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CHAPTER

Evolving and Emerging Perspectives on the Transfer of Learning

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Abstract

This chapter considers the phenomenon of *transfer of learning* in light of heightened concerns over power, privilege, equity, gender, and race in education. The authors argue that assumptions about transfer have a tremendous impact on education via classroom assessments and achievement tests and that discriminatory and racist practices in education are often produced and reproduced via inappropriate assessment and testing practices. The chapter is organized around four dimensions of assessments as they relate to transfer. These dimensions are *format*, *level*, *function*, and *theory*. The authors consider each dimension with a particular eye on contemporary “asset-based” responses to historical educational inequities. The authors consider how these dimensions are currently represented in research on culturally responsive educational practices (or not) and speculate about the ways that these dimensions might be used to organized more culturally responsive assessment and testing. The authors specifically explore the synergies between two situative transfer mechanisms and several contemporary asset-based responses to historical inequities. They conclude by arguing that a situative multilevel approach to assessment and new models of research-practice partnership offer a coherent means of applying these synergies to educational practice.

Keywords: [formative assessment](#), [classroom assessment](#), [achievement testing](#), [educational equity](#), [race](#), [gender](#)

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Transfer of learning is the phenomenon by which learning that occurs in an initial setting (the *learning environment*) impacts activity in a subsequent setting (the *transfer environment*). Transfer is relevant to nearly any consideration of education or training and most considerations of learning. As described by Engle, Lam, Meyer, and Nix (2012):

The success of the educational enterprise requires that students are able to transfer what they have learned to future classes as well as to their professional, personal, or civic lives. Otherwise, instruction is wasted. Therefore, knowing how to design learning environments to foster transfer is crucial if education is to be successful. (p. 349)

Thus, the search for “generative” learning (Engle, 2006; Fiorella & Mayer, 2016) that is both useful and used in a wide range of transfer contexts has long organized the research of many cognitive scientists, educational psychologists, and learning scientists.

As implied by the title of *Transfer on Trial*, a landmark volume by Detterman and Sternberg (1993), the phenomenon of transfer surfaces more fundamental questions about knowing and learning and corresponding debates over the nature and goals of education. For the goals of our chapter, it is important to note the differences between the vision of transfer in the chapter “Transfer of Situated Learning” by Greeno, Moore, and Smith (1993) and the other chapters in *Transfer on Trial*. The chapter by Greeno et al. highlighted how new “situative” characterizations of knowing and learning were questioning fundamental assumptions about transfer that many cognitive and educational psychologists embraced without question at that time. This emerging divide subsequently received broader attention in the widely cited debate between Anderson, Reder, and Simon (1996) and Greeno (1997) and continues to this day.

Extending Transfer Research to Address Educational Inequities

We agree with a conclusion in the expert panel report from the National Research Council (NRC; (2001), entitled *Knowing What Students Know*, that assumptions about transfer have a significant impact on education via their manifestation in educational assessments and external achievement tests (see also Goldman & Pellegrino, 2015; Shepard, Penuel, & Pellegrino, 2018). As elaborated in Hickey and Pellegrino (2005), the relationships between transfer and the range of educational assessments and tests are both obvious and nuanced. Our goal in this chapter is to revisit and extend these relationships through the lens of educational equity.

Drawing primarily from chapters in prior handbooks and special issues of leading journals, we aim to add new insights to the prior transfer research by considering continuing efforts to make education more equitable and better support the success of students who are marginalized and/or minoritized by the makeup and content of their classrooms and schools. More specifically, we argue that assumptions about transfer, as embodied in classroom formative and summative assessments and in external achievement tests, present significant obstacles to efforts to overcome group-based educational inequities that are rooted in racial, ethnic, and gender discrimination. We further argue that an emerging approach to transfer and assessment based on situative–sociocultural theories of learning is a promising path forward for addressing racist and discriminatory assessment and testing practices.

Transfer and Assessment in Culturally Relevant Education

A particular goal of this chapter is to explore how assumptions about transfer, as embodied in assessment and tests, may obstruct the adoption of culturally relevant education (CRE) practices. These practices include *culturally responsive teaching* (e.g., Gay, 2002), *culturally responsive pedagogy* (e.g., Ladson-Billings, 1995), *Funds of Knowledge* (Moll et al., 1992), and *Funds of Identity* (Esteban-Guitart & Moll, 2014). In this regard, we agree with the widespread critiques of older deficit-based remedial responses to educational inequities and agree with Neri, Lozano, and Gomez (2019) in support of asset-based responses to the needs of minoritized students:

It is not even mildly controversial to suggest that in order to successfully teach nondominant students all their teachers should possess practical pedagogies that effectively draw on the racial, ethnic, linguistic, and cultural assets that these learners bring to school. (p. 197)

Despite the commonsense appeal of asset-based responses to educational inequities and evidence of impact, Neri et al. characterize the adoption of CRE approaches as “sporadic and underwhelming.” They attribute the “muted” response to CRE to teacher resistance, which they characterize as “a multilevel problem that stems from (a) limited understanding, and belief in the efficacy, of CRE and (b) a lack of know-how needed to execute it” (p. 202).

We see added value in subsequent conceptions of culturally *sustaining* pedagogy (CSP) that are relatively more activist than prevailing asset-based approaches:

The term *culturally sustaining* requires that our pedagogies be more than responsive of or relevant to the cultural experiences and practices of young people—it requires that they support young people in sustaining the cultural and linguistic competence of their communities while simultaneously offering access to dominant cultural competence. Culturally sustaining pedagogy, then, has as its explicit goal supporting multilingualism and multiculturalism in practice and perspective for students and teachers.

(Paris, 2012, p. 94)

As discussed throughout this chapter, our suggestions for transforming assessment and testing similarly aim to sustain (and elevate) the cultural and linguistic competence of diverse learners (via informal classroom assessments) while also offering access to dominant cultural competence (as captured by high-stakes tests that can prevent those same students from accessing valuable education and employment opportunities).

Unsurprisingly, our initial review uncovered very little discussion of the transfer of learning in the CRE literature. As elaborated below, considerations of assessment and testing in this literature has been rather sporadic and mostly focused on K–12 schooling; Montenegro and Jankowski (2017, p. 5) characterized research on “culturally responsive assessment” in higher education as “largely quiet.” To this end, our chapter explores how assessment and testing are currently represented in the CRE literature and considers how teachers’ assessment “know-how” (and lack thereof) might support (or undermine) their willingness and ability to embrace more equitable assessment and testing practices. Given the current investment in formative assessment in preservice teacher preparation (e.g., Brookhart, 2017), in-service professional development (e.g., Cisterna & Gotwals, 2018), and university teaching (e.g., Jönsson & Eriksson, 2019), we propose exploring the extent to which this professional development might be extended to support CRE and more equitable assessment practice.

Our consideration of transfer, assessment, and equity is primarily organized around the three dimensions of transfer and assessment in Hickey and Pellegrino (2005): learning *theory*, assessment *level*, and assessment *function*. However, the current chapter (a) adds an additional dimension of assessment *format*, (b) rearranges the order in which the dimensions are discussed, (c) extends each dimension to consider CRE, and (d) uses examples from more recent research. These changes are intended to better set up our core arguments, which are ultimately bound up in the complex interactions between these dimensions. We have also added consideration of new technologies that are rapidly transforming many aspects of instruction and assessment, and which we worry might “lock in” some of the obstacles to CRE.

Assessment Format, Transfer, and Equity

The *format* of items is a particularly salient dimension of educational assessment. One of the most common item formats is *selected response*, whereby individuals select from two or more responses. Common selected-response item formats include *binary* (e.g., true-false), *multiple-choice*, and *matching*. Another common format is *constructed-response*, including short-answer and essay items. But constructed-response formats also include extended performance assessments whereby individuals engage in extended problem-solving around a complex problem. A very different format is represented by *portfolio assessment* whereby learning and expertise are assessed via artifacts produced by individuals or teams. As we elaborate below, a broadened view of learning and (therefore) assessment associated with sociocultural theories assigns a distinct role to informal observation and interpretation by educators and acknowledges the unique potential of self-assessment and peer assessment.

Item format obviously has implications for the assessment of transfer. But these implications are not as straightforward as they might appear. For example, some theorists argue that selected-response formats can only capture relatively shallow “recognition-level” cognitive processes, such as basic declarative and procedural knowledge, and therefore cannot capture transfer of more sophisticated learning. Consider, for example, Mayer and Wittrock’s (1996) distinction between *knowledge transfer* and *problem-solving transfer*:

Knowledge transfer (or transfer of knowledge) occurs when prior learning (task A) affects new learning (task B). Typically prior knowledge is measured by an achievement test (e.g., percent correct on task A) and new learning is measured by ease of learning (e.g., time to master task B). Problem-solving transfer occurs when prior problem-solving experience (task A) affects solving a new problem (task B), that is, when a problem solver uses previous experience with one kind of problem to help solve a different kind of problem. Typically, prior experience is measured by performance on task A (e.g., percent correct or type of method used on solving old problems) and new problem solving is measured by performance on task B (e.g., percent correct or type of method used in solving problem B). (p. 48)

This characterization of meaningful transfer in terms of problem-solving and the implicit assumption that “tests” and specifically “achievement tests” can’t capture transfer of more sophisticated learning was widely held at the time and continues.

A more nuanced consideration of format and transfer is offered in the study by Ruiz-Primo, Shavelson, Hamilton, and Klein (2002), elaborated below. They used complex performance assessments in their “multilevel” evaluation of systemic science education reforms. While acknowledging that multiple-choice assessments are inexpensive and reliable assessments of declarative knowledge, they contend that such formats “fall short” in assessing the *structure* of declarative knowledge and suggest that performance assessments “may be used” to assess procedural knowledge. They further suggest that it is possible to assess strategic knowledge using multiple-choice items “depending on the characteristics of the assessment task and *how novel it is* [emphasis added] to the student” (p. 374). We return to this important point below, along with consideration of newly available computer technologies that are addressing some of the psychometric issues associated with performance assessment item formats.

The Issue of Sequestered Problem-Solving Assessments

As influentially argued by Bransford and Schwartz (1999), many believe that all “on-demand” assessments can only capture evidence of what they call sequestered problem-solving (SPS):

Just as juries are often sequestered in order to protect them from possible exposure to “contaminating” information, subjects in experiments are sequestered during tests of transfer. There are no opportunities for them to demonstrate their abilities to learn to solve new problems by seeking help from other resources such as texts or colleagues or by trying things out, receiving feedback, and getting opportunities to revise. (p. 68)

The concerns expressed by Bransford and Schwartz are central in their larger quest to shift education from a focus on “replicative” knowledge (i.e., “knowing that”) into a quest for “applicative knowledge” (i.e., “knowing with”). From this perspective, successful transfer of school learning is represented by “preparation for future learning” (PFL), where “the focus shifts to assessments of people’s abilities to learn in knowledge-rich environments” (p. 68). We return to SPS and PFL in our discussion of coordinative/perceptual theories of learning and transfer.

On the surface, the preceding paragraph might suggest that portfolio assessment formats are appropriate and possibly necessary for assessing PFL. Somewhat to our surprise, we found relatively little research or even discussion of portfolio assessment formats in the extensive research and theory referencing PFL and SPS. However, theorists like Batson (2011), Dysthe (2008), and Habib and Wittek (2007) have explored portfolio assessment from the perspective of sociocultural/situative learning theories, which raises some of the same issues as PFL and SPS, and are elaborated below.

We are entirely in agreement with Bransford and Schwartz and others who contend that the most important function of education is preparing students to be more successful in a broad range of subsequent learning contexts. For reasons elaborated below, we believe that on-demand SPS assessments *can* provide valid estimates of PFL. We argue that in particular-but-important cases, multiple-choice standardized achievement tests may be the most appropriate tools for estimating PFL in the practical context of helping classroom teachers make better classroom assessment for all students and not using those assessments in ways that are discriminatory.

Item Format and Culturally Relevant Education

Our initial review of the published CRE research revealed that the primary concern with assessment has been with standardized achievement tests (that usually employ multiple-choice formats) and classroom assessments that often mimic those tests. In response, some CRE proponents argue for using alternative assessment formats to allow diverse students to better demonstrate what they have learned. For example, Castagno and Brayboy (2008) argued that:

Although standardized forms of assessment certainly may present difficulties for students who are not members of the dominant culture, they also represent inappropriate and inaccurate ways of assessing knowledge in some Native language immersion and culturally focused schools for Indigenous youth. (p. 978)

Castagno and Brayboy go on to endorse performance assessment because it “allows parents and communities to be involved, is more consistent with norms in tribal communities, provides space for students to assess their own progress, and provides an alternative way to demonstrate knowledge and skill” (p. 978; see also Rhodes, 1994).

Of course, the interaction between item format (typically constructed response vs. selected response) and group difference has been studied extensively. For example, studies have shown diminished mathematics scores for females when using selected-response formats (DeMars, 1998; Reardon et al., 2018) and reduced racial and economic achievement gaps when moving from selected response to open-ended reading assessments (Kevelson, 2019). From our perspective, Neri et al. (2019) identified a crucial link between

assessment format and CRE. They argued that “recognizing diverse ways of knowing, communicating, and participating” requires that teachers “utilize various forms of assessment to reflect upon their instruction and *types of knowledge and participation* [emphasis added] it privileges and constrains” (p. 209). Clearly, some assessment item formats are better suited for accomplishing this than others. But our initial review of the CRE literature uncovered little specific guidance or research on doing so.

Notably, assessment and measurement scholars offer more specific guidance for characterizing and beginning to address inequities associated with assessment formats. For example, *Assessment, Equity, and Opportunity to Learn*, edited by Moss, Pullin, Gee, Haertel, and Young (2008), includes contributions from leading measurement and assessment scholars, along with those from leading cognitive scientists and linguists. The volume is the culmination of meetings in 2002–2005 sponsored by the Spencer Foundation. These meetings and this volume were organized around the policy notion of *opportunity to learn* (OTL). While the OTL concept emerged in the context of international comparisons of achievement, it rose to prominence in the United States in response to increased high-stakes testing in the 1990s:

By the early 1990s, OTL had entered the policy arena in debates over educational standards and whether schools had a responsibility to provide students with an adequate opportunity to learn before they could be held accountable for meeting achievement standards.

(McDonnell, 1995, p. 306)

Not surprisingly, OTL raised significant controversy, in terms of both policy (e.g., Porter, 1995) and law (e.g., Pullin, 2007). Consistent with our suggestions in this chapter, the various chapters in Moss et al. all explore the unique potential of situative and sociocultural theories for addressing format and other assessment issues. In addition to using this work to bolster our alternative to OTL, we consider whether our alternative response might sidestep the significant political opposition that effectively blocked the implementation of OTL policies and laws.

Readers should also note the discussions of assessment formats and equity included in *Human Variance and Assessment for Learning*, edited by Armour-Thomas, McCallister, Boykin, and Gordon (2019). This volume is a collection of articles and chapters that emerged from the Gordon Commission on the Future of Assessment in Education which was sponsored by Educational Testing Service (ETS) from 2011 to 2013 and chaired by Edmund Gordon, a Yale psychology professor who was a pioneer in the systematic study of equitable education for low-income racial minority students. The ensuing report (Educational Testing Service, 2013) and website (https://www.ets.org/research/policy_research_reports/gordon_commission/) provide extensive critiques of traditional assessment formats and practices and offer alternatives, though more rooted in the cognitive-constructivist perspectives of the “Knowing What Students Know” report (NRC, 2001). Rajagopalan and Gordon (2016) offer additional insights and suggestions from this work.

Assessment Levels, Transfer, and Equity

Assessment *level* concerns how removed a given assessment is from instruction targeting its content. As introduced in Kennedy (1999) and employed by Ruiz-Primo et al. (2002), many recognize the following five levels: *immediate*, *close*, *proximal*, *distal*, and *remote*. We use the Ruiz-Primo study and a second “multilevel” assessment study to illustrate how each level relates to transfer and equity. Ruiz-Primo et al. operationalized their levels in a large-scale evaluation of the impact of a reform-oriented science curriculum. They set out to assess the extent to which the curriculum impacted three different types of knowledge at the first four assessment levels. This included declarative knowledge (“*knowing that*”), procedural knowledge (“*knowing how*”), and *strategic knowledge* (*knowing when, where, and how to apply declarative and strategic knowledge*).

Hickey Kindfield, Horwitz, and Christie (2003; Hickey & Zuiker, 2012) used these same four levels (but different learning theories) in studies of *GenScope*, an inquiry-oriented multimedia computer program for teaching introductory genetics and inheritance to secondary biology students. Building on Kindfield (1994), the performance assessments used across multiple design-based studies characterized the knowledge of genetics and inheritance by crossing a domain-specific dimension (reasoning *within-generations* and *between-generations*) with a domain-general dimension (*cause-to-effect* and *effect-to-cause* reasoning).

At a very general level, as assessment gets more removed from instruction, the resulting evidence is more representative of transfer. But this relationship is confounded by two related dimensions. The first dimension is *formality*. As assessments get more removed from instruction, they typically represent disciplinary knowledge in increasingly formal and decreasingly contextualized ways. The second dimension is *timescale* (Lemke, 2000). Across levels, assessments capture evidence of learning that occurs over increasingly lengthy timescales. These dimensions are as follows, along with in introduction of our ideas about making assessments more culturally relevant.

Immediate-Level Assessment

Assessment at the *immediate* level concerns the enactment of curricular routines. Assessment at this level is typically very informal, capturing evidence of learning that is highly contextualized by the curricular routines and that occurs on timescales of minutes-hours. In Ruiz-Primo's study, immediate-level assessments consisted of analyses of student writing in lab notebooks for evidence that students' written communication was complete and understandable and whether that communication indicated conceptual and procedural understanding of the content. In Hickey's studies, the immediate-level assessment consisted of interpretive analyses of collaborative discourse in video recordings and informal analysis of live classroom discourse by instructors and researchers.

Immediate assessments *might* capture evidence of transfer. But for the most part they are limited to capturing evidence of whether prior learning enabled students to participate more successfully in the curricular routines. This is what Schwartz, Branford, and Sears (2005) called "transfer-in." In Ruiz-Primo's study, transfer-in consisted of students' appropriate use of scientific terms in the lab notebooks; In Hickey's study, transfer-in was represented by more successful participation in collaborative computer-supported inquiry. For example, they assessed collaborative discourse to examine whether students were finding "common ground" (Stalnaker, 2002) in the form of shared understanding of key disciplinary terms (e.g., "homozygote"). But for most observers and theorists, the lack of evidence of "transfer-out" means that immediate-level assessment does not capture "transfer" at all.

We envision a crucial role for immediate-level assessment in culturally relevant assessment and testing. In short, we believe that (a) teacher *feedback* (e.g., Warren, 2014) has enormous implications for whether each students' own cultural knowledge and forms of participation are privileged or constrained, (b) immediate-level assessment is a promising place and framework for doing so, and (c) peer feedback and teacher assessment of that feedback has significant potential in this regard. Put differently, we assume that transfer-in is a crucial element of culturally relevant assessment and that teacher and peer feedback via immediate-level assessment of classroom discourse is a promising practice for understanding and improving transfer-in of personal knowledge and experience that is culturally *and* pedagogically relevant.

Close-Level Assessment

Assessments at the *close* level are embedded in the curriculum but are somewhat removed from specific curricular routines. They are oriented to specific curricular activities that are known to be in a curriculum (i.e., “activity-oriented”). Close assessments are relatively informal and capture learning that is still contextualized by the curricular activities and that occurs over a rough timescale of days. In Ruiz-Primo’s study, the close assessments were structured performance assessments that were like the curricular problems but used different materials. In contrast, Hickey’s close assessments were paper-and-pencil problems that used screenshots taken from the GenScope program. While these problems used the familiar organisms and representations from the multimedia program, the problems beyond the first few were different from the “inquiry-oriented” puzzles that students had been learning to solve in the multimedia computer program (but were like some of the problems on the proximal-level assessment described below).

The learning captured by both of these examples of close assessment appear more significant than what Perkins and Salomon (1994, p. 6456) defined as “near transfer.” This refers to:

transfer between very similar contexts, as for instance when students taking an exam face a mix of problems of the same kinds that they have practiced separately in their homework or when a garage mechanic repairs an engine in a new car but with a design much the same as in prior models.

We contend that our two examples of close assessment represent more transfer than this because both assessments included problems that students had not previously been directly taught to solve. As elaborated below under assessment functions, Ruiz-Primo’s close-level assessments were used to summatively assess prior learning of scientific inquiry. In contrast, Hickey’s close-level assessments were used to formatively advance student understanding of biological inheritance. The assessments did so by using student’s shared understanding of inheritance (gained during extended collaborative GenScope investigations) to participate in collaborative “feedback conversations” (inspired by Duschl and Gitomer, 1997). Importantly, our suggestions for making close-level formative assessments more culturally relevant build directly on Lobato’s (2003) situative critique of the “answer explanations” (detailed text and graphic rubrics) used to support learning in these feedback conversations during the GenScope research. Building on her *actor-oriented* theory of transfer, Lobato critiqued those materials and the broader formative assessment practice for embracing the perspective of a scientific “expert” (i.e., an “observer”) rather than the perspectives of the students (i.e., the “actors”). Specifically, we believe that close-level formative assessments that start with each learner’s own perspective may have unique potential for helping students connect the intellectual and cultural assets that they bring to schools and universities with the disciplinary content targeted in their courses.

Proximal-Level Assessment

Assessments at the *proximal* level capture knowledge of concepts and principles targeted by the curriculum, but with new problems. Such assessments are *curriculum-oriented* in that they are oriented to the principles and concepts taught in a specific curriculum (but not necessarily the curricular activities used to teach those principles and concepts). Proximal assessments are relatively formal and decontextualized; they typically capture learning that occurs on a timescale of roughly weeks. Ruiz-Primo’s proximal assessments were created using performance tasks that presented new problems to get at the concepts and principles targeted by the curriculum; Hickey’s proximal assessments consisted of sophisticated performance assessment tasks that used conventional representations of genetics and inheritance (e.g., pedigree charts) as well as entirely new species and traits that were not used in the GenScope program.

Proximal-level assessments occupy a crucial role in schools and universities because the resulting scores often comprise most of each student's grades. Because of this, proximal assessments have been a focus of some (but not all) of the "waves" of assessment reform that started in the United States, the United Kingdom, and many Western countries around 1990. As introduced above, this often involved supplanting selected-response proximal assessments with "alternative" formats such as portfolio and performance assessment. Given that many of the CRE recommendations entail using such alternatives, their summative function of providing evidence of school success is worthy of careful consideration. We believe that the central issues here are (a) the extent to which proximal assessments acknowledge/accept/embrace the diversity of ways of knowing and participating that individual learners bring with them and (b) the extent to which proximal assessments help students create "intercontextuality" (Bloome, Bierle, Grigorenko, & Goldman, 2009; Floriani, 1993) between those funds of knowledge and the disciplinary knowledge targeted in a course of instruction.

Distal-Level Assessment

Assessments at the *distal* level are *standards-oriented* in that they capture the achievement of external standards that might be targeted by multiple curricula. Distal assessments are very formal and capture learning that is relatively decontextualized and that occurs over a timescale of months-years. Ruiz-Primo's distal assessment was a standardized science performance assessment that was developed by a statewide consortium. Because the performance assessment included problems that differed in many ways from the curriculum, their distal assessments captured evidence of what most theorists would agree is evidence of "far transfer" as deemed by Perkins and Salomon (1994). This refers to "transfer between contexts that, on appearance, seem remote and alien to one another" (p. 6456). With significance for our arguments, the "distality" of Ruiz-Primo's distal assessment was established *interpretatively*, by comparing the problems on the distal assessment with the problems in the curriculum.

In contrast, Hickey's distal assessment was 15 randomly selected items from the subset of items on the Scholastic Aptitude Test Subject Tests (i.e., SAT II) for Biology that targeted genetics and inheritance. The items were randomly selected from a larger pool of more than 100 test items (rather than being "cherry-picked"). This means that the students were never *deliberately* exposed to problems like those on the distal test. In contrast to Ruiz-Primo, the distality of this assessment was established *empirically*, via the random selection of items from the larger pool. As such, Hickey et al. argued that pre-post gains on the distal assessment were valid evidence of impact on other achievement tests targeting the same standards. With seemingly large consequences for CRE, this was immediately relevant for students in the predominantly African American school in the second study reported in Hickey and Zuiker (2012). Historically, many of these students struggled with the science subtest of the district's graduation test, which included inheritance problems that historically had been particularly difficult. But for reasons introduced above and elaborated below, many theorists disagree that such a multiple-choice achievement test can provide evidence of far transfer *beyond* achievement testing (i.e., for PFL).

Distal-level assessments are often characterized as "high-stakes" when they are used to evaluate the success of schools and teachers in helping students meet regional, national, or professional educational standards. As perhaps best evidenced by rancorous debates in the United States over the No Child Left Behind Act of 2001 and the *Race to the Top* initiative launched in 2009, distal-level high-stakes assessments are quite resistant to change, and the "achievement gaps" that they reveal raise significant political and policy issues. These issues quickly expand beyond the scope of our chapter (but see Jordan, 2010). While we will touch on these issues in our discussion of newer "computer-adaptive" tests, we maintain a relatively agnostic stance toward distal assessment. Specifically, we assume that standardized tests will likely persist in their current form and influence for the foreseeable future wherever they are currently in use. Given that success on such assessments is often necessary to gain access to economically and socially valuable

opportunities (particularly secondary graduation and college admissions), drawing on the assets that students bring to support success in this regard seems like a worthy pursuit. This is not to say that we do not support the broader transformations of high-stakes testing envisioned by many proponents of CRE and some of the proponents of OTL. Rather, we are skeptical that such transformation will occur at scale in the absence of much broader wholesale transformation of schooling. Put differently, we find the idea of shifting to culturally responsive classroom assessment much more plausible than the idea of culturally responsive achievement testing.

Remote-Level Assessment

Finally, assessments at the *remote* level are typically norm-referenced external tests used to capture evidence of large-scale educational achievement over extended periods of time, typically at the national level. These include the National Assessment of Educational Progress (NAEP) used in the United States as well as the Program for International Student Assessment (PISA) used worldwide. Remote assessments are extremely decontextualized and can capture evidence of institutional changes, demographic shifts, and educational reforms that occur over timescales that extend to decades.

Neither Ruiz-Primo nor Hickey included remote-level assessments in their studies. Such tests are so removed from any actual curriculum that it is difficult to conceptualize their role in any consideration of transfer. However, remote-level assessments are featured prominently in many considerations of culturally relevant education because they confirm the persistence of racial disparities in student achievement. For example, Aronson and Laughter's (2016) review of CRE referenced an earlier study by Muller, Stage, and Kinzie (2001) citing NAEP scores documenting that the 12th-grade achievement for African American and Latinx students was comparable to 8th-grade achievement of Euro-American and Asian-American students.

Whether or not remote assessments can provide evidence of success as an alternative approach to assessment, like we are suggesting, is an open question. One possibility that seems worth exploring is the extent to which "echoes" of improvement at the remote level might help distinguish between random variation and systematic improvement at the proximal and distal levels (as demonstrated in Hickey & Zuiker, 2012, p. 573).

Transfer, Assessment Purpose/Function, and Equity

Another dimension that Hickey and Pellegrino (2005) used to explore the relationship between assessment and transfer was assessment *purposes/functions*. The distinction between formative and summative assessment introduced above is widely understood among educators and is likely deeply appreciated by most readers. Assessment researchers have traditionally focused on the intended *purposes* of assessment. "Knowing What Students Know" (National Research Council, 2001) distinguished between *formative*, *summative*, and *evaluative* purposes. Formative purposes have traditionally been characterized as "assessment *for* learning" where the process of completing the assessment and getting feedback is intended to result in student learning (as popularized by Black & William, 1998). In contrast, summative purposes have traditionally been characterized as "assessment *of* learning" whereby the act of completing an assessment is intended to determine how much a test taker knows about a particular topic (and often, therefore, what knowledge they gained from a curriculum or program of education). While less widely appreciated, evaluative purposes have traditionally concerned assessments that are completed for the purposes of evaluating the effectiveness of educational programs, as nicely illustrated by Ruiz-Primo et al.

A focus on assessment purposes leads to concern about attempting to use the same assessment for multiple purposes. As argued by the NRC (2001), a primary concern is that summative and evaluative purposes often undermine formative purposes. Those experts first conceded that “serving multiple purposes is not necessarily wrong, of course, and in truth, few assessments can be said to serve a single purpose only” (p. 225). But throughout the report, they critique the design and use of high-stakes summative and evaluative tests and argue that such assessments generally work at “cross-purposes” with any intended formative purposes. They concluded that “the more purposes a single assessment aims to serve, the more each purpose will be compromised. This is not necessarily a problem as long as the assessment designers and users recognize the compromises and trade-offs involved” (pp. 41–42).

The NRC report ultimately argued for a *balanced assessment system* where formative, summative, and evaluative assessments are coordinated around a common cognitive-constructivist perspective. They argued that such a system would offer *coherence* whereby “the external assessment results will be consistent with the more detailed understanding of learning underlying classroom instruction and assessment” (p. 256). They also argued that such a system would further offer *continuity* whereby “multiple sets of observations over time must be conceptually linked so that change can be observed and interpreted” (p. 257). The report goes on to describe several efforts underway at that time to establish such a system, including ones in Australia (Masters & Forster, 1996) and one at the University of California Berkeley (Wilson & Sloane, 2000). In the ensuing decade, substantial progress was made in defining the “learning progressions” in specific disciplines needed to organize such systems as well as the new computer-adaptive tests and new statistical techniques they required. A notable contribution in this regard is Mislevy’s groundbreaking work on *evidence centered design*, as elaborated a contribution to the aforementioned OTL volume (Moss et al., 2008).

Arguably, these elements came together in the Smarter Balanced Assessment Consortium (SBAC; <http://www.smarterbalanced.org/assessments/#>, 2021), which formed in 2010 as part of *Race to the Top* and ultimately created new formative assessments for teachers, interim assessments for checking progress, and annual summative tests, all aligned to the new Common Core State Standards in English and mathematics. It is beyond the scope of this chapter to describe or even take a position on what ultimately became of the SBAC. As of 2020, only seven U.S. states were still members. We note that some observers argue that the program did not deliver the kinds of overall improvement or reduction in racial and ethnic disparities that the coalition had hoped to obtain (e.g., Gao & Lafortune, 2019). But our goal here is to introduce a different way of conceptualizing and integrating multiple assessments that each serves multiple *functions*.

A Situative Focus on Assessment Functions

As introduced in Hickey and Pellegrino (2005) and elaborated in Hickey (2015) and below, situative theories of learning lead beyond a concern with assessment purposes to focus on assessment *functions*. This is important because the broader view of learning associated with situative theory makes it possible for the same assessment to function as a summative assessment of one aspect of learning (e.g., engagement) while also functioning as a formative assessment of another aspect of learning (e.g., understanding). For example, the close-level assessments in the GenScope research functioned as a summative assessment of prior engagement (in the inquiry activities) but also as formative assessments of current understanding.

In our experience, the idea that a single assessment might simultaneously function as a summative assessment of one kind of learning and a formative assessment of another kind of learning is problematic for conventionally minded assessment researchers. We have recently found that close-level engagement reflections (introduced below) make it easier for others to appreciate the potential for this practice. We believe that this idea is important for CRE because assessments that are primarily intended to serve formative functions in support of understanding (i.e., classroom assessment) can likely be more responsive

and sensitive to diverse cultures and backgrounds than assessments that are primarily intended to serve summative functions. Inversely, it is worth pondering whether ostensibly formative classroom assessments are actually serving more summative functions and therefore possibly undermining some student's confidence, success, or access in ways that are exacerbating inequities via other unintended functions, as described next.

Conformative, Deformative, and Transformative Assessment Functions

In addition to directing attention to assessment functions, a sociocultural perspective broadens the range of functions that assessment serves. From this perspective, Torrance (2012) argued that “all assessment is formative, for student dispositions and self-identities as learnings, as well as knowledge and understanding, but not necessarily in a positive way” (p. 325). Torrance went on to elaborate on three other functions of assessment that are central to our arguments. *Conformative* functions refer to the trends toward increasingly specific criteria and formative assessments that are narrowly organized to meet those criteria. Torrance echoed the arguments made in Sadler's (1989) groundbreaking formative assessment paper that students should learn to use multiple evaluative criteria and some of those criteria need to be “fuzzy.” Both Torrance and Sadler acknowledge that *some* of the criteria in formative assessment can be relatively objective and straightforward. But they argue that all students need practice evaluating work against criteria that have no absolute and unambiguous meaning and can therefore only be fully appreciated in the context of their application. In our experience, accomplishing this goal is easier in domains like composition (where Sadler was working). As demonstrated in the GenScope research, we believe that (a) even in domains like biology, students can and should practice evaluating work with fuzzy criteria; (b) Lobato's (2012) actor-oriented transfer theory and the ideas of expansive framing in Engle et al. (2012) provide a ready framework for creating such criteria; (c) immediate-level and close-level assessment are ideal settings for students to practice using such criteria; and (d) most criteria associated with evaluating student-formed connections between their own personal and cultural experiences and course content are inherently fuzzy.

The second assessment function that Torrance (2012) introduced was *deformative*. Torrance reminded readers:

Providing and receiving feedback is a highly demanding emotional process, impacting on learners' identities and notions of self-worth. This is particularly the case if the feedback is just a grade or a mark, and especially a low grade or low mark, but it also applies to more extensive forms of feedback. Reading critical comments, even when accompanied by advice about how to improve, can be as disconcerting as receiving a poor grade, especially if the critical comments are unexpected or if the reader disagrees with them. (p. 334)

This concern with the consequences of feedback on student identity and motivation and recognition of the exhausting nature of typical formative assessment is central to the “conundrum” of formative assessment elaborated in Hickey (2015). This is where conformative and deformative functions result in formative assessment practices leaving students with *less* knowledge *and* less favorable dispositions toward that knowledge, when compared with other potentially more effective and motivational curricular routines.

We contend that the many formative assessment studies showing that students who get more feedback ended up learning more than other students are simply demonstrations of educational malpractice. In other words, it is obvious that students learn more when they get more feedback. These and other related concerns led Bennett (2011, p. 12) to quip that formative assessment “has essentially become the educational equivalent of an urban legend.” To the extent that ostensibly formative assessments are particularly deformative for minoritized students, this issue demands further consideration.

Our goals are consistent with what Torrance (2012) characterized as the *transformative* functions of assessment. Transformative assessment “exposes the process of assessment itself to scrutiny, along with the role of criteria in legitimizing the discourse of assessment and the social construction of judgment” (p. 338). This in turn is necessary for further progress toward Frederiksen and Collins’s (1989) elusive goal of *systemic validity* whereby the introduction of assessment results in more of the knowledge they are designed to capture.

Interactions Between Function, Level, and Theory

Systemic validity and the corresponding transformative functions are bound up in the interaction between assessment function, assessment level, and learning theory. Formative functions are more likely to be associated with assessments at the close and proximal levels. Consider the influential definition of formative assessment by Black and Wiliam (1998):

We use the general term assessment to refer to all those activities undertaken by teachers—and by the students in assessing themselves—which provide information to be used as feedback to modify the teaching and learning activities. Such assessment becomes formative assessment when the evidence is actually used to adapt the teaching to meet student needs. (p. 144)

Certainly, assessments at the immediate level can serve formative functions. But to reiterate, immediate-level assessments are so integral to the curriculum that few would characterize them as “assessment.” On the other hand, distal and remote-level assessments are so removed from instruction that it is difficult to use the resulting evidence to adapt teaching. This is precisely the concern that Shepard (2005) raised as commercial publishers began aggressively (and successfully) marketing “interim” external achievement tests as “formative assessments.” Given the difficulty of using such tests for anything other than tracking and placement, Shepard argued that such tests should be labeled “early warning summative tests.”

The two multilevel assessment studies detailed above illustrate how complex the ultimate functions of assessment systems can become. All the assessments used by Ruiz-Primo et al. served summative functions regarding student learning. But the resulting evidence was used for evaluative functions for the curricula. This evidence may have also served formative functions if the conclusions of the evaluation were used to refine the curricula. In contrast, each of the assessments used by Hickey et al. were designed to serve multiple functions. By “aligning” learning across the various levels, these assessments were intended to maximize the summative and formative functions within and across levels. As elaborated below, using different theories of learning to represent knowledge at each level made it possible to systematically vary the way that knowledge was represented at each level. This minimized the introduction of what the validity theorist Messick (1994) called *construct-irrelevant easiness* and which most others describe as “teaching to the test.”

Assessment, Transfer, Equity, and Learning Theory

As articulated by the National Research Council (2001), assumptions about the nature of knowledge constrain theories of learning (i.e., how that knowledge is gained). Assumptions about learning, in turn, constrain theories of transfer (i.e., whether gained knowledge is subsequently useful and used). According to the NRC (and Greeno, Pearson, and Schoenfeld, 1996), most theories of knowing, learning, and transfer fall within one of four *perspectives* (sometimes called “grand theories”). The NRC labeled these perspectives *differential*, *behaviorist*, *cognitive*, and *situative*. Reflecting ongoing debates and differing goals, others have collapsed the first two perspectives and used different labels. For example, Greeno, Collins, and Resnick (1996) compared *behavioral/empiricist*, *cognitive/rationalist*, and *situative/pragmatist-sociohistoric* perspectives. In contrast, Case (1996) compared *empiricist*, *rationalist*, and *sociohistoric* perspective. We have chosen to use the labels *differential*, *associationist*, *constructivist*, and *sociocultural* for the four perspectives because we believe that these labels best capture the implications of each perspective for our arguments about assessment and equity.

Differential Theories

Differential theories of knowing and learning emerged in the early 20th century within efforts to uncover stable intellectual traits such as IQ. This perspective assumes that “whatever exists, exists in some amount and can be measured” (Greeno, Pearson, & Schoenfeld, 1996, p. 10). Tests were developed to obtain evidence of a variety of knowledge and skills that children at a given age were expected to have developed. The implicit theory of learning was defined by the test items that were included in an assessment. This is because those items consistently discriminated between children within and across various ages: “Theories of intelligence and mental ability emerged that were entirely based on analysis of patterns of correlations among test scores” (National Research Council, 2001, p. 60).

Many observers conflate differential perspectives and associationist perspectives. They do indeed present substantial overlap. But like the NRC (2001), we find it useful to distinguish between them. As that group of experts concurred:

Theories of intelligence and mental ability emerged that were based entirely on analyses of the patterns of correlation among test scores. To pursue such work, elaborate statistical machinery was developed for determining the separate factors that define the structure of intellect. (pp. 61–62)

For the most part in education, differential theories of knowing and learning were supplanted by theories that came later. They are no longer widely embraced and are sometimes unacknowledged (e.g., Case, 1996; Greeno, Collins, & Resnick, 1996). Relative to this chapter, differential perspectives were never part of the modern discussion of transfer. But the “elaborate statistical machinery” that they produced is largely compatible with the associationist theories that supplanted them and that were central in the development of standardized achievement tests, which continue to have a profound influence on educational practice.

Associationist Theories

These theories argue that knowing and learning are organized around many small associations. Some equate these perspectives with behaviorism (e.g., National Research Council, 2001). From a behaviorist perspective, knowledge consists of numerous stimulus–response associations that all organisms (i.e., humans and animals) created in response to contingencies (i.e., reinforcements) in the environment. However, after the “cognitive revolution” supplanted behaviorism in the 1970s and 1980s, associationist perspectives continued in one influential strand of cognitive science. This work is epitomized in the work of John Anderson (1983/2013) and embodied in some modern learning technologies such as “cognitive tutors” (e.g., Koedinger & Corbett, 2006) and intelligent tutoring systems (e.g., Koedinger, Brunskill, Baker, McLaughlin, & Stamper, 2013). While cognitive–associationist perspectives transcend the behaviorist prohibition on reference to internal cognitive structures, they maintain the assumption that knowledge consists of many small associations (in the form of goals, declarative knowledge, procedural knowledge, and conditional knowledge) that organize readily into higher–order thinking. As such, learning is the process of forming those associations and organizing them into useful structures. From this perspective, what “transfers” from the learning environment to the transfer environment are these smaller associations (which include associations between those associations, Singley & Anderson, 1989).

Because this perspective assumes that specific associations transfer readily, the assessment of transferable learning can be accomplished by gathering evidence that the learners can recognize associations formed in the learning environment. This can be accomplished readily with conventional multiple–choice test items. As such, assessments that show that students have formed new associations can provide evidence of transferable learning. This is particularly relevant to computer–based testing and artificially intelligent tutors. As summarized by Mislevy (2018, p. 29), the associationist perspectives as embodied in Anderson’s work are “at a fine grain size, can solve problems in the domain, and can help interpret students problem–solving actions. They are not measurement models, and they do not directly support assessment and courser grain size as in most educational assessments.”

This distinction between the fine–grained psychological research and courser–grain research on educational assessment is crucial to our arguments. As learning technologies continue to advance and online learning has become ubiquitous, associationist assumptions about assessment have increasingly significant implications for education. Particularly as embodied in increasingly popular commercial cognitive tutors (e.g., Carnegie Learning, <https://www.carnegielearning.com/>, 2021; McGraw–Hill, <https://www.aleks.com/>, 2021), it seems possible that these technologies may “lock in” associationist assumptions and approaches.

Because of their reliance on multiple–choice item formats, achievement tests appear at first glance to be entirely consistent with associationist perspectives. Put differently, answering multiple–choice test items appears to be recognizing which of four or five associations is the correct one. However, professionally designed achievement tests usually include “best answer” items with multiple responses that are plausibly correct to less knowledgeable test takers. The reasoning processes that test takers use to identify the most appropriate response are debatable and debated (e.g., Mislevy, 1996). As demonstrated in the research summarized in Pellegrino and Glaser (1982), there is ample evidence that different types of test takers (e.g., high–scoring youngsters vs. lower–scoring adults) can attain the same score via very different reasoning processes. As elaborated below, we believe that, when used to assess learning from *non associationist* learning environments, well–constructed multiple–choice tests that feature associations that were not directly presented in the learning environment can provide precise estimates of transfer to subsequent achievement testing contexts and valid estimates of transfer to a wide range of subsequent educational, professional, and personal contexts.

Constructivist Theories

In contrast to associationist perspectives, constructivist perspectives characterize knowing and learning in terms of higher-order cognitive or conceptual structures. These perspectives assume that these structures are uniquely human and are constructed when making sense of the world (i.e., rationalizing) and solving problems. From a constructivist perspective, the higher-order mental “schema” constructed when solving problems in the learning environment are what individuals transfer and use to solve problems in subsequent transfer environments (e.g., Reed, 1993). More specifically, the assessment of transferable knowledge requires that an individual be asked to use the schema they learned solving problems in the learning environment to solve new (i.e., different) problems in the transfer environment (Mayer & Wittrock, 1996).

Constructivist theories became widely influential in education and educational research in the 1980s. These perspectives are still widely embraced among educational psychologists and were central to assessment reform efforts that became prominent in the 1990s (e.g., Wolf, Bixby, Glenn, & Gardner, 1991). Constructivist assumptions led many to reject traditional achievement tests and multiple-choice formats for classroom assessments in favor of more open-ended performance assessments. For many assessment experts working in this tradition, this has often meant “assessments of extended performance” and “crediting varieties of excellence” (Greeno, Collins, & Resnick, 1996, p. 39). This is typically accomplished with “alternative” assessment formats such as open-ended problem-solving tasks and extended performance assessments (e.g., Hickey, Wolfe, & Kindfield, 2000; Wiggins, 1998). Such formats typically include a relatively small number of items that traditionally needed to be scored by humans and presented challenges to traditional psychometric methods. But such assessments now benefit from the aforementioned new statistical models and digital technologies to automate them, as pioneered by Mislevy and Gitomer (1995) and later summarized by Quellmalz and Pellegrino (2009). Such “computer-adaptive” items are now included in the high-stakes tests used by the U.S. states participating in the SBAC (2021) and which some other states are now incorporating into their own statewide assessments (e.g., Indiana Department of Education, 2020).

Sociocultural Theories

Sociocultural theories organize knowing and learning around participation in social and cultural practices. While rooted in Vygotsky’s seminal work following the Russian Revolution, these perspectives were largely unknown in Western education circles until the 1980s. Whereas associationist and constructivist perspectives assume that there is a clear distinction between the individual and the environment, sociocultural perspectives assume a dialectical relationship between the individual and the environment. Particularly within the strand of sociocultural theory known as *situated cognition* (i.e., Greeno, 1998; Lave & Wenger, 1991), knowledge is presumed “stretched across” the context where it was learned and where it is used. Mislevy (2018) introduced the label “linguistic, cultural, and substantive patterns” (“LCS patterns”) to refer to such representations of knowledge in the context of contemporary assessment research.

According to (Greeno, Collins, & Resnick, 1996) assessment from this perspective means “assessing participation in inquiry and social practices of learning,” “student participation in assessment,” and “design of assessment systems” (p. 39). To use Mislevy’s terms, sociocultural assessment of transferable knowledge requires examining whether individuals can participate more successfully in particular LCS patterns in a new environment after engaging with those same LCS patterns in the learning environment. The most obvious assessment format that follows from these perspectives is portfolio assessment. To reiterate, assessment theorists including Batson (2011), Dysthe (2008), and Habib and Wittek (2007) have explored portfolio assessment from situative/sociocultural perspectives. However, some theorists working

with situative theories argue that the very notion of transfer is too rooted in cognitive perspectives and should be abandoned (e.g., Beach, 1999).

We return to the challenge of the assessment of transferable knowledge from a sociocultural perspective below. In the meantime, we introduce one of the most complex and far-reaching issues that situativity presents for assessment theory and practice. This issue has to do with how one *reconciles* individual and social activity. As introduced in Greeno and Moore (1993), the more common and straightforward approach uses “levels of aggregation” to reconcile individual and social activity. It does so by using aggregated individual activity to characterize social activity. While this is common among researchers and theorists working in both associationist and constructivist perspectives, they each lead to very different characterizations of social activity. Greeno (2007) characterized these approaches to reconciliation as “inside out” because they extend theories of individual cognition to explain social activity.

What distinguishes situative theory from other theories within sociocultural perspectives is an insistent embrace of a *dialectical* reconciliation whereby all individual activity is treated as “special cases” of socially situated activity. Greeno (2007) characterized this reconciliation as “from the outside in” because it uses sociocultural activity to explain the informational structures that define human cognition and information processing. As elaborated at length in the context of assessment in Hickey (2015), Greeno’s (1998) “situative synthesis” has an important implication for assessing the specific associations that many assume are best captured with multiple-choice assessments *and* the constructivist problem-solving proficiency that others assume are best captured with performance assessments. Hickey (2015) argued that the situative synthesis makes it possible to treat “having” such associations and “resolving” such problems as very specific forms of cultural ways of knowing. We return to this issue and its implications for the assessment of transfer below.

Evolving Views of Transfer and Their Implications for Education

This section presents a selective review of the evolution of overlapping views of transfer, building on the discussion of learning theory above. We start with the historical review of transfer views in “Problem Solving Transfer,” a handbook chapter by Mayer and Wittrock (1996), and then draw on subsequent handbook chapters and special issues. We attempt to summarize the implications of each view for education and then the goals of CRE. We acknowledge that research and theory on transfer can be (and has been) organized in other ways. This organization helps set up our arguments in the final section regarding our “emerging” view of transfer that underpins our suggestions for making classroom assessments more culturally relevant.

General Transfer of General Skills

Following from the differential theories introduced above, this view of transfer is often referred to as *formal discipline*. This view is embodied in the assumption that certain school subjects like Latin, and geometry make students more logical and disciplined, and that these general skills transfer readily to a wide range of subsequent contexts. While this view was largely sidelined by subsequent associationist views, it continues to influence education and equity in at least three ways. The first was relatively straightforward and concerned “thinking skills” programs that exercise minds with special tasks that were thought to improve general mental functioning. Many such programs and theories emerged at the dawn of the cognitive revolution, including those of Covington (1972), Feuerstein (1980), and Papert (1980). However, numerous studies documented that the learning gained in such programs only transferred to very similar problems while failing to transfer to new problems or achievement tests (e.g., Mansfield, Busse, & Krepelka, 1978; Pea & Kurland, 1984; Perkins, 1985). While Papert’s vision has lived on in *constructionism* (e.g., Ackermann, 1996; Kafai & Resnick, 1996) and the “maker” movement (e.g., Halverson & Sheridan, 2014), the thinking skills movement largely stalled in the 1990s. It is worth noting, however, that providing equitable access to STEM learning has emerged as a significant theme in the maker movement (e.g., Barton, Tan, & Greenberg, 2016; Peppler, Sedas, & Dahn, 2020).

A second more complex implication of this view of transfer is via the resurgence of “classical” education that builds on approaches that were widespread among elite western schools and Chinese schools through the 1800s. Contemporary versions (e.g., Bauer, 2015) focus on Socratic methods and the Greek trivium of grammar, logic, and rhetoric in the elementary grades and the quadrivium of arithmetic, geometry, music, and astronomy in the secondary grades. This approach is widely used in Christian schools (Association of Classical Christian Schools, <https://classicalchristian.org/>, 2021; Wilson, 2002) and by homeschoolers (Bauer & Wise, 2016; Sherfinski, 2014) and are expanding among Catholic schools (Institute of Catholic Liberal Education, <http://www.catholicliberaleducation.org/>, 2021,) and secular charter schools (Classical Charter Schools, <https://classicalcharterschools.org/>, 2021). Although some of these schools specifically target students of color, there is evidence that they appeal to children from Anglo-American and more affluent and academically prepared families, potentially leading to de facto segregation and reduced test scores in traditional public schools (Brewer & Lubienski, 2017).

A third very complex way that the formal discipline view of transfer impacts education and equity is via the “elaborate statistical machinery” that it yielded and the standardized achievement tests that followed (National Research Council, 2001, p.61). On one hand, we agree with widespread concerns that high-stakes tests have insidious influences on schooling via ostensibly-formative “interim” achievement tests and inappropriate test preparation practices (Koretz, 2017; Shepard, 2005). Such practices take time away from more productive forms of classroom engagement, have fleeting positive impacts on test scores (and potentially negative), and are more widespread among schools that serve minoritized students (Boaler, 2003; McNeil, 2001). Meanwhile, more advantaged and affluent students are more likely to take advantage of expensive private test preparation programs, private tutoring, and other extracurricular activities. This so-called shadow education does not take time away from the school day and has been shown to have at least moderate positive consequences for college entrance exam scores and selective college enrollment (Bray & Kwo, 2013; Buchmann, Condron, & Roscigno, 2010). We further reiterate that the primary discussion of assessment and testing among proponents of culturally responsive education is concerns over traditional achievement tests and a push for the alternative formats discussed above. On the other hand, we believe that conventional standardized tests are inevitable in most Western educational contexts and particularly in the United States. Furthermore, we believe that standardized tests, *when used appropriately*, can serve a narrow but useful (and possibly essential) role in continuing efforts to make education more equitable.

Specific Transfer of Specific Associations

Following from the associationist theories above, this view of transfer assumes that what transfers are specific associations. Mayer and Wittrock (1996) characterized this theory as “specific transfer of specific behaviors.” They asserted that Thorndike’s work in the early 1900s represented a “new science of educational psychology” and the assumption that “transfer involves the application of identical behaviors from an initially learned task to the new task” (p. 49). Also known as *identical elements*, this view assumes that behavioral associations learned in an initial environment will transfer when elements of the transfer environment are identical to elements in the learning environment.

Limiting associationist views of transfer to behavioral associations highlights a central dilemma in characterizing transfer research. To reiterate, after the cognitive revolution, an influential associationist strand of cognitive psychology emerged. This theory supplanted the stimulus–response associations of behaviorism with fine–grained consideration of procedural and declarative knowledge. This idea is embodied in Singley and Anderson’s (1989) consideration of transfer within Anderson’s broader Adaptive Control of Thought (ACT) theory. Singley and Anderson were unabashed in acknowledging the behaviorist roots of their theory:

The essence of this book is that Thorndike’s identical elements theory is alive and well in a new body. We have resurrected Thorndike’s theory by redefining his identical elements as the units of declarative and procedural knowledge in the ACT* theory.... The key difference between his proposal and ours is that, whereas Thorndike’s elements referred only to external behaviors, ours include purely cognitive operations that reference abstract mental objects. (p. 248)

Sometimes referred to as “information processing” theories, cognitive–associationist theories of transfer were readily modeled using computers, making them quite influential in cognitive science, instructional technology, and education. Before discussing these influences, it is worth reiterating that associationist transfer is relatively unproblematic. Thorndike assumed that behavioral stimulus–response associations formed in the learning environment would transfer as long as the same stimuli (i.e., “elements”) were present (i.e., “identical”) in the transfer environment. Similarly, specific cognitive associations of declarative, procedural, and conditional knowledge formed in a learning environment are assumed to transfer readily as long as the representations learned in the learning environment are present in the transfer environment. This means that evidence that learners have formed those associations (as can be assessed efficiently and automatically with selected–response test items) is evidence of knowledge that can transfer to subsequent settings. When coupled with the further assumption that these specific associations assemble relatively readily into higher–order thinking, cognitive–associationist theories of transfer support artificially intelligent cognitive tutors (e.g., Fang, Ren, Hu, & Graesser, 2019; Koedinger & Corbett, 2006), expository forms of “direct” instruction (e.g., Kirschner, Sweller, & Clark, 2006), and much of the research using educational data mining (e.g., Baker & Yacef, 2009).

While these views of transfer have significant implications for educational research and practice, their implications for equity and culturally responsive pedagogy are rather unspecified. At minimum, we assume that starting instruction with very specific disciplinary associations leaves little room for students to transfer in their own unique personal and cultural assets to support their learning. But the implications are much more apparent in the burgeoning “no excuses” and other “back to basics” schools, such as the Knowledge Is Power Program (KIPP Public Charter Schools, <https://www.kipp.org/>, 2021), that overwhelmingly serve students of color in urban areas, use strictly expository instruction, and employ strict behavioral disciplinary methods (Brewer & Lubienski, 2017). Proponents point to “large and meaningful gains” in achievement in experimental lottery–based studies (Cheng, Hitt, Kisida, & Mills, 2017). But skeptics point out that some of differences documented are the result of higher attrition rates in treatment groups (Lubienski & Brewer, 2016) and worry that such approaches undermine self–determination, self–

regulation, and lifelong learning (Bailey, Meland, Brion-Meisels, & Jones, 2019; Golann, 2015), while critics argue that such schools are inherently racist (Sondel, Kretchmar, & Hadley Dunn, 2019) and stigmatizing (Marsh & Noguera, 2018).

Specific Transfer of General Skills

Following from constructivist learning theories, this view characterizes transfer in terms of relatively general skills. Like the general transfer of general skills view, this view assumes that transfer occurs when broader reasoning structures constructed by solving problems and making sense in the learning environment are then used to solve different problems in the transfer environment, even when there are no identical elements in the learning context and transfer context. Mayer and Wittrock associated this view of transfer with Gestalt psychologists (e.g., Judd, 1936) and argued that this work stalled because it failed to explain how people learn to manage and control their cognitive strategies (as included in the transfer view discussed next).

For us, the open question is whether modern and contemporary “schema-based” theories of transfer (e.g., Jacobson et al., 2020; Reed, 1993) belong in this category as well. As evidence mounted that general transfer of domain-general thinking skills was not occurring, a significant trend emerged among constructivist theorists toward more domain-specific thinking skills (e.g., Glaser, 1984). Consider, for example, the contribution by Richland, Sigler, and Holyoak (2012) to the special issue of *Educational Psychologist*, “New Conceptualizations of Transfer of Learning” (Goldstone & Day, 2012). Richland et al. summarized the evidence that specific skills in mathematics often fail to transfer because students incorrectly apply previously memorized procedures. They argued for increased instructional focus on experimentally derived higher-level “flexible and comparative” reasoning strategies in mathematics, alongside more conventional instruction on specific mathematical procedures.

From our perspective, it may be worthwhile to continue treating this as a distinct view of transfer (rather than merging it into the next view) because of the tremendous influence of this view on assessment practice. To reiterate, constructivist theories provided much of the impetus for the waves of assessment reform that emerged in the 1990s that were focused primarily on performance and portfolio assessment (e.g., Wiggins, 1998; Wolf et al., 1991).

Transfer as Metacognitive Control of General and Specific Skills

Mayer and Wittrock (1996) labeled this fourth view of transfer as simply “cognitive science.” Reflecting a perspective that is still embraced by many cognitive and educational psychologist, this view did not take a strong stand on general versus specific skills but rather emphasized the importance of learners’ metacognitive control over their learning and transfer of both specific and general skills. This relatively encompassing view is noteworthy because it incorporates elements of the three prior views:

The metacognitive view of transfer combines features of the previous three views: transfer to a new problem is enhanced when students have learned relevant general and specific processes as well as techniques for selecting and monitoring them ... problem solvers are managers of their general specific knowledge; they need to possess relevant specific and general knowledge, but they also need to know how to use that knowledge in the context of problem solving. (p. 51)

This view sidestepped the tensions between general and specific transfer and allowed consideration of the entire range of ideas of teaching for transfer that had emerged by that time. This allowed Mayer and Wittrock to dismiss the general thinking skills movement while endorsing the teaching of domain-specific thinking skills and metacognitive skills. Similarly, it allowed them to acknowledge the value of fluency with

basic skills while promoting methods for teaching for understanding and by analog. Significantly for our purposes, in distinguishing between *knowledge transfer* and *problem-solving transfer* (p. 48), Mayer and Wittrock reified the primacy of problem-solving as the only evidence of meaningful transfer and implied that achievement tests cannot capture evidence of meaningful transfer. Building on the groundbreaking article by Salomon and Perkins (1989), Mayer and Wittrock went on to distinguish between *high-road* versus *low-road* transfer (i.e., effortful and conscious vs. automatic and without conscious attention), and *weak methods* versus *strong methods* (i.e., domain-general heuristics often used by novices vs. domain-specific methods typically used by experts).

Notably, Mayer and Wittrock did not even acknowledge the situative view of transfer introduced in Greeno et al. (1993) and summarized in the chapter by Greeno, Collins, and Resnick (1996) in the same handbook. Rather Mayer and Wittrock merely referenced that chapter after stating that “learning communities in which these [cognitive and metacognitive] strategies are modeled and valued might be particularly effective in promoting their use” (p. 59). This is important for us because Mayer and Wittrock reframed social *perspectives* on learning and transfer as social *contexts* that “might help” individuals learn and transfer resolutely cognitive problem-solving proficiency.

Mayer and Wittrock’s (1996) cognitive science view of transfer is largely consistent with the modern perspective embraced by the NRC (2001) and another widely cited NRC expert consensus report published in 1999 called *How People Learn*. Both NRC reports (a) highlighted the importance of metacognition in both initial learning and transfer, (b) embraced learning and transfer of both specific and general skills, and (c) expressed skepticism regarding the value of conventional achievement tests and formats for assessing meaningful learning and transfer. However, reflecting a broader trend in cognitive science, both NRC reports included more consideration of the role of social and cultural contexts in learning. To a varying degree, other influential characterizations of transfer that can be considered in this view include handbook chapters by Bransford et al. (2006) and Bereiter and Scardamalia (2006).

As illustrated by the voluminous references to the principles for instruction and assessment in both NRC reports, the educational implications of this modern view of transfer are profound. Arguably, by that time, this view had come to dominate the field of educational psychology. But implications of this view of transfer for CRE are less clear. It is possible that the acknowledgement of the importance of social and cultural contexts in the NRC reports helped open doors for contemporary asset-based responses to historical inequities. Indeed, recent years have seen interest in equity on among educational psychologists working with relatively conventional individually oriented constructs (e.g., DeCuir-Gunby, 2020; Zusho & Kumar, 2018).

But a chapter in the first *Handbook*, “Ethnicity and Culture in Educational Psychology,” by Portes (1996) raised a fundamental concern with educational psychology’s responses to inequity. Portes acknowledged that equitable access and success had long been a goal of many educational psychologists. But Portes argued that by focusing primarily on individuals, educational psychology may be a fundamental part of the problem:

From a critical pedagogical view, educational psychology may be viewed as part of the group-based inequality program and may be unable to extricate itself sufficiently to be able to address it. Insofar as the real factors underlying group-based inequality appear to extend beyond individual psychology, educational psychology has little to offer. Research in educational psychology is not concerned with contextual issues, and only a small part of culture-related educational problems can be addressed at the instructional level in schools. In effect, *educational psychology may be necessary but is not sufficient* [emphasis added], as currently practiced, in eliminating group-based inequality. (p 333)

We believe that Portes's argument can be extended out to theories of transfer as those theories are embodied in assessment and testing. Put differently, we believe that a view of transfer that focuses *primarily* on individual factors (even while acknowledging contextual factors) leads to classroom assessments and external tests that are likely to exacerbate group-based inequality in education. We return to this issue below after considering three more specific views of transfer that emerged within this broader cognitive science view.

Motivational Views of Transfer

An article by Belenky and Nokes-Malach (2012) in a transfer strand advanced a distinct view of transfer that emphasized motivational factors along with metacognitive control of specific and general skills. They reported a study showing that (a) motivation (in the form of a mastery-approach goal orientation) was generally associated with transfer, (b) a particular intervention could enhance that motivation, and (c) those enhancements were associated with increased transfer. A similar push for increased focus on motivation in transfer research was offered in the commentary by Perkins and Salomon in the contributions to a special issue of *Educational Psychologist* (Goldstone & Day, 2012). Perkins and Salomon first set out an important qualification that helps explain why there are so many different explanations for the same demonstrations of transfer or lack thereof:

How is it that contrasting descriptions of the same situation arise? Because different researchers can have different conceptions of what applications fall within the intended scope of the initial learning (where failure indicates failure of the initial learning) and what applications reach markedly beyond it (where failure indicates failure of transfer). (p. 250)

They explain that much of the disagreement about evidence of initial learning and evidence of transfer is bound up in broader arguments over the domain specificity of knowledge. This is because these broader arguments define whether something that was learned belongs to a specified domain of knowledge. Perkins and Salomon then go on to critique many experimental studies on transfer (including most of the articles in the special issue) for obscuring the role of motivation and disposition by directly asking research subjects to undertake transfer tasks.

In response, Perkins and Salomon (2012) offered the *detect-elect-connect* view of transfer. This view considers whether individuals, when faced with a potential opportunity to transfer prior learning, (a) *detect* a potential relationship with something they have previously learned, (b) *elect* to explore that relationship, and (c) successfully *connect* their prior learning with the new context. In their model, the motivational and dispositional aspects of transfer are primarily represented by the elect phase, whereby the many competing demands on attention and time lead learners away from actively connecting relevant relationships once they are detected. They argue that many educational practices embody what they call a *learning culture of demand* whereby school assignments and tests directly call for intended learning. Such a culture “can serve quite well when later contexts of use cue and motivate deploying what’s been learned” (p. 257). But they point out that the broader environment does not strongly cue up knowledge, meaning that one “needs to be motivated to do so or have a general mindful disposition to look for possible bridges” (p. 257).

Perkins and Salomon (2012) argue that schools instead need to foster a *learning culture of opportunity*. Rather than “a series of highly targeted demands,” they suggest:

Learners would more often need to grope for potentially relevant prior knowledge (detect) and use judgment to decide on its relevance and how to proceed (elect). Such a culture would anticipate likely counter habits and counter motivations undermining later opportunities and prepare learners to face them. Indeed, such a culture would not limit its activities strictly to the classroom,

but reach beyond the walls, for instance, through reflective diary keeping about facets of everyday life or participation in social and intellectual initiatives in the home and community. (p. 257)

Perkins and Salomon further suggested that *expansive framing* introduced in the same special issue by Engle et al. (2012, elaborated below) offered a promising approach to creating such a culture that is compatible with their own framework. As elaborated in Hickey (2003) and summarized below, we believe that a situative approach to motivation when coupled with expansively framed instruction and assessment might indeed create such a culture of opportunity. We also point readers to the edited collection by DeCuir-Gunby and Schutz (2016)

Perceptual Views of Transfer

Another discernable strand of contemporary transfer research is a contribution by Day and Goldstone (2012) to the special issue they edited. Following a summary of traditional transfer research, they provide a detailed review of the range of research that challenges the traditional view. This includes research embracing both the cognitive science view above and the situative view summarized below. After reviewing Anderson et al.'s (1996) widely cited critique of the general claims of situated learning (but not Greeno's, 1997, response), Day and Goldstone summarized research showing that "some of the research and ideas from mainstream psychologists are at least consistent with the points raised by situative researchers" (p. 166). This included research documenting how analogical mental representations were transformed or adapted during the transfer process, drawing on "real-world" knowledge from beyond the experimental context (e.g., Clement, 1988; Dunbar & Blanchette, 2001). This is important because "real-world" knowledge is presumably strongly situated in the social and cultural experiences of the subjects. This also included studies documenting more implicit (i.e., non deliberative) analogical transfer where subjects were unaware that they were using previously learned knowledge (e.g., Day & Goldstone, 2011). This is important because it challenges the traditional assumption that the transfer of analogical reasoning requires individuals to actively map the relationship between the learning and transfer contexts (i.e., "high-road" transfer in Salomon & Perkins, 1989).

The remainder of Day and Goldstone (2012) summarized studies of their own "perceptual" view of transfer that aims to "shift transfer from an abstract high-level conceptualization to perception-action processes" (p. 166). They concluded that "findings such as these provide a way of extending and enriching our understanding of traditional transfer phenomenon while also addressing many of the concerns and critiques that have been raised against the standard cognitivist approach" (p. 171). Whereas traditional transfer models start with the recognition of common structural aspects of the learning and transfer context, they argue that "perception and action routines can provide the basis for linking the two situations, and once linked, more formal, more generalizable structures that are compatible with the linking can be constructed" (p. 171).

In summary, this perceptual view of transfer (a) does not begin with the traditional recognition of the similarities between the learning and transfer context, (b) does not require conscious deliberate mapping across the learning and transfer contexts, (c) has been empirically demonstrated in carefully controlled studies, and (d) can explain some of the findings of the situative demonstrations of transfer. However, the educational implications for this view of transfer are unclear. After acknowledging that that they were *not* suggesting that "perceptual representations were 'the' basis for knowledge transfer" (p. 171), Day and Goldstone (2012) also assert that they were not "suggesting that the path to improved transfer is making learning materials 'more perceptual'" (p. 171). Rather, they argued that the perceptual view "is one important, effective, and largely unexplored means of supporting transfer" (p.171).

Coordinative Views of Transfer

The contribution by Schwartz, Chase, and Bransford (2012) to Goldstone and Day's special issue defined what we label a "coordinative" approach to transfer (see also Schwartz & Goldstone, 2016). After summarizing the phenomena of *adaptive expertise* and *preparation for future learning*, Schwartz et al. (2012) reiterated concerns about using "sequestered problem solving" measures in transfer research. Specifically, they argue that "one shot" assessments "are too blunt an instrument for discovering whether and why previous experiences have prepared people to transfer for future learning" (p. 205).

The "coordinative" aspect of this approach to transfer refers to the need to coordinate learning from previously successful routines with the need for new learning in transfer situations. They review a series of empirical studies that examined what they call *overzealous transfer*, or OZT. This is where "students transfer skills, knowledge, and routines that are effective for the task at hand but may nevertheless be sub-optimal in the long run because they block additional learning" (p. 206). OZT seems particularly relevant to our concerns over classroom assessment because of its relationship with feedback. They argue that OZT leads to seemingly satisfactory solutions, which function as positive feedback, when in fact negative feedback might lead individuals to recognize that they missed an opportunity to learn. They further argued that OZT is common in classrooms because of reliance on "tell & practice" instructional routines and that most studies of transfer used tell & practice routines in both control and treatment conditions.

Schwartz et al. (2012) then reviewed empirical studies of guided-inquiry instructional alternatives to tell & practice that minimize OZT. These were mostly "inquiry-first" strategies that help students recognize the conditions where what they will be learning through tell & practice will be applicable. Significant for our concerns about formative feedback, their alternatives did not provide or offer extra feedback to students in the alternative condition. Put differently, they avoided merely showing that students who get more feedback learn more than students who get less feedback. But consistent with our arguments about the varied formative functions of assessment and concern with systemic validity, they assign a much broader function to feedback than is common in the assessment literature:

Many school practices do not provide the kinds of feedback opportunities that are important for adaptation—especially in our fast-changing environment. For example, many schools do not gather sufficient feedback about the performance of policymakers, teachers, students, and communities—the lack of which allows individual and institutional learning routines to become entrenched. (p. 212)

We find this more nuanced consideration of feedback to be directly relevant to our concerns over racist and discriminatory classroom assessment practices. There is compelling evidence that minoritized students are often "positioned out" of disciplinary discourse by teachers and more advantaged peers (e.g., Anderson, 2009; Bang, Warren, Rosebery, & Medin, 2012; Philip, Olivares-Pasillas, & Rocha, 2016) and/or positioned as incompetent, lazy, or disruptive (Ben-Yehuda, Lavy, Linchevski, & Sfard, 2015; Lambert, 2015; Langer-Osuna, 2011). While we found surprisingly little research on this issue within assessment feedback, we suspect that this might be a particularly insidious problem in formative assessment contexts because of the powerful influence of teacher feedback. Put differently, we believe that gender, race, and ethnicity loom large in the concerns raised by Schwartz et al. (2012) that (a) many students do not develop effective routines for seeking feedback; (b) when feedback is not naturally forthcoming, ostensible positive feedback undermines learning; and (c) school instruction often does not prepare students to seek feedback once they leave the realm of coordinated assignments and assessments. Schwartz et al. (2012) argue that OZT "brings in a host of new issues that range from seeking more information to developing dispositions for handling ambiguity and failure" (p. 213). We contend that transfer research and assessment practice would benefit by including issues of power and privilege as another one of those new issues.

Situative Views of Transfer

As suggested in the introduction and reiterated throughout, situative theories of cognition (i.e., Greeno, 1998) support a particularly distinctive view of transfer. Situative theory is a noteworthy outcome of the broader trend toward increased concern with sociocultural factors and the context of learning in cognitive science. This trend was nicely captured in the subtitle and the content of the updated *How People Learn II: Learners, Contexts, and Cultures* (HPL II; National Academies, 2018). While acknowledging the consideration of context and culture in the earlier volume, HPL II documented a strong consensus among experts that (a) context and culture matter and (b) that context and culture matter more than a similar panel of experts had concluded two decades earlier. The more recent volume devoted an entire chapter to context and culture, asserting:

What has become far clearer since *HPL I* was published is that every individuals' learning is profoundly influenced by the particular context in which that person is situated. Researchers have been exploring how all learners grow and learn in culturally defined ways in culturally defined contexts. While humans share basic brain structures and processes, as well as fundamental experiences such as relationships with family, developmental stages, and much more, each of these phenomena is shaped by the individual's precise experiences. Learning does not happen in the same way for all people because cultural influences pervade development from the beginning of life. (p. 22)

Despite this increased focus, HPL II did not specifically embrace situated cognition. In fact, there were substantially more references to situated cognition in HPL I than in HPL II.

The situativity of one's view of transfer is central to our arguments. To reiterate, Mayer and Wittrock (1996) reframed situative views of transfer and excluded them from their cognitive science view of transfer. Somewhat similarly, after summarizing situative critiques of traditional transfer research, Day and Goldstone (2012) asserted that "in general, *mainstream psychologists* have not responded to (or even acknowledged) the critiques from *educational researchers* [emphasis added]" (p. 165). In other words, they characterize situative views of transfer as "educational research" while characterizing conventional cognitivist research and (presumably) their own perceptual approach as "mainstream psychology." From our perspective, doing so reifies the long-standing dichotomy between basic/experimental research and applied/practice research that most learning scientists reject and which is antithetical to our suggestions for using design-based research methods.

The view of transfer advanced by Greeno et al. (1993) was a significant outcome of the research initiated at the Institute for Research on Learning (IRL) in Menlo Park, California in the 1980s. Greeno, Collins, and Resnick (1996) later wrote:

In the view of learning as coming to participate in a community of practice, *transfer becomes a problematic issue* [emphasis added]. The question is whether transfer applies to new practices within the community (e.g., for school communities this might mean working new problems or accomplishing new kinds of tasks) or to practices outside the community (e.g., for school communities these might be work environments). (p. 24)

In this and other ways, situative views added new complexity to the larger debates acknowledged in the title of Detterman and Sternberg (1993). The research at the IRL built on earlier work carried out at the Laboratory of Comparative Human Cognition (LCHC; 1983; e.g., Scribner & Cole, 1981) which emerged following the translation of earlier work by Vygotsky (e.g., 1934/1962). The research at the LCHC provided some of the earliest considerations of transfer from this perspective. As later summarized by Pea (1987):

An important consequence of the culture–practice approach to transfer is that since cognitive achievements are largely unique in their contextual characterizations, and yet clear influences of prior learning on present activity are evident, one must “look to the organization of the environments in which interactions occur” (Laboratory of Comparative Human Cognition, 1983, p. 341) and recognize that “transfer is arranged by the social and cultural environment.... Overlap in environments and the societal resources for pointing out areas of overlap are major ways in which past experience carries over from one experience to the other” (Laboratory of Comparative Human Cognition, 1983, p. 341). (p. 648)

We have found that many observers struggle to see the distinction between situative views of transfer and socially oriented cognitive–constructivist views (e.g., Adams, 2006). The distinction lies in the aforementioned “situative synthesis” and the assumption that human information processing and human sense-making are special cases of socially situated activity. Simply put, situative theories assume that knowing, learning, and transfer are primarily social phenomena and are only secondarily phenomena associated with individual minds.

In the introduction to the transfer strand in the *Journal of the Learning Sciences*, Lobato (2006) first summarized cognitivist critiques of the classical view of transfer. Lobato then went on to summarize Lave’s (1988) situative critique of classical transfer research. This critique included using *expert models of performance, functionalist view of learning, isolated laboratory contexts, decontextualized knowledge, and static knowledge*. The remainder of the introduction summarized three dimensions from which Lobato and other like-minded scholars had taken up Lave’s call to reconsider transfer:

1. *Metaphors*. These emerging perspectives reject static application or transportation metaphor where what transfers is unchanged in favor of more dynamic metaphors such as *production, transformation, and preparation for future learning* where what transfers is fundamentally changed.
2. *Abstraction*. While mainstream information processing accounts of transfer treat abstraction as a prerequisite for transfer, the nature and existence of abstraction was debated extensively in these emerging views of transfer. Rather than forgoing abstraction altogether, alternative characterizations of abstraction were proposed, including *situated, collective, reflective, and actor-oriented* abstraction, as well as *abstraction in context*.
3. *Transfer “mechanisms.”* While acknowledging a “mechanism” is strongly associated with classical views of transfer, Lobato (2006) acknowledged the need for a way “to refer to an explanation of how social environments afford and constrain the generalization of learning” which in turn “shifts the focus from external factors that can be controlled to conceiving of transfer as a constrained socially situated phenomenon” (p. 442).

We believe that this third dimension is particularly important. Some situative theorists had controversially argued that the very notion of transfer should be abandoned because it was so beholden to cognitivist assumptions (i.e., Beach, 1999; Carraher & Schliemann, 2002). We strongly agree with Lobato that a transfer mechanism should be maintained. This is because we find so much potential in two of the most prominent situative transfer mechanisms as described next for addressing our concerns over racist and discriminatory assessment and testing practices.

Lobato's Actor-Oriented Transfer

The actor-oriented transfer (AOT) mechanism introduced by Lobato (2003) draws on the notion of *process causality* (as opposed to *regular causality*). Process causality explores why and how learning events and transfer events are related (rather than establishing *that* they are related). AOT attends to the ways learners notice the most relevant properties or patterns when a variety of features compete for their attention. Central to this transfer mechanism is a *focusing phenomenon* which “casts transfer as a constrained socially situated phenomenon rather than something that can be controlled by altering external conditions” (Lobato, 2006, p. 443). AOT suggests that educators should worry less about the number of different contexts in which students practice skills and worry more about the regularities and properties to which students' attention is drawn and that they notice (or not).

Lobato (2012) outlined five ways that AOT differs from mainstream cognitive views of transfer. We see implication for equity in each. The first difference is *the nature of knowing and representing*. AOT assumes a much more interpretative view of knowledge and representation that is consistent with situative theories of cognition. Rather than a relatively unproblematic view of mental representations of learning and transfer contexts, AOT assumes that “knowing and representing arise as a product of interpretive engagement with the experiential world, through an interaction of prior learning experiences, task and artifactual affordances, discursive interplay with others, and personal goals” (p. 234). From our perspective, this nicely captures the range of relevant cultural knowledge and experience that diverse individuals bring to learning and transfer contexts.

The second difference in AOT is *point of view*. Most transfer research embraces the expert “observers” point of view. Lobato argued that examining transfer from an expert perspective can under estimate the generalization of learning. Instead, looking at the way that each individual (the “actor”) interprets the learning and transfer context directly brings that individual's (potentially unique) ways of knowing more directly into the transfer process. This seems particularly relevant to our emerging ideas about helping students “transfer in” diverse social and cultural knowledge in immediate-level assessment and connecting that to instructional content in close-level assessment.

The third difference in AOT is *what transfers*. AOT and most conventional cognitive accounts of transfer focus on transfer of specific content knowledge (as opposed to domain general problem-solving ability). But conventional accounts focus more on well-defined actions and strategies, while AOT focuses on more holistic conceptualizations of content knowledge. Lobato acknowledges that the more specific accounts lend themselves to computerization and intelligent tutoring systems, but “may not account for an underlying conceptualization that can give rise to multiple strategies or behavioral actions” (p. 238). For us, such “underlying conceptualizations” are much more likely to arise when students are encouraged to transfer in diverse cultural experiences and are provided instructor and peer feedback in this regard that is useful and used. Our emerging dilemma then is defining proximal classroom assessments that can capture the “multiple strategies or behavioral actions” that are expected to follow.

The fourth difference in AOT concerns *methods*. Some of the prior debate over transfer was whether more general performance tasks or more specific fine-grained measures were used to assess transfer. Regardless of the measures used, Lobato (2012) argued that “the use of a predetermined standard or a cognitive model based on an observer's perspective leaves an opening for more information to be gathered regarding unexpected ways in which people may construe learning and transfer situations as connected” (p. 238). To this end, AOT relies on qualitative methods, typically depending on inductive coding to capture unanticipated forms of learning and transfer. Lobato acknowledged the laborious nature of such coding and the challenges in demonstrating causality and generalizability with the inevitably small samples. We see potential efficiencies in using such methods in a more constrained fashion when examining the transfer (or lack thereof) of these diverse unanticipated kinds of reasoning as they are or are not (a) transferred into

learning environments, (b) recognized in informal assessments, (c) articulated in formative assessments, and (d) transferred to summative tests.

The fifth difference in AOT concerns *goals*, in that the goal of mainstream transfer research is to “document the occurrence of transfer (or explain the failure of transfer), which includes investigating the types of knowledge that transfer better, the conditions that promote or hinder transfer, and the instructional methods that support transfer” (p. 239). In contrast, AOT transfer research aims to “understand the interpretive nature of the connections that people construct between the learning and transfer situations, as well as the *socially situated processes* [emphasis added] that give rise to those actions” (p. 239). Indeed, Hickey’s program of formative assessment research that was initiated when the GenScope program was fundamentally redirected by Lobato’s (2003) critique of that research for embracing an expert/observer perspective. More specifically, the close-level formative assessments and feedback conversations were entirely organized around an expert model of genetics problems solving (i.e., Kindfield, 1994), with no consideration of the perspectives that learners brought to those conversations. In response, close-level assessments within the multi level assessment framework were ultimately reframed using AOT and Engle’s expansive framing principles introduced below.

In an important clarification for cognitivist skeptics of situative approaches to transfer, Lobato (2012) pointed out that “investigating the nature of how people generalize their learning experiences, even when such generalizing results in incorrect performance, should not be misinterpreted as a lack of interest in the goal of ultimately having students achieve mathematical correctness or expertise” (p. 239). This is entirely consistent with the multi level assessment framework introduced above and the idea that carefully aligning classroom assessment is promising and pragmatic way of drawing on diverse experiences to boost the performance of all learners on distal summative tests while ensuring transfer to a broad range of other subsequent contexts. This goal of AOT and multi level assessment appears entirely consistent with Paris’s (2012) argument that culturally sustaining pedagogy needs to provide minoritized students access to “dominant cultural competence.”

Engle’s Expansive Framing

In another article in the initial transfer strand in the *Journal of the Learning Sciences*, Engle (2006) introduced a situative transfer mechanism that is based on *framing*. Framing concerns the way learners might find enough connections between learning and transfer contexts to foster intercontextuality (Bloome et al., 2009; Floriani, 1993). Engle’s consideration of framing was rooted in earlier studies of *productive disciplinary engagement* (PDE; Engle & Conant, 2002). In PDE, *engagement* means making substantive contributions in coordination with each other, physically attending to other students, and being emotionally involved during discussions. Such engagement is *disciplinary* when it directly relates to the issues and practices of a discipline’s discourse. Disciplinary engagement is *productive* when students make intellectual progress, recognize confusion, make new connections, generate solutions, and so on.

Central to PDE is the distinction between disciplinary *knowledge* (what experts *know* and can deploy in multiple contexts) and disciplinary *practices* (what experts *do* in disciplinary contexts, where their expertise is typically recognized). Like AOT, PDE assumes that each learner’s experience and perspective are unique and, by definition, different from those of experts. Rather than helping students form connections between disciplinary knowledge and experts’ disciplinary practices (common in constructivist instruction), PDE pushes learners to connect disciplinary knowledge with their own developing (i.e., “nascent”) disciplinary practices, while interacting with other learners doing the same. Engle and Conant (2002) advanced the following design principles for fostering PDE: (1) help students problematize content from their own perspective, (2) give students authority to address the resulting problems, (3) hold students accountable to each other and to shared disciplinary norms, and (4) provide students relevant resources to accomplish the

first three principles. The PDE framework and design principles have since been taken up in numerous subsequent studies, primarily (but not exclusively) in K–12 STEM (science, technology, engineering, and mathematics) classrooms. Arguably, the PDE principles are among the most widely used instructional principles to emerge from situative theories of learning. As shown in Engle (2011), the PDE principles were generally consistent with many other sociocultural approaches to instruction that had emerged around the turn of the century.

Engle's subsequent studies of *expansive framing* extended the PDE framework to consider intercontextuality and its role in transfer. As elaborated in Engle et al. (2012) framing is enacted in the discursive moves through which participants in interaction propose and align themselves with expectations regarding the nature of the interactions in which they are engaged (Goffman, 1974). Such framing is “expansive” when intercontextuality is established in the form of numerous connections between the learning environment and other contexts. For example, a classroom teacher can expansively frame a lesson by presenting it as an opportunity for students to share with the community the knowledge they have previously constructed because it is likely to help them and others in different situations later in life.

Two key aspects of a learning environment that can be expansively framed to establish intercontextuality and support transfer are *settings* and *roles*. Regarding settings, expansive framing argues that educators and curricula should push students to find connections with people, places, topics, and times beyond the boundaries of an assignment or the course of instruction. Regarding roles, expansive framing argues that educators and curricula should position learners as active participants in the learning environment where they author their own ideas and hold themselves and each other accountable to the discipline (as opposed to consuming and/or reporting ideas from a textbook or teacher).

A Constructive Critique of PDE and Expansive Framing

Engle et al. (2012) outlined five explanations of why expansive framing should support transfer. As with Lobato's five AOT dimensions, we see profound implications for culturally responsive classroom assessment in these explanations. These implications are particularly significant when extended using the critiques of PDE and (by extension) expansive framing from Agarwal and Sengupta-Irving (2018, 2019). Agarwal and Sengupta-Irving first acknowledge that the PDE design principles might support engagement of minoritized students, compared to conventional curricula. But they argue that this will still be insufficient given the compelling evidence (summarized above) that minoritized students are positioned out of disciplinary discourse by teachers and more advantaged peers and positioned as lazy and disruptive.

Building on the four PDE design principles introduced above, Agarwal and Sengupta-Irving (2018) argued that (1) problematizing content in ways that challenge culturally dominant ways of knowing can lead to racialized controversies, (2) supporting *intellectual* authority may ignore the potentially overwhelming power of *social* authority, (3) gaining authority to share and justify one's ideas is easier than maintaining accountability to critique and revise ideas, and (4) minoritized students may fail to connect disciplinary concepts with the majoritized racial and cultural meanings embedded in educational resources. In response, Agarwal and Sengupta-Irving (2018) encourage teachers to “pay explicit attention to issues of power and positioning arising in the classroom interactions, and *reposition* [emphasis original] students perceived as low status in order to provide and maintain access to their discourse and participation” (p. 835). They introduced four new *connective and productive disciplinary engagement* (CPDE) principles for repositioning students: (1) use sociopolitical uncertainties to help problematize disciplinary knowledge, (2) curb undue social authority, (3) ensure equitable accountability, and (4) treat sociopolitical controversies as resources.

Our emerging culturally relevant view of transfer uses Agarwal and Sengupta-Irving's CPDE principles and the idea of repositioning to extend the five explanations of expansive framing and transfer in Engle et al. (2012). To reiterate, expansive framing suggests that teachers should help students connect course content

to outside settings (i.e., people, places, topics, and times) and position students as accountable authors. The first explanation of why this should support transfer is that doing so creates *more intercontextuality between settings during learning*. These settings include prior experiences, the learning context, and potential transfer contexts. This intercontextuality leads students to expect that they will need to use what they are learning in the future, which encourages them to adopt learning strategies associated with generative learning and knowledge transfer. Using the four CPDE principles to invite minoritized learners to reposition themselves should help those students transfer in diverse prior experiences and foster intercontextuality. This should in turn help them to imagine diverse future contexts where they would expect to use what they are learning and lead them to adopt more effective learning strategies.

The second explanation of expansive framing concerns the way that students might later engage in subsequent transfer settings. If initial learning is expansively framed, students are more likely to recognize the relevance of learned content in the transfer context. If learners recognize the relevance of prior learning, they are more likely to decide to use it in the transfer context and more likely to be able to do so. CPDE suggests that educators invite minoritized students to reposition themselves by using sociopolitical controversies to problematize content while curbing undue social authority of majoritized participants and perspectives. To the extent that this succeeds, we assume this will help minoritized students recognize the relevance of learned content in a broader range of transfer contexts. Of course, a key question worth exploring is if and how doing so helps minoritized students recognize the relevance of learned content in majoritized transfer contexts. This includes, but is certainly not limited to, high-stakes distal tests.

The third explanation of expansive framing concerns the synergy expected when students relate prior settings to learning settings *and* are positioned as authors of their own ideas. Doing so should lead students to *transfer in more of their prior knowledge and experience* because students should see the relevance of their prior knowledge in the learning setting and recognize that their prior knowledge might be useful to others and is therefore socially desirable. This additional prior knowledge enables useful social learning processes such as comparing examples between students and identifying the most relevant examples. The CPDE principles should encourage minoritized students to transfer in their prior experience because that experience is (by definition) unique; instructor recognition of student repositioning should then help majoritized students recognize the value of the unique experiences and perspectives of minoritized peers. For example, students of color are uniquely positioned to discuss sociopolitical controversies that stem from racism. If teachers succeed in helping students problematize content using such controversies and recognize their value, minoritized students would find their prior knowledge relevant to the learning setting and to others and therefore socially desirable.

The fourth explanation of expansive framing is that positioning students as authors is likely to *foster accountability to content*. This “ownership” of the knowledge generated in the learning context engenders confidence in using that knowledge later. Put differently, when students generate the disciplinary ideas in the learning setting, they are presumably more confident using that knowledge in transfer settings. When the CPDE principles and repositioning successfully position minoritized students as authors of unique insights regarding course content, their sense of responsibility for sharing (i.e., transferring) that knowledge is likely to apply to a wider range of majoritized *and* minoritized transfer contexts.

The fifth explanation is that positioning students as authors should generalize to transfer settings independent of content. Successful repositioning of minoritized students as authors should lead them to position themselves as authors in multiple transfer settings. In other words, multiple experiences authoring knowledge in learning settings are likely to result in a more general disposition toward authorship in all settings. Rather than giving up in the face of new or unfamiliar problems (e.g., settings that require new dominant cultural competence), this authority should lead students to draw from their prior knowledge to find connections and adapt to the problems. This explanation takes on added meaning for minoritized student when coupled with evidence that diverse students bring unique representations of disciplinary

knowledge that are just as valid as “mainstream” (i.e., White male) representations of that same knowledge (e.g., Bang, et al, 2012, summarized in Warren, Vossoughi, Rosebery, Bang, & Taylor, 2020). As elaborated next, pragmatic insights for doing so are abundant in one of the most prominent approaches for helping diverse students bring their own perspectives and experiences into a range of educational settings.

An Emerging Vision of Culturally Responsive Transfer and Assessment

Both situative transfer mechanisms introduced above argued that starting from each learner’s own experience will support generative learning that transfers readily and widely. We first showed that it was possible to extend each of Lobato’s (2012) five goals for AOT to specifically support generative learning for diverse and minoritized learners. We then showed that Agarwal and Sengupta-Irving’s (2018, 2019) CPDE principles and suggestions for repositioning lent themselves nicely to the five explanations of expansive framing in Engle et al. (2012). Along the way we pointed to further convergence with some of the ideas in the situative multi level assessment framework introduced above.

In this final section, we first summarize a particularly promising approach to CRE. We then further elaborate on our ideas about the potential synergy between this approach, design-based research methods, and prevailing educational assessment practices and associated professional development. We acknowledge that these ideas are quite tentative and have yet to be reviewed by CRE scholars or other assessment scholars beyond the reviewers for this volume. Our intention with this final section is to initiate such discussions.

Funds of Knowledge/Funds of Identity

Funds of knowledge (FoK) is rooted in anthropological research by Vélez-Ibáñez and Greenberg (1992) who used the term to refer to the historical accumulation of abilities, assets, and cultural ways of interacting that were evident in Latinx households along the southern U.S. border. They showed that while these funds of knowledge were socially, cognitively, and culturally complex, few teachers (including Latinx teachers) were using them as resources to contextualize and enhance the educational experience and academic progress for the children from these households. Building directly on sociocultural theory, Moll, Amanti, Neff, and Gonzalez (1992), González, Moll, and Amanti (2006), and others began researching strategies to help teachers identify FoK and use it to scaffold school learning. Central to FoK practice are *ethnographic studies* (i.e., home visits) and parent meetings, along with an FoK *inventory matrix* used to connect home/community practice with classroom applications for various categories of knowledge (economics, geography, politics, technology, etc.). Over time, FoK pedagogy emerged as one of the most widely studied asset-based approaches to historical inequities; a review by Rodriguez (2013) identified 45 peer reviewed studies of FoK pedagogy beyond the work of the originators.

Funds of identity (FoI) was introduced in 2011 by Saubich and Esteban-Guitart and further elaborated in Esteban-Guitart and Moll (2014) and Subero, Llopart, Siqués, and Esteban-Guitart (2018). FoI draws more attention to the FoK that students themselves consider meaningful and use to construct their identities. FoI assumes that identity is historical and sociocultural, and is constructed with cultural resources, including language and ideologies which are distributed among artifacts, persons, settings, and activities. Relative to FoK, FoI expands beyond families and sidesteps the home visits which proved difficult to sustain. From our perspective (which is informed by our interest in social media and open learning), the extension of FoI into digital technologies and artifacts (e.g., Esteban-Guitart, 2015; Esteban-Guitart, Coll, & Penuel, 2018) is a crucial development.

Central to the FoI approach are activities where students create artifacts and narratives that reflect and celebrate their personal and cultural identities. A systematic review by Hogg and Volman (2020) identified

several such techniques that regularly appeared in the FoI literature. These include drawing a *self-portrait*, completing a *self-definition task*, drawing a *significance circle*, and working with *new media* such as videos and digital maps and collages. All these FoI practices appear consistent and compatible with the CPDE principles that extend the design principles for PDE, expansive framing, and AOT. We are particularly intrigued by the popular FoI self-definition task whereby students write down 10 answers to the question “who am I?” and then place their answers in order of significance because the ranking and justification seem necessarily expansively framed.

Indeed, we see significant synergy between the various FoI activities and several engagement routines that are already being used to help students engage expansively in a wide range of fully online courses. As described in Hickey, Chartrand, and Andrews (2020) and Hickey and Andrews (2018), students are first asked to describe themselves in personal terms and then asked to describe their educational and professional trajectory and the role that the course plays in it. They are then asked to repeatedly use this “identity” to uncover the relative relevance of course concepts or learning resources in order of personalized relevance. Consistent with the “who am I?” activity above, students are typically asked to (a) rank-order elements of course content or sets of educational resources according to personal relevance, (b) provide rationale for those rankings that say something important about themselves and their identities, and (c) interact with other students who are doing the same. The rationale that students provide for their rankings have proven to be very receptive to informal immediate-level assessment in the form of instructor comments; close-level summative reflections on this engagement can then help students formatively connect the knowledge that they transferred in with course content, helping establish intercontextuality and supporting transfer. One promising insight from the rapid transition to asynchronous online instruction during the pandemic of 2020 was that this engagement and assessment strategy was particularly effective when implemented using one of the many newly available platforms for *social annotation* of course resources (e.g., Hypothes.is, <https://web.hypothes.is/>, 2021; see Kalir, 2020).

Practical Issues

To reiterate, we embrace the conclusion of Neri et al. (2019) that limited uptake of CRE is due to educators’ limited understanding and belief in these approaches and lack of knowledge of how to execute them. To elaborate on ideas introduced above, we suspect these strategies might be effectively introduced in the context of assessment-related practices that are already ongoing in many schools. We imagine at least four sets of such practices. The first set of practices is awarding points or grades for engagement in and/or completion of curricular routines. Awarding students “participation points” for class discussion and online forums is a common practice; many instructors use some form of peer assessment as well. Of course, “completion points” are also common, as is evaluating completed assignments or artifacts for completion and/or mastery. Such practices can be stressful and problematic and can privilege dominant and majoritized ways of engaging and knowing. They can also consume vast amounts of instructor time and attention in warranting any deductions to head off corrosive arguments. We have found that close-level assessment of student annotations, artifacts, and engagement may present a particularly effective space for fostering intercontextuality while supporting this informal (but often necessary) classroom accountability practice. In some of our classes, close-level assessments consist of informal *engagement reflections* that students place directly on their completed artifacts that are generated each week. As elaborated in Hickey et al. (2020; Hickey & Harris, 2021), these are assumed to summatively assess prior engagement while formatively assessing understanding of course content and future engagement.

The second set of existing assessment-related practices that we imagine transforming is the relatively extensive professional development in formative assessment that emerged following Black and Wiliam (1998). Arguably, formative assessment is the most prominent focus of the “professional learning communities” that emerged over the same period as the primary form of professional development in K–12

schools (e.g., Bailey & Jakicic, 2011). In summary, we believe that (a) immediate-level assessment in the form of teacher's feedback on student annotations and artifacts may be a uniquely effective way of encouraging students to transfer in relevant prior experiences to support learning of school concepts, (b) close-level assessments are a promising context for helping students connect the knowledge that they transfer in the with dominant disciplinary knowledge of the course, and (c) proximal classroom assessments can help students and teachers explore and ensure that their new knowledge resonates with relatively conventional (i.e., dominant) representations.

While our observations have yet to be formally warranted, students take these reflections seriously when instructors use these reflections as a substantial part of grades. While the phrasing and context of the reflections have evolved over years, they have always asked students to consider how the content of the assignments connected with each student's prior experiences and might be used in the future (building directly on the notion of *consequential engagement* in Gresalfi, Barab, Siyahhan, & Christensen, 2009). A newer reflection on *cultural engagement*, which asks students about the connections they found between their personal experiences, is a particularly promising way of supporting transfer in of FoK and FoI. And with public reflections, instructors can provide feedback that celebrates and elevates evidence of productive and culturally diverse engagement.

The third set of ongoing practices in schools that we imagine transforming is the direct preparation of students for high-stakes standardized achievement tests. To reiterate, we believe that typical test-prep practices (a) take valuable time away from more meaningful forms of instruction, (b) are overrepresented in schools that serve minoritized students, and (c) are associated with fleeting gains, if any, on high-stakes tests. We further believe that such practices grant primacy to dominant mainstream characterizations of knowledge at the expense of more personally and culturally relevant representations of disciplinary knowledge. We propose redirecting test preparation to the three practices described in the previous paragraph. Teacher feedback should then be focused on positioning all students as accountable authors and positioning minoritized students as uniquely qualified to generate new knowledge associated with the disciplinary concepts of the course.

The fourth set of assessment practices to be transformed are the aforementioned "interim" assessments such as the *Measures of Academic Progress* marketed by NWEA, Inc. (<https://www.nwea.org/the-map-suite/>, 2021). As argued by Shepard (2005), detailed in the special issue by Bulkeley, Nabors Oláh, and Blanc (2010) and captured in title of the special issue commentary by Goren (2010), using interim assessments to improve education is "easier said than done." Helping educators and administrators use existing interim assessments to evaluate and improve classroom formative and summative assessment practices as described in the previous paragraphs seems like a plausible way to redirect interim assessments away from tracking and placing. This might be as simple as showing teachers the correlations between scores on their summative classroom assessments and the corresponding interim assessments. Given the likelihood that existing interim assessment practices are tracking minoritized students into lower-achieving classes and the potential for helping teachers observe and enhance the impact of their formative assessment practices, such transformations might ensure that minoritized students indeed gain access to dominant cultural competencies.

Theoretical and Methodological Issues

As illustrated by the various chapters in Moss, Pullin, Gee, Haertel, and Young (2008) on OTL, situative and sociocultural theories provide a coherent framework for rethinking the foundations of measurement in ways that address the broader social challenges that test-driven accountability has helped many appreciate and that some argue have been exacerbated (see also Mislevy, 2018). Most of the culturally responsive assessment strategies that we have imagined are rooted in extended efforts using situative theory to resolve enduring challenges in engagement (Hickey et al., 2020; Hickey & Rehak, 2013), formative and summative assessment (Hickey & Zuiker, 2012; Hickey & Harris, 2021), and motivation (Hickey, 2003; Hickey & Andrews, 2018). These were carried out as *design-based research* (DBR; Sandoval & Bell, 2004). DBR develops “humble” theories in the form of design principles in sustained efforts to improve educational practice. By sharing these design principles with others along with the salient features of the implementation context, DBR provides immediately useful guidance that others can build on by elaborating on additional contextual factors, revising the principles, and even generating new principles for different contexts. We are particularly enthusiastic about new “participatory” approaches to DBR that more explicitly bring multiple stakeholders directly into the design and conduct of educational research. These include design-based *implementation* research (DBIR; Penuel, Fishman, & Cheng, 2011), *participatory design research* (Bang & Vossoughi, 2016), and *research-practice partnerships* (Coburn & Penuel, 2016).

Summary and Conclusion

In summary, our chapter argued that assumptions about the transfer of learning have tremendous complex impacts on educational practice via classroom formative and summative assessment practices and high-stakes achievement tests. We further argued that prevailing assessment and testing practices are an obstacle to efforts to make education more equitable for non dominant students who are minoritized by the makeup and content of their schools and coursework. In response, we imagined strategies for transforming classroom formative and summative assessment to help minoritized students transfer in more of their prior relevant personal and cultural knowledge and use it to engage with and master course content.

We conclude that there is promising synergy between the pragmatic implications of two situative transfer mechanisms (*actor-oriented transfer* and *expansive framing*) and the range of asset-oriented responses to historical inequities (*funds of knowledge*, *funds of identity*, *culturally relevant education*, and *culturally sustaining pedagogy*). We further concluded that a situative multi level approach to assessment and testing is a promising framework for coherently applying these synergies to ongoing assessment and testing practices and that new models of DBR that support partnership with multiple stakeholders are promising approaches for doing so.

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