Chapter 3
Access and Opportunity to Learn: Essentials for Academic Engagement

Access is a fundamental educational principle. Effective access involves overcoming barriers that limit students' meaningful engagement in learning and demonstrating what they have learned. Such access leads to opportunities to learn (OTL), a defining goal for all educators who are motivated to advance the development of students of all kinds. People need many opportunities in the process of acquiring new knowledge and skills to listen and interact with a teacher or other learners, many opportunities to apply these skills and receive feedback regarding their correctness and effectiveness, and many opportunities to generalize their knowledge and skills with others and to other situations.

Accessibility—defined as the extent to which a product, environment, or system eliminates barriers and permits equal use of components and services for a diverse population of individuals—is necessary for effective instruction and fair testing (APA, AERA, & NCME, 2014; Kettler, Elliott, Beddow, & Kurz, 2018). To the extent that instruction, instructional materials, and tests are not accessible to any portion of the student population, engagement is undermined, learning is likely to be incomplete, and inferences made from observations and test results are likely to be underestimates of a student's actual knowledge and skills. Optimal accessibility is promised implicitly to all students. Delivering on the promise of accessible instruction and testing practices, therefore, is a shared responsibility for educational stakeholders, including teachers, school leaders, policy-makers, software developers, textbook authors, test designers, and many others. The availability of access to learning situations and accessibility of meaningful learning opportunities are necessary, if not sufficient conditions, for engagement—cognitively, behaviorally, emotionally, autonomously, and socially—in learning that results in the use of knowledge and skills. In this chapter, we focus on access to meaningful learning opportunities that optimize students' engagement in instruction and classroom assessments and conceptualize accessibility to instructional materials and classroom tests as important enablers of meaningful and active participation. The engagement-enhancing strategies featured in this chapter are considered by many to focus primarily on cognitive aspects of students' learning; however, with more robust cognitive

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engagement often comes more successful learning experiences, which, in turn, can improve students' learning behaviors, collaboration with others, and attitudes about learning to reduce educational exclusion in important ways. Thus, the goals of this chapter are first to understand the evolving concepts of access, accessibility, and opportunity in relation to learning; then to examine strategies based on these concepts for increasing cognitive, emotional, and behavioral engagement for all students; and, finally, to translate theory- and research-based findings on accessibility into actionable guidelines for teachers.

Case Vignette: *Overcoming Barriers to Learning and Showing What You Know*

Setting: Eighth-grade science class

Situation: Class lesson with an activity about types of friction and ways to reduce friction

Persons involved: Teacher, classmates, and Sarah

Mr. Vincent was excited today. He was going to teach one of his favorite topics: *Friction*. He knew some of his students would readily understand the concept and be able to jump right into the activity he had planned. He also knew that a couple of his students, Sarah, for example, would find it uninteresting and probably difficult to understand. He wanted to be sure that everybody understood the concept of friction and planned to teach a hands-on activity to increase the likelihood that learning happened for each student, Sarah included, who came from a poor family.

Mr. Vincent started his lesson by writing the word *friction* on the board and asking, "What is Friction? Why is it important?" He paused for perhaps a minute to let students think. Mr. Vincent used wait time well and would walk around prompting all students to think about friction. Nearly 80% of the class had raised one of their hands to signal they had an answer. Sarah wasn't one of them, nor did it seem that Matthew or Drew, both of them came from the same neighborhood where Sarah lived, had an answer or any interest in the questions. He smiled, moved closer to Sarah and Drew, and said, "By the end of the class today, everybody will be able to answer these questions if you listen closely and do the activity that follows my short lesson. Right Drew? Sarah is with us?"

He started his lesson by stating: "Friction is the resistance to motion of one object moving relative to another. Listen again: Friction is the resistance to motion of one object moving relative to another object. It is not a fundamental force, like gravity or electromagnetism. Instead, scientists believe it is the result of the electromagnetic attraction between charged particles in two touching surfaces. Did you hear that? Friction involves two touching surfaces."

Mr. Vincent paused for a few seconds, walked around the classroom saying, "Friction involves two touching surfaces." He stopped at Sarah's desk and picked up her pencil and moved it across her desk and noted it moved easily. He then asked Sarah to move her eraser across the desk, which she did. It did not slide easily.

Mr. Vincent moved to the front of the class and continued his lesson and asked every student to write down two words—*static* and *kinetic*. He also wrote the words on the board. After observing that all students had written these words down, he said, “Static friction operates between two surfaces that aren’t moving relative to each other, while kinetic friction acts between objects in motion. Please make a note of these points: static friction is about objects not moving, while kinetic friction is about moving objects. Are there any questions?” A few students raised their hands. Surprisingly, Sarah was one of them (who was often rather reluctant to ask questions in the class), so Mr. Vincent called on her. She wanted to confirm that when they had rubbed the sandpaper sheets together that it was an example of kinetic friction. Mr. Vincent answered enthusiastically, “You’re totally correct, excellent application of the definition.”

Mr. Vincent called for the class’ attention once again. He stated, “Let’s continue to think about examples of friction or more specifically applications of friction. Friction plays an important part in many everyday processes. For instance, when two objects rub together, friction causes some of the energy of motion to be converted into heat. This is why rubbing two sticks together will eventually produce a fire. Friction is also responsible for the wear and tear on bike gears and other mechanical parts. That’s why lubricants, or liquids, are often used to reduce the friction—and wear and tear—between moving parts.” Mr. Vincent then requested each student to take a minute or two and write down three key points they had heard today about friction. He noted there were no wrong answers, just what they personally thought was important to remember about what friction is and why it is important.

While all students were beginning to respond in writing, Mr. Vincent walked over to where Sarah was seated. She was not writing. He asked her, what are you thinking? She looked confused but did say she knew what friction was and could tell when something was moving and at the same time creating friction like when they had rubbed the sandpaper. Mr. Vincent smiled and reinforced her responses. “Now try to write that information down in a sentence or two,” he suggested. Sarah smiled a little and then made an effort to write some notes about the friction lesson.

Mr. Vincent noted most students were done writing, so he called on a few to read what they had written and then asked Drew to help him once again start another activity. A fun experiment. He gave Drew ten spinners to share with ten classmates and ten tops to share with another ten classmates. The activity was to determine through observation, which surfaces created the least amount of friction for spinners and which for the tops. Students worked in pairs and recorded their observations to discuss at the start of class tomorrow. Both Sarah and Drew were active participants in the activity and completed observation notes, although brief, before leaving class.

Outcomes: Mr. Vincent is an engaging teacher who demonstrated a good understanding of his students’ learning needs, including those who came from poor families, and actively encouraged and supported them to participate. His science lesson on friction was designed with engagement in mind. For example, he started by getting the students’ attention, a prerequisite to their engagement. He then posed two questions—in both written and spoken format—to stimulate their thinking and to encourage them to respond. When this approach didn't get a response from Sarah and Drew, he moved next to them, using physical proximity, a smile to show his support, and another question to get their responses. Once they responded, connecting with him just a little, he moved forward with the rest of the lesson, but he stayed "in touch" with Drew and Sarah consistently throughout the session and actually involved them in some hands-on demonstration to facilitate engagement and comprehension of important aspects of friction. Thus, Mr. Vincent created a lesson that provided all students with opportunities to think and respond, to get feedback, and to interact with their classmates. These aspects of the lesson seem to have encouraged all students to be involved, while Mr. Vincent concurrently was able to personalize aspects of the session for Sarah and Drew, both of whom were generally responsive to the opportunities provided them.

In the instructional lives of many learners, particularly learners who struggle academically and students with disabilities, there often are a number of access barriers that limit meaningful engagement. These barriers often start with limited opportunities to learn the intended and assessed curriculum. They also often involve denial or disruption of receipt of individualized accommodations for learning and assessments that can invalidly characterize knowledge and skills. Unfortunately, these barriers confront students from disadvantaged backgrounds who struggle disproportionally and deny or limit their meaningful engagement in learning (Elliott, Kettler, Beddow, & Kurz, 2018). Fortunately, however, there are strategies and resources to overcome these access barriers to OTL and minimize or overcome educational exclusion.

Key Access Concepts and Strategies to Improve Engagement

Access is an issue for all students, including those who come from economically, culturally, and linguistically disadvantaged backgrounds, when it comes to engagement in classroom learning and assessments. Access involves the availability of a learning opportunity and the ability to participate in the learning event. Access is diminished by limited opportunities to learn valued content, poor or limited instructional and assessment accommodations, as well as by test items that feature extraneous content and designs insensitive to persons with various disabilities and students' cultural backgrounds. Given our definition of engagement—i.e., *student's active participation in academic and co-curricular or school-related activities, and commitment to educational goals and learning…*—it is clear that access matters. Barriers to access involve cognitive, social, and emotional aspects of learning events. Research and theory regarding access has focused on cognitive aspects of materials and teachers' actions that can function as barriers to engagement (Beddow, 2018). Barriers to full access may occur at several points in the learning process: with the introduction of a lesson, during instruction, with the design of classroom tests, and during testing events. So how can teachers overcome these barriers and improve access, make learning events meaningful and interesting, and thus optimize engagement for all their students, specifically those coming from disadvantaged backgrounds?

Five interrelated evidence-based strategies have emerged from the research literature that many teachers have used to overcome access barriers and improve students' meaningful engagement with classroom learning and assessment events under varying conditions. These strategies are (a) the opportunity to learn strategy, (b) the universal design for learning strategy, (c) the cognitive load reduction strategy, (d) the accessible test design strategy, and (e) the instructional and testing accommodation strategy. These strategies are primarily cognitive in nature and can be complemented with additional strategies that address the sociocultural and emotional side of engagement—e.g., promoting belonging and relationship and developing facilitative classroom talk and conversation. Teachers are the primary implementers of these strategies and need to be knowledgeable about them and timely in applying them. Each of these cognitive strategies is described next with key supporting research summarized.

Opportunity to Learn Strategy

To acquire intended knowledge and skills, students must first have an opportunity to learn what is expected of them. A teacher's classroom instruction and how he/she manages classroom interaction and rules to govern them provide this opportunity on a daily basis. While having an OLT may not be sufficient for actual learning, it certainly is a necessary condition for engagement. This simple fact is one of the main reasons why the concept of OTL has been used for decades to describe and measure the various instructional inputs and processes that can lead to engagement and desired student learning outcomes. Moreover, opportunity to learn represents the most critical access point to the general curriculum for all students and specifically for those coming from disadvantaged backgrounds (Kurz, 2011, 2018). Next, we discuss the concept and research related to OLT. Our discussion applies to all students including those from disadvantaged backgrounds.

We conceptualized OTL as a teacher effect forming a significant part of the context that promotes and empowers active participation for students coming for various disadvantaged backgrounds. That is, teachers provide OTL through their instruction, management of classroom interaction, and design of learning activities and assessment tasks, which is part of the enacted curriculum. We argue that such teacher effect is essentially part of the context dynamics (see Chap. 2) that either support or constrain student engagement. Although researchers (e.g., Carroll, 1963; Porter, 1995; Kurz, 2011) have provided different definitions for OTL, they developed instructional indices for measurement purposes along three distinct dimensions of the enacted curriculum: time, content, and quality (Kurz, 2011). OTL has been discussed in instructional circles for decades (e.g., Kurz, 2018), and with the recent revision of the Standards for Educational and Psychological Testing (APA, AERA, & NCME, 2014), it has become a central aspect of test fairness as well. In its most general definition, OTL refers to the opportunities that schools afford their students to learn what is expected of them (Herman, Klein, & Abedi, 2000). As Kurz (2011) noted, this definition highlights two important issues: the "who" and "what" of OTL. The "who" are students (and teachers), and the "what" are the learning and learning expectations for these students in the subject-specific content standards at their grade level (and also the teacher's teaching). The content of these standards is typically referred to as the intended curriculum (Porter, 2006). Consequently, OTL can be characterized simply as students' opportunity to learn the intended curriculum (Kurz, 2011). In this book, we have built on this conceptualization and applied it to examine opportunities to learn in the context of social skills development (Chap. 4), reading engagement (Chap. 5), mathematics aspirations (Chap. 6), re-engagement of marginalized adolescents (Chaps. 7 and 8). In the section that follows, we take a microscopic perspective to examine OTL in instructional and assessment designs that form the most important and regularly encountered setting where all students including those from disadvantaged backgrounds engage in learning. Our argument is that careful attention to instructional and assessment designs reduces barrier to learning and promotes equitable OTL for students who are disadvantaged as a result of economic, sociocultural, and linguistic limitations.

Three strands of research have emerged with OTL and classroom instruction. This research has focused on three malleable variables: the content of instruction (e.g., Rowan & Correnti, 2009), the time on instruction (e.g., Carroll, 1963; Vannest & Hagan-Burke, 2010), and the quality of instruction (e.g., Pianta, Belsky, Houts, Morrison, & NICHD, 2007). Researchers also have provided empirical support for the relation between each of those OTL variables and student achievement (e.g., Elliott, Kurz, & Schulte, 2015; Gamoran, Porter, Smithson, & White, 1997; Thurlow, Ysseldyke, Graden, & Algozzine, 1984). Thus, there is substantial research that suggests by increasing instructional time on content in the intended curriculum and using practices known to enhance engagement and learning, student performance on achievement tests of the content is very likely to improve. In other words, when teachers effectively increase OTL of the intended curriculum, they are helping students directly to overcome a major barrier to academic success! This, of course, is easier said than done because it is difficult for many teachers to effectively monitor and change these attributes of their instruction without specific feedback. Much more information is provided about these malleable variables of instructional time, instructional content, and instructional quality and strategies for improving achievement in a recent Opportunity to Learn Research-to-Practice Brief (Kurz, Elliott, & Schulte, 2015).

The OTL dimension of instructional quality involves three aspects, cognitive demand or depth of knowledge (i.e., recall, skills/concepts, strategic thinking, and extended thinking), teaching practices (i.e., direct instruction, visual representation, talk aloud, modeling, questioning, and assessment of knowledge), and grouping formats. Collectively, the actions of teachers covered by the instructional quality dimension of OTL intersect nicely with a number of strategies for being responsive to the sociocultural background and needs of students examined in subsequent chapters on reading and mathematics engagement.

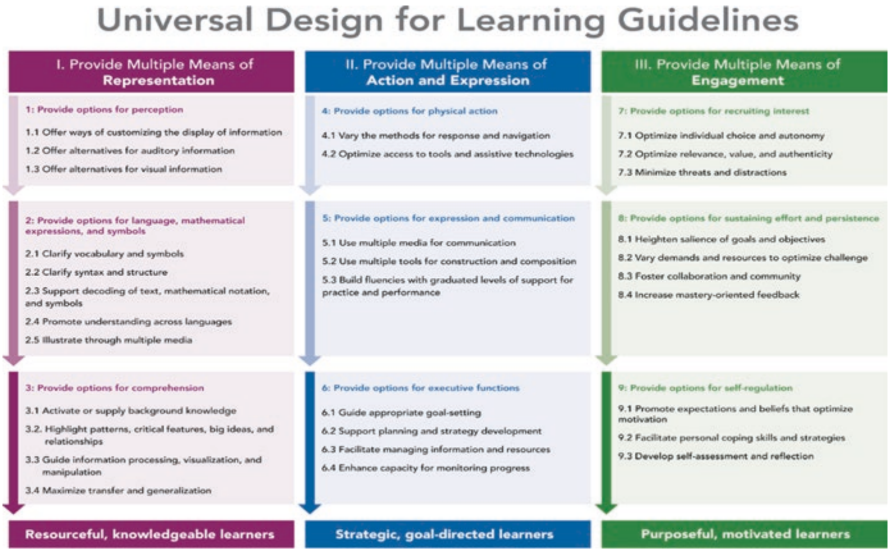

Fig. 3.1 Universal design for learning guidelines

Universal Design for Learning Strategy

The concept of Universal Design also has influenced design of instructional materials/practices and is recognized as Universal Design for Learning (UDL). UDL is a scientifically valid framework for guiding educational practice (Higher Education Opportunity Act of 2008). Accordingly, it (a) provides flexibility in the ways information is presented, in the ways students respond or demonstrate knowledge and skills, and in the ways students are engaged and (b) reduces barriers in instruction; provides appropriate accommodations, supports, and challenges; and maintains high achievement expectations for all students, including students with disabilities and students who have limited English proficiency. Figure 3.1 provides an overview of core UDL guidelines and principles.

The UDL Guidelines are organized according to three main principles: (a) provide multiple means of representation, (b) provide multiple means of action and expression, and (c) provide multiple means of engagement. For each of these principles (see Fig. 3.1), specific "checkpoints" are provided followed by examples of practical suggestions. A closer look at each of the UDL Guidelines is instructive.

Principle #1: Provide Multiple Means of Representation

The principle behind providing multiple means of representation is that students differ in the ways that they perceive and comprehend information that is presented to them, so it is essential to provide them options for representation. These individual differences can be compounded as a results of students' SES backgrounds, ethnicity, and their life exposure. For this principle, there are three option guidelines: (1) provide options for perception; (2) provide options for language, mathematical expressions, and symbols; (3) provide options for comprehension. Collectively, these options maximize the alternative ways students' can express themselves and respect differences that may be the result of varying educational and sociocultural experiences.

Principle #2: Provide Multiple Means of Action and Expression

Students differ in the ways that they can navigate a learning environment and express what they know. For example, students with significant physical impairments (e.g., cerebral palsy), students with strategic and organizational abilities (executive function disorders), students who have speech or language difficulties, and students from different cultures each may approach learning tasks differently. Some students may be able to express themselves well in written text, but not speech or vice versa. In practice, there is not one means of action and expression that will be optimal for all students, thus providing students options for expressing themselves is important to an inclusive approach to learning that maximizes opportunities to learn.

Principle #3: Provide Multiple Means of Engagement

Students' affect represents a crucial element of their learning. Students differ markedly in the ways they can be engaged or motivated to learn. A variety of sources exists that influence individual variation in affect including culture, personal relevance, and background knowledge, along with a variety of cognitive factors. Some students are highly engaged by spontaneity and novelty, while others are disengaged, even frightened, by those aspects, preferring a predictable routine. Some students like to work alone, while others prefer to work with their peers. In sum, there is not one means of engagement that will be optimal for all students in all contexts, so providing multiple options for engagement is essential. Three guidelines for the UDL principle of provide multiple means of engagement are central to this book and are explored in more detail than the previous two principles.

Guideline on Providing Options for Recruiting Interest

As noted by Rose and Meyer (2002), information that is not attended to, which does not engage students' cognition, is in fact inaccessible. It is inaccessible both in the moment and likely in the future because relevant information goes unnoticed. As a result, teachers often need to devote considerable effort to "recruiting" students' attention and engagement; however, students differ significantly in what attracts their attention and engages their interest. Even the same student will differ over time and circumstance; their "interests" change as they develop and gain new knowledge and skills, as their biological environments change, and as they develop into self-determined adolescents and adults. It is, therefore, important to have knowledge about students' economic and sociocultural backgrounds and alternative ways to recruit students' interest given their life experiences and knowledge of a subject matter.

Guideline for Providing Options for Sustaining Effort and Persistence

The learning of skills and strategies for most students requires sustained attention and effort. When motivated to do so, many students can regulate their attention and affect to sustain the effort and concentration required. However, students differ considerably in their self-regulatory abilities. Many students will need help in learning to manage or self-regulate themselves effectively. A key UDL instructional goal is to build the individual skills in self-regulation and self-determination that will equalize learning opportunities. In the meantime, the external environment must provide options that can equalize accessibility by supporting learners who differ in initial motivation, self-regulation skills, and interests. This promotes equitable opportunities to engage in learning for students who are deprived of such engagement at home due to various forms of barriers originated from economic and sociocultural constraints.

Guideline for Providing Options for Self-regulation

While it is important to design school and classroom environments so they can support engagement, it is also important to develop students' abilities to regulate their own emotions and learning behaviors. The ability to self-regulate—to strategically modulate one's emotional reactions or states to be more effective at coping and engaging with the environment—is a critical aspect of development. While many individuals develop self-regulatory skills on their own, either by trial and error or by observing successful adults, many students from disadvantaged backgrounds or with disabilities have significant difficulties in developing these skills. Many teachers, unfortunately, do not teach self-regulation skills explicitly, leaving them as part of an "implicit or hidden" curriculum that is often inaccessible to many students. Teachers that address self-regulation explicitly will be more successful in applying the UDL principles through modeling and prompting in a variety of situations. A successful approach to teaching self-regulation requires providing sufficient alternatives to support students with different backgrounds, abilities, and prior experiences to effectively manage their own affect and ultimately engagement.

With this detailed examination, we trust you see the potential power of the UDL strategy to overcome instructional barriers and facilitate meaningful engagement in learning for all students. For much more information about the other UDL principles and their guideline options and checkpoints, visit the website for the National Center on Universal Design for Learning (http://www.udlcenter.org) where there are examples and resources to guide implementation and a summary of the research evidence in support of each checkpoint.

Cognitive Load Reduction Strategy

In the article, *The Magical Number Seven, Plus or Minus Two: Human Limits of Information Processing*, Miller (1956) applied Shannon's (1948) information theory to human cognition research. Miller's work suggested a limitation to the amount of information humans' can process existed. Specifically, Miller concluded people are able to process on average, seven elements ± two elements, after which there is likely to be a degradation in recall accuracy. Miller referred to this upper limit as *channel capacity*, a conclusion that represented the inception of the notion of working or short-term memory. Over the past several decades, many have dismissed the mean (i.e., 7 ± 2) informational capacity claim, but Miller's underlying limitation assumption is widely accepted and continues to stimulate research and influence theory (Baddeley, 1994, 2003; Beddow, 2018; Cowan, 2001).

Sweller (2010a), influenced by Miller, argued there are five principles that govern the functions and processes of human cognition, particularly with regard to knowledge acquisition. These principles are (a) long-term memory store, (b) schema theory, (c) problem-solving and randomness as genesis, (d) novice working memory and narrow limits of change, and (e) environment organizing and linking.

Sweller (2010b) described the long-term memory store as the central structure of human cognition and asserted our understanding of the complex store of information people use to govern their activity develops slowly. Specifically, he cited researchers who found the only difference between master chess players and less-able counterparts was the masters' memory of a store of game board configurations (Simon & Gilmartin, 1973). In terms of learning theory, long-term memory also has been found to be a predictor of expert–novice differences in other relevant areas.

Sweller's (2010a) borrowing and reorganizing principle explains how long-term memory can be acquired and organized for retrieval. Although most long-term memory involves acquiring knowledge from the knowledge stores of others, the way individuals organize information varies widely. Specifically, by categorizing and bundling multiple elements of information into a single element, a learner can manage more information. Clark, Nguyen, and Sweller (2006) indicated that learning occurs most efficiently when a learner's construction of schema is automated. They hypothesized that for schema construction to be automated, a learner must have a broad enough store of information in long-term memory so that single elements can "fit" into schemas without requiring additional cognitive resources.

Thus, the instructional implications of cognitive load theory largely apply to how to facilitate the retrieval, or borrowing, of information from long-term memory for the purpose of schematization—or, at least, how to reduce extraneous cognitive demand, thus ensuring the availability of cognitive resources for schematization. Since long-term memory storage varies across individuals, no two learners schematize information in exactly the same way.

The third principle of cognitive load theory is the *problem-solving and the randomness as genesis principle*, which explains how information is generated in the first place. Specifically, while a learner may be able to solve most problems based on long-term memory stores, new problems may have two or more possible solutions. As the learner tests these solutions, their effectiveness determines how the new problem and solution will be added to long-term memory. Randomness as genesis will only occur when no definitive information is available to solve a problem, for Sweller (2010a) argued, "if knowledge is available to us, we are highly likely to use it" (p. 36).

The fourth principle, *novice working memory and narrow limits of change*, explains how as schema formations are changed, the amount of change is governed by the learner's working memory. Sweller (2010b) argued the limited capacity of working memory that ensures adaptive structures of knowledge is not compromised because large, rapid changes in long-term memory likely will be deleterious to one or more schemas useful for problem-solving and other cognitive activities. This concept is central to cognitive load theory, which explains how instruction is most effective when the novice learner is not expected to borrow information from long-term memory that could be presented to them without compromising the objective (i.e., by definition, novices do not possess large stores of information related to the content at hand). When instruction requires learners to borrow information from long-term memory, the learner's available working memory is limited, and, depending on his/her working memory capacity, the potential to solve novel problems or engage in novel cognitive activities also may be limited.

Sweller's (2010a) fifth principle, *expert working memory and the environment organizing and linking principle*, explains that the primary difference between experts and novices is in the efficiency with which he/she can transfer large amounts of information from long-term memory to be used in working memory. An expert is able to organize and link information from long-term memory with environmental information to generate appropriate actions. The novice, by contrast, has reduced ability to organize and link information from long-term memory with environmental information, resulting in less efficient use of working memory and reduced cognitive capacity to generate appropriate actions.

Using the principles and assumptions of cognitive load theory as a framework, cognitive load can be categorized into three types: *intrinsic* load, *extraneous* load, and *germane* or *effective* load. Intrinsic load refers to the number of items, or elements, of information that simultaneously must be considered or processed for learning to occur. Sweller (2010a) calls this *element interactivity*. The greater the element interactivity of instruction, the greater the consumption of working memory and the fewer cognitive resources for processing new information (also known as *working memory load*). The second type of cognitive load (this is not consistent with the ordering above—you have created extra load for my reading of this part!) is the logical opposite of the first: *extraneous* load. Extraneous load refers to the demand for cognitive resources that do not facilitate useful change to the long-term memory store (i.e., learning). Cognitive load theory research primarily has focused on ways to reduce or eliminate extraneous load in instruction. The third type of cognitive load is *germane* (or effective) load or the demand for cognitive resources that are relevant or germane to the acquisition of the knowledge or skill. Cognitive load theory assumes that as long as effective load in instruction does not exceed the working memory capacity, it facilitates learning. That is, the more relevant the items that can be brought into working memory for schematization, the better; the more opportunities the learner has to "fit" item elements into existing schema, the greater the probability the schematization will occur automatically (i.e., requiring no additional working memory load).

Proponents of cognitive load theory argue the intrinsic load of instructional tasks is the load required to learn the primary objective(s) of the task, while any germane load demands of the task support the generalization of student learning and/or higher-order thinking—typically a secondary objective of the task (Debue & Van De Leemput, 2014). Thus, depending on the balance and intensity of the task demands, cognitive overload may limit the attainment of either or both of the instructional objectives. Finally, it generally is accepted that the extraneous load demands of instructional tasks should be avoided whenever possible to permit learners to allocate needed cognitive resources to the intrinsic and germane load demands of the tasks. In summary, the cognitive load of the tasks students are working on matters when it comes to engagement in the tasks and completion of the work (Beddow, 2018).

Accessible Test Design Strategy

Assessment is an important part of instruction, especially classroom tests and interim/formative assessments designed to provide both students and teachers feedback on learning progress. The results of research on accessibility suggest many achievement test items written by teachers and professional test developers alike can be improved to reduce access barriers and enhance measurement of the targeted constructs (Elliott & Kettler, 2015). Accessible test items, therefore, must contain little or no content that compels a student test-taker to demonstrate skills that are irrelevant to the construct intended for measurement. Equally important is that accessible test items should be written taking into account students' cultural values and knowledge and should avoid arousing cultural conflict and misunderstanding and rendering students' inabilities to respond due to these cultural issues (e.g., religious issues, values regarding alcohol, card games, being photographed by others). This is of particular importance when skills that are required in addition (i.e., prerequisite skills) to the target construct are challenging and culturally inappropriate for the test-taker. Of these prerequisite skills, a common example concerns the need to read narrative text to solve many mathematics problems. For a student who comes from a poor family with low reading ability, complex text in a mathematics test item likely represents an access barrier that may preclude him or her from fully demonstrating knowledge, skills, and/or abilities in mathematics. Many students who experience a series of test problems that are difficult to cognitively access, owing to whether lacking of required background knowledge or lacking of relevant social and cultural experiences and understanding, will disengage and either start guessing or simply quit the test (Feldman, Kim, & Elliott, 2011). The inclusion of extraneous and/or construct-irrelevant demands, therefore, must be addressed at both the test and item levels to ensure that the resulting scores represent, to the greatest extent possible, a measure of the intended construct that is free from the influence of ancillary interactions due to access barriers arisen from personal, sociocultural, and economic limitations. To this end, cognitive load theory (CLT; Chandler & Sweller, 1991), a model for understanding the effects of various features of instructional task demands on learning outcomes, offers a useful lens through which to understand and evaluate the accessibility of tests and items. With the limitations of human working memory in mind, CLT indicates for optimal learning efficiency, designers of instructional materials and test items should aim to eliminate extraneous load while maximizing intrinsic load. This helps a learner allocate his or her cognitive resources to the primary objectives of the task or test item and not be burdened by extraneous material irrelevant to the process of solving the problem.

In relation to promoting learning and engagement for students with disabilities, the CLT and UDL guidelines, and knowledge of information processing, effective tools can be developed for educators to develop accessible test items that yield scores from which inferences are equally valid for all test-takers. Specifically, Beddow, Kettler, and Elliott (2008) developed the Test Accessibility and Modification Inventory (TAMI) and the TAMI Accessibility Rating Matrix (ARM; Beddow, Elliott, & Kettler, 2009). These tools are available to teachers and test developers at http://www.accessibletesting.com/tami/ for the design and evaluation of items on classroom and large-scale tests. The Accessibility Rating Matrix consists of a diagnostic checklist and item analysis rubric for evaluating items. A teacher or test developer begins by using the item analysis rubric to evaluate the accessibility of the items (he/she created or others have created) according to five basic elements of a multiple-choice test item (see Fig. 3.2): (a) the item passage and/or stimulus, (b) the item stem, (c) visuals, (d) answer choices, and (e) the page and/or item layout. Given the performativity culture in education and persistent achievement gaps between students who are disadvantaged and students who are non-disadvantaged in key areas of learning reported in national and international tests, it is important to take a microscopic perspective and to look specifically into how test items can be developed to promote accessibility and to reinforce students' opportunities to learn. Much of the concerns about the educational plight of students who are disadvantaged stem from their underperformance on assessments. A reflection on the construction of test items using ARM is warranted in light of promoting engagement for students who come from various disadvantaged backgrounds and trying to maximize access to tests used to evaluate them.

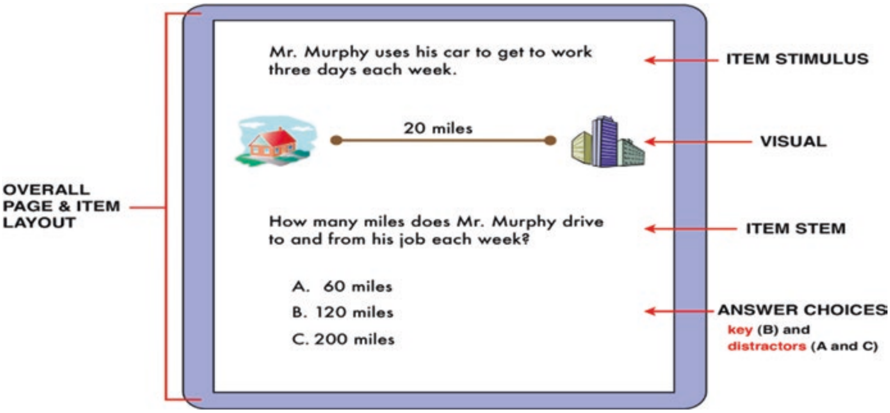

Fig. 3.2 Anatomy of a multiple-choice item

For the purposes of rating items using the ARM, the passage and stimulus are rated separately since it is common for multiple items to be connected to the same passage, with each individual item containing its own stimulus and stem. Key accessibility actions and modifications can be functionally identified for each of the five elements of an item as follows:

Passage/Item Stimulus

The length of text is an essential accessibility factor for the passage and item stimulus elements. Passages and stimuli must contain sufficient wording to communicate the message or present essential information and should be sufficiently long to provide material for a set of items. It is desirable, therefore, that passages and stimuli contain the minimal number of words, written as plainly as possible, to permit the maximum number of test-takers to respond to the item. Accessible passages should not demand additional memory or reading load apart from those required to demonstrate knowledge of the target construct. A failure to consider students' sociocultural experiences may create extra load and sometimes major difficulties in comprehending test items.

One challenge for teachers and test developers is the desire to create accessible test items that contain "real-world" application problems, taking into account students' unique experiences arisen from their class backgrounds and familial and cultural practices. Such authentic problems are thought to induce interest and engagement, yet they often are more difficult for students to access due to the ways that these passages are written or composed. For instance, many passages contain abridged versions of copyrighted publications that cannot be altered easily to reduce reading load. Likewise, mathematics and science items often require the application of conceptual knowledge to solve problems or demonstrate knowledge without taking into account students' cultural understanding and practices. Typically, these items contain more text and a higher degree of complexity than other items, which may pose difficulties for students who do not read well. Teachers and test developers should be aware that the potential is high for application problems, such as these, to contain barriers to accessibility due to extraneous cognitive load and failure to consider students' unique experiences. When barriers exist, whether they are cognitive or sociocultural in nature, engagement suffers.

Item Stem

The item stem typically contains the question or directive for an item and should be written as directly as possible to permit test-takers to understand what is required. An unclear item stem may preclude a test-taker from demonstrating what he or she knows even if the person has learned the tested content. To facilitate the identification of the question, item stems should be distinguished through spacing from item stimuli.

Visuals

According to the cognitive theory of multimedia learning (e.g., Mayer & Moreno, 2003), visuals can be useful for communicating information in a concise manner, but they also tend to be confusing and, if designed or used improperly, may actually increase the extraneous cognitive demands of learning tasks. Using culturally relevant images is an important consideration. Ideally, any visuals should be essential for responding to the item (rather than being included for ancillary reasons such as improving test-taker interest or motivation) and convey culturally relevant messages consistent with a test item. Indeed, many items, particularly in mathematics and science domains, require visuals to present essential information and convey a culturally inclusive conception of education. From accessibility and engagement standpoints, it is critical that all visuals depict the intended image(s) as simply and clearly as possible, with no extraneous text or information, and be culturally inclusive.

Answer Choices

Factors that commonly reduce the accessibility of response options for multiple-choice items are the use of implausible, absurd, or unnecessary distractors or unbalanced options (e.g., choices such as (a) Jim, (b) Sue, (c) Reginald, (d) Mary—if option C was the correct answer, the other names should be closely matched in terms of their length) or culturally irrelevant choices. Likewise choices in mathematics or science items should be reviewed to ensure that one option does not stand apart from the others, cognitively or socioculturally. As with the other item elements, answer choices should be minimal in length and written as simply as possible.

It is ideal that only one option is correct; indeed, if a strong rationale can be made that one of the distractors may be a correct response due to differences in perspectives or cultural understanding, then some test-takers who know the tested content may subsequently be marked incorrect for the item. This is an accessibility issue insofar as the item may actually measure the extent to which the test-taker “overthinks” the item, brings their own cultural knowledge and perspective to make their interpretation, or may test a construct referred to as “test-wiseness” or the degree to which students are able to infer what the test developer intended based on their cultural experiences and understanding, as opposed to simply responding based on content knowledge or skills. Little research exists on the use of items with more than one correct response with students with disabilities or other struggling students, but based on research on item distractors, cognitive load, and culturally inclusion education, it is expected that multiple-choice items with more than one correct response will be very difficult. To reduce this difficulty, test preparation during instruction is likely necessary.

Further, based on a meta-analysis of over 80 years of research on item development, Rodriguez (2005) concluded that three-answer choices are optimal for multiple-choice items. The author indicated that reducing items from four- or five-answer choices to three tends to result in nonsignificant or positive effects on the discriminatory power of items, nonsignificant changes in item difficulty, increased reliability of scores, and, ultimately, a positive effect on the subsequent validity of inferences from results. As applied to the development of tests with a focus on accessibility, Rodriguez’s conclusion suggests best practice is to reduce the number of response options of multiple-choice items to three whenever it is feasible to do so. This suggestion also makes sense from a motivational and engagement perspective, especially for test anxious students and students who struggle taking tests.

Page/Item Layout

The layout of items on a page/screen, or—if necessary—across pages/screens, is also an important aspect of accessibility. For optimal accessibility, the entire item—including relevant passages, visuals, or stimuli—should be presented on one page/screen. To the extent the necessary information for an item is spread across multiple pages, the accessibility of the item is compromised for some test-takers. It often is difficult to ensure a passage or common stimulus with its entire item set is presented on a single page. Nevertheless, the layout of item

and passage sets should be designed with caution to reduce the need for turning the page/excessive scrolling to respond to an item. For a similar reason, visuals that are necessary for responding should be integrated with the other item elements, rather than placed off to the side.

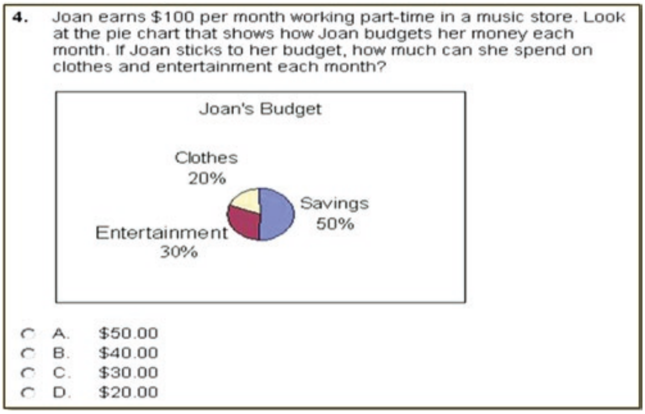

Fig. 3.3 Original fourth-grade mathematics item

Using TAMI and UDL principles to refine instructional materials and classroom tests. Learning and testing materials can be surprisingly messy, complicated by extraneous words, numbers, and visuals, which often results in ineffective performances for many students besides those with disabilities. As a summary of the key points for the item modification strategy, let's look at a real mathematics test item created by a fourth-grade teacher. As you can read in Fig. 3.3, the original mathematics item was comprised by an item stimulus of one sentence (12 words) and an item stem of one sentence (31 words), a visual, and four-item answer choices. An example modification of this same item measuring the same underlying knowledge and skill is provided as Fig. 3.4. Note that this modified item has an item stimulus of 5 words, an item stem of 15 words, a simplified black and white visual, and three-item answer choices. The layout of both items is very similar. Research with these items and many more like them has indicated that the modified items are easier to read, take less time to answer, result in students answering more items, and, perhaps most importantly, provide more accurate estimates of what students know and can do.

The lessons from research on item development using TAMI and from the UDL guidelines provide teachers many tips on how to organize, order, and simplify materials at a given grade-level whether for a test or for classroom instruction. The design of materials, whether for instruction or testing, should be done with an understanding of how students typically process information—whether as words, mathematic formulas and symbols, or visuals—and with the goal of having minimal extraneous information, except when the teaching goal is to have students differentiate between essential and extraneous information. Extraneous material is a barrier that can be overcome by teachers who are sensitive to students' information processing skills, understand the target goals to be learned or tested, and can apply research on cognitive load. Following these research-based test and classroom material development guidelines along with sensitivity to students' cultural backgrounds will facilitate access and allow students equitable opportunities to learn.

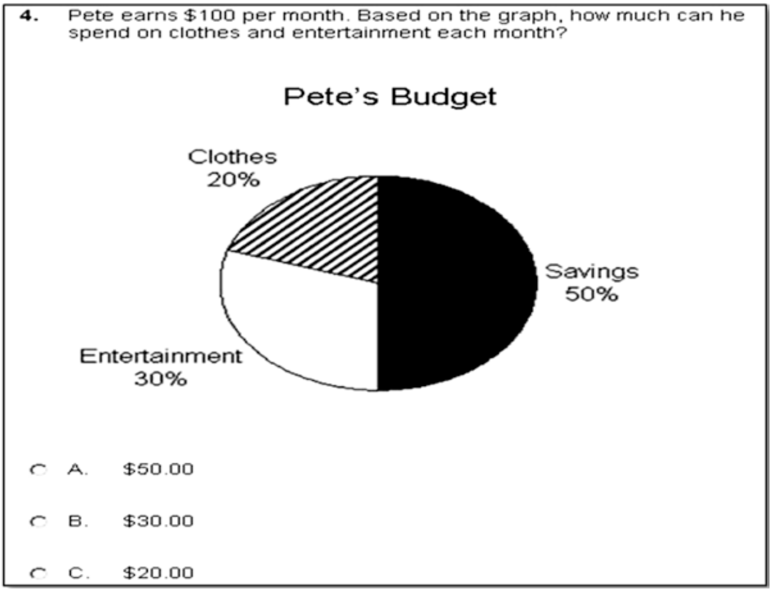

Fig. 3.4 A modified fourth-grade mathematics item with less cognitive load but unchanged construct

Testing Support and Accommodation Strategy

Access barriers in testing have been addressed primarily by the use of testing accommodations (also referred to as adjustments in some countries), which typically have been defined as changes in the administration procedures of a test to address the special needs of individual test-takers (Hollenbeck, 2002). Testing accommodations historically have been individualized and used with the aim of reducing construct-irrelevant variance due to a variety of access skill deficits exhibited by students with special needs (Elliott, Kratochwill, & Gilbertson-Schulte, 1999). We argue here whenever possible that such accommodation should also cover students' class, cultural, and geographical backgrounds. Typically, accommodations involve changes in the presentation format of a test (e.g., oral delivery, paraphrasing, Braille, sign language, encouragement, permitting the use of manipulatives), the timing or scheduling of a test (e.g., extended time, delivering the test across multiple days), the recording or response format (e.g., permitting test-takers to respond in the test booklet instead of on the answer sheet, transcription), or the assessment environment (e.g., separate room, elimination of distractions). Accommodations for most testing situations are not allowed to the content of test items; however, all major tests typically undergo a fairness review that includes consideration of students' background and cultural differences, thus minimizing the likelihood that items are bias against students from different cultures or ethnic groups.

Appropriate testing accommodations, while applied individually based on specific student needs, should not interfere with the measurement of the target construct and provide teachers with the same amount of information about the student's skill level on the construct measured on the test as results from students not receiving accommodations (Kettler & Elliott, 2010). The application of accommodations also should differentially affect test results of students for whom accommodations are intended, compared to those for whom testing accommodations are not needed. That is, when test accommodations are provided to the students who need them, their test scores will often improve, related to the scores they would attain when taking the test without accommodations; however, students without the need for this support should not exhibit higher scores when taking the test with those accommodations (i.e., the interaction hypothesis). This is an important consideration that is rarely discussed when examining achievement gaps between students from disadvantaged groups and more advantaged groups in different parts of the world.

The National Research Council in the United States commissioned Sireci, Scarpati, and Li (2005) to conduct a comprehensive review of the evidence for effects on test scores by testing accommodations with pencil and paper tests. Specifically, Sireci et al. (2005) reviewed 28 empirical studies on the effects of testing accommodations completed over nearly two decades. They found the most common accommodations were reading support (39%) and extra time (24%).

Reported effect sizes (i.e., the amount of change or difference between an accommodated mean score and an unaccommodated mean score divided by the pooled standard deviation for the means) of most testing accommodations appear small, but there is evidence they are practically meaningful. In a survey of the accommodations literature, Kettler and Elliott (2010) reported effect sizes from accommodations for students with Individualized Education Plans (IEPs) were twice as large as those for students without IEPs. Specifically, effect sizes ranged from 0.13 for students without IEPs to 0.42 students with IEPs. These results suggest, for some students, appropriate accommodations may indeed reduce barriers, facilitate engagement, and yield more accurate measures of achievement and, in many cases, higher test scores.

To facilitate teachers' efforts to use accommodations, Davies, Elliott, and Cumming (2016) developed an instrument called the Checklist of Learning and Assessment Adjustments for Students (CLAAS). The CLAAS is a user-friendly instrument based on the Assessment Accommodations Checklist (Elliott et al., 1999). The CLAAS is comprised of a list of 67 specific adjustments that represent eight categories of support. The adjustment categories and number of representative items are as follows: Motivational Adjustments for Learning and Assessment (5 items), Scheduling Adjustments for Learning and Assessment (4 items), Setting Adjustments for Learning and Assessment (10 items), Assistance with Learning and Assessment Directions (10 items), Assistance During the Assessment (12 items), Assistance Prior to Administering a Test (2 items), Equipment or Assistive Technology (18 items), and Learning and Assessment Formats (6 items). The items in each of these categories are rated according to an individual student's needs under three general conditions: classroom learning, classroom assessments, and state and

Checklist

Levels of Adjustments: No (for none), A (Support within differentiated teaching practice), B (Supplementary), C (Substantial) or D (Extensive).

Motivational Adjustments for Learning and Assessment		Adjustments for Classroom Learning					Adjustments for Classroom Assessments					Adjustments for State/National Tests				
		No	A	B	C	D	No	A	B	C	D	No	A	B	C	D
1. Provide treats, snacks, or prizes, as appropriate	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
2. Provide verbal encouragement of student's efforts	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
3. Encourage student who may be slow at starting to begin	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
4. Encourage student who may want to quit to sustain effort longer	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
5. Encourage student to remain on task	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
6. Providing scaffolding of learning or assessment activities	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Scheduling Adjustments for Learning and Assessment		Adjustments for Classroom Learning					Adjustments for Classroom Assessments					Adjustments for State/National Tests				
		No	A	B	C	D	No	A	B	C	D	No	A	B	C	D
7. Provide extra time	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
8. Allow frequent or extended rest breaks	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
9. Schedule learning or assessment over extra days	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
10. Undertake assessment at a time most beneficial to the student	Student 1	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐
	Student 2	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐	☐

Fig. 3.5 CLAAS items and adjustments for classroom learning, classroom assessments, and testing situations (Source: Reprinted with permission of Michael D. Davies. Griffith University, Brisbane AU)

national tests. An example section of the CLAAS with items concerning Motivational Adjustments and Time Adjustments is provided as Fig. 3.5.

Although testing accommodations can be helpful for many students, there remain a number of challenges associated with actually implementing them. First, many students, in particular middle school students, are averse to testing accommodations for different reasons including the fact that the accommodations often draw attention to them (Feldman et al., 2011). Additionally, there are logistical challenges associated with their appropriate implementation including time, personnel, and cost, which often result in poor integrity. Clearly, teachers need to plan for the implementation of accommodations and work with students to make sure the accommodations are acceptable, implemented with integrity, and work as intended. With the advent of more online instruction and assessments, more students are finding accommodations acceptable and helpful because students have a larger role in selecting and refining the accommodations provided (Russell, 2018). In the context of current book, challenges to develop accommodations for students coming from various disadvantaged backgrounds include teachers' understanding of students' needs, their capabilities and training in addressing these needs in instruction and assessment, and the extent to which supports are received from other teachers, the school, and other significant stakeholders including parents and policy-makers.

Research-Driven Actions to Maximize Student

The five access strategies we have discussed in this chapter have emphasized cognitive aspects of engagement in academic tasks, although with increased cognitive involvement both behavioral emotional engagement frequently also improves. These strategies, when used consistently with students from both disadvantaged and advantaged backgrounds, reduce exclusion. In particular, intellectual and pedagogical exclusion are reduced, and overtime matters of social isolation can also be reduced given the social supporting attributes of the creation of classrooms and schools that provide students of all types real opportunities to learn.

The research in support of these strategies suggests they indeed do enable many students with disadvantages more meaningful engagement in learning and testing events, and for many of these students, this engagement results in measurable improvements in achievement and attitudes about future learning opportunities. Briefly, an actionable summary of the theory and research on access strategies and opportunity to learn is:

- Increase instructional time daily on content objectives in the intended curriculum to improve opportunities to learn important content that also is likely measured to document achievement.
- Design instructional material and activity that offers students choices in the way they access the material and respond to it.
- Design classroom tests that optimize access and maximize the likelihood that students can show what they know. Such testing is perceived to be fairer and students are more motivated to participate in testing that is fair.
- Match instructional and testing support needed to improve accommodation integrity and its effect on academic performance.
- Reduce extraneous content in instructional and classroom testing material to improve readability, decrease cognitive load, and focus on targeted knowledge and skills.

Teachers' use of this guidance will occur largely within their own classrooms and schools, and when used consistently and daily across the majority of a school year, even small changes smartly made have potential to have substantial impact on the engagement and learning outcomes for many students who otherwise would under-engage and underperform academically. Therefore, to expand access and engagement in daily instruction and on classroom tests for all students, especially those who are struggling to learn, teachers are encouraged to:

- Increase the amount of instructional time daily within which students have opportunities to learn content standards that are aligned highly with blueprints for tested knowledge and skills. In other words, maximize teaching to the standards that are the focus of grade-level instruction. To accomplish this objective, it is likely that many teachers will need innovative professional development activities that focus on the intended curriculum and provide them feedback about their efforts to increase opportunities to learn.

- Increase the use of highly accessible instructional materials and classroom tests to advance learning. To accomplish this objective, teachers will need to understand fully and translate effectively guidelines like those from UDL and test item criteria such as those emphasized in the TAMI when developing new or refining existing learning and testing materials. Although one-size-fits-all instructional materials and tests cannot be developed, all materials can be improved to better match student needs by simply reducing extraneous content. In many ways, less is more when it comes to instructional materials and test items.
- Identify students' access and support needs based on daily instructional activities, and translate them into feasible testing accommodations that match the needs and can be implemented with integrity. To accomplish this set of actions, teachers need knowledge of their students' instructional support needs and their attitudes about making use of needed support or accommodations during testing situations. Teachers also need clarity on allowable supports and accommodations for a given test and a plan to ensure specified accommodations are implemented with integrity.

Each of these theory-based and research-driven actions can be accomplished on a large scale when educators are dedicated on a daily basis to provide all students optimal access to learning and testing while also being sensitive to students' ethnic and cultural backgrounds. These actions start with teachers in their classrooms with individual students, but when done consistently and smartly, these small moves collectively can result in maximizing accessibility, engagement, and ultimately achievement for many more, if not all, students.