systems to Support Ambitious Teaching and Assessment

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CONTENTS

INTRODUCTION

Ms. T's first and second graders are partway through a unit investigating plant growth and development by exploring pumpkins (Rosebery et al., n.d.; Warren & Rosebery, 2011). After germinating seeds *out* of soil in Petri dishes using moist paper towels, Ms. T (a White European American teacher) begins to shift students to exploring how roots grow using a root chamber—a glass-sided container that makes root growth visible in soil (Warren & Rosebery, 2011). Simon (an African American second grader) interrupts her and asks the question, "Did you put magic beans in there or something?" (Warren & Rosebery, 2011, p. 100).

Rather than close down Simon's question, Ms. T seizes on his contribution as a powerful intellectual opportunity. She asks Simon to "say more," an instructional move that has important implications for both Simon's and the class's learning. Reflecting on the Petri dishes, Simon replies that "he was wondering how seeds could germinate without soil" (Warren & Rosebery, 2011, p. 101). His explanation allows Ms. T to see Simon's question from a different perspective, highlighting the contradiction Simon saw between seeds growing in and out of the soil. Ms. T followed up by exploring these ideas with Simon and drawing on the implications of Simon's question with the whole class.

This interaction, like many others in Ms. T's classroom, was not purely serendipitous. Rather, it was shaped through the intersection of classroom activities, a classroom culture in which students feel safe to share their ideas, and teaching moves in which Ms. T creates—and seizes on—opportunities to explore student ideas and draw implications with the whole class (e.g., Rosebery et al., 2016). By inviting Simon to share and develop his thinking, Ms. T "opened a space for him to shape an identity as a powerful, engaged, and critical scientific thinker – in his own eyes, her eyes, and the eyes of his classmates" (Warren & Rosebery, 2011, pp. 101–102).

CONCEPTUALIZING AMBITIOUS TEACHING

Ms. T's lesson on the pumpkin life cycle illustrates several salient characteristics of what has come to be called *ambitious teaching*. Many instructional approaches have been described under the umbrella of ambitious teaching (Hammond, 2021; Lampert et al., 2013; Shepard, 2021; Smith et al., 2001; Smylie & Wenzel, 2006; Windschitl et al., 2018), including:

1. Centering the interests and experiences of students from diverse cultural and linguistic backgrounds;
2. Engaging students in rich, authentic tasks with scaffolds to support their participation;
3. Inviting students to be active co-constructors of and participants in their learning through productive classroom discourse that involves reasoning, explaining, analyzing, and justifying;
4. Developing students' disciplinary knowledge and practice in a community of learners; and
5. Utilizing assessments designed and enacted in alignment with these goals.

As Ms. T's response to Simon illustrates, questions and other talk moves that invite students to participate in discussions and build on what peers have said (Michaels et al., 2016) support her in learning more about what her students are thinking. Questions and talk moves draw together threads from prior class conversations, readings, student experiences, and class investigations to help her use those ideas to revise and improve a common representation. The instance described at the start of this chapter—an occasion of informal, everyday assessment—was the intersection of a carefully planned sequence of lessons, a curated set of resources to support student learning, and a commitment to developing and refining students' thinking through ongoing classroom discourse. In this type of environment, students develop their understanding of both foundational science concepts and science practices.

Ambitious teaching principles are grounded in sociocultural theories of learning, situate learning in a cultural context organized by tools and routines, and conceptualize learning as changing participation in disciplinary practices (Chapter 3 of this volume, "Human Learning and Development: Theorectical Perspectives to Inform Assessment Systems"; Brown et al., 1989; Engeström, 2001; Greeno, 2006; Lave & Wenger, 1991). A sociocultural view contemplates classrooms as organized disciplinary communities of practice that attend to the interconnected cognitive, social, emotional, and cultural facets of learning and development. A sociocultural view also encourages consideration of both teachers and students as key participants in classrooms, bringing their previous knowledge, identities, and lived experiences into these learning environments (see Chapter 3 of this volume, "Human Learning and Development: Theorectical Perspectives to Inform Assessment Systems"; Gutiérrez & Rogoff, 2003).

Sociocultural perspectives emphasize that what students learn, think, and feel is the result of complex interactions that reflect their cultural and contextual circumstances (see Chapter 3 of this volume, "Human Learning and Development: Theorectical Perspectives to Inform Assessment Systems"). Learning, then, can be defined "as the transformation of an individual's participation in valued social and cultural activities" (see Chapter 3 of this volume, "Human Learning and Development: Theorectical Perspectives to Inform Assessment Systems," p. 57). Any disciplinary practice involves a set of activities (special ways of acting and interacting to produce and use knowledge; Gee, 2008) and experiences (special ways of seeing, valuing, and being in the world; Gee, 2008). Interactions between learners and their environments that involve those disciplinary activities and experiences evolve, reflecting a change in the characteristics of the participation of learners (e.g., the way to *do* science, to *talk* science, to *value* science; Gee, 2008) and diverse levels of appropriation of the disciplinary practices. In the classroom context, a sociocultural perspective should respond to the diversity of students' home and community cultures. It should be a step toward bridging the gap between the classroom and students' homes and communities (Ladson-Billings, 2021).

CONCEPTUALIZING AMBITIOUS CLASSROOM ASSESSMENT

As the views of teaching shift, so must the ways that classroom assessment is theorized, designed, and enacted (see Chapter 3 of this volume, "Human Learning and Development: Theorectical Perspectives to Inform Assessment Systems"). Thus, ambitious classroom assessment is integrated into and overlaps with ambitious teaching

practices (Shepard, 2021). A sociocultural perspective has implications for how to think about supporting students' learning and how activities related to assessing students do more than just provide information about students: they shape understanding about what learning is, what is important to learn, and who the learners are (Haertel et al., 2008).

From a sociocultural perspective, assessment means observing, documenting, and analyzing how students use and modify their knowledge, skills, and engagement in disciplinary practices over time to participate in a classroom community (Moss, 2008; National Research Council, 2001). It follows that classroom assessments should be designed with learners' interests and identities in mind. In addition to assessing an in-depth understanding of key knowledge and skills within a domain, teachers should assess learners' engagement in disciplinary practices. Therefore, ambitious assessment—like ambitious teaching—should involve the ways of acting on, interacting with, seeing, and valuing the disciplinary world.

Classroom assessment is based on the idea that much of what teachers and students do in their classrooms can be utilized as evidence of students' learning. Assessment, then, is a part of social interactions and is a socially situated activity (Jordan & Putz, 2003). What students say, write, do, and produce are potential sources of evidence of learning and evidence toward achieving rich learning goals.

In the classroom context, learners and teachers are both participants in assessment. Teachers design and/or select assessment tasks and can also take on an unexpected student question as an assessment opportunity. Teachers must make sense of all information sources about students' developing understanding and engagement in practice, and in turn, make decisions based on this information. Assessment also expands beyond individual learners to include their interactions with each other and their reflections on their learning. Participants' engagement in assessment is defined not only by the tasks embedded in curricula but also by the opportunities that arise from the regular participation of the members of a community that supports ambitious teaching and learning. Assessment events are aligned with what students are doing and learning at any given moment during instruction.

The goals for ambitious learning frame gathering or eliciting evidence about students' learning, as well as analyzing and interpreting that information to inform subsequent instructional actions. These assessment activities can happen informally, at any moment during instruction, or more formally, at specific times (Ruiz-Primo & Furtak, 2006, 2007). This means that classroom assessment involves planned as well as unplanned events that should be viewed as opportunities to learn and refine students' conceptual understanding and disciplinary practices.

Classroom assessment can be both formative—conducted on a day-to-day basis while learning is in process—or summative—conducted at the end of an instructional period (e.g., a unit). Engaging learners in assessment—both formative and summative—provides them with opportunities to assess themselves and their peers and to receive or provide feedback. These activities help learners develop and internalize criteria that define what counts as evidence of their learning and also serve as agents of their own learning. In ambitious teaching classrooms, teachers and students work together to promote the learning of the community.

LEARNING ENVIRONMENTS THAT SUPPORT
AMBITIOUS TEACHING AND ASSESSMENT

The descriptions of ambitious teaching and ambitious assessment previously presented are part of multifaceted classroom learning environments. As illustrated by the example of Ms. T, these environments reflect a particular culture in which students' learning develops through classroom practices and circumstances (Gay, 2018; Rogoff, 2003). Learners flourish in a classroom culture where everyone contributes; their ideas are valued; and they are supported academically, socially, and emotionally. Learning environments should be informed by the cultures and identities of the learners they serve. In this way, classroom learning environments can be culturally responsive—inviting and building on "the cultural knowledge, prior experiences, frames of reference, and performance styles of ethnically diverse learners to make learning encounters more relevant to and effective for them" (Gay, 2018, p. 36).

Culturally responsive classrooms acknowledge the legitimacy of the cultural heritage of different ethnic groups (attitudes and approaches to learning); build bridges between students' homes and school experiences; use a variety of instructional strategies; teach students how to praise their own and other's cultures; and incorporate multicultural information, materials, and resources into teaching and learning (Gay, 2018). They are conducive to *equitable and collaborative practices* that have the potential to provide all students with multiple opportunities to explain their thinking and develop purposeful and deliberate disciplinary practice. Equitable classroom environments (1) provide access to high-quality instruction and opportunities to learn to all students; (2) offer opportunities to refine students' conceptual understanding and solutions to problems and make connections with students' cultural background and identity; (3) support an expanded view of disciplinary knowledge and practice (e.g., what counts as science); and (4) support teachers and students in seeing disciplinary work as part of justice movements (National Academies of Sciences, Engineering, and Medicine, 2022).

In this chapter, we build on sociocultural theories of learning to define a classroom activity system that supports ambitious teaching and classroom assessment. The activity system is comprised of multiple elements, each informed by what research says about how students learn and the kinds of classroom practices that support their learning. In the next sections, we focus on each of the elements of the activity system. This chapter dives deeply into each element—learners, curriculum, instruction, learning culture, and assessment—and provides examples for each. We start with the critical element, the learners, and then discuss curriculum, instruction, assessment, and the classroom learning culture. Finally, we describe how the elements work together to create a learning environment that supports ambitious classroom assessment to support all learners.

CLASSROOM ACTIVITY SYSTEM: AN ORGANIZATIONAL
FRAMEWORK FOR CLASSROOM TEACHING AND ASSESSMENT

We begin with a framework for a classroom activity system (previously proposed by Ruiz- Primo, 2021), presented in Figure 4-1. The framework illustrates classroom activity systems as an interplay of five elements: *learner*, *curriculum*, *instruction*, and *assessment*, all immersed in a *classroom learning culture.* These five elements have an interdependent purpose in supporting student learning. The framework reflects the
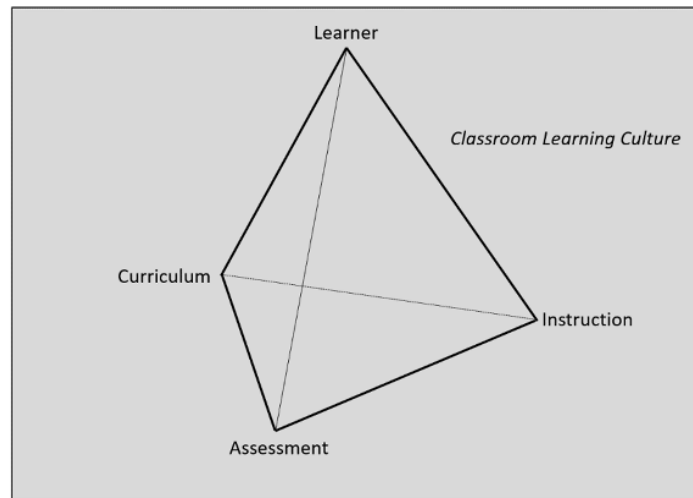
FIGURE 4-1 Classroom activity system elements.
SOURCE: Ruiz-Primo, 2021.

relationship among teachers and learners (the who), the subject matter reflected in a curriculum (the what), the instructional and assessment approaches (the how), and the environment in which this all happens (the where).

In this chapter, we describe research-based practices that support ambitious teaching and assessment by attending to learners' cultural and personal backgrounds, as well as ways of knowing, doing, and being as resources to support their learning (Hammond, 2021; Shepard, 2021; Windschitl et al., 2018). While this chapter's ultimate purpose is to highlight the role of assessment in a classroom environment that supports ambitious teaching, we also use the activity system to define how assessment is embedded within a larger system of learners, instruction (and teachers), curriculum, and a classroom learning culture.

The framework reflects multiple orientations (Lee, 2008) encompassed by a socio-cultural perspective, including:

1. A *sociocognitive orientation* that reflects the importance of helping learners develop their knowledge and abilities progressively over time (National Research Council, 2000; Penuel & Shepard, 2016; Tobias & Everson, 2009; Zimmerman & Moylan, 2009);
2. A *distributed view of cognition* that reflects the importance of interactions among people and with tools in the classroom, as well as interactions among people with tools and tasks to construct learning (Lee, 2008; Newman et al., 1984); and
3. A *cultural orientation* that acknowledges multiple ways of knowing; considers learners' background, prior knowledge, and "funds of knowledge" (i.e., accumulated developed bodies of knowledge and skills in households); and the norms and routines that guide interactions in classrooms (Gee, 2008; McDermott & Pea, 2020; Moll et al., 1992; Moss, 2008; Nasir et al., 2020; National Academies of Sciences, Engineering, and Medicine, 2018b; Rosado-May et al., 2020; Ruiz-Primo et al., 2022).

Learners

Learners come to school with prior knowledge and lived experiences from their homes, families, and communities. This knowledge influences what is seen, heard, and felt, and what learners understand and construct (National Research Council, 2000). In essence, "One's existing knowledge serves as the foundation of all future learning by guiding organizations and representations, and by coloring and filtering all new experiences" (Murphy & Alexander, 2007, p. 16). Human development is a cultural process and learners' development largely depends on their social environments, including their norms and relational characteristics (Rogoff, 1995, 2003). Therefore, learners become members of multiple social environments and cultures (e.g., home, school, neighborhood, or race/ethnicity group). These memberships affect what and how they think and learn.

Individual cognition develops through social interactions, both in and out of school (Alexander, 2006; Penuel & Shepard, 2017; Rogoff & Angelillo, 2002; Rogoff et al., 2003). The roots of learning and development depend on sociocultural interactions. What any individual can come to know is determined by the social collective. Conversely, the collective is a result of a group of learners with diverse prior knowledge and experiences (Brown et al., 1989; Rogoff, 1998).

Learners' prior knowledge is also developed through school experiences, defined by specific curricula and opportunities to learn—including the kinds of resources and instructional practices they were exposed to—and supported by opportunities to demonstrate what they learned and how that learning is applied. These experiences are likely to have influenced their beliefs about their abilities to complete tasks, intrinsic motivation to learn, strategies to process information and control their own learning, and the way they interact with their classmates. There is evidence that learners' encounters with diverse cultural classroom contexts influence how they perceive and experience themselves (e.g., self-appraisal and self-esteem) as well as their attributional processes about the self (e.g., *I can learn mathematics* versus *my capacity does not allow me to learn mathematics*) (Rosenholtz & Simpson, 1984; Spencer, 1999).

A crucial component of ambitious teaching and learning is centering the interests of all learners, particularly those from historically marginalized backgrounds, in classroom learning environments (National Academies of Sciences, Engineering, and Medicine, 2022). We focus on three aspects of learners below: their interests and identities, linguistic and cultural capital, and knowledge about themselves as learners.

Learners' Interests and Identities

Ambitious learning environments begin by activating learners' natural interests and curiosities and using them as entry points to sequences of learning. Learners are motivated, work harder, persist longer, and learn better when what they are learning seems useful and connected to their motivations, identities, and future goals (National Academies of Sciences, Engineering, and Medicine, 2018b). In the classroom, students develop their identity as learners, which is shaped by the culture established in the classroom.

At the same time, learners do not simply learn *about* content; they also learn ways of *being* (Bruner, 1996; Gutiérrez & Rogoff, 2003). For example, learners develop certain ways of participating within their families, their circle of friends in the neighborhood, and their circle of friends in the school. Learners, then, navigate diverse cultural in and out of school practices that require diverse repertoires or ways of participation (Nasir et al., 2022). These experiences lead to particular ways of talking or participating in each context. Finding ways to connect these skills with academic disciplinary practices can positively affect the development of learners' interests, identities, and performance. Here it is important to mention that classrooms cannot support identity "without embracing the differences in the classroom as resources for learning" (Steel, 2012, p. 1,127). Discovering small differences in social relations can make a big difference in the level of learners' engagement in school (Erickson & Mohatt, 1982).

In our research, we have observed teachers' specific strategies to gather information about their learners. On the first days of the school year, an elementary school teacher asked her learners to write her a letter about themselves, describing what they liked or disliked and whatever else they wanted to share (Ruiz-Primo et al., 2022). This information helped the teacher gain insights about—in learners' own words—things she could connect to and leverage during instruction. For example, if some learners liked basketball, she could use that information as context for teaching mathematics concepts (see Nasir, 2007, for an example of how to use basketball in teaching statistics). Once these interests are considered during instruction, they can also be used in a corresponding assessment task, whether informally (e.g., in a classroom conversation), or formally (e.g., in a test at the end of a unit) (Randall et al., 2021).

Learners' Linguistic and Cultural Capital

Learners' home knowledge and languages can be a foundation for classroom instruction and assessment (Brown et al., 1989; Fine & Furtak, 2020; Lee, 2008; Mehan, 2008; Moll et al., 1992; Shepard, 2021). When learners' home languages differ from the dominant culture, these non-dominant language varieties can be devalued and racialized in the classroom (Flores & Rosa, 2015). This devaluation affects learners' participation in classroom discourse and, therefore, their opportunities to learn (Lee, 1995; Mehan, 2008). These differences can be repositioned as an asset, reflecting the "multi-competence" that multilingual youth bring to the classroom, as they have a broad conception of language and cultural knowledge that, with the appropriate curricular and instructional support, enables them to participate, contribute, and succeed (National Academies of Sciences, Engineering, and Medicine, 2018a). Warren and Rosebery (2011) reflected on the interaction between Ms. T and Simon:

> Viewed culturally and historically, Simon's ways with words were neither random nor mysterious. He was speaking from within a powerful intellectual and expressive tradition of African American discourse practices, which includes incisive argumentation, metaphorical invention, counterfactual reasoning, and language play (Lee, 2007; Mitchell-Kernan, 1981; Smitherman, 1977, 2000).… In fact, the language use practices of African American students are frequently misread in school as signs of confusion, off-topic digressions, disengagement or disrespect (Foster, 1983; Michaels, 1981). (p. 101)

Ms. T was receptive to Simon's multicompetence, affirming his cultural identity. Teacher–student language patterns that are closer to students' home and cultural interaction patterns are more successful in improving learning than language patterns that are culturally incongruent to the students (Au & Jordan, 1981; Erickson & Mohatt, 1982; Mohatt & Erickson, 1981). If a teacher does not recognize how learners' everyday ways of expressing ideas reflect disciplinary understandings, they "may fail to capitalize on rich, meaningful opportunities for children's learning" (National Academies of Sciences, Engineering, and Medicine, 2022, p. 96). The "interactional etiquette" (Erickson & Mohatt, 1982, p. 135) students bring to the classroom from their everyday experiences varied from one cultural context to another (e.g., the role of "silence"). Understanding these differences should allow teachers to interpret students' remarks and behaviors and make the necessary adaptations in the classroom (like in the case of Simon).

This reframing of multilingual learners' expertise as a resource for assessment is also illustrated by Khisty and Chval (2002), who provide the example of a teacher of Latino students. The teacher introduced the concept of quadrilateral, asking learners to listen carefully to the word and repeating it more than once: "Qua–dri–lat–er–al, Qua–dri–lat–er–al, Qua–dri–lat–er–al" (p. 158). She then asked the learners whether the sound of the word or which part of the word was something that they recognized. One said "cuadro," to which the teacher responded, "What is a cuadro?" (Khisty & Chval, 2002, p. 158). The discussion led to a co-constructed definition: "cuadros" had a square shape and four sides. This teacher capitalized on learners' knowledge of Spanish by connecting the concept of a quadrilateral to cuadro, and other students learned a new word in Spanish. "What is a 'cuadro'?" is a question that can be considered an informal assessment prompt, or task, to find out more about learners' understanding and build from that knowledge.

Learners also bring multiple ways of knowing and being to the classroom. Close collaboration with students, families, and community members can richly inform curriculum and assessment. For example, Indigenous learners view themselves as part of—and not separate from—nature (Bang & Marin, 2015). Instead of limiting what "counts" as ways of knowing to White, Western epistemologies, learning environments should be constructed in ways that not only honor but invite in students' identities and ways of knowing as foundational elements of their learning (Tzou et al., 2019, 2021). The Learning in Places curriculum, for example, begins with activities that invite students into conversation with their families, then encourages taking nature walks to allow for reflections in school as starting points for conversations about the socio-ecological systems near their homes (Learning in Places Collaborative, n.d.).

Students, families, and community members can both contribute to developing curricula and assist in thinking differently about how to develop assessment tasks. Earnest and colleagues (2023) used classroom observation and family interview data to define the types of tasks that would appropriately assess students in an urban public school that actively engaged with and valued the surrounding community. The analysis of classroom observations and interviews led to the identification of themes that could improve assessment practices by focusing on tasks that were developed using the students, families, and community's "funds of knowledge."

Learners' Knowledge About Themselves

It is important to know what students know about themselves as learners, including the strategies they use to study and learn, how they self-regulate their learning, and how they respond to and use feedback. Learners who are reflective, have appropriate self-regulation strategies, and take control of their actions depending on where they are in their understanding (e.g., ask for help when needed, ask for clarifications) will perform better in school and in general throughout their lives (Alexander, 2006; Murphy & Alexander, 2007; Pugh et al., 2000; Weinstein & Mayer, 1986; Winne, 1995). Strategies are learner-initiated actions and strategic learners are "invested learners" (Alexander, 2006; Palmer & Goetz, 1988).

Strategic thinking should be nurtured. Teachers can encourage learners to think about their thinking—metacognition—to better know what they should do next (Alexander, 2006; Winne & Azevedo, 2014). Being metacognitive means that learners self-monitor their knowledge, can self-direct their actions to improve their knowledge, and self-regulate their learning to become independent and strategic learners. Metacognition and motivation support each other—hence the importance of using activities and topics that connect with students' interests and are familiar to them. Strategy use is heavily influenced by motivation, which in turn may be affected by previous experiences that have led to learners' holding positive or negative self-perceptions such as, for example, being a poor student (Palmer & Goetz, 1988).

In the classroom, teachers can support strategic thinking and metacognition during instruction and assessment. For example, competent learners have an ample repertoire of general (e.g., how to study) and domain-specific strategies (e.g., rehearsal strategies to learn multiplication tables). Teachers can ask learners to share and reflect upon the strategies they use for certain tasks, and can help learners to reinforce the strategies by making their characteristics explicit (e.g., organizational strategies for complex tasks may imply planning or outlining steps) and making connections with task characteristics (e.g., simple tasks like naming the names of planets may require less sophisticated strategies than more complex tasks like planning and conducting a scientific investigation). Teachers can provide further support to learners by checking for comprehension failures (e.g., self-questioning whether students are understanding) and by developing strategies that can help them in their learning. For example, teachers can ask students to underline or highlight what they consider important ideas and justify their importance, ask themselves questions about the information they are learning, or organize that information in a manner that helps them connect to what was previously learned in the unit or in the course. Talking aloud while solving a problem, analyzing a literary paragraph, or reading the instructions on how to conduct a scientific investigation can all support students' metacognition (e.g., "Hm, I do not understand this word, I will circle it and make sure I know what it means before I continue" or "I need to check my calculation before I continue"). Teachers can also model positive self-talk (e.g., "I can do this") and point out when negative self-talk does not help students to move forward (e.g., "This is too difficult, I cannot respond to these questions"). These strategies can be particularly helpful to lower-performing students, whose thinking may be self-deprecating (e.g., "I will never learn this stuff, it is too complicated").

For example, a mathematics teacher asked her learners whether they wanted to respond to an easy problem, a medium-difficult problem, or a difficult problem about a certain topic during the warm-up segment of the lesson (Ruiz-Primo et al., 2015). She always chose the difficulty that the majority of the learners selected, and then asked the students why they chose that level of difficulty that day. Some days, the responses involved explanations related to their level of understanding—those days sparked a short discussion about their ability to judge their own understanding or difficulties perceived by the students. These conversations promoted self-monitoring. The teacher was careful to ask after learners whose voices were not heard at first. On occasion, she changed the level of the task—usually from medium to difficult—based on the learners' responses, challenging them to challenge themselves.

Teachers can seek to know their students' strengths as learners and what their areas of challenge are (Conley, 2018). Important assessment questions can be answered by intentionally observing students' behavior: Do most of the learners need to hear explanations more than once before they can discuss them? In any given task, how do students manage their time? What learning strategies do they use?

Self-assessment can also help learners reflect on their learning skills (Conley, 2018). For example, they can reflect on the process of completing a particular product or piece of work. Students can respond to questions provided by the teacher like: "Did I manage my time efficiently to finish this task? Did I get stuck on something while conducting this task? If so, what did I do? Did I rethink my approach to the task? Did I ask for help? How did my actions affect the quality of the product?" Questions like these can help learners think about the type of learners they are and support them in taking control of their learning.

Taken together, these three aspects—learners' interests and identities, linguistic and cultural capital, and knowledge of themselves as learners—can inform approaches to centering learners in classroom environments. Doing so opens space for them to try new ways of knowing and being and builds motivation and engagement (National Academies of Sciences, Engineering, and Medicine, 2018b, 2019).

Curriculum

Curriculum sets the rigorous, authentic, and challenging tasks that support learning, teaching, and assessment in the classroom. It is a crucial starting point for building bridges to students' interests and prior experiences to create more equitable learning opportunities. While the curriculum may be just one of many instructional resources present in a classroom activity system, it is a critical one (Remillard & Kim, 2020). Intended or planned curriculum provides the specificity and organizational structure that guides instruction and assessment (Schmidt et al., 2001). The *intended/planned curriculum* helps teachers understand what, when, and how students have opportunities to learn; have clarity about how the different components of the curriculum fit together; see how the sequence of topics and activities build on each other, making the *enacted or implemented curriculum* more likely to succeed; and have clarity about where to focus assessment of students' learning—that is, the *learned curriculum* (Giamellaro et al., 2017; Remillard & Kim, 2020; Ruiz-Primo, 2016; Schmidt et al., 2001).

Instructional materials reflect curriculum developers' theories of learning. From a sociocultural perspective, curriculum materials should support not just students' acquisition of knowledge but also center and respond to their lived experiences while seeking to sustain their linguistic resources and cultural practices (Paris, 2012). Meaningful learning opportunities develop in part from demanding and challenging learning goals, but also from how the enactment of the curriculum secures active participation that provides a sense of belonging (Shepard, 2021). In this section, we discuss how curriculum can be designed and adapted to center learners' experiences, knowledge, and identities, as well as what, why, and how teachers need to enact curriculum to support learners.

Responding to and Sustaining Learners' Knowledge and Practice

Curricula for ambitious teaching are designed in ways that respond to and seek to sustain learners' knowledge, practices, cultures, and languages (Ladson-Billings, 1995, 2014; Paris, 2012). Ambitious curricula start with learners in mind, dedicating time to finding out students' interests and building on these interests and home knowledge (e.g., Bang & Medin, 2010; Penuel et al., 2019). This type of curriculum engages learners as active participants and promotes motivation and interest. Curricula can be designed to be *adaptive*—lessons can be easily adjusted by the teacher according to the students' interests; *responsive*—lessons provide opportunities for teachers to respond to students' ideas, cultural backgrounds, and experiences; and *sustainable*—engaging students' evolving linguistic and cultural practices (Paris, 2012).

For example, Bang and Medin (2010) engaged Menominee community members and teachers in designing learning experiences in which the Menominee's "ideas, their public expressions, and the practices and behaviors of individuals and groups" (p. 1,014) were an integral part of learning. These learning experiences engage and intertwine students' everyday experiences with their subject matter learning (Tzou et al., 2019). Another example of culturally sustaining curricula is *Math in a Cultural Context: Lessons Learned from Yup'ik Eskimo Elders*, a supplemental mathematics curriculum developed by Lipka et al. (2005) using an expert-apprentice model that is familiar to Yup'ik students. They combined discourse structures with mathematical content based on students' cultural knowledge and spatial abilities. Results from a randomized controlled experiment conducted in Alaska showed that the "Picking Berries" (representing and measuring) and "Going to Egg Island" (grouping and place value) modules significantly improved students' mathematics performance, with relatively robust effect sizes (0.82 and 0.39; Kisker et al., 2012; see Box 4-1).

Curriculum Materials Structure and Sequence

The nature of the materials to be learned matters for both teachers and learners (Choppin et al., 2021; Remillard & Kim, 2020; Ruiz-Primo et al., 2013; Wang et al., 2013). Materials should be rich, challenging, and organized in a way that facilitates learning (e.g., in an appropriate sequence, with characteristics that can help learners recognize patterns, with appropriate cues that tell learners how to connect and use the

BOX 4-1
An Example of a Unit Based on the Yup'ik Culture

"Going to Egg Island: Adventures in Grouping and Place Values"

A first- and second-grade interdisciplinary unit on Yup'ik culture, geography, and biology was founded on the lands, everyday practices, and cultural and traditional knowledge of the Yup'ik Eskimo. The module is based on the life of a second-grade girl living in a Yup'ik Eskimo community. Using the girl's experiences, students learn to use the Yup'ik abacus and play traditional Yup'ik games while grouping objects in a variety of ways and investigating number patterns until they have a strong sense of grouping and place values.

Students are taught to communicate orally, using traditional Yup'ik ways of counting using the human body (hands, feet, limbs, and the whole body). Students are provided with ways of counting in other cultures (e.g., Native Americans of the Great Plains and Zulu [South Africa]). The unit includes a letter to the students' families that explains what students will be doing and how the family can support the student at home.

Math in Cultural Contexts: Lessons Learned from Yup'ik Eskimo Elders

The Curriculum
- Follow the Yup'ik way of knowing by using expert-apprentice modeling. Elders and the teacher first demonstrate a concept to the students (the apprentices). Students begin to approximate the knowledge of the expert, which establishes a collaborative classroom setting.
- Engage students *cognitively* by using analytic creative and practical strategies, *socially* by working together, and *practically* by applying or investigating mathematics problems from their daily lives.
- Promote student collaboration in solving challenging problems that can lead to understanding underlying mathematics principles and procedures.
- Allow different learning modalities, assuming that not all students learn in the same way. The curriculum has hands-on activities based on real-world problems, as well as abstracting and deducing activities using analytic, creative, and practical abilities.
- Promote communication among peers in ways that strengthen students' mathematical and logical thinking and help to understand the reasoning and mathematical decisions of their peers. The materials provide strategies to guide students' conversations, improving how students focus on mathematical thinking and help students support their conceptual understanding by practicing in the context of particular problems.
- Sustain the Yup'ik language. The materials include the Yup'ik words used to describe mathematical concepts along with mathematical terms.
- Promote Yup'ik values in each module. Elders counsel against waste and value listening, learning, working hard, being cooperative, and passing knowledge to others.

The Assessments
- Are embedded within instructional activities.
- Require teachers to carefully observe, listen to, and challenge their students' thinking.
- Involve students keeping a daily journal that documents their work as well as a record of their increasing mathematical knowledge and ability to communicate what they know. Students can define, explain, sketch, design, ask questions, revisit them, etc. by using this tool.
- Require teachers to adapt instruction based on the information collected through journals, observation, and listening to students in whole classroom dialogues as well as small group conversations.

SOURCE: Lipka (2003).

information, and with linguistic characteristics that are suitable to diverse students; Giamellaro et al., 2017; Ruiz-Primo, 2016; Shepard, 2021; Windschitl et al., 2018).

Curriculum materials that support ambitious learning are designed to provide multiple pathways for students and teachers. For example, OpenSciEd learning resources take a storyline approach, beginning with an anchoring phenomenon that engages learners and encourages them to draw on their prior experiences to ask questions (Edelson et al., 2021). A storyline approach to sequencing curriculum materials prioritizes coherence from a learner's perspective—that is, rather than building knowledge sequentially, as an expert might conceive, it assembles pieces in ways that logically respond to sequences of learners' wonderings and questions (Reiser et al., 2021). A curriculum storyline—such as the one shown in Figure 4-2—connects a series of routines that are a planned part of the enacted curriculum, combining multiple rounds of investigations and assembling pieces of what has been learned so far, what remains to be figured out, and culminating with students developing answers to the questions that were posed at the outset of the unit.

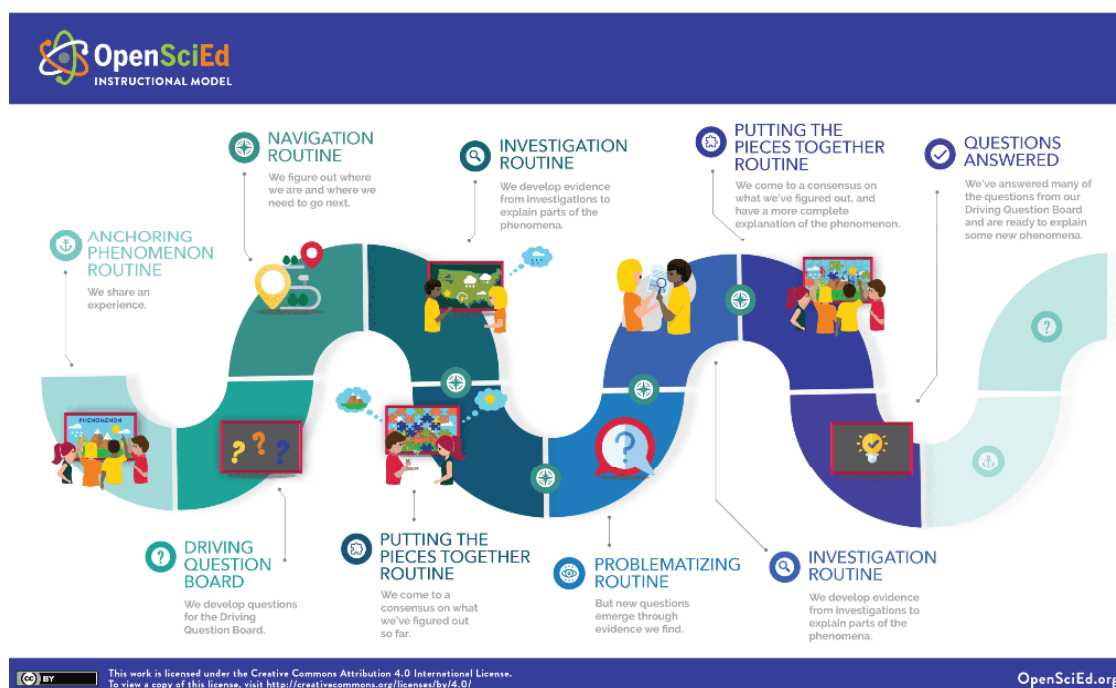**FIGURE 4-2** OpenSciEd storyline model.
SOURCE: OpenSciEd. (n.d.) *Instructional Model.* https://www.openscied.org/openscied-instructional-model. This work is licensed under a Creative Commons Attribution 4.0 License. http://creativecommons.org/licenses/by/4.0.

Curriculum materials that support ambitious teaching and learning are also designed around issues that students experience every day. Figure 4-3 shows the Classroom Storyline developed by Learning in Places, a curriculum that was co-developed with families, educators, and community-based organizations. Learning in Places provides a culturally and community-relevant field-based learning experience for students. Activities within the curriculum explore socio-ecological systems in students' neighborhoods by taking "Wondering Walks," making observations, asking "should we" questions, modeling data and relationships, conducting investigations, analyzing and explaining data, and shared decision making with families and friends. Curricula like Learning in Places allow teachers and students to work on issues that matter to students' everyday lives. What they do impacts not only the students' learning but their families as well (Learning in Places Collaborative, 2023).

Students are motivated to engage in these curricula by questions that engage students' natural curiosity and connect with their lives. For example, a question that guides Learning in Places is, "What do we notice from our Wondering Walks at school and with our families?" Even if curricula are not designed in this manner, teachers can make necessary adaptations so that the curricula are more engaging (deBarger et al., 2017). Curricula such as OpenSciEd and Learning in Places provide students with opportunities to approach problems they encounter in their environment with what they are learning, which makes them more prepared "to be effective members of society" (Ladson-Billings, 2021, p. 7).
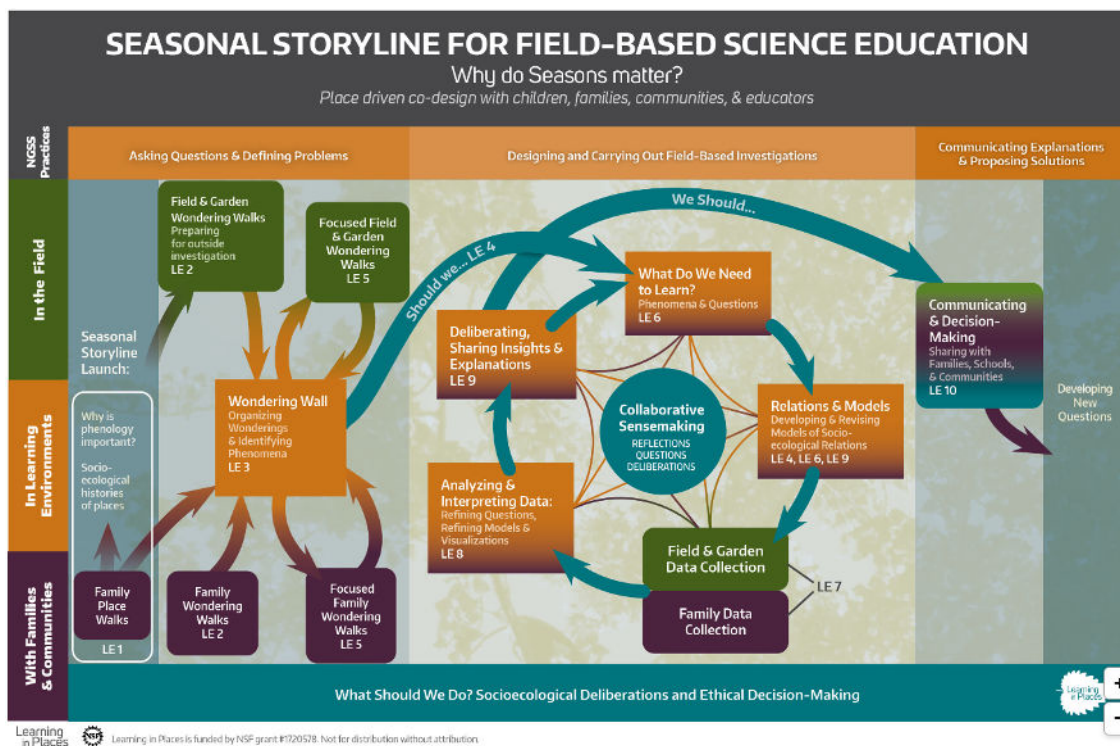

FIGURE 4-3 The Learning in Places storyline.
SOURCE: Learning in Places Collaborative. 2023. *Our classroom storyline*. http://learninginplaces.org/about.

Curriculum and Assessment

Teachers must have a deep understanding of their curriculum to effectively implement assessment in the classroom and build on students' cultural and social backgrounds in the process (Giamellaro et al., 2017; Ruiz-Primo, 2016). To appropriately focus the assessment of students' learning, teachers need to know where they want to take the students and how—in other words, they need to understand the curriculum deeply. A deep understanding of the curriculum includes *what* is to be learned—understanding the ambitious learning goals; *why* students should learn it—understanding the importance of current learning for future learning or for making connections with what was learned before; and *how* they will learn it—the manner in which the instructional activities and experiences will support students in meeting learning goals (Ruiz-Primo, 2016).

A deep understanding of what will be taught helps teachers determine how to gather information, what evidence will show that learning is taking place, what they need to pay attention to—what to notice—and when to gather information using formal tools. This understanding also allows teachers to design and/or select assessment tasks to provide evidence that students are learning and determine critical junctures at which to implement formal assessment checks.

Instruction

Students' opportunities to learn via curricula and assessment are mediated through the process of instruction. Research has overwhelmingly indicated that the ways teachers enact lessons and conduct assessments are consequential for students' learning (e.g., Dini et al., 2020; Furtak et al., 2016; Kang et al., 2014; Shulman, 1987). Like learners, the ways teachers participate in classroom activity systems are informed by their previous experiences, their knowledge, their values, and their multiple identities.

Teachers' Knowledge and Its Multiple Dimensions

Teachers' implicit theories of learning affect how they interact with learners. They can see themselves facilitating students' construction of knowledge or see their students as recipients of information provided by teachers. Educators with a multidimensional perspective on learning understand the social nature of learning and the importance of considering emotional, cultural, and cognitive facets of learning and development (see Chapter 3 of this volume, "Human Learning and Development: Theoretical Perspectives to Inform Assessment Systems").

Teachers with a deep understanding of how learning unfolds are analytical, creative, and more selective of instructional activities, materials (e.g., texts), and assessment tasks that help learners achieve ambitious goals (Giamellaro et al., 2017; Ruiz-Primo, 2016; Shulman, 1987). Understanding the *what*, *why*, and *how* of what needs to be taught allows teachers to sequence learning activities with (1) *increasing complexity*—providing additional concepts and skills necessary to approach the tasks required from students as they progress in their learning; (2) *increasing variety*—providing additional strategies required to approach these tasks so that students can learn how certain strategies work under what conditions; and (3) *a conceptual road map*—a clear model of the over-

all activity to help students make sense of the different elements they are working on (Collins & Kapur, 2022). By viewing themselves as facilitators of learning, teachers can continuously look for evidence of learning to assist with their own instructional decisions, to provide helpful feedback to students, or to identify opportunities for students to provide feedback to one another.

Teachers can be supported to develop awareness of how their lives and the lives of their students are shaped by experiences and factors such as race/ethnicity, social class, and gender (see Chapter 5 of this volume, "Assessment Literacy and Professional Learning"). By reflecting on their own cultural reference points, teachers can expand their interpretations of student behavior and promote myriad cultural displays of learning and social interaction, just as Ms. T opened the opportunity for Simon to explain his question to the class (Hammond, 2014). Teachers can also deliberately look for barriers that may affect students' learning; allocate or reallocate resources to ensure that every student has what they need to succeed socially, emotionally, and intellectually; and cultivate each student's strengths (Dugan, 2021).

Teachers' perceptions of learners can also be biased, which can in turn influence their ability to support learners through culturally responsive approaches. In a study conducted at the end of the 1970s, 100 White preservice teachers were asked to teach a student who was behind a screen (Taylor, 1979). The preservice teachers were randomly told whether the student was White or African American. When students were identified as African American, preservice teachers provided significantly less feedback after mistakes, less positive feedback after correct responses, and significantly less coaching than for students identified as White. The study also found an interaction effect of student race and gender, as White male students received the most favorable treatment and Black male students the most unfavorable. The study clearly demonstrated that student race and gender interact with teachers' perceptions about student ability, which in turn affects teachers' behavior.

Ultimately, ambitious teaching practices are supported when teachers have a deep understanding of their subject matter, know how students learn it, know their students, and have clear learning goals in mind (Shulman, 1987).

Discourse-Rich Learning Environments

There is well-documented research literature on the types of teaching practices that facilitate student engagement in ambitious classroom learning (e.g., Hammond, 2021; Shepard, 2021; Windschitl et al., 2018). These practices share the common feature of teachers creating space for, working with, and responding to student thinking beyond the management of student behavior. Teachers can begin to create this space by utilizing strategies like varying the organizational modes of classroom activity so that learners have opportunities to engage with their ideas—and those of their classmates—individually, in pairs, in small groups, and as a whole class. To create this space, teachers can balance these different participation structures to support learners in multiple ways. Unfortunately, this condition is not always met. A study conducted in 13 classrooms showed that teachers rarely interacted with learners working individually or in small groups, thus missing the opportunity to identify and address the individual needs of learners, whether English learners or not (Solano-Flores et al., 2024).

Teachers' everyday interactions with learners are hugely consequential for their opportunities to learn (Gipps, 1999). Therefore, teachers must create space to listen and respond to learners' thinking, and use diverse modalities and strategies such as conversations in which students' reasoning, ideas, or communication styles are made explicit and can be discussed (e.g., Duschl & Gitomer, 1997). These informal interactions can open meaningful spaces for learners to think with and respond to their peers and hold students accountable to disciplinary norms, such as making arguments (Engle & Conant, 2002). "Talk moves" are a commonly recognized approach to support student thinking in these interactions, including statements that encourage students to "say more," or to build on their own or peers' thinking (e.g., Michaels et al., 2016). Teachers can also follow up on student statements by encouraging them to cite relevant evidence, provide examples, and leverage their everyday experiences.

Teachers' Self-Reflection

Scholars have encouraged teachers to engage in critical self-reflection that can surface their own identities and positionalities and how they play out during daily interactions with learners (Hammond, 2014; Randall, 2021; Randall et al., 2021). For example, when teachers frame classroom conversations to allow learners to share their thinking, teachers can inadvertently shut down students' sensemaking opportunities if they limit what counts as knowledge or what might be relevant to the conversation. Teaching in a way that considers all dimensions of learning (cognitive, cultural, social, and emotional; see Chapter 3 of this volume, "Human Learning and Development: Theoretical Perspectives to Inform Assessment Systems") requires self-reflection, checking implicit biases, practicing awareness of where one stands, and thinking about how that stance affects a teacher's relationship with their students (Hammond, 2014). This self-reflection can involve teachers recounting their lived experiences, acknowledging their identities (particularly when teachers identify as members of dominant cultures), and reflecting on how their daily decision making can influence whose ideas are recognized and shared (e.g., Wright et al., 2019).

Self-reflective teachers "make the familiar strange" by learning about their cultural values and how these values shape what they do and expect in their classrooms (Spindler & Spindler, 1982, p. 23). Spindler and Spindler (1982), rephrasing Margaret Mead, described this process as such: "If a fish were to become anthropologist, the last thing it would discover would be the water" (p. 24). Hammond (2014) also suggested that teachers can (1) first identify the cultural frame of reference in place (e.g., what they believe about learning, their models of teaching, as well as models of how they expect students to behave in class); (2) widen their cultural aperture (e.g., challenging how they interpret other people's actions or ways of knowing solely through their cultural frames); and (3) identify the triggers that may affect interactions in the classroom or can lead to miscommunication or unintended conflicts (e.g., is there an overgeneralization of certain learners' behavior by class or race?).

Assessment

We define assessment as a process of gathering or eliciting, analyzing, and interpreting relevant information that becomes evidence about where students are in relation to the pursuit of rich learning goals, and then using this information to make decisions. Assessment refers to many things—tools to instruments to events (see Briggs, 2022; Solano-Flores, 2016; Taylor & Nolen, 2022). The idea that assessment is not the same as measuring, testing, or grading is central to this chapter's argument—assessment does not require a numeric scale (Briggs, 2022; Taylor & Nolen, 2022). As mentioned previously, classroom assessment may involve informal observations, classroom discussions, or formal documentation about students' learning. From a sociocultural perspective, assessment should allow multiple opportunities for students to show what they have learned in the context of, and richly informed by, their backgrounds and lived experiences. Assessment practices that best support student learning include (Taylor & Nolen, 2022):

- ensuring understanding of the learning goals by the teacher,
- ensuring that the learning goals are understood by the students,
- using assessment tasks that demonstrate the learning goals,
- paying attention to factors that may affect learners' performance,
- evaluating learners' performance based on learning goals—not unrelated factors, and
- providing opportunities to close the gap between where learners are and where they need to be through feedback, revision, and promoting self-assessment.

Classroom assessment consists of a diverse set of strategies to gather information about student learning (Fine & Furtak, 2020; Furtak & Ruiz-Primo, 2008; Ruiz-Primo, 2011; Ruiz-Primo & Brookhart, 2018; Ruiz-Primo & Furtak, 2006, 2007):

1. The assessments should include a range of *informal to formal* assessment tasks (e.g., instructional dialogues, quizzes).
2. They should be *multimodal* in documenting students' learning (e.g., performance, explanations, graphical representations).
3. They should appear in different *organizational modalities* (i.e., diverse size and composition—individual, pairs, small groups, whole class; Ruiz-Primo et al., 2016).
4. They may have *different foci* (e.g., tasks that focus on content and skills and tasks that focus on reinforcing metacognitive forms of thinking—metacognitive monitoring, metacognitive control, and self-regulation).

Classroom assessments sometimes involve grading—but not always. While grading is a difficult practice, it is necessary in the current education system to document academic achievement (Shepard, 2019). In the context of classroom assessment, it is important to distinguish between assessment intended to assist student learning—which requires no grading since its purpose is not to measure but to support learners—and assessment of individual achievement, which involves summative assessment along

with other pieces of evidence reflected in a grade. Grading should be handled with care because it can affect students' motivation, self-confidence, and efficacy, as well as unearth problems that are not immediately apparent. Grading can promote motivation to achieve good grades, rather than a motivation to learn well, to have deep learning. When grading is used, comparisons with peers are inevitable. Another issue is that in many cases grading does not focus only on students' learning, but also on other factors that may not necessarily reflect what students know and can do. For example, teachers tend to include student effort in the classroom in their grading practices, which is different from what students know and can do (Brookhart, 2013; Brookhart et al., 2016). Omnibus grading—grading that involves factors other than learning—is an inappropriate assessment practice; it is more suitable to bias (Feldman, 2019).

Students are a crucial element of classroom assessment and should be engaged with as such. Two strategies that promote student engagement in assessment practices are self- and peer assessment (judging their own work or the work of others) (Formative Assessment for Students and Teachers State Collaborative on Assessment and Student Standards, 2018; Leahy et al., 2005; Wiliam & Thompson, 2008). Self- and peer assessment are both important practices that can support metacognitive awareness and self-regulation. For these practices to work, students need to understand what is expected—they need to be provided with criteria that help them monitor their learning. Defining the criteria by which students assess their work is critical, as is helping students to decide what to do next (e.g., ask for help to the teacher or peers; re-read the information). When students examine the work of their peers, knowing that their peers will also look at their work, it helps them to develop internal standards to evaluate their work, thus improving self-regulation (Bourgeois, 2016; Panadero et al., 2016).

Classroom assessment is more effective when learning goals are clear, students know the criteria for success, and there are opportunities to provide and use feedback. Effective feedback is based on learning goals and success criteria—or "student look-fors" (Moss & Brookhart, 2012). Students should know what they are supposed to be learning and the criteria by which their learning will be assessed. Research has shown that students who understand success criteria produce better work and are more self-regulated learners; teachers who provide clear success criteria use students' work and responses more efficiently as evidence to support their instructional decisions; and teachers use insights gleaned from the classroom to provide helpful feedback (Kroog et al., 2016; Minstrell et al., 2009; Panadero et al., 2012; Ruiz-Primo & Kroog, 2018; Ruiz-Primo et al., 2014a, 2016).

There are many ways to characterize feedback, but an important distinction should be made between *evaluative* and *descriptive* comments (Ruiz-Primo & Brookhart, 2018). *Evaluative* feedback (e.g., your response is incorrect; good work!) does not help to improve students' learning or develop strategies to approach problems—it can create more "noise" than true change and should be avoided (Hattie & Timperley, 2007). In contrast, *descriptive* feedback (e.g., your response is missing X, it would be important for you to always check Y) helps students to focus on their learning and understand where they are and what they can do to move forward. Statements that are clear and useful contain information to influence students' future performance. *Descriptive* feedback has the potential to shape the student's motivation toward achieving learning goals (Dweck, 1986). *Descriptive* feedback guides the student's attention to the process

underlying the task (e.g., "you need to remember the three characteristics that define X") or the students' product (e.g., "the table is incomplete, it is missing X and Y"), rather than characteristics of the student (e.g., you are so smart!). *Descriptive* feedback is process oriented, it focuses on aspects of the student's performance, including describing what the student has accomplished and/or what needs to be worked on or improved; clarifying the process the student needed to engage in to do the task; and/or helping the student compare previous and current achievements or performance. High-level feedback involves the student as a learner who can reflect on his or her learning, helping the student to make connections about what has been learned at any given point (Ruiz-Primo & Brookhart, 2018).

There are two generally accepted forms of classroom assessment: formative assessment, or assessment for learning, which is used to draw out what students know and can do while learning is in progress; and summative assessment, or assessment of learning, which takes place at the end of learning experiences to certify individual achievement—most likely for grading purposes (Shepard, 2019). For any type of classroom assessment, summative or formative, assessments should be closely aligned with and connected to the curriculum that students are experiencing. When curriculum, instruction, and assessment support each other, there is horizontal coherence in the classroom activity system (National Research Council, 2001; see Chapter 2 of this volume, "The Struggle to Implement Balanced Assessment Systems: Explanations and Opportunities"; Shepard et al., 2018a). For formative assessments, the grain size of the assessments is small, meaning specific aspects of the disciplinary knowledge and practices used can be interrogated (e.g., specific concepts and practices that are part of the big ideas being pursued). External assessments, such as state assessments, cannot focus on these specific aspects because the grain size is larger (e.g., based on standards). Therefore, classroom assessments should not be separated from curriculum, instruction, and student opportunities to learn (Gee, 2003; Stobart, 2005). Classroom assessment should reflect a clear alignment between the "what" and "how" of instruction and the "what" and "how" of the assessment strategies used (see Chapter 3 of this volume, "Human Learning and Development: Theoretical Perspectives to Inform Assessment Systems").

Formative Assessment

Formative assessment is an ongoing process involving planned and unplanned events that provide opportunities to gather or elicit information that becomes evidence about student learning. This evidence can be used by teachers and students to support students in pursuing rich disciplinary learning goals and supporting students in becoming self-directed learners (e.g., Formative Assessment for Students and Teachers State Collaborative on Assessment and Student Standards, 2018; Ruiz-Primo, 2010; Ruiz-Primo & Furtak, 2006, 2007). Formative assessment enables teachers and students to support students' future learning, either by adjusting instruction to achieve learning goals or by providing focused feedback to support their learning (Black & Wiliam, 1998; Sadler, 1989). Formative assessment focuses on continuously gathering information to allow immediate action to support student learning and instruction in pursuit of daily learning goals.

Four critical formative assessment practices and activities include (Herman, 2016; Ruiz-Primo, 2010; Ruiz-Primo et al., 2015)

1. Sharing and clarifying learning goals, expectations, and/or quality/success criteria;
2. Gathering or eliciting evidence of where learners are in achieving learning goals;
3. Analyzing and interpreting the information collected; and
4. Acting on that information to improve students' learning through instructional adjustments or focused feedback.

Formative assessment can be conceptualized as a continuum from very informal (students' questions, which cannot be predicted) to very formal, requiring specific documentation of students' performance (e.g., quizzes). Considering formative assessment as a continuum presents many possibilities to gather and respond to information as needed. Gathering informal information about what students know and can do often happens "on-the-fly" in classroom discourse (Jordan & Putz, 2003; Ruiz-Primo, 2011; Ruiz-Primo & Furtak, 2006, 2007). For example, a question asked by a student—like Simon's question from the vignette that opens this chapter—provides an opportunity for a teacher to assess the student (e.g., what information can be gathered about this student's learning from this question?). It also provides an opportunity to analyze and interpret the student's question within the frame of the learning goals (e.g., Ms. T needed to quickly navigate the intellectual substance of Simon's question before acting with a key instructional move). A student's question provides an opportunity to take action with an *instructional move* (like Ms. T asking Simon to explain his question and using Simon's response to move forward the discussion), or *useful feedback* that is focused and explicit in moving learning forward.

Another type of formative assessment is when a teacher asks specific, carefully crafted, and planned questions to the students. These "back-pocket" questions are challenging and require explanations, justifications, and analysis, inviting students to think critically about their ideas (Windschitl et al., 2018). These types of questions are also assessment tasks that will provide evidence about students' learning. The responses will require analysis and interpretation "on-the-fly," as well as certain responsive actions (e.g., an instructional move or feedback) that are only possible when learning goals are clear.

Yet another type of formative assessment is when teachers provide tasks for all students to gather information from each of them. The teacher can use diverse sources—handouts or exit tickets (that do not look like tests or assessment tasks), quizzes (more test-like tasks), and everything in between (e.g., classwork or homework)—to gather information from students in a formal way. Once this information is collected, teachers should use their understanding of the discipline at hand to analyze and interpret student responses before taking action based on that interpretation.

In our observational studies, we have tracked classroom discussions that show this pattern of eliciting, interpreting, and acting on information to inform teachers' instructional moves (Furtak et al., 2017; Ruiz-Primo & Furtak, 2006, 2007). In each of these cases, teacher and student participation in assessment practices were organized

by sets of tasks or tools to gather information from all students at the same time—the information was then interpreted to assist student learning toward the learning goal by adapting instruction or providing feedback (Furtak et al., 2019).

Opportunities to provide descriptive feedback to students are critical in formative assessment. Given the many opportunities provided to gather information about students' learning in formative assessment, teachers can respond almost immediately with short targeted comments or with an instructional move to help students reflect on their thinking or performance (e.g., move students around in different small groups; Ruiz-Primo et al., 2014a, 2015).

Most of the activities conducted in classrooms are intended to introduce new topics or serve as purposeful practice (e.g., homework) that can improve students' learning based on feedback. These activities, in a coherent and appropriate combination, provide evidence of how students move toward expertise. At the same time, teachers expect that students will make mistakes as part of the learning process. These mistakes are not only expected, but desirable because they provide the opportunity to improve learning (Feldman, 2019; McMillan, 2018; Wiliam, 2018). Grades provided to in-progress learning activities are not appropriate because they may negatively impact the learners' motivation and, therefore, their learning. Grading correct responses in activities meant to encourage taking risks and making mistakes can send students the wrong signal and reduce their academic confidence (Brookhart, 2013; Feldman, 2019). Attention, organizational skills, and collaboration are appropriate targets for formative assessment, but not for grading (Shepard, 2019). Grades should be based only on appropriate evidence of what students know and what they can do as participants within a discipline.

Summative Assessment

The most accurate information about what students have learned is their performance at the end of the learning process (Feldman, 2019). Summative assessments are formal tasks (e.g., a test or a final project) used to gather evidence about students' learning or mastery of the knowledge, skills, and practices that were the instructional focus across a specific period. Since the summative test (administered at the end of an instructional unit) or summative formal tasks (an end of semester project) are usually used for grading purposes, teachers should seek to maximize their students' performance by ensuring that all students are fairly assessed, have opportunities to demonstrate what they have learned, and that the evidence collected from the assessment is as free as possible from extraneous influences (e.g., use of certain language that may interfere with what is being assessed). When summative assessment tasks are being selected, teachers should ensure that the tasks are aligned with the opportunities students had to learn the material (e.g., does the assessment map to what was taught in the classroom?) and that the characteristics of the task do not favor a subgroup of students (e.g., the assessment does not include features that prevent some groups of learners—such as multilingual learners or students with disabilities—from demonstrating what they have learned).

The design and development of quality summative assessment tasks matter and should provide opportunities for all students to demonstrate what they have learned. It is important to allow learners to provide evidence of what they know and therefore

to identify and utilize tasks that can accurately reflect what they have learned. An end-of-year grade will include different sources of information that are considered important evidence of students' learning. Grading should be based on rich tasks (e.g., project-based tasks) that best reflect the learning being pursued.

Rich tasks represent as fully as possible the ambitious learning goals set for the learners. They are not "more of the same" of what learners experienced during the instruction, but instead challenge learners to use what they have learned in different ways, to promote knowledge that is more conditional, strategic, and simulates the type of thinking required "in the real world." Tasks that support ambitious learning and teaching are also cognitively demanding, requiring students to go beyond factual recall and engage in disciplinary practices (e.g., Tekkumru-Kisa et al., 2020). These tasks also place learning in contexts that students are likely to encounter in their everyday lives. For example, learners might be asked to conduct a short- or long-term investigation in which the applications of what they have learned are not straightforward, but require examining documents, revising what they have done and adapting it to the new situation, or developing arguments that support the decisions they made to conduct the investigation.

To inform parents about their children's progress, teachers can provide examples of their performance—what they know and can do—at different times during the year, rather than only sharing grades. These examples can reflect critical milestones (Shepard, 2019; Shepard et al., 2018a, 2018b). Practices that consider collaboration or effort in the provision of grades make the grading less accurate, encourage performance orientation, and decrease intrinsic motivation. Instead, motivation can be built by offering relevant tasks to the students—when possible, a choice of tasks—and focusing both on academic success and opportunities to improve.

Classroom Learning Culture

The previous elements of the activity system all exist within a social and physical context called a classroom learning environment or learning culture. Learning cultures are developed and designed with specific characteristics and organizational structures that create communities of practice with shared norms, routines, values, practices, discourse patterns, and particular physical, symbolic, and non-verbal cues (e.g., artifacts, images, icons; Gay, 2018) that support learners.

Classroom learning cultures create contexts that are suitable for learning and have an impact on learners' behavior and intellectual functioning. When classroom environments are safe and engaging and learning is supported and rewarded, students are connected to the classroom community and feel efficacious (Hammond, 2021; Melnick et al., 2017; Shepard, 2021). This type of learning environment allows students "to develop the social and emotional, as well as academic skills, habits, and mindsets needed to succeed in life" (Melnick et al., 2017, p. v).

Classroom cultures are initiated at the beginning of the school year and can be cultivated over time. The importance of the first days of the school year, and even the first hours of the first day of a class are critical for helping students understand the learning expectations, rules, and norms that will be followed, as well as orienting students toward overarching learning goals (Boaler, 2022; Jackson, 1971; Seidel et al.,

2005). Learning goals support students' experiences and who they are as members of the learning community.

In a culturally and socially responsive classroom learning culture, teachers select or design rich and authentic tasks based on students' interests and experiences, and facilitate classroom discourse to help students develop disciplinary knowledge relevant to their lives. Assessment practices should provide students with opportunities to show their learning using tools that consider their cultural and social identities, backgrounds, and experiences (Taylor & Nolen, 2022).

Culturally responsive classrooms provide students with participation opportunities that invite their "funds of knowledge" into learning activities. Moll and Greenberg (1990) described a sixth-grade classroom that included a high percentage of Mexican students who had problems with writing. To help students actively create and shape their writing tasks, the teacher asked the students to brainstorm a list of writing topics. They discussed the topics that were of main interest and then chose construction and building—one of the most prominent direct experiences for these learners outside the classroom and a clear example of the use of "funds of knowledge" (Moll & Greenberg, 1990; Moll et al., 1992). Learners were asked to design models of houses or buildings and then write about how they were planning to build the model with paper and other materials. The teacher then introduced the idea of learners researching design and construction. The students visited the library and obtained information about different ways of building structures. Learners then wrote brief essays about construction—some students wrote about how to build a model, others created stories about construction, and yet others compared construction to the human body. Learners found writing more exciting by focusing on something interesting to them (Moll & Greenberg, 1990; Moll et al., 1992).

These learning activities grew out of the teacher's initial focus on the students' interest in writing. The teacher provided feedback to the students' writings as they wrote about their construction stories. Over time, learners' writing showed better punctuation, fewer orthographic errors, and improved narrative structures. The students' enthusiasm about construction led the teacher to suggest inviting their parents as experts (e.g., constructors, plumbers, carpenters) to provide more information about the topic—what Moll and Greenberg (1990) called "mobilizing funds of knowledge." The parents and relatives of the learners made an intellectual contribution to the classroom by sharing their knowledge and experience (e.g., how to estimate materials or measure areas).

This example shows how learners can increase their curiosity and disciplinary engagement when their experiences, interests, and identities are centered in classroom learning environments. This example also illustrates a distributed view of knowledge construction with a cultural orientation: learners' interests and cultural backgrounds were considered in critical instructional decisions and the teacher welcomed their contributions by considering their strengths (e.g., proposing questions in Spanish). The teacher helped the learners actively create and shape the instructional activities by connecting the activities to students' "funds of knowledge." Formal and informal assessments included the learners' brief essays and discussions (e.g., how to formulate appropriate questions) as a source of information about how to support the students in future learning.

The culturally responsive classrooms described in this chapter are deliberately created around norms and routines that support student participation. They have organizational structures that create specific classroom communities of practice with shared norms, routines, values, discourse patterns, and particular physical and symbolic cues. Culturally responsive classrooms are designed to be safe spaces for learners, where they feel a shared sense of belonging and respect (Melnick et al., 2017; Shepard, 2021). Norms (rules and expectations), routines (instructional segments that occur regularly), and tools (artifacts that promote certain forms of interactions) all contribute to classroom culture.

Some norms, routines, and tools are more conducive to gathering information about students' learning (e.g., discussions); supporting learners' engagement and contributions; and allowing for meaningful collaboration among learners of different racial identities, economic circumstances, cultures, and ability levels (Kahlenberg et al., 2019; Killen et al., 2015; Ruiz-Primo et al., 2022). They can provide students with *affordances* ("action possibilities"; Gee, 2008, p. 81) or *constraints* (disengagement). Helping students to see these possibilities allows them to transform the *affordances* into effective actions that they can take advantage of. Peers are part of the learning environment that also offer diverse *affordances* through their knowledge and skills (Gee, 2008).

Identifying the norms that are conducive to learners' engagement, agency, and productive discursive practices—and therefore, formative assessment—is critical. For example, a teacher may establish the norm that students should draw on their own experiences to make sense of what they are learning in school, and as such, everyday examples are welcome (e.g., Odden & Russ, 2018). Teachers could also emphasize a norm that errors are welcome because they are a very important part of how we all learn and change.

Some classroom routines are more conducive than others to the implementation of assessments with a formative purpose. For example, the "Navigating Routine" in the OpenSciEd storyline in Figure 4-2 invites students to revisit the driving question for a unit, determine what they have learned so far, and determine what to investigate next as a classroom community (OpenSciEd, 2022). In another example, we observed a teacher establishing "homework circles" on the first day of the school year, a routine that allows learners to talk to each other about the problems they encounter in completing their homework, providing an opportunity for learners to support each other (Ruiz-Primo et al., 2022).

Classroom tools can also be used to support learners. As an example, a teacher hung science concepts from the ceiling in different languages on double-sided pieces of cardboard (Ruiz-Primo et al., 2014b). During the unit, when introducing a new concept, the teacher pointed out the words attached to the ceiling to help students to recognize the term in English and in other languages. We also observed a teacher in a multilingual classroom use her hands to explain to students what they needed to do—to draw a scatterplot. The teacher moved her hands up and down and right to left to represent the two coordinates and use her right hand to exemplify how students needed to plot the data using the coordinates. She explained with her hands the changes in the value of the dependent variable and she modulated the tone of her voice while describing the

relationship (Ruiz-Primo et al., 2014b). These and other semiotic modalities (symbolic, physical, or verbal) can provide affordances that help multilingual students participate more completely in classroom discussions—for example, learners using different vocal intonations to support their description of different sounds made when guitar strings are plucked (Suárez, 2020).

Learners can be involved in developing norms and routines in the classroom. Teachers can use different practices in the first days of the school year, including providing scenarios in which norms or routines can be applied and then asking learners questions about what they should do in the scenario (Ruiz-Primo et al., 2022). Involving learners in the development of these types of cultural practices can make them feel like they are contributing to the characteristics of their classroom community.

The cultural context can also support assessment practices and cultural responsiveness. How students participate, how they feel about making mistakes, and how much they value cultural differences will depend on how the characteristics of the learning environment are established. Creating caring learning communities that use cultural knowledge of ethnically diverse cultures to guide the curriculum, instruction, and assessment and where differences are valued creates a safe climate for learning. Culturally responsive learning environments value the traditions, languages, and communication styles of the students to create a community of practice. Learning environments that create communities of practice lead to a sense of "ownership characterized by personal investment and mutual dependency" (Collins & Kapur, 2022, p. 163).

BRINGING IT TOGETHER: IMPLICATIONS FOR THE DESIGN OF CLASSROOM ASSESSMENT TO SUPPORT AMBITIOUS INSTRUCTION

To illustrate how a classroom activity system lens helps with understanding how assessment can support ambitious teaching, we return to Ms. T's classroom, first shown at the beginning of this chapter. Ms. T's learning environment was designed around the topic of growing pumpkins, a plant that students have prior experience with and that they can directly observe in their classroom. The classroom conversation that led to Simon's question—and Ms. T's response—is embedded in a larger curriculum that invites everyday examples and language to help learners understand the life cycles of plants. Across the course of a larger unit, Ms. T used a variety of classroom participation structures and resources to support students in sharing their thinking. She employed multiple talk moves that drew out student thinking and encouraged students to provide further elaboration to support their ideas. The task was completed in a classroom culture in which students knew their ideas were valued and where they felt safe sharing what they know with each other and their teacher. The features of the classroom activity system described in the previous sections are summarized in Table 4-1.

Culturally and Socially Relevant Assessments

Classroom assessments need to be designed to be more culturally and socially relevant for diverse students. This involves students, parents, and community members—not just teachers—contributing to and even participating in the assessment design process (Taylor & Nolen, 2022). Culturally and socially relevant assessments, like any

TABLE 4-1 Characteristics of Classroom Activity Systems That Support Ambitious Instruction and Assessment by Element

Element	Classroom Assessment Systems Should
Learners	• Be centered on learners' interests and identities • Draw on learners' linguistic and cultural capital • Nurture the development of learners' metacognition and self-regulation
Curriculum	• Be designed to respond to and sustain learners' knowledge and practice • Be structured around learners' understanding and explicit learning goals • Be designed to support teachers' understanding of what is to be learned, why it is being taught, and how it will be taught • Be designed to reflect increasing complexity and variety • Be designed to support learners' organization and representation of information
Instruction	• Be built on teachers' knowledge of the discipline and curriculum • Be based on teachers' conception of learning • Be based on a discourse-rich learning environment • Be informed by self-reflection
Assessment	• Focus on a good understanding of the learning goals • Use both formative and summative assessments • Align to everyday learning • Align to classroom practices that draw out and work with student thinking • Provide multiple self- and peer assessment opportunities • Be comprehensive, multimodal, formal and informal, and cognitively challenging
Classroom Learning Culture	• Be culturally responsive • Include norms, routines, and tools that support student participation • Be safe and engaging • Support and recognize learning • Connect students to a classroom community • Support the development of social, emotional, and academic skills, habits, and mindsets needed to succeed in life

assessments, should consider certain characteristics to support appropriate interpretations of student performance, such as fairness and representation (Gee, 2003; Taylor & Nolen, 2022) and cognitive demands (Tekkumru-Kisa & Stein, 2015).

There are a range of emerging approaches to this type of co-designing with multiple stakeholders, including student interest surveys, which solicit input from students that teachers can use to design or adapt classroom assessments like those in use by Open-SciEd, or ongoing and in-depth collaboration with communities and families (Earnest et al., 2023; Edelson et al., 2021; Tzou et al., 2021).

Fairness and Representation

In the classroom context, fairness is a sociocultural issue rather than a technical one (Gee, 2003; Stobart, 2005). There are critical questions to ask about fairness in the testing, assessing, and measuring context (adapted from Stobart, 2005):

- What knowledge is assessed and equated with learning?
- Are the forms, content, and mode of an assessment appropriate for different groups and individuals?
- Is the range of cultural knowledge and practices reflected in definitions of learning?
- How does cultural knowledge mediate responses to assessments in ways that alter what is being assessed?

Taylor and Nolen (2008) suggest asking students to generate ideas to be assessed based on their learning experiences (e.g., instructional activities, classroom discussions). It is important to also question: (1) what content is to be taught, learned, and assessed (Taylor & Nolen, 2022); (2) who has the power to determine what content is to be taught (Randall, 2021); and (3) who is being considered in gathering the full range of understandings in the classroom? (Ruiz-Primo & Brookhart, 2018; Solano-Flores, 2016).

There are many considerations for the design of classroom assessments that will better represent all that learners know and can do. We have argued that centering the interests and identities of marginalized learners in the classroom can reposition expertise and help to highlight the assets and resources that students bring to their learning. For example, Kang and colleagues (2022) illustrated how different forms of classroom assessment tasks can broaden what is known about learners. In a high school physics unit, learners completed different forms of tasks aligned with next-generation standards, including a claim-evidence-reasoning assessment and a letter to a loved one. Both assessments were intended to create expansive space for learners to show what they know about how different car designs help to make them safe. However, for some learners, what they knew was better captured in the letter—which many wrote in their home language, rather than English—explaining how they would design a dream car. Many additional designs can be integrated into tasks to make them applicable to all learners, such as decreasing language load, including pictures and other visual representations, and breaking longer tasks into smaller pieces that can be done in different sequences (Fine & Furtak, 2020).

Cognitive Demands

Assessment tasks that support ambitious instruction go beyond simple factual recall or assessing knowledge or practices in isolation and are designed to move students from their comfort zone into a learning zone where the level of struggle is well calculated—not too easy and not too hard. There should be tasks that challenge the students outside of their comfort zone but should not be so difficult that the tasks demotivate the learners. This type of task seeks to elicit students' integrated knowledge and practice while they are doing disciplinary tasks (Tekkumru-Kisa & Stein, 2015). The design of the tasks signal what is important and how students can show their intellectual activity and engagement in disciplinary practices (Tekkumru-Kisa et al., 2015). To support student learning, assessment tasks need to be designed with a purpose in mind.

CONCLUSION

In this chapter, we have articulated elements of ambitious instruction; their relation to ambitious classroom assessment; and the importance of taking a broader lens to encompass learners, curriculum, instruction, and classroom learning cultures as well as assessment. These concepts help to illuminate multiple aspects of classroom learning and teaching that are essential to realizing assessments that are cognitively demanding, build on students' prior experiences, and support their engagement in disciplinary practices.

While we have deliberately focused on classrooms, we acknowledge that there are other influences on these systems that have not been discussed in this chapter. School, district, and state policies and initiatives; district and interim assessments; and accountability measures enforced by statewide tests can also enable—or constrain—what is possible in classrooms (e.g., Au, 2007). These outside-the-classroom influences will be discussed in greater depth later in this volume (e.g., Chapter 6 of this volume, "District and School Practices and Assessments to Support a Learning-Centered Vision" and Chapter 7 of this volume, "State Practices and Balanced Assessment Systems").

This chapter does not include all research on learning, instruction, and assessment. Rather, it focuses on what we consider to be important information to think about for each element of the system. We hope that the information provided in this chapter can help to broaden the lens when considering assessment within larger classroom activity systems and inspire readers to look deeper into each element.

We acknowledge that approaches to assessment systems that interrogate the constructs being assessed and whose values are represented is an emerging area of research that needs more study (Randall, 2021). To realize visions of ambitious instruction that broaden access and opportunity for all learners, we must continue to consider how all elements of an activity system can support equity and justice (Kang & Furtak, 2021).

As we look to a future in which classroom assessment is embedded within ambitious approaches to classroom teaching, we emphasize the benefits shown by collaborative efforts at scale. The approach of long-term, mutually beneficial partnerships centered on problems of practice emerging from educational organizations can support the design of assessment systems at scale by building infrastructures to support professional learning, curriculum design, and assessment (see Chapter 5 of this volume, "Assessment Literacy and Professional Learning"; Chapter 6 of this volume, "District and School Practices and Assessments to Support a Learning-Centered Vision"; Penuel et al., 2011). Furthermore, groups of teachers seeking to learn new practices can be connected across schools to support the spread of local innovation (Thompson et al., 2019).

Gathering information from different sources to develop a more accurate vision of students' learning—Cronbach's (1990) view of what constitutes assessment—should be done at the classroom level, where the information is more likely to directly impact instructional practices. To support students' learning, formative assessment should be aligned with ambitious instruction and attention should be paid to teacher preparation programs and professional development. Ambitious teaching that provides more and better opportunities for students to explain their thinking and reasoning and to develop disciplinary practices requires a deep understanding of the subject matter and sociocultural practices that allow students to be part of a community of cognitive

apprenticeship. There is no question that proper alignment of classroom assessment practices with ambitious instruction requires changes at higher levels of the education system (e.g., modifying grading practices).

Assessment is a powerful tool that can serve stakeholders at all levels of the educational system if they are committed to improving their understanding of the role that assessment has at different levels, its purposes and uses, and the characteristics of its design and development (Ruiz-Primo et al., 2024). If assessment's role at different levels is better understood, it can be properly designed and used to support student learning.

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