Alternate Assessment Design–Mathematics

Technical Report 2:

Current State of Mathematics Assessment in Alternate Assessment

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SRI International
Katherine Nagle
Renée Cameto
Geneva Haertel
Angela Haydel DeBarger
Kathryn Morrison

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Introduction and Background

It is now over ten years ago that the Individuals with Disabilities Education Act Amendments of 1997 ("IDEA 97," 1997) required states and districts to develop alternate assessments for those students with disabilities who could not participate in their general education assessments (Kleinert, Quenemoen, & Thurlow, 2010). Until this reauthorization many students with significant cognitive disabilities and sometimes all students with disabilities were routinely excluded from state accountability systems as a matter of policy (Kohl, McLaughlin, & Nagle, 2006; Rigney, 2009; Thompson & Thurlow, 2003). Most students with disabilities participated in general assessments with or without accommodations and alternate assessments were seen as a way to include students with disabilities who could not do so participate in large scale assessment systems. Interestingly in light of subsequent policy developments IDEA 97 did not define the population for whom an alternate assessment could be designed, nevertheless most states restricted their use to a small percentage of their students with IEPs (Kearns, Towles-Reeves, Kleinert, & Kleinert, 2009). Generally the cognitive functioning of these students was thought to be below that needed for instruction and assessment using the content and achievement standards and/or formats expected of students who received the general instructional program (Kleinert, Quenemoen, et al., 2010; Quenemoen, 2008).

IDEA 97 gave states until July 1 2000 to develop and begin conducting alternate assessments. This was no small task given that at the time there were few models on which to base these new assessments and subsequently each state charted its own course. The result was a medley of alternate assessments using widely different formats that attempted to measure a mix of functional academics and life skills thought then to be appropriate for students with significant cognitive disabilities (Quenemoen, 2008; Tindal, 2009). These early alternate assessments varied both from each other and more decidedly from the general education assessments typically used in large scale systems (Kearns, 2010). Tindal points out that given the nature and scope of the problems these students faced in accessing large scale assessments portfolios were identified as a viable strategy. Portfolios allowed the teacher leeway in how and when to administer the assessments and also allowed for greater flexibility in how the student interacted with the assessment items and tasks. However the flexibility and teacher control of the assessment process common in the early alternate assessments based on alternate achievement standards came into conflict with the need to establish reliability—a key requirement if scores were to be included in accountability systems.

The 2001 reauthorization of the Elementary and Secondary Education Act (ESEA) and its posse of accompanying regulations and the Individuals With Disabilities Education Improvement Act of 2004 spiced up the world of alternate assessments considerably. ESEA required states to develop alternate assessments separately in reading/ELA, mathematics, and science; specified that they were for students with significant cognitive disabilities, and allowed states to measure the performance of these students on alternate achievement standards (Rigney, 2009). ESEA reinforced IDEA 97 and required involvement in the general curriculum by stating that all assessment options, even if they differed in respect to their academic achievement standards, were to be aligned to grade level content standards. Finally, ESEA required that alternate assessments, like their general assessment counterparts be “valid and reliable for the purposes for

which the assessment system is used and be consistent with relevant, nationally recognized professional and technical standards." ("Individuals with Disabilities Education Act," 2007) and established standards and assessment peer review panels to confirm this for each state.

The Standards and Assessments Peer Review process, used by USDE to determine state compliance began under the 1994 reauthorization of ESEA. It was an ongoing process that states went through whenever they developed new assessments (Rigney, 2009). The reviewers were state assessment directors, researchers, and others selected for their expertise in assessments. According to the Government Accountability Office (U.S. Government Accountability Office, 2009), the peer review process included multiple steps. In the first step of the peer review process, a group of at least three experts known as peer reviewers examined the boxes of evidence submitted by the state to demonstrate compliance with statutory requirements, identified areas for which additional state evidence is needed, and summarized their comments. After the peer reviewers completed their review, their notes and the states evidence was reviewed internally by an official assigned to the state and, using the same guidelines as the peer reviewers, and a recommendation on whether the state met, partially met, or did not meet each critical element and on whether the state's assessment system should be approved was made. A group of Education officials from relevant offices—including a representative from the Office of the Assistant Secretary of Elementary and Secondary Education—met as a panel to discuss the findings. The panel made a recommendation about whether to approve the state and the Assistant Secretary made the final approval decision. A state's system of standards and assessments received one of the following categories of approval: Full Approval, Full Approval with Recommendations, Approval Expected, Approval Pending, or Non-Approval (U.S. Department of Education, 2009). Afterwards a letter was sent to the state notifying them of the decision and if the state was not approved, identified why. States also received a copy of the peer reviewers' written comments as a technical assistance tool to support improvement.

Challenges to Developing Alternate Assessments Based on Alternate Achievement Standards

For a field described recently by Towles-Reeves, Kearns, Kleinert, and Kleinert (2009) as "still in its infancy" the goal of developing technically sound alternate assessments and achieving USDE approval proved to be illusive for many states (Kettler et al., 2010). It became readily apparent during the initial peer review panels that many states' alternate assessments were unable to satisfy the requirements and the U.S. Department of Education extended the 2005-06 deadline to permit states to revise or rebuild their alternate assessments based on alternate achievement standards (Rigney, 2009). In a survey conducted by the GAO (2009) nearly two thirds of the states reported that demonstrating the validity and reliability of alternate assessments based on alternate achievement standards was either moderately or very difficult. In contrast, few states reported that demonstrating either the validity or reliability of general assessments was moderately or very difficult. Furthermore, although most states met peer review expectations for validity and reliability of their general assessments, as of July 15, 2009, alternate assessments based on alternate achievement standards were a factor preventing full approval in 11 out of 12 states (GAO). Moreover, in the four states where alternate assessments based on alternate achievement standards were the only issues preventing full approval, technical quality or alignment were at the heart of the Peer's concerns. Three specific challenges to the development of valid and reliable alternate assessments based on alternate achievement standards were identified: (1) How to account for the characteristics of the students to be tested,

(2) a lack of research on how to develop valid and reliable alternate assessments, and (3) how to demonstrate alignment between assessment, academic content, and instruction, (Cameto et al., 2009; Kearns, 2010; Kettler et al., 2010; Towles-Reeves, Kleinert, & Muhomba, 2009; U.S. Government Accountability Office, 2009). These three issues provide the framework for this Technical Report and are discussed in the following three sections.

Accounting for the Characteristics of the Tested Population

Ensuring the validity and reliability of alternate assessments has been challenging because of the highly diverse population of students eligible to be assessed on an alternate assessments based on alternate achievement standards (Browder, Flowers, et al., 2004; Browder, Wakeman, & Flowers, 2009; Cameto et al., 2009; Towles-Reeves, Kearns, et al., 2009; U.S. Government Accountability Office, 2009). Students with significant cognitive disabilities may come from any of the 13 regulatory categories included in the IDEA. Cameto and colleagues (2010), similar to findings reported by Kearns et al. (2009), found that students primarily clustered into three disability categories. Teachers in three states were asked to indicate the primary disability category of a student with significant cognitive disabilities taking the alternate assessments based on alternate achievement standards in their classroom or on their caseload selected at random (known as the "target student"). Forty-four percent of teachers indicated the primary disability of the student was mental retardation, 19% indicated the student's disability was autism, and 18% indicated that the students primary disability category was multiple disabilities. An additional finding was that a majority of these students have multiple disabling conditions with 69% of teachers indicating that their target student had at least one other disability (Cameto, Bergland, et al., 2010). Of these teachers, 25% indicated that their target student had three or more additional disabilities and 54% indicated that the additional disability was speech/language impairment. Most teachers responded that their target student's visual, auditory, and motor functioning were normal (90%, 93%, and 79% respectively) and that their target student attended school over 75% of the time.

Students with significant cognitive disabilities also demonstrated a range of learning characteristics and response modalities that needed to be considered in developing alternate assessments based on alternate achievement standards (Almond & Bechard, 2005; Kearns et al., 2009; Kleinert, Kearns, & Kleinert, 2010; Towles-Reeves, Kearns, et al., 2009). For example, for some students their only means of communication was eye movements and blinking, whereas others had serious and complex medical conditions that interfered with their learning and performance (U.S. Government Accountability Office, 2009). Towles-Reeves, Kearns and colleagues (2009) used the Learner Characteristics Inventory to (LCI) identify three distinctive sub groups of students with significant cognitive disabilities based on their levels of communication (see Figure 1).

Figure 1. Communication Levels of Students with Significant Cognitive Disabilities

Level 1: Pre-Symbolic: Has not yet acquired the skills to discriminate between pictures or other symbols (and does not use symbols to communicate). May or not use objects to communicate. May or not use idiosyncratic gestures, sounds/vocalizations, and movements/touch to communicate with others. A direct and immediate relationship between a routine activity and the student's response may or may not be apparent. The student may have the capacity to sort very different objects, may be trial and error. Mouthing and manipulation leads to knowledge of how objects are used. May combine objects (e.g., place one block on another).

Level 2: Early symbolic: May use some symbols to communicate (e.g., pictures, logos, objects). Beginning to acquire symbols as part of a communication system. May have limited emerging functional academic skills. Representations probably need to be related to the student's immediate environment and needs.

Level 3: Symbolic: Communicates with symbols (e.g., pictures) or words (e.g., spoken words, assistive technology, ASL, home signs). May have emerging or basic functional academic skills. Emerging writing or graphic representation for the purpose of conveying meaning through writing, drawing, or computer keying.

Using the same instrument as Towles-Reeves and colleagues and consistent with their findings and earlier findings (Almond & Bechard, 2005), Cameto and colleagues (2010) reported that 68% of teachers indicated that their target student used symbolic language to communicate including verbal or written words, signs, Braille, or augmentative systems to conduct a range of communicative roles and a further 20% of teachers reported that their student used intentional, though not symbolic, communication. A much smaller percentage of teachers (12%) reported that their students had no clear communication system. In the area of receptive communication Cameto, Bergland, et al. (2010) again reported findings consistent with earlier ones indicating that students with significant cognitive disabilities fell into two primary groups: those who independently followed one or two step directions presented through words without any additional cues (46% of teachers so reporting) and those that required additional cues to follow 1 to 2 step directions (42% of teachers). A smaller percentage of teachers indicated that their target students alerted to sensory input but required physical assistance to follow simple directions (9%) or had uncertain responses to sensory stimuli (3%).

Regarding skills in mathematics 47% of teachers reported that their target student performed computational procedures with or without a calculator, 18% of teachers described their target student as performing at a more basic level of counting with one to one correspondence, while a smaller percentage of teachers reported that their target student was able to count by rote to 5. Finally, 23% of teachers reported that their target student had no observable awareness or use of numbers.

Findings such as those described above will continue to have considerable bearing on the future development of alternate assessments in mathematics. Although a majority of students with significant disabilities do have functional mathematics skills and at a minimum can complete bare number computational problems research has repeatedly identified a small percentage of students who have insufficient communicative resources and tools and lack even the most basic understanding of numbers (Kearns et al., 2009; Kleinert, Kearns, et al., 2010). Few researchers harbor any illusions that developing alternate assessments based on alternate achievement standards that both accurately capture the academic skills that presymbolic students

have acquired and are linked to grade level achievement are not some of the field's most pressing conundrums. Academic content and its subsequent assessment by their very nature reside in a symbolic world, one that is difficult to for students who are functioning at a presymbolic or awareness level to enter (Kleinert, Kearns, et al., 2010). Schafer (2005) argues that the breadth of learning domain coverage in enter must be sufficient to place all alternate-assessment eligible students somewhere among the eligible content and process domain that may appear on the assessments. Until this is empirically demonstrated a concern lingers that alternate assessments may not cover the full range of the learning domain as it must be realized for all students.

The solutions are unlikely to come from a single source and will require the collaboration of individuals from several fields including psychometricians, special educators, content experts, and experts and practitioners in UDL and assistive and adaptive technology. For example, the newly designed guidelines on UDL for alternate assessments from CAST could be used to develop accessible assessment tasks (CAST, 2008). These guidelines address multiple means of representation, expression, and action and engagement in performance tasks (see Table 1).

Table 1. Universal Design for Learning Principles and Guidelines

UDL Principles	Guidelines
Principle I. Provide Multiple Means of Representation	1: Provide options for perception 2: Provide options for language and symbols 3: Provide options for comprehension
Principle II. Provide Multiple Means of Action and Expression	4: Provide options for physical action 5: Provide options for expressive skills and fluency 6: Provide options for executive functions
Principle III. Provide Multiple Means of Engagement	7: Provide options for recruiting interest 8: Provide options for sustaining effort and persistence 9: Provide options for self-regulation

Although UDL has been used primarily to differentiate instruction (Van Garderen & Whittaker, 2006) its principles are beginning to be incorporated into testing and especially testing via the use of technology (Ketterlin-Geller, Yovanoff, & Tindal, 2007). Salend (2009, p. 42) addresses how nine UDL principles (Figure 2) relate to testing and presents examples of how to implement the principles of universal design via technology-based testing. Salend argues that integrating UDL principles into technology-based testing can potentially allow for the development and administration of assessments that are accessible to students with a wide range of ability levels.

Figure 2. UDL Principles

Principle 1: Equitable Use
Principle 2: Flexible Use
Principle 3: Simple and Intuitive
Principle 4: Perceptible Information
Principle 5: Tolerance for Error
Principle 6: Low Physical Effort
Principle 7: Size and Space Approach and Use
Principle 8: Community of Learners
Principle 9: Inclusive Environment

Experts from a variety of disciplines frequently work together to develop alternate assessments based on alternate achievement standards, in the next section we discuss how a lack of research and existing knowledge created obstacles to development of technically adequate assessments.

Limited Research on Developing Technically Adequate Alternate Assessments

According to state officials and assessment experts the field lacked the necessary knowledge and expertise to develop valid and reliable alternate assessments (Tindal, 2009; Towles-Reeves, Kearns, et al., 2009; U.S. Government Accountability Office, 2009). Work by Elliott, et al. (2007) and Kettler, et al. (2010) has begun to fill in the gaps in the fields knowledge base, but considerable work remains to be done in this area. Traditionally, large-scale assessments have relied on large sample sizes and quantitative data analyses to form their validity argument—that is, that the tests measured what they purported to measure and supported the types of decisions they were intended to support. Assessment developers did not have to consider deeply the ways in which content, design, or task characteristics influence the ability of students to perform, especially students at the margins of the achievement distribution until required to develop and defend an AA-AAS. Cameto and colleagues (2009) found that states struggled initially to present the evidence at the Department of Education's Peer Review panels that satisfactorily demonstrated that their alternate assessments were consistent with the relevant, nationally recognized professional and technical standards against which large scale assessments were typically measured. Unsurprisingly, the technical requirements in some areas were more difficult to address than others, generally because when states had first developed their alternate assessments based on alternate assessments they were developed by special education experts and not by assessment and content area experts. Areas related to validity that were problematic included documentation of scoring and reporting structures consistent with the subdomain structures of the state content standards; documentation of test and item scores and their relationship to internal and external variables; documentation of intended and unintended consequences; and documentation of grade-level equating (Cameto et al., 2009). However, findings from Cameto and colleagues (2009) indicated that states had an easier time documenting the validity of their alternate assessments in terms of construct relevance. Areas related to reliability that were problematic included documentation of the reliability of the alternate assessment in terms of variability across groups; in terms of internal consistency of item responses; and in reporting standard errors of measurement. However, states had an easier time

documenting the reliability of their alternate assessments in terms of interrater consistency in scoring.

To help states develop and implement alternate assessments that are psychometrically appropriate USDE provided both technical and financial assistance to states (Rigney, 2009; U.S. Government Accountability Office, 2009). For example, the USDE provided technical assistance to states in a variety of ways, including written guidance, user guides, contact with staff, and assistance from its Comprehensive Centers and Clearinghouses. Relevant program offices within USDE provided additional assistance as needed. For example, the Office of Special Education Programs provided assistance to states in developing alternate assessments for students with disabilities and funded the National Alternate Assessment Center. In addition, the office of Elementary and Secondary Education awarded competitive Enhanced Assessment Grants to state consortia, including this one, to work on a variety of assessment topics such as developing valid and reliable assessments for students with disabilities. Projects are required to share the outcomes of their projects with other states at national conferences but until quite recently, since these are multiyear projects, the results of many of them were not available. One promising outcome of these investments is the development of a validity-based approach for evaluating the technical quality of alternate assessments (Marion & Pellegrino, 2006). This model places consequential validity as the central validity benchmark for this type of assessment while also addressing other essential elements of technical quality related to AA-AAS.

Although much valuable research has been conducted and progress has certainly been made in the area of technical adequacy of alternate assessments (Kettler et al., 2010; Towles-Reeves, Kearns, et al., 2009) misconceptions about the evidence for the reliability and validity of alternate assessments and the inferences based on AA-AAS results remain (Chudowsky, Chudowsky, & Kober, 2009; Quenemoen, Kearns, Quenemoen, Flowers, & Kleinert, 2010). Clearly, much remains to be learned.

In the next section we describe why demonstrating alignment between alternate assessments and state academic content standards and classroom instruction has been problematic for many states and discuss methods of demonstrating alignment of alternate assessments based on alternate achievement standards to state content and classroom instruction.

Demonstrating Alignment Between Alternate Assessments, Academic Content Standards, and Classroom Instruction

Federal legislation required that alternate assessments based on alternate achievement standards be aligned to academic content standards, promote access to the general education curriculum, and reflect the highest achievement possible ("Title I---Improving the Academic Achievement of the Disadvantaged, Final rule," Dec. 9, 2003). In this section we discuss the challenges to demonstrating alignment between alternate assessments and academic content standards and alignment between academic content standards and classroom instruction. Finally we discuss the various methods used to demonstrate alignment.

Challenges to Demonstrating Alignment Between Assessments and Academic Content Standards

Alternate assessments based on alternate achievement standards were designed to assess grade-level academic content, but with less depth, breadth, and complexity of assessments based on grade level achievement standards. The emphasis on academic content was problematic and results from early alignment studies indicated that many states had initially created alternate assessments based on functional curricular and life skills thought to be important for them (Lehr & Thurlow, 2003; Roach, Elliott, & Webb, 2005) rather than academic content standards.

To differing degrees many states therefore had to transition from functional curricula to academic curricula based on state content standards and then align their alternate assessments. To do this many states extended, prioritized or clarified their state grade level content standards to describe how students with significant cognitive disabilities accessed the academic content standards (Cameto et al., 2009; Flowers, Wakeman, & Browder, 2009; Wakeman, Browder, Jimenez, & Mims, 2010). Cameto and colleagues (2009) found that 88% of states reported they had extended or clarified content standards for students with significant cognitive disabilities. States that extended their content standards needed to develop a rationale for their approach to extending, prioritizing or clarifying their content standards (Flowers et al., 2009). Figure 3 provides an example from Idaho at 4th grade for mathematics. It shows a general content standard, a goal, and objective and the corresponding extended content standard, goal and objective for students with significant cognitive disabilities.

Figure 3. General Content Standard and Extended Content Standard: Idaho Grade 4 Mathematics

Standard 1: Number and Operation: *Students in Grade 4 read, write, compare, and order whole numbers to 1,000,000 and commonly used fractions with pictorial representations*. Students identify and apply place value in whole numbers. Students add and subtract whole numbers, fractions with like denominators that do not require simplification, and decimals using money. Students recall multiplication facts through ten, multiply up to two-digit by two-digit whole numbers, and divide whole numbers by one-digit divisors. Students estimate to predict computation results and to evaluate the reasonableness of the answer.

Goal: Understand and use numbers.

Objective: 4.M.1.1.1 Read, write, compare, and order whole numbers to 100,000.

Extended Standard 1: *Students in Grade 4 read, write, compare, and order whole numbers and identify commonly used fractions with pictorial representations*. Students identify place value in whole numbers. With the use of a calculator, abacus, or manipulatives, students add and subtract whole numbers, simple, common fractions with like denominators, and common decimals using money. Students recognize multiplication through the addition of repeated sets of whole numbers, and division by separating sets into equal parts. Students estimate size of quantity to predict computation results and then determine reasonableness of the answer.

Goal: Understand and use numbers.

Objective: 4.M.1.1.1A

Communicate and demonstrate whole numbers in order up to 50, using a number line or chart when necessary.

States that developed content extensions needed to provide evidence demonstrating how the alternate assessment aligned with the extended content standards *and* how well the extended content standards aligned with the state's grade level content standards.

Challenges to demonstrating alignment between state content standards and classroom instruction

Following the lead of the *Standards* which emphasized the need for alignment between what was taught in the classroom and what was tested in the assessment ESEA required that alternate assessments based on alternate achievement standards promote access to the general education curriculum to afford students with significant cognitive disabilities the opportunity to learn the content and skills tested on the alternate assessment based on alternate achievement standards. There were several reasons why students with significant cognitive disabilities were not traditionally provided an opportunity to learn academic content. First, it was thought that this population could not learn academic content. Recent work has however demonstrated that students with significant cognitive disabilities can learn academic content albeit much more slowly than their peers without disabilities and most need systematic, consistent, and explicit instruction, including systematic prompting with an explicit fading procedure (Allor, Mathes, Roberts, Jones, & Champlin, 2010; Browder, Flowers, & Wakeman, 2008; Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006; Land, Pugalee, Denham, & Kleinert, 2010; Wiener, 2005). In a meta-analysis on teaching mathematics to students with significant cognitive disabilities researchers found that students with moderate and severe cognitive disabilities could learn specific target skills like computation, graphing, matching shapes, counting money, and could apply skills to real life context (Browder et al., 2009).

Second, there was some resistance on the part of the education profession to teaching academic content to students with significant cognitive disabilities, especially when balanced against the need to learn the functional and social skills thought to be essential for this population (Agran, Alper, & Wehmeyer, 2002; Flowers, Ahlgrim-Delzell, Browder, & Spooner, 2005; Quenemoen, 2008). The instructional programs provided to students with disabilities concentrated on the domains of functional curricula such as community, recreation, independent living, and self determination. In a functional curriculum any academics taught were practical and cross disciplinary in nature and consisted of recognizing sight words and using money in natural settings including school, home, and community. For example, instruction in mathematics focused on teaching mathematics within activities related to independent daily living such as grocery shopping, buying lunch, balancing a check book, or using a bus timetable (Browder, Spooner, et al., 2004; Browder, Spooner, Ahlgrim-Delzell, Harris, & Wakeman, 2008; Orelove & Sobsey, 1991). A typical activity based goal that included functional academics (both mathematics and reading) was: "When accompanied by her trainer Sheila will purchase one or two items at a grocery store, fast food restaurant, or school bookstore, three times per week using picture cards." (Orelove & Sobsey, 1991, p. 245). It is uncertain if teachers have become more receptive to teaching academic content. While over 90% of teachers strongly agreed or agreed that it was important that students with significant cognitive disabilities receive instruction in academic content, the same percentage reported that teaching academic standards versus other skill areas was a large or moderate challenge (Cameto, Bergland, et al., 2010). Furthermore, 94% of teachers indicated that meeting the instructional needs of individual students versus meeting state expectations for academic instruction was a large or moderate challenge.

There is evidence that the instructional programs of students with significant disabilities have begun to include academic content (Rigney, 2009). Cameto and colleagues (2010) asked teachers in three states to describe the frequency of instruction in mathematics received by a target student over a thirty day period. Teachers were asked to respond at the strand level: number sense and operations, algebra, geometry, measurement, and data. The percentage of teachers reporting instruction 3 or more times per week in specific mathematics strands ranged from 75% for number sense and operations to 19% for data. Ninety-two percent of teachers reported that the target student received instruction in number sense and operations at least one or two times a week; 57% of teachers said that the target student received instruction in algebra at least one or two times a week; 54% of teachers said that the target student received instruction in measurement at least one or two times a week; 46% of teachers said that the target student received instruction in geometry at least one or two times a week; and 45% of teachers said that the target student received instruction in data at least one or two times a week.

A final reason for the limited opportunity to learn academic content is insufficient training offered to teachers on how to teach state academic standards to students with significant disabilities (Flowers et al., 2005; Flowers et al., 2009; Wehman, 2001; Wehmeyer, Agran, & Hughes, 1998). The special education teacher is usually responsible for planning and providing instruction to students with significant cognitive disabilities so access to academic content is dependent on his or her skills and knowledge (Cameto, Bergland, et al., 2010). Cameto and colleagues (2010) found that although 77% of teachers reported that they had taught mathematics for 2 years or more few of the teachers (4%) surveyed for the National Study on Alternate Assessments had any formal qualifications (such as a teaching certificate or concentration/endorsement) in teaching mathematics.

The change to teaching academic content represents a major paradigm shift and teachers will have an ongoing need for guidance and support in curriculum planning, locating, adapting, or developing materials and teaching academic content to this population. Cameto and colleagues (2010) asked teachers how many hours during the last year they had spent engaged in professional development in instructional strategies in teaching mathematics. Thirty-six percent of teachers said they had received 1 to 5 hours of professional development in instructional strategies in mathematics and 31% reported they had received no professional development in this area over the past 12 months. Furthermore, 41% of teacher reported receiving between 1 and 5 hours in mathematics content standards during the last month and 35% reported that they had received no professional development in mathematics content standards during the past 12 months.

Methods of demonstrating alignment

The *Standards* warn, “Valid interpretation of the results in light of the standards entails assessment of the degree of fit between the test domain and contents and the descriptive statements of standards and goals.” (p. 140) Assessing this degree of fit generally involves mapping the content and skills targeted by the test items to the academic content standards and strands to check that no gaps or unevenness are present. This is usually achieved by conducting an alignment study (Browder et al., 2009). There are a number of methods to demonstrate alignment between large scale educational assessments and academic content standards, including the model developed by Norman Webb (1997), the Surveys of Enacted Curriculum (SEC) model (Porter, 2002), and the Achieve Model (Achieve, 2002). Of these three approaches

the most frequently used in K-12 was the Webb model (Karvonen, Wakeman, & Flowers, 2006; Tindal, 2009). However, these methods have had mixed results in demonstrating alignment between alternate assessments and academic content standards and while some researchers (Almond & Bechard, 2005; Flowers, Browder, & Ahlgrim-Delzell, 2006; Roach et al., 2005) have used approaches similar to Webb's others have developed new alignment approaches to demonstrate alignment of alternate assessments. One such new approach is the Links for Academic Learning (LAL) model, developed by researchers from the National Alternate Assessment Center (Browder et al., 2009; Flowers, Wakeman, Browder, & Karvonen, 2007; Flowers et al., 2009). The LAL model (Figure 4) has eight alignment criteria based in part on the work of Webb and Achieve, but also on best practices for students with significant cognitive disabilities and guidelines from the U.S. Department of Education (Flowers, 2009).

Figure 4. LAL Alignment Criteria

1. The content is academic and includes major domains/strands of the content area as reflected in state and national standards.
2. The content is referenced to the student's assigned grade level 9based on chronological age).
3. The focus of achievement maintains fidelity with the content of the original grade level standards and when possible with the specified performance.
4. The content differs from grade level in range, balance, and depth of knowledge, but matches high expectations set for students with significant cognitive disabilities.
5. There is some differentiation in content across grade levels or grade bands.
6. The expected achievement for students is for students to show learning of grade-referenced academic content.
7. The potential barriers to demonstrating what students know and can do are minimized in the assessment.
8. The instructional program promotes learning in the general curriculum.

According to its developers, the LAL not only addresses the relationship between the alternate assessment and content standards but also how state content standards are extended for students with significant disabilities, whether academic instruction has taken place, student characteristics, and professional development opportunities for teachers.

Future Directions for Alternate Assessments in Mathematics

The advent of the Common Core State Standards Initiative (CCSSI), a state-led effort coordinated by the National Governors Association Center for Best Practices (NGA Center) and the Council of Chief State School Officers (CCSSO), changes the situation somewhat depending on how policy develops henceforth. On June 2, 2010, the final K-12 standards in ELA and mathematics were released and the CCSSO reported that it had commitments from 41 of the 50 states to have the standards adopted as replacements for state standards by the end of the summer 2010. As of December 2010, 40 states and the District of Columbia had formally adopted the CCSSI and an additional 2 states had provisionally adopted them (Kober & Rentner-Stark, 2011).

Where students with significant disabilities sit in relation to the common standards would on its face not appear to be in dispute. The regulations implementing IDEA 1997 describe the term

general curriculum as the same curriculum as that established for students without disabilities (34 C.F.R. § 300.347(a)(1)(i)). States that adopt the common core standards will have adopted them for all their students with IEPS, including those students who are eligible for the AA-AAS.

Work is already underway to explore how students with significant cognitive disabilities can be included in the CCSSI. The National Assessment Center at the University of Kentucky and the National Center for the Improvement of Educational Assessment has begun to develop learning progressions framework s (LPF) in mathematics, language arts, and science (Hess, 2010). During 2010 content experts and researchers from both general education and special education met to review and synthesize the research literature about mathematics learning and draft LPFs in mathematics. According to Hess, this work included identification of enduring understandings and essential learning targets for the elementary (K–4), middle (5–8), and high school (9–12) grade spans. In addition, master general and special education teachers and professional development providers formed curriculum development committees to focus and break down specific targeted sections of the draft LPFs into "mini progressions" for a smaller grade span. These mini progressions included progress indicators. The curriculum development committees used the mini progressions to design instructional modules based on best practices in instruction for students with significant cognitive disabilities to show how a teacher in the general education classroom might move students along this smaller grain-sized learning progression.

For the states that adopt the CCSSI the implementation of these new standards will likely require changes to state assessment systems. In May 2010, the U.S. Department of Education announced The Race to the Top Assessment Program, which was a $350 million grant competition to support the work of a consortium of States to develop and implement common, high-quality assessments aligned with common college- and career-ready K–12 standards. In September 2010, the Partnership for Assessment of Readiness for College and Careers (PARCC) and the SMARTER Balanced Assessment Consortium (SBAC) were announced as the winners of competition and were awarded the amounts of approximately $170 and $160 million respectively (Tamayo, 2010). The PARCC is a coalition of 26[1] states and the SBAC is a coalition of 31[2] states. The assessments will be ready for use by the 2014–15 school year.

What assessment of the common core standards will mean for students with significant disabilities remains uncertain given the exclusion of students with disabilities who participate in the AA-AAS in ED's the Race to the Top grant program. Responsibility for developing assessments for this specific group fell instead to the Office of Special Education and Rehabilitative Services, (OSERS) under a separate grant competition ("Overview information; Race to the Top Fund Assessment Program; Notice inviting applications for new awards for fiscal year (FY) 2010,"). The Consortium for Citizens with Disabilities (Consortium for Persons with Disabilities, 2010) commented that this exclusion "sends a clear message that a "comprehensive assessment system" for U.S. public school children need not include all students with disabilities."

[1] AL, AR, AZ, CA, CO, DC, DE, FL, GA, IL, IN, KY, LA, MA, MD, MS, ND, NH, NJ, NY, OH, OK, PA, RI, SC and TN

[2] AL, CO, CT, DE, GA, HI, IA, ID, KS, KY, ME, MI, MO, MT, NC, ND, NH, NJ, NM, NV, OH, OK, OR, PA, SC, SD, UT, VT, WA, WI, and WV

On September 2, 2010, the U.S. Department of Education announced that it had awarded grants to two consortia of states to develop a new generation of alternate assessments for students with the most significant cognitive disabilities (U.S. Department of Education, 2010). The new assessments will be designed for a wide range of students with significant cognitive disabilities and will be aligned to the CCSSI. The tests will assess knowledge of mathematics and English language arts in grades 3-8, and one grade in high school. The alternate assessments are expected to align with the assessment systems being developed by the PARCC and the SBAC consortia. The grants were awarded to the National Center and State Collaborative Partnership (NCSCP), a consortium of 18 states, the District of Columbia, and several territories led by the University of Minnesota, and the Dynamic Learning Maps Alternate Assessment System Consortium (DLMAAS), a consortium of 11 states led by the University of Kansas.

According to University of Minnesota (2010) consortium will build a comprehensive assessment system that includes products and processes to support educators to plan for and provide appropriate instruction that addresses the CCSSI. These supports will help Individualized Education Program teams accurately identify the learner characteristics of students with the most significant cognitive disabilities and make appropriate decisions about how each student participates in the overall system of assessments. Martha Thurlow, Director of the National Center for Educational Outcomes commented "The ultimate purpose is to provide states with a full set of assessments, curriculum and instructional supports and professional development tools to implement a research-based, systemic approach to improving academic outcomes for students with the most significant cognitive disabilities," (http://www1.umn.edu/news/news-releases/2010/UR_CONTENT_257101.html)

According to the website for DLMAAS (http://dynamiclearningmaps.com/) the consortium will create an assessment system to support teachers in improving the learning of students with the most significant cognitive disabilities. Activities include developing alternate academic achievement standards aligned with the CCSSI and using universal design principles and current research based on evidence-centered design and learning maps to develop alternate assessments. DLMAAS intends to form a coherent system with assessments developed by RTTT assessment competition grantees. The proposed system will measure achievement and growth of students with SCD and report on student participation and performance on AA-AAS. Other outcomes will be the creation of guidelines for IEP teams to use in determining which students should be assessed using an AAAAS and training on those guidelines for IEP teams. Finally, the consortium will create and implement professional development for teachers in instruction and assessment of challenging academic content to show progression of student learning.

Alternate assessments are the means by which some students with disabilities can be represented in a broad assessment and accountability system. These assessments are designed for students with the most significant cognitive disabilities. Developing alternate assessments that have the same technical rigor as traditional large scale assessments remains a significant undertaking. Three specific challenges to the development of valid and reliable alternate assessments based on alternate achievement standards were identified: (1) How to account for the characteristics of the students to be tested, (2) a lack of research on how to develop valid and reliable alternate assessments, and (3) how to demonstrate alignment between assessment, academic content, and instruction. In this technical report we have discussed these challenges, described the progress made, and considered the possible trajectory of alternate assessment development in relation to the Common Core Standards Initiative in mathematics.

The Potential Role of ECD in Future Alternate Assessment Development

The U.S. Department of Education and professional organizations such as the American Psychological Association, the National Council on Measurement in Education, and the American Educational Research Association require that assessments be aligned to grade level content and be designed and developed following systematic and rigorous processes that are reflective of industry standards. ECD is a framework and set of processes that meet these criteria and lead to the design of families of items that are well-aligned to the focal constructs of interest.

ECD use a replicable assessment design process that can be applied to all content areas and all types of evidence, from performance tasks and portfolio activities to technology-based simulations and animations to traditional multiple-choice item formats (Cameto, Haertel, DeBarger, & Morrison, 2010). The application of ECD to alternate assessment addresses validity issues as described by Shafer (2005) and Tindal et al. (2003) by applying a replicable process that makes explicit the content to be assessed, the evidence to be collected, and the features of tasks to be developed.

The work conducted during this project was innovative in two respects: the application of ECD to assessments for students with significant cognitive disabilities and the integration of UDL into ECD principles in the design of tasks for AA-AAS. A major strength of this unique approach is the support it provides for the development of items and tasks for all students that focus on construct-relevant content, minimize the impact of construct-irrelevant skills, and take into account appropriate accessibility options (Cameto, Haertel, et al., 2010). For example in the development of math design patterns and tasks, math content would be targeted and the need for non-construct-relevant skills such as reading would be minimized. In addition; designers would consider supports such as use of a large font or alternate response options during item design, which would then be built into the items. Thus reducing the need for teacher selected and administered accommodations or modifications during the assessment process.

In conclusion, the marriage of ECD and UDL extends current knowledge in the field and contributes much-needed information for improving AA-AAS in mathematics. Moreover, it has demonstrated that ECD and UDL have the potential to improve assessment practices generally across the ability spectrum and specifically for students with significant cognitive disabilities. The use of ECD can enhance the quality of assessments for students with significant cognitive disabilities, improve the efficiency with which future assessments are developed, and capture the myriad design decisions required when developing a valid assessment of student learning (Mislevy, Steinberg, & Almond, 2003).

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