The Assessment Triangle and Students with Significant Cognitive Disabilities:

Models of Student Cognition

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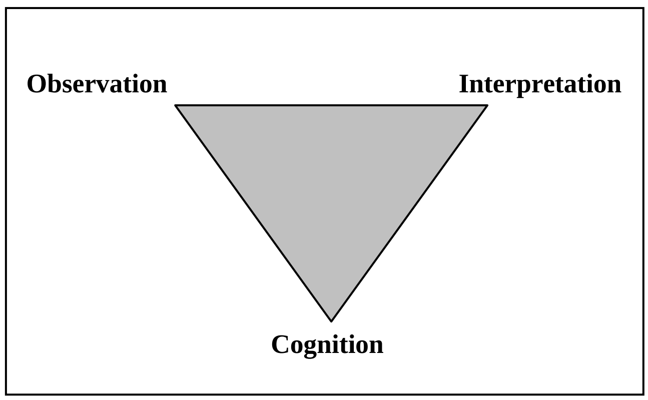
With the advent of the *Individuals with Disabilities Education Act Amendments of 1997* and the *No Child Left Behind Act of 2001*, all students, including students with significant cognitive disabilities, are to be included in state and district educational assessment and accountability systems. The primary mechanism for the participation of students with significant cognitive disabilities in measures of educational assessment and accountability is through alternate assessment (Kleinert & Thurlow, 2001; Thompson, Quenemoen, Thurlow, & Ysseldyke, 2001). While all states were required to have alternate assessments in place by July 1, 2000, the concept of alternate assessments is one that is still very much evolving. Alternate assessments must now be linked to grade level content standards for all students (U.S. Department of Education, Dec. 9, 2003). This new emphasis upon instruction and progress on grade level content gives added importance to insuring that alternate assessments are grounded in coherent theories of how students with significant disabilities gain academic and subject matter competence.

A scientifically-validated conceptual model of how such assessments might be developed can be taken from the work of the National Research Council's Committee on the Foundations of Assessment (Pellegrino, Chudowsky, & Glaser, 2001), namely the Committee's work on the "Assessment Triangle". This triangle, developed as a unifying foundation for the development of educational assessments for all students, is fundamentally a process of reasoning from evidence about what students know and how they know it. As described by Pellegrino et al. (2001), the triangle consists of three elements on which every assessment must rest: "a model of how students represent knowledge and develop competence in the subject domain, tasks or situations that allow one to observe students' performance, and an interpretation method for drawing inferences from the performance evidence thus obtained" (p. 2). Pellegrino et al. suggests that the elements of this triangle—cognition, observation, interpretation—must be articulated and aligned for inferences drawn from the assessment to have integrity. The triangle is illustrated in Figure 1.

Figure 1: The assessment triangle (Pellegrino et al., 2001)



This paper will address the first vertex of the triangle, that of cognition, to examine characteristics of students with significant cognitive disabilities in representing what they know. We will discuss the primary elements of knowledge representation and domain competence identified by Pellegrino et al. for *all* students, and then for each of these elements, discuss how these elements may have special ramifications or considerations for alternate assessments of students with significant cognitive disabilities. Before we do this, we will briefly describe what alternate assessment is, who it is designed for, and the research that exists to date on what students are actually participating in alternate assessments.

What Is Alternate Assessment?

As noted above, alternate assessment is the primary mechanism through which students with the most significant cognitive disabilities participate in measures of educational assessment and accountability. Thompson and Thurlow (2003) report most states currently offer one type of alternate assessment, while a small number of states offer two or even three alternate assessment options. However, states vary considerably in the approaches that they use for alternate assessments, and these approaches are typically very different from those used for states' general assessments (Lehr & Thurlow, 2003).

There are three basic alternate assessment approaches. The first is a portfolio or body of evidence approach. A portfolio is a purposeful and systematic collection of student work that is evaluated and judged against predetermined scoring criteria. The second approach is a checklist or rating scale. This approach requires teachers to identify if students are able to perform certain skills or activities. The scores for these assessments are most often based on the number of skills the student is able to successfully perform. Finally, there is the performance assessment approach, which is a direct measure of a skill in a typically one-to-one assessment format (e.g., responding to questions about a reading passage in language arts). Performance assessments range from being highly structured, with very prescribed directions for administration and scoring, to a more flexible approach tailored to students' needs (Roeber, 2002). It is important to note that portfolios or performance events may again vary considerably from state to state, as each state is given the freedom to develop its alternate assessment to most appropriately fit within its own large-scale assessment system.

For Whom Are Alternate Assessments Designed?

Alternate assessments are designed for a very small percentage of the student population for whom traditional assessments, even with appropriate accommodations, would be an inappropriate measure of student progress within the general education curriculum. The number of students within a state who participate in alternate assessment is generally less than one percent of the total student population (i.e., those students who have the most significant cognitive disabilities). Students participating in alternate assessments may have a variety of special education labels such as autism, mental retardation, and multiple disabilities (NAAC, 2005). Not all students in these three categories receiving special education services will need an alternate assessment, but the majority of students who take an alternate assessment may have one of these three special education labels.

For each student with a disability, the student’s Individualized Education Program (IEP) team decides how the student will participate in the state assessment system. The process of choosing the appropriate assessment for an individual student (e.g., regular assessment, regular assessment with accommodations, or alternate assessment) again varies considerably from state to state. State participation guidelines for the alternate assessment direct the IEP team to ensure that each student “participates in a way that accurately portrays the student’s achievement of knowledge and skills so as to hold accountable the educational system responsible for the student’s learning” (NCEO, 2003). Students should always first be considered for the general assessment system with appropriate accommodations prior to the alternate assessment. These decisions, made by the IEP team, are ones that should be taken very seriously, and consideration of the appropriate assessment for each student is of utmost importance for accountability purposes.

What Do We Know About the Characteristics of Students Currently Participating in Alternate Assessments?

As indicated previously, students currently participating in alternate assessments typically have a special education label of autism, mental retardation, or multiple disabilities

(NAAC, 2005). However, the label a student receives to qualify for special education services may not accurately describe the true characteristics of the student. There is currently little research that identifies the characteristics of students taking alternate assessments, although one study has provided preliminary data. The Colorado Alternate Assessment Collaborative conducted a pilot study developing two new types of alternate assessments (Almond & Bechard, 2005). In addition to administering the pilot assessment to each student, teachers responded to two surveys used to describe the capabilities of students in the study, along with providing demographic student information and a copy of the student's current IEP. In order to better understand the population of students who take alternate assessments, information was collected from teachers in four major categories: academics, assistive technology, communication, and need for supports in physical movement. Findings in each major category for this study are explicated below:

- (Demographic data) Of the 165 students in the study, 142 had mental retardation, but more than one-third of the students also had two or more significant disabling conditions.
- (Academics) Most students' instructional objectives fell into two categories: (1) functional living and communication skills or (2) English language arts and mathematics.
- (Assistive technology) Exactly 49 students used 1-4 assistive technologies during day-to-day instruction, 41 used 5-7 technologies, and 46 students used 8-11 assistive technologies. These were most frequently printed or picture schedules and word cards, a word book, or word wall.
- (Communication) While 10% of students did not use words to communicate, almost

40% used 200 words or more in functional communication.

- (Need for supports in physical movement) There was a range of physical movement and level of support required by students in this study ranging from students not performing the task at all, to students performing the task without any supports (Almond & Bechard, 2005)

While this information provides us with only a snapshot of the characteristics in this one sample, it is currently the only research to date regarding characteristics of students participating in alternate assessments. Further research is necessary to better understand the characteristics of this population of students, which is clearly extremely heterogeneous. Students have individualized capabilities and needs for support, making both instruction and assessment a challenge; this challenge accentuates our need for an integrated theory of learning and assessment for these students. Having provided a brief overview of what alternate assessment is, for whom it is designed, and the existent research on what students are actually participating in alternate assessments, we will now focus upon what we know about how these students learn, that is, the cognition vertex of the "assessment triangle" for these students.

A Framework for Approaching Models of Cognition for Students with Significant Cognitive Disabilities

There are essentially two approaches for explicating the cognition vertex for students with significant cognitive disabilities. The first method would be to directly generate that cognition model ourselves. While there is a certain attractiveness to developing a model "from scratch", there are some immediate difficulties with such an approach. For one thing, precisely because of the history and power of behavior analysis in shaping the foundations of the field of special education, professionals have not given a great deal of thought to "how students with severe cognitive disabilities think." Rather, educational progress has occurred through teaching measurable and observable behaviors that enable students to be independent as possible. Also, past efforts to apply cognitive theories to the education of students with significant cognitive disabilities have been unsatisfactory. For example, developing assessments and educational goals based on early Piagetian stages (Robinson & Robinson, 1978) yielded educational programs that were not appropriate to students' chronological age and that ignored the students' need to acquire skills of daily living. Cognitive models may also have been ignored because they seemed to promote a deficit model (i.e., what these students lacked) rather than a capacity building model (i.e., what students could do with education and support). However, *not* relying on a cognitive framework for building assessments and teaching prevents us from developing an understanding of how students with significant cognitive disabilities actively construct knowledge and apply mental models and processes to the problems they encounter. While such a framework may be useful for understanding how students acquire skills of daily living, it may yield especially helpful implications for addressing academic content with this population, as required under federal accountability mandates.

Given the conceptual distance to be traveled in developing a cognitive framework for students with severe disabilities, we think the best starting point is to use the elements in the cognition vertex developed for *all* students by Pellegrino et al., to see how they apply, and how might they differ, for students with significant cognitive disabilities. In doing so, we will build bridges to what we have learned about how this population learns, which to date comes primarily from a behavioral perspective. We will also try to avoid past pitfalls in applying cognitive theory to students with significant cognitive disabilities including: a) promoting deficit models that describe at length what this population can not do or b) stigmatizing school-aged students with significant disabilities by describing them like infants or toddlers. We also recognize from the onset that these students' communication challenges will make understanding how they construct knowledge and the nature of what they know and understand especially difficult and that great care must be taken in making inferences about these students' cognition.

Finally, we should note that while the assessment triangle applies to all types of educational assessments (from teacher-made tests covering daily lessons to large-scale educational assessments used for school accountability and improvement under our nation's educational laws), we will frame our discussion largely in terms of assessment used for accountability. We do this because of the immediate need within our field to focus our attention, under the *Individuals with Disabilities Education Act of 1997*, the *No Child Left Behind Act of 2001*, and the *Individuals with Disabilities Education Improvement Act of 2004*, to include all students, even students with the most severe cognitive disabilities, in indices of school accountability. With this inclusion, it is essential that we insure that the large-scale assessments constructed for students with significant disabilities are technically adequate, that they do what they purport to do, align with what needs to be taught, and are reliable and valid measures of what students have learned. The assessment's focus, for students with significant disabilities, should be first on the inclusion of all that they can do in the presence of adequate instruction in the domain content, as assessments for these students have traditionally served as a litany of all they cannot do, often without reference to whether they received instruction in that area (Klenert & Thurlow, 2001). Of course, good assessments should also distinguish those skills that are just emerging, but are not yet performed independently, and those skills that students have not *yet* learned, as a method for determining future targets. What is important, though, is that assessment for students with significant cognitive disabilities be based on that which they have had a comparable opportunity to learn (Salvia & Ysseldyke, 1998). With this final caveat, we now turn to the cognition vertex.

Four Perspectives on the Nature of Human Learning and Knowing

Pellegrino et al. propose that there are four basic perspectives for understanding the nature of human learning and knowing. Each of these perspectives has important implications for the assessment of students with significant cognitive disabilities.

The *Differential Perspective* (which is also the perspective that has most guided the development of tests of intellectual aptitude and academic performance) focuses on measuring and describing individual differences in the processes and products of human learning and knowing, with an emphasis on the products. While the theory of measurement within this perspective is consistent with behavioral theories of learning (Pellegrino et al.) that have been so instrumental in developing successful learning strategies for students with significant disabilities, this model also emphasizes the concepts of relatively stable mental traits and intellectual competence that can be reliably measured. It is, of course, primarily in these traits that students with significant cognitive disabilities “score” most poorly (at times even rated as “untestable” or excluded from testing altogether, see McGrew, Thurlow, & Spiegel, 1993; Kleinert & Thurlow, 2001). Professionals have questioned the validity of using these assessments for educational planning for the last two decades (Sigafoos, Cole, & McQuarter, 1987). For example, a student’s “mental age” is no longer considered an appropriate criterion for curriculum planning (Browder, Spooner, et al., 2004). For students with significant cognitive disabilities, a model of the mind that focuses strictly on the differential perspective would severely limit a conception of what these students are capable of learning and understanding.

The second perspective, the *Behaviorist Perspective*, is described by Pellegrino et al. (2001) as the “organized accumulation of stimulus-response associations that serve as the components of skills” (p. 61). As Pellegrino et al. point out, this perspective has had significant influence on both our understanding of learning and assessment. The behaviorist perspective is reflected in the task analyses of curricula, in the organization of steps within those analyses from simple to complex, and in the careful consideration of pre-requisite skills. Within assessment, the influence of this perspective occurs in the systematic analysis of the components required for domain competence, and in the careful sampling of those component skills within test development. The Behaviorist Perspective has also had a profound influence on the history of education of students with significant disabilities; much of what we know about the “technology of teaching” and the organization of life-skills and functional academic curricula for these students is the direct result of the application of this perspective (Snell & Brown, 2005). Most of the options for measuring Individual Education Program (IEP) progress for this population, such as task-analytic, repeated trial assessment, permanent product, and time-based observations rely on principles of applied behavior analysis to define and measure observable responses (Browder, 2001). The Behaviorist Perspective also has ongoing implications for the understanding of alternate assessment; for example, most state alternate assessments for these students require the demonstration of clearly measurable and observable targeted skills, many of which are broken down into subskills for both teaching and measurement (Browder, Ahlgrim-Delzell, et al., 2005). However, as Pellegrino et al. have noted, the Behaviorist Perspective, by itself, does not focus on *how* students construct, organize and/or use the knowledge they attain (e.g.., the mental models they construct for problem-solving). For this additional understanding, other perspectives on the mind are needed.

The third model, the *Cognitive Perspective*, focuses more on understanding how people construct or represent knowledge, and the strategies employed for connecting new knowledge to prior knowledge, and in the formal processes for problem-solving. As Pellegrino et al. note, cognitive theorists are not so much interested in *how much* knowledge one has accumulated (as measured by a more differential approach) but in the *quality* and *organization* of that knowledge in ways in which it can be meaningfully applied. This model also emphasizes the concept of growth over time in developing increasingly sophisticated knowledge structures and problem-solving approaches. The Cognitive Perspective has important implications for students with significant disabilities. First, we know that while these students often lack systematic approaches to identifying and solving problems, there are problem-solving strategies that can be directly taught to even students with severe cognitive disabilities (Agran, Blanchard, & Wehmeyer, 2000; Agran, King-Sears, Wehmeyer, & Copeland, 2003). Secondly, while students with significant disabilities often develop competence in a domain at a slower rate than other students, the concept of growth for these students is essential. It would appear that for this highly diverse group of students, a one-time snapshot of what they know might not capture the significant gains in how they have learned to represent their knowledge over time. Even data collected over time to demonstrate effective teaching may not reflect in depth growth of conceptual knowledge unless developed to do so. For example, over the course of a year, a student may show progress in acquiring more and more sight words, but no true “growth” in understanding their meaning and use.

The fourth model of learning and knowing, the *Situative Perspective* (or socio-cultural perspective), has additional implications for learners with significant disabilities. “Developed in part as a reaction to the ‘in-the-head’ work of cognitive psychologists, researchers began to postulate that context, culture, and community have an important role in human learning and development” (Marion, 2004, p.31). Learning, from a Situative Perspective, is considered mediated by one’s place in a community of learners, or as Pellegrino (2005) has referred to this concept, as “distributed cognition”, that is, the capacity of individual learners to contribute to each other’s understanding. According to Pellegrino et al. (2001), “from the situative perspective, assessment means observing and analyzing how students use knowledge, skills, and processes to participate in the real work of the community” (p. 64). Closely aligned with the situative perspective is the work of the Russian psychologist Lev Vygotsky, who emphasized the role of the child’s communicative surrounding and social relationships with peers and adults as central factors in the development of such psychological functions as reasoning, planning, and decision-making (Vygotsky, 1993). For students with significant cognitive disabilities, the situative perspective introduces two essential concepts for both learning and assessment. First, students with significant disabilities benefit from instruction with typical peers in inclusive settings. Research has shown not only social benefits for this inclusion (Cole & Meyer, 1991; Fryxell & Kennedy, 1995), but also attainment of educational goals (Brinker & Thorpe, 1984; Hunt, Staub, Alwell, & Goetz, 1994). Second, students with significant disabilities, if they are to acquire usable skills that will contribute to competence in the real world, must be able to perform those skills in the settings in which they will be needed (Brown, Nietupski, & Hamre-Nietupski, 1976; Heward, 2006; Kleinert et al., 2001). Students with significant cognitive disabilities often experience difficulty in generalizing skills to new settings and situations, and instruction and assessment must both address effective strategies for insuring that students are able to transfer what they have learned (Westling & Fox, 2004). Of course, a lack of generalization is hardly unique to students with significant disabilities, but may be especially problematic for these students.

Components of Cognition: How These Elements Apply to Students with Significant Disabilities

Pellegrino et al. identify several elements critical to the construction of a model of student cognition. We consider each of these elements briefly here, and their implications for students with significant cognitive disabilities. Table 1 summarizes each of the dimensions discussed below.

Table 1. Implications for Alternate Assessment Based on Components of Cognition

Variables that Relate to Cognition	**Characteristic of Students with Significant Cognitive Disabilities**	**Support and Opportunities Needed During Instruction and Alternate Assessment**
Working or Short Term Memory	Limitations in short term memory	Compensatory strategies (e.g., picture cues); systematic instruction of mnemonic strategies & chunking with ongoing, frequent opportunities to use new learning
Long Term Memory	Less clear that deficits are in long term memory, but are	Need opportunities to continue using priority skills (e.g., in daily routines);

	rather affected by short term memory challenges	Need opportunities to apply skills reflecting two types of long term memory - the "way the world is" and "how things are done"
Metacognition	Students can use self determination skills that require "thinking about thinking", but may need instruction to do so	Opportunities and instruction to learn to problem-solve, self-evaluate, and self-correct; Need to be planful about giving students opportunities to negotiate novel tasks and communicate about their learning
Practice and Feedback	While all learners need practice and feedback, this needs to be much more explicit and more frequent for students with significant cognitive disabilities	Need many opportunities to practice tasks with feedback; Need feedback that goes beyond accuracy (e.g., instructive feedback)
Transfer of Knowledge	While generalization cannot be assumed for any students unless they are provided with opportunities to experience the concept with multiple representations, transfer/ generalizability of concepts and skills can not be assumed for students with significant cognitive disabilities unless explicitly taught and assessed.	Will need instruction in multiple contexts, materials, examples to generalize; Need opportunities to show both near and far transfer and to show degree of conceptual generalization, not just generalization across people and settings

Microgenetic analysis	Need to consider how students learn on an intensive, ongoing trial-by-trial basis to understand the process of learning, as this process may be subtle and gradual	Need for ongoing instruction of specific target skills with systematic instruction (prompting and feedback); Need for ongoing assessment of acquisition of target skills with data-based decisions about progress
Social and situative context of learning	Learning is mediated by social and situational context	Need to consider how social supports impact learning (e.g., opportunities to learn with typical peers in inclusive contexts) Need for opportunities to learn and apply skills in "real world" context

Components of Cognitive Architecture

While it is not within the scope or intent of this paper to propose that students with significant cognitive disabilities have a "cognitive architecture" substantially different from their typical peers, there is some research that would suggest that students with intellectual disabilities as a group do experience some very specific challenges with how they process information. The goal of special education is to provide students with the supports and strategies needed to compensate for these challenges.

Working or Short-term Memory. Pellegrino et al. have noted Baddeley's (1986) definition of working or short-term memory as that which "people use to process and act on information immediately before them" (p. 65). Pellegrino et al. have noted that the key variable in this type of memory is capacity, but that this is not the type of physical capacity analogous to filling up a plastic container until it reaches the top. Rather, the functional capacity of working memory can be expanded through the use of intentional learning strategies to chunk or code information. This is critical for students with intellectual disabilities. While there is research that indicates that students with intellectual disabilities do experience more limitations in short term memory capacity (Bray, Fletcher, & Turner, 1997), there are specific strategies for teaching students with disabilities how to chunk and organize information into more coherent and encodable forms (see Mastropieri & Scruggs, 2004). Learning strategies that systematically teach chunking or mnemonic strategies should be an essential feature of instruction for students with significant cognitive disabilities, and assessments for these students should encourage them to use these encoded "chunks" in novel situations to solve new problems. It is also crucial that assessments for these students be designed so that limitations in short-term memory (e.g., the capacity to remember a multi-step direction) do not result in the student *not* being able to demonstrate skills that are a part of that student's learned repertoire. In other words, because of potential deficits in short-term memory, there is a clear risk for these students that assessments will not fairly represent what they do know, unless adequate supports for understanding the dimensions of the assessment task are clearly built into the assessment itself.

Long-term Memory. As Pellegrino et al. have noted, long-term memory "contains two distinct types of information – semantic information about 'the way the world is' and procedural information about 'how things are done'"(p. 67). Both types of long-term memory are crucial for students with significant cognitive disabilities. For example, being able to identify words or symbols in the same ways understood by most readers of English implies semantic information about 'the way the world is'. Being able to use symbols or words on an augmentative communication device to influence a conversational partner implies procedural information on 'how things are done.' Older research seems to suggest that individuals with intellectual disabilities retain information in long-term memory about as well (or as poorly) as the general population (Ellis, 1963). Most significantly for our discussion, we do know that we can enhance retention by insuring that students have opportunities to learn skills that are applicable across contexts and learning settings, thus ensuring that this knowledge will be encoded in a way that it is readily recognized and retrievable for the student. Assessments should also measure those skills that will substantially add to a student's knowledge of how the world is and how things (that are truly important) are done.

Question for Alternate Assessment: *Will tasks selected for assessment provide information on the students understanding of "how the world is" and "how things are done"? Are students given the opportunity to show how they respond using supports and strategies (e.g., with picture prompt) that may compensate for potential short-term memory difficulties?*

Metacognition

Metacognition, or "thinking about thinking", refers to the capacity to not only select a problem solving strategy, but to monitor and evaluate one's use of that strategy, and to self-correct as necessary (Pellegrino et al.). As such, metacognitive strategies are closely aligned with some of the most important components of self-determination and self-directed models of learning (Agran, King-Sears, Wehmeyer, & Copeland, 2003: Wehmeyer & Schwartz, 1998) that have been addressed in the literature for students with cognitive disabilities, and that have been identified as associated with more positive life outcomes for students with intellectual disabilities (Wehmeyer & Palmer, 2003; Wehmeyer & Schwartz, 1998). For students with significant cognitive disabilities, metacognitive strategies can include explicit steps in setting goals (e.g., completing a science project, obtaining an after-school job, planning a service learning activity with peers), developing action steps to reach that goal, and evaluating one's progress toward that goal (see Agran et al. for the specific steps in such a model of self-directed learning).

Pellegrino et al. have noted that strong metacognitive skills separate the performance of experts from novices in specific domains, and that the assessment of metacognitive strategies should be an important component in determining domain competence. It is essential to note that even students with significant cognitive disabilities can be taught the component skills that promote metacognition, including setting personal goals, planning one's own learning (e.g., the strategies that work best for a student in learning a particular subject, or the order in which one will do a set of prescribed learning activities), and monitoring and evaluating that learning (Agran, King-Sears, Wehmeyer, & Copeland, 2003; Kleinert, Denham, et al., 2001). For example, Hughes, Copeland, Agran, Wehmeyer, Rodi, & Presley (2002) taught 4 high school students with intellectual disabilities to self-monitor their behaviors in general education classes. Students were taught to successfully monitor their performance on modified class worksheets, their initiations with classroom peers, and their social responses in school-based activities. The metacognitive skills of planning, monitoring and self-evaluation can also be embedded into the context of daily instruction based on grade level content standards (see Kleinert & Kearns, 2004, for examples).

Closely aligned with metacognition are strategies for self-instruction (Agran, King-Sears, Wehmeyer, & Copeland, 2003; Hughes & Agran, 1993). Agran et al. define the purpose of self-instruction as "enabling students to control their *own* behavior using their own language or verbal instructions" (p. 29). An example of a self-instruction reading strategy would be for the student to internally verbalize the following steps when presented with a comprehension question to a class reading passage: 1) look for key words in the question; 2) search for those same key words in the reading passage; 3) re-read very carefully those sentences in which the key words appear; 4) write his or her response to the question. Certainly, the extent to which students can monitor their approach to tasks through self-instruction increases both their independence and generalization of these tasks to novel settings (Heward, 2006). While self-instruction represents an important element in instruction for students with significant cognitive disabilities, it should also be a part of assessment practices. Pellegrino et al state that "assessment practices should focus on making students' thinking visible to themselves and others by drawing out their current understanding so that instructional strategies can be selected to support an appropriate course for future learning" (p. 90-91). It would make sense that alternate assessments should also include a measure of how students approach a task, and the extent to which they can rely on such metacognitive strategies as self-evaluation and self-instruction to successfully solve those tasks.

Closely related to metacognition, and specifically to problem-solving, are the cognitive demands of alternate assessments, or as Flowers, Browder, & Ahlgrim-Delzell (in press) have described, "depth-of-knowledge" demands. Flowers et al. applied Webb's (1997) cognitive demands in terms of four levels, from simple recall (level 1) to complex planning requiring "students to make several connections and apply one approach among many to solve the problem" (level 4). In a study of three states' alternate assessments, these researchers found that the majority of alternate assessment items for these states in math and language arts scored in the lowest two levels of cognitive demands. Clearly, higher-order problem solving skills are critical for all students, and should be reflected in alternate assessments as well.

It is not surprising then that several states (e.g., Kentucky, Iowa) have included the broad rubric of self-determination skills as a dimension in scoring (which involves elements of both the observation and interpretative parts of the assessment triangle) for their respective alternate assessments for students with significant cognitive disabilities. A focus for the future may be to explore the extent to which tasks used for self-determination can be expanded to include more information on metacognition. For example, if information currently is collected on self-evaluation, can information also be obtained on problem solving and self-correction?

A final caveat on the dimension of metacognition for students with significant cognitive disabilities rests not so much on its importance, but on how we teach and measure it. "Thinking about thinking" is more than checking off with a "smiley face" on a task evaluation sheet whether one has done a good job, but rather must be demonstrated in applying learning mastered in one context to solving a different but related problem, and *then* evaluating whether one has truly solved that new problem! In our efforts to insure that everything we teach students with significant cognitive disabilities, including metacognition, is reduced to the smallest and most concrete steps or behaviors, we may, in fact, have *decreased* the likelihood of students developing more sophisticated, higher-order rules about learning itself. We run the danger of "mechanizing" skills that are anything but rote, and in trivializing that which makes metacognition so important for successful learning for all students.

<u>Questions for Alternate Assessment:</u> *Are tasks used to understand how students are "thinking about thinking"? Are students given problems to solve and opportunities to self-evaluate and self-correct? Are they given resources to work through a novel task with self-instruction? Do we select assessment items that sample the range of cognitive demands, including higher order thinking? Do we select tasks that challenge students to think about what they have learned in new ways, or do we sample such a narrow range of behaviors in the context of metacognition that we trivialize the very construct we hope to teach and measure?*

Development and Learning

Pellegrino et al. make a distinction between the concepts of development and learning. According to these authors, "some types of knowledge are universally acquired in the course of normal development, while other types are only learned with the intervention of deliberate teaching" (p. 80). Among the types of knowledge that Pellegrino et al. rate as part of development are learning to walk, language, and a basic sense of numbers and causality. Yet, for students with significant disabilities, these more developmental forms of learning are often *not* acquired incidentally (Heward, 2006), but rather require very intentional and focused instruction. Sometimes, explicit instruction is required on basic tasks because students with significant cognitive disabilities also have higher incidences of sensory or physical disabilities than students with less severe disabilities. Such attendant sensory or physical disabilities result in fewer opportunities for imitative or incidental learning, or increased difficulties in performing skills with high motoric strength or coordination demands. At other times, explicit instruction is required because the student does not assimilate the cognitive demands of the task without such instruction.

A larger question is whether these more basic skills, such as personal care and physical mobility, should be a focus of large-scale educational assessments for these students. The U.S. Department of Education specifies that alternate assessments for students with significant cognitive disabilities be aligned with grade level content standards. This does not preclude using the IEP to target additional functional and therapy goals that may represent critical skills for individual students. The context for learning, and for assessment, may thus be broader for the IEP than for the alternate assessment, which will necessarily be targeted towards academic content.

Question for Assessment: *Does the alternate assessment focus on academic learning linked to grade level content for all learners, as opposed to sampling more basic functional life skills?*

Practice and Feedback

Pellegrino et al. consider two elements of learning for all students that have particular implications for learners with significant disabilities. These are the *power law of practice* and *knowledge of results*. We will consider each of these. First, Pellegrino et al. note that with "each repetition of a cognitive skill - as in accessing a concept in long-term memory from a printed word, retrieving an addition fact, or applying a schema for solving differential equations - some additional knowledge strengthening occurs that produces (the) continual small improvements" (p. 85). For students with significant cognitive disabilities, the challenge often is in providing sufficient opportunities for active responses so that students have adequate practice to first acquire and then develop fluency in critical skills (Heward, 2006; Snell & Brown, 2005). For these students, the issue is not slowing down the pace of instruction, but rather increasing the rate of learning trials within an instructional lesson. Formative examples of assessment for these students, such as continuous assessment of daily performance, should reflect this essential need for adequate instructional opportunities on targeted skills.

The second major law of learning – knowledge of results – is also important for all learners. Pellegrino et al. note that "individuals acquire a skill much more rapidly if they receive feedback about the correctness of what they have done" (p. 84). For students with disabilities, positive and specific, corrective feedback is especially essential (Konold, Miller, & Konold, 2004). Positive reinforcement for correct responses is critical for establishing a skill in a student's repertoire, especially in the initial stage of student learning, and systematic and immediate correction of student errors is essential to prevent students from learning erroneous information or incomplete skills (Snell & Brown, 2005; Westling & Fox, 2004). In contrast, the type of feedback Pellegrino et al. describe assists the learner's development of metacognition, rather than simply promoting accurate responding. A parallel used with students with significant cognitive disabilities is the use of instructive feedback (Werts, Wolery, Holcomb, & Gast, 1995.) With instructive feedback, rather than simply giving feedback on the accuracy of the response (e.g., "Good, you selected a dollar"), additional information is provided about the task to help the student make connections (e.g., "You could also use four quarters.")

Adequate, active practice and accurate, immediate feedback are both hallmarks of effective instruction for students with significant disabilities. Assessment for these students should also provide both opportunities for skill practice and timely feedback on the accuracy of the assessed skills. While large-scale assessments are typically "summative" assessments, for students with significant cognitive disabilities the value of these assessments is minimized without the availability of timely feedback; we would suggest that this feedback should be built into the assessment tasks themselves.

<u>Question for Alternate Assessment.</u> *Does the assessment provide the opportunity for students to practice with feedback to ensure they fully understand the expectations of the task (e.g., practice or "warm up" tasks) before they take part in the assessment? Is student feedback provided as a part of the assessment process itself, and does that feedback enable students to build additional connections to what they know?*

Transfer of Knowledge

Pellegrino et al. recognize that a "critical aspect of expertise is the ability to extend the knowledge and skills one has developed beyond the limited contexts in which they were acquired" (p. 87). Indeed for students with significant disabilities, this problem of transfer or generalization of skills to new settings and situations is a critical dimension of instruction (Westling & Fox, 2004). Authorities in the field have referred to the concept of a “zero degree of inference” (Brown, Nietupski, & Hamre-Nietupski, 1976) in teaching students with significant cognitive disabilities – we cannot infer that a student can apply a newly learned skill in a new situation or setting unless we specifically test whether or not the student can perform that skill in the new context. It is for this reason that practitioners have developed specific strategies for systematically teaching skill generalization, including general case programming (Sprague & Horner, 1984) and naturalistic teaching strategies (Kaiser, 2000). These strategies involve the presentation of multiple exemplars or representations of a skill or concept, with the purpose of insuring that the student can then apply that skill or concept to a novel situation. It is not surprising that nearly half of all states (43%) responding to a national survey by Browder et al. (2005) indicated that they included a measure of student skill generalization in their alternate assessments for students with significant cognitive disabilities. What is less certain is whether these assessments *only* address generalization across materials, contexts, and people or also address generalization of an academic concept. For example, a student might be able to select the numeral ‘3’ in different contexts or materials, but not comprehend that it represents a quantity of three when that numeral is applied to different real-life problems. What is also less certain is whether transfer or generalization is considered in ways that measure a fundamental understanding of the underlying concept, such as the ability to recognize *how* and *when* to apply numerical quantities to solve everyday problems, or whether we choose to restrict our “measurement” of transfer to a simple listing of the different settings in which a student can perform a targeted skill (e.g., can the student count with one-to-one correspondence in the classroom, gym, and cafeteria).

Questions for Alternate Assessment: *To what extent does this assessment expect the student to show transfer of acquired skills? Are there some opportunities for near transfer (same, similar materials used to learn the response)? Is information obtained on the extent to which the student can make the same or similar responses in other contexts or with other materials? Is consideration also given to the level of conceptual transfer, that is, a fundamental understanding of the underlying concept?*

The Role of Social Context

While we have discussed the importance of a community of learners and practice within the Situative Perspective, a few additional comments are warranted here. Pellegrino et al. cite a study by Hull, Jury, Ziv, & Schultz (1994) in which workers in an electronic assembly plant were responsible for evaluating their own performance. Pellegrino et al. report that “although team members had varying fluency in English, the researchers observed that all members actively participated in the evaluation and representation processes, and used texts and graphs to assess and represent their accomplishments” (p. 89). This finding is similar to the examples provided by Kleinert, Denham et al. (2001) and Kleinert & Kearns (2004) of how even students with severe cognitive disabilities can represent, graph, and evaluate their performance, and participate in a community of practice. Pellegrino et al. further note that “studies of the social context of learning show that in a responsive social setting, learners can adopt the criteria for competence they see in others and then use this information to judge and perfect the adequacy of their own performance” (p. 89). Clearly, this point needs to be emphasized for learners with significant cognitive disabilities, for whom the power of modeling in supportive, integrative settings provides a rich source for both motivation and improved results. For example, Ryndak, Morrison, and Sommerstein (1999) have provided a case study illustration of how a student's literacy skills improved with the opportunity to learn in a general education setting.

From the consideration of social contexts, we can draw several conclusions for students with significant disabilities. First, as Pellegrino et al. have noted, "reading, writing, quantitative reasoning, and other cognitive abilities are strongly integrated in most environments" (p. 89). For students with significant disabilities, instruction should focus on how to integrate these skills into daily instruction, and how to measure them in the context of authentic life tasks. Secondly, instruction for students with significant disabilities needs to take advantage of the powerful impact of modeling within integrated environments. Given the importance of peer mediated performance in the context of daily life tasks, alternate assessments should also reflect the extent to which students with significant disabilities can participate in a community of practice, and adjust their performance based upon the models and feedback provided by their peers. Thirdly, closely related to the concept of social contexts is that of individualized supports. Vygotsky's perspective that the "higher" psychological functions could be attained by individuals with intellectual disabilities, and that such development was predicated upon educational, social, and communicative supports, suggests that we should insure that both learning and assessment are mediated through these supports, including assistive technology, that enable students to show what they have learned. Vygotsky introduced the concept of the Zone of Proximal Development (see Gindis, 1999) to illustrate the importance of emerging concepts that students learn through the process of scaffolding, or carefully planned individualized supports through the mediation of peers and adults.

Questions for Alternate Assessment: *Is the student given the opportunity to perform the tasks with typical peers serving as models? Does the student self- evaluate and self-correct in this social context? Is the student provided with individualized supports, including assistive and instructional technology, that truly enable the student to demonstrate what he or she has learned? Finally, does the alternate assessment provide both grade level content tasks and a process for scaffolding that allows for inferences about the student's Zone of Proximal Development (e.g., emerging skills) as a measure of both problem-solving and concept development?*

Methods of Observation and Inference: Microgenetic Analysis

Pellegrino et al. end their discussion of the advances in the science of learning with "a discussion of some of the methods of observation and inference that underlie our current thinking of cognition" (p. 97). One of these methods, microgenetic analysis, may have special significance for students with significant cognitive disabilities. According to Pellegrino et al., "the properties of microgenetic analysis include: (1) observations that span as much as possible (of) the period during which rapid change in competence occurs; (2) a density of observations within this period that is high relative to the rate of change in the phenomenon; and (3) observations that are examined on an intensive, trial-by-trial basis, with the process of understanding the process of change in detail" (p. 100).

This description will be immediately recognized by practitioners in the field of severe disabilities as elements of the principles of systematic instruction and continuous assessment of student performance (see Snell & Brown, 2005; Westling & Fox, 2004; Wolery, Ault, & Doyle, 1992) that characterize effective instructional programs for these learners. Indeed, the trial-by-trial analysis referred to Pellegrino et al. is remarkably similar to the importance of data-based decision-rules to enhance instructional effectiveness (Browder, 2001; Farlow & Snell, 1994). Systematic instruction, continuous assessment, and the use of data-based decision making have implications for alternate assessments as well. While the literature on microgenetic analysis describes intensive, often trial-by-trail measures within concentrated time periods of maximum behavioral change (Lemke, 2000), we suggest that the principles for rigorously examining increments of change inherent in microgenetic analysis can be extrapolated to broader scales of time for students with significant cognitive disabilities. For example, the use of these principles can result in more effective student learning over "macro-periods"; certainly within many states' alternate assessments, growth models (or how much new knowledge or skills a student has gained) play an important part in both the observation and interpretation parts of the assessment triangle (Browder, 2005). Secondly, providing training to teachers in these principles can result in enhanced state alternate assessment scores for their students (Browder, Karvonen, Davis, Fallin, & Courtade-Little. 2005). For example, Browder et al. found that teachers who received a training package that included a clear definition of measurable instructional objectives and the systematic application of data-based decision rules had students who scored higher on both their state alternate assessment scores and in the overall rate of growth on their Individualized Education Program objectives.

<u>Questions for Alternate Assessment:</u> *Do students receive ongoing systematic instruction that promotes learning of state standards, and is evidence of the effectiveness of this instruction presented within alternate assessments? Are teachers trained in the use of progress monitoring for this learning, so that evidence of data-based decisions is presented within alternate assessments?*

Future Directions: Implications for Instruction and Assessment

In this white paper, we have attempted to explicate the principles of thinking and learning discussed by Pellegrino et al. as a part of the cognition vertex of the assessment triangle for *all* students. We have attempted to discuss the particular relevance of these principles for the assessment of students with significant cognitive disabilities, especially in the context of large-scale alternate assessments. For students with significant disabilities, we have seen these distinctions not so much as fundamental differences in how these students learn and think, but as matters of degree in how they process information that result in a need for more intensive supports and specialized instructional strategies. For students to accurately portray what they know and can do, these supports also need to be present within the assessment process itself (e.g., memory supports or pictorial cues to offset potential limitations in short-term memory that can obscure learned concepts in long-term memory). In this final section, we attempt to provide some future considerations for large-scale alternate assessments for students with significant disabilities, based upon our explication of the cognition vertex. First, we would like to reiterate that the purpose of assessment for students with significant disabilities, as it should be for all students, is to not only show what students know and can do, but also to actually enhance instruction and student outcomes (Kleinert & Thurlow, 2001; see also the Commission on Instructionally Supportive Assessment, 2001). For this to occur, it would seem that we need to address at least the following guidelines in both our instructional and assessment practices for students with significant cognitive disabilities:

1) *Some alternate assessment tasks should be familiar.* Students with significant disabilities are most likely to demonstrate new knowledge in assessments that

require the least amount of transfer and are situated in familiar, meaningful contexts. For example, tasks presented with the same materials and context used for daily instruction are most likely to reveal the student's typical performance. Students also need ongoing instruction with progress monitoring that promotes learning on state standards with tasks that are similar to those used in alternate assessments.

2) *Some alternate assessment tasks should be novel and challenging.* In contrast, alternate assessments should also be developed to provide the student with opportunities to demonstrate knowledge beyond current expectations. Consideration should also be given to how students are able to demonstrate acquisition of different types of information if given supports or strategies to compensate for potential deficits in short-term memory. Cognitive support strategies should be built into the directions and format of the assessment itself to insure that the assessment truly measures what it was intended to do.

3) *Some alternate assessment tasks should be designed to assess transfer.* While familiar tasks are most likely to yield successful demonstrations of knowledge for students with significant cognitive disabilities, it is important to determine the extent to which the student can transfer this learning. Instruction that has promoted student applications across novel activities, materials, and contexts can help students demonstrate broader knowledge. Assessments should also be developed to gain information on how well students respond to novel tasks to show understanding of academic concepts. For example, a student may be able to read a sight word or print a numeral, and even do so with "generalization" across

materials or settings, but have no concept of what the word or number means.

4) *Some alternate assessment tasks should be developed to understand how students think about the task.* Another aspect of the student's knowledge and competence is metacognition. Both instruction and assessment should make students' problem-solving processes explicit to themselves and to others, and students should have ample opportunities both within instruction and assessment for the application of metacognitive strategies, including self-correction, self-evaluation, and self-instruction. For example, it may be helpful to know if students can make a correct response if given access to additional information.

5) *Some alternate assessment tasks should be developed to determine how students respond with social and other supports.* An important aspect of the student's knowledge is how the student responds to the social context for learning. Within both instruction and assessment practices for students with significant disabilities, opportunities should be provided for students to work as a community of practice, and assessment observations and scoring interpretations (or rubrics) should reflect how well students with significant disabilities function in interactive, problem-solving tasks with their typical age-peers. This really involves two issues: first, how students with significant cognitive disabilities learn to become members of a community practice (e.g., the community of practice of mathematicians), including learning to use the tools and technology of that practice (Lave & Wenger, 1991). For students with significant disabilities, these tools and technology can include appropriate assistive technology (see Denham & Lahm, 2001). The second element of this dimension is how students with significant

> disabilities function as a part of a group of their peers in problem-solving novel problems within that discipline. Both types of support – social and technological – are essential elements of a rigorous alternate assessment process.

Limitations

There are important limitations to the approach we have taken in explicating the cognition vertex of the “assessment triangle” for students with significant cognitive disabilities. First we have described these cognitive elements in a *domain general* way, focusing on those areas of knowledge representation that might be particularly problematic for students with significant cognitive disabilities, irrespective of the academic core content area. To fully appreciate the power of these elements in understanding how students represent knowledge, and in constructing valid assessments based on those knowledge representations, it is important to consider how these concepts are applied to *domain specific* knowledge representation for students with significant disabilities, especially in such areas as reading and math. Yet as a field, we simply do not have adequate theories of how students with significant disabilities acquire domain specific academic knowledge. There is a critical need to explore the application of these elements to domain-specific or subject area knowledge, if we are to construct coherent alternate assessments linked to grade level content standards.

Secondly, this paper has described how these elements of cognition, as they have been identified for all students, may pose particular challenges for students with significant cognitive disabilities. Yet this is a tremendously heterogeneous population, and any attempt to describe a model or models of cognition for such a population must recognize from the onset that we can at best describe *patterns* of learning characteristics for students with significant cognitive disabilities. There are grave dangers in assuming that these patterns hold true for all students within this population. Clearly, an examination of these patterns is only useful if it improves our ability to make valid inferences about what these students have learned in the context of the academic standards we value for all children.

Conclusion

This paper has addressed the first vertex of the assessment triangle, that of cognition, to examine the unique characteristics of students with significant disabilities in representing what they know and in developing domain competence. We first discussed the primary elements of knowledge representation and domain competence identified by Pellegrino et al. for *all* students, and then for each of these elements, based upon our current knowledge of instruction and learning in the field of severe disabilities, discussed how these elements have special ramifications or considerations for students with significant cognitive disabilities. Finally, we have presented, for each of these elements, what we believe to be the essential questions if alternate assessments are to be truly aligned to this first vertex of the assessment triangle.

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