Alternate Assessment Design–Mathematics

Technical Report 9:

Implementing Evidence-Centered Design to Develop Assessments for Students with Significant Cognitive Disabilities: Guidelines for Creating Design Patterns and Development Specifications and Exemplar Task Templates for Mathematics

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This procedural manual is intended to be a user-friendly document that details the processes, procedures, and considerations for applying evidence-centered design (ECD) methodology to the development of high-quality alternate assessments in mathematics for students with significant cognitive disabilities. Part I of the manual details the procedures for creating *Design Patterns*. Part II describes the processes, procedures, and considerations involved in the creation of *Development Specifications and Exemplar Task Templates*. This manual is intended to be used by co-design teams of experts to use an ECD methodology in the design and development of assessments and tasks.

Background Information

Alternate Assessment Design–Mathematics Project

This manual was created out of the work conducted by the Alternate Assessment Design–Mathematics (AAD-M) project. SRI International worked with the departments of education in the states of Utah, Idaho, and Florida to design and develop assessment tasks that were linked to state extended content standards in mathematics. The AAD-M project combines current knowledge from multiple disciplines to advance the design of alternate assessment tasks for students with significant cognitive disabilities that can be applied to performance events, portfolio, or mixed approach assessments. The goals of the project were to (1) extend the conceptual framework of ECD to alternate assessment using the Principled Assessment Designs for Inquiry (PADI) model, (2) integrate the principles of universal design for learning (UDL) with ECD to guide the development of tasks that are accessible to all learners, (3) use the National Council of Teachers of Mathematics (NCTM) *Principles and Standards for School Mathematics* to identify common expectations, (4) develop *Design Patterns* and *Development Specifications and Exemplar Task Templates* (which include assessment task specifications and exemplar tasks), (5) enhance the human capital of state departments of education staff, and (6) support state department of education staff and teachers in the development of additional tasks in mathematics to expand the task bank for each state.

Using Evidence-Centered Design to Develop Alternate Assessments

Students with significant cognitive disabilities challenge conventions with respect to the teaching, learning, and assessing of academic content. Assessment has been instrumental in changing the learning expectations of these students, which in turn is beginning to influence classroom instructional practices. Assessment designers are challenged to develop assessments that adequately and reliably show what these students know and can do. The sheer variability in this target population, the assumptions about measuring their achievement, and the variability of design implementation procedures make traditional assessment design approaches inapplicable without some reformulation (Gong & Marion, 2006; Ryan, Quenemoen, & Thurlow, 2004; U.S. Government Accountability Office, 2009). The methods used to date in designing alternate

assessments and selecting their content are varied but typically do not match the technical rigor used for designing general education assessments (Bechard, 2005).

Historically, large-scale assessments have not focused on how content, design, or task characteristics influence the ability of students to perform, especially those students in the tails of the achievement distribution. Alternate assessment designers in particular have often lacked systematic design processes that (1) define the focal knowledge, skills, and abilities (KSAs) required to demonstrate what students know and can do in academic content areas; (2) design assessment tasks with features that are well aligned with the focal KSAs; (3) design assessment tasks that minimize nonfocal KSAs and thereby mitigate construct-irrelevant variance; and (4) take into account the many ways that students perceive test content and express their responses.

ECD directly addresses these most pressing issues by using a rigorous and replicable assessment design process that carefully considers how the content, task, and learner characteristics interact in the creation of assessment tasks. ECD 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. The use of ECD can enhance the quality of assessments and improve the efficiency with which future assessments are developed, while documenting the myriad design decisions required when developing a valid assessment of student learning (Mislevy, Steinberg, & Almond, 2003).

ECD works synergistically with UDL. By considering multiple means of perception, expression, cognition, language and symbol use, executive functioning, and engagement, the application of UDL in the ECD process accounts for individual differences in how students recognize, strategize, and engage in learning and testing situations. This synergistic process minimizes the unintended negative influence that access needs may have on student performance and maximizes the opportunities for students to show what they know and can do. This can include consideration of augmentative and alternative communication systems.

Overview of ECD Products

Design Patterns and *Development Specifications and Exemplar Task Templates* are schemas/structures developed to support assessment developers in implementing ECD approaches.

Design Patterns

When completed, *Design Patterns* describe the elements of an assessment argument, including the targeted or focal KSAs, the student behaviors or actions that would provide evidence of these knowledge and skills, and the situations that will evoke those observations (Mislevy & Haertel, 2006). *Design Patterns* also play a key role in articulating additional KSAs that may be required for successful performance on a task, but are not targeted by assessment tasks (e.g., ability to perceive components of a task). *Design Patterns* provide a structure for also considering ways to vary task features (e.g., whether to use manipulatives) to support students in communicating what they understand and are able to do in relation to the focal KSAs. In this way, *Design Patterns* facilitate communication among members of the co-design team about how academic content can be made accessible for students with significant cognitive disabilities.

Development Specifications and Exemplar Task Templates

Development Specifications and Exemplar Task Templates include two categories of information: design specifications for tasks based on a *Design Pattern* and detailed descriptions of the exemplar assessment tasks themselves.

Design Specifications. Design specification information in the template includes:

(1) Decisions regarding specific content to assess in a task;

(2) Variable features selected for attaining the appropriate amount of scaffolding, depth of knowledge, complexity, and scope for the task (for example, the designers can specify the complexity of a task by indicating that four data points [rather than three or five] will be presented to students who are asked to create a line graph); and

(3) Variable features selected to support the multiple means of representation, expression, and engagement of students (as operationalized in the principles of UDL) (Rose & Meyer, 2006).

Exemplar Tasks. The detailed description of the exemplar assessment task in the template includes:

(1) Information that will be communicated to the student,

(2) Materials that will be presented to the student,

(3) Response options that will be presented to the student,

(4) The correct response, and

(5) Materials that examiners will require to administer the task.

Establishing a Co-Design Team

The process of implementing ECD to inform the design of assessment tasks for students with significant cognitive disabilities requires a team that can provide expertise in special education (including those with specific knowledge about and/or experiences with students with significant cognitive disabilities), content (e.g., math), instruction in the content, assessment design and development using ECD, and measurement. Co-design teams meet to develop and refine the *Design Patterns* and *Development Specifications and Exemplar Task Templates*. It is essential that all members of the co-design team have an opportunity to provide input on the products, which are the outcome of the ECD process. If in-person meetings are not possible for all members of the team, teleconference phone calls with technologies to support live document editing and sharing can be used to facilitate communication among the co-design team.

Strategies for Co-Design Team Management

The ECD co-design process is intensive and requires consideration of time management issues as well as a clear division of labor. Below are several helpful strategies:

Use small teams—Create and revise ECD products in small interdisciplinary teams. Smaller teams work more efficiently. Working in multiple small teams is also useful for simultaneously developing many tasks.

Document your work—Keep a copy of every version of the *Design Patterns* and *Development Specifications and Exemplar Task Templates*. Note every change that was made, and where possible include the reasoning behind the change. This will help avoid

repeated discussions and provide historical documentation of the team's conceptual path regarding the development of the ECD products.

Share responsibility—Co-design teams should have one member (e.g., team leader) who is primarily responsible for the conceptual work involving that team. However, each member of the team should take an active part in reviewing and revising the *Design Patterns* and *Development Specifications and Exemplar Task Templates*.

Devote time—When planning the timeline of the teams' work, set aside enough time for product development. The team will typically undergo several iterations for the development of one product.

Follow the order—When members of the co-design team are new to developing ECD products, work sequentially through the steps outlined in the procedures so that team members become familiar with the details of the attributes and the assessment argument considerations.

Manage discussions and track status of products—Discussions in large multidisciplinary groups have the potential of "going off on tangents" since everyone wants to contribute their unique perspective. In order to facilitate efficient meetings, the team leader should make sure that (1) the length of discussions is proportional to the importance of the topic discussed; (2) at the end of the meeting all the main points including next steps (e.g., for completing a particular task) are summarized and agreed upon, and responsibility to carry out tasks is delegated to a particular individual when necessary; and (3) one team member is in charge of taking notes, summarizing changes to the task specifications/exemplar task template, and disseminating the working version among the team members after the meeting is over. Occasionally, team members can benefit from taking a break from working on a particular product. When team members return to the product, they can review it with fresh eyes and come up with new and interesting ways to improve it.

Part I: Procedures for Creating *Design Patterns*

Design Patterns are the first opportunity for the co-design team to define the targeted KSAs to be assessed and to discuss appropriate task designs and supports for students with significant cognitive disabilities. Each *Design Pattern* builds around the general form of an assessment argument, concerning the knowledge or skill to address (examples in mathematics include one-to-one correspondence and using a number line), the kinds of observations that can provide evidence about acquisition of this knowledge or skill, and the features of task situations that allow students to provide this evidence. Explicating the assessment structure in a narrative form with slots to be filled, *Design Patterns* arrange an underlying assessment argument into attributes that can subsequently be instantiated in particular operational tasks. Table 1 defines the attributes within a *Design Pattern*, rendering explicit an assessment argument (shown according to Messick's student, evidence, and task model components) (Messick, 1994).

Table 1. *Design Pattern* Attributes, Definitions, and Corresponding Messick Argument Components

***Design Pattern* Attribute**	**Attribute Definition**	**Messick Assessment Argument Component**
Title	Short name for the *Design Pattern* (DP)	
Summary	Brief description of the family of tasks implied by the DP	
Rationale	Nature of the KSAs of interest and why they are important	**Student Model/Claim** What construct (complex of student attributes) should be assessed?
Focal Knowledge, Skills & Abilities (KSAs)	The primary KSAs targeted by this DP	
Additional KSAs	Other KSAs that may be required by tasks from this DP, some of which can be supported by universal design for learning (UDL) and accommodations	
Potential Observations	Observed behaviors of students that can provide evidence of Focal KSAs	**Evidence Model/Actions** What behaviors should reveal the construct?
Potential Work Products	What students say, do, or make that provides evidence about the Focal KSAs	
Potential Rubrics	Some evaluation techniques that may apply	
Characteristic Task Features	Aspects of assessment situations likely to evoke the desired evidence	**Task Model/Situation** What tasks should elicit those behaviors?
Variable Task Features	Aspects of assessment situations that can be varied in order to control difficulty or target emphasis on various KSAs	
Educational Standards	State extended standards (if appropriate)	**Student Model/Claim**

Elements of the *Design Pattern* related to the student model include Educational Standards, the Rationale, Focal Knowledge, Skills, and Abilities (Focal KSAs), and the Additional KSAs. The Educational Standards are the participating states' extended standards that are aligned to the standard or expectation being addressed. They are statements of core ideas and practices that experts in the domain believe students with significant cognitive disabilities should learn. The Rationale provides context for why the content being addressed (e.g., the standard or the expectation) is important for students to learn and can include context to situate the Focal KSAs within the larger content domain. The Focal KSAs are knowledge, skills, and abilities targeted by the *Design Pattern*. The Additional KSAs are nonconstruct relevant knowledge, skills, and abilities that may be required for successful performance on tasks associated with this *Design Pattern*. The Additional KSAs define relevant Cognitive Background Knowledge as well as knowledge and skills that reflect six categories related to UDL: (1) Perceptual (Receptive), (2) Skill and Fluency (Expressive), (3) Language and Symbols, (4) Cognitive, (5) Executive, and (6) Affective (CAST, 2008) (see Table 2).

Potential Observations and Potential Work Products are associated with the evidence model component of the assessment argument. Potential observations are the "correct" and "accurate" student actions or expressions that provide complete and clear evidence of the Focal KSAs. Potential work products are descriptions of the products that students create or make (e.g., constructed response, drawing, verbal response) that can be judged to infer whether a student has acquired the Focal KSAs.

Characteristic Features and Variable Features inform the task model by specifying design features of tasks associated with this *Design Pattern*. Characteristic Features describe features of tasks that must be present to elicit the Focal KSAs. They also include descriptions of ways to constrain the task design space (e.g., in the domain of mathematics, limitations on the types of fractions that would be included in tasks resulting from the *Design Pattern*). Variable Features are related explicitly to Additional KSAs in that they describe features of tasks that can be used to support cognitive background knowledge, as well as student abilities associated with perceiving task stimuli, expressing responses to tasks, comprehending linguistic components of tasks, information processing, executive functioning, and engagement. UDL is enacted through the principled implementation of these Variable Features. Definitions of associated categories of Additional KSAs and Variable Features are shown in Table 2.

Table 2. Definitions of Categories of Additional KSAs and Variable Features

Category	Definition of Additional KSA	Definition of Variable Features
Cognitive Background Knowledge	Prerequisite knowledge, skills, and abilities (KSAs) required for students to demonstrate proficiency on Focal KSAs	Task options for supporting recall and application of prerequisite KSAs
Perceptual (Receptive)	KSAs associated with perceiving or receiving images, physical objects, and linguistic components of tasks	Ways to vary the delivery mechanisms by which tasks are perceived and task supports for the use of equipment required for assessments
Skill and Fluency (Expressive)	KSAs associated with communicating/expressing a response and using/manipulating equipment and physical materials	Task supports for responding to and composing a response and supports for manipulating equipment and physical materials
Language and Symbols	KSAs associated with decoding, recognizing, and comprehending text, symbols and images, and understanding vocabulary and syntax in which tasks will be presented	Task options for presenting language and symbols and supporting students in comprehending essential text, symbols, and images
Cognitive	KSAs associated with cognitive and information processing (e.g., ability to process multistep problems, ability to recall and use information presented in the task) and skills associated with using supports provided as part of the task (e.g., ability to understand the purpose of highlighted features in text or illustrations)	Task options for varying the complexity of tasks; for guiding exploration and information processing (e.g., sequential highlighting); for supporting the identification of critical task features, big ideas and relations (e.g., graphic organizer); and for supporting memory and transfer (e.g., embed task in a scenario)
Executive	KSAs associated with monitoring, planning and sequencing, self-regulating and reflecting, and setting goals and expectations	Task options for the provision of guides, checklists, graphic organizers, and templates; for prompts, scaffolds and questions to monitor progress; and for adjusting levels of challenge and support
Affective	KSAs associated with engaging, persisting, and sustaining effort in tasks	Task options for engagement (e.g., enhancing relevance, value, and salience of tasks) and teacher options for supporting student attention and engagement (e.g., prompting the student to engage)

Design Pattern Development Guidelines

The nine steps in the following pages describe the process to complete a *Design Pattern*. However, it is possible for the process to be more iterative than implied by these steps; that is, prior steps may be revisited and the *Design Pattern* refined accordingly to further specify attributes or make the assessment argument more explicit. The example described in the steps that follow was developed by the AAD-M project for the Number and Operations expectation: "**Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers.**"

Step 1. Create a Title and Summary

The title is a name for the *Design Pattern* that briefly describes the content or skills addressed in it. It is important to adopt a naming convention and to consistently use it. For the AAD-M project, the title was comprised of three elements: the content area subdomain, the label or code of the standard or "expectation" addressed, and the grade-level range. For example, the title "Number and Operations A3 (grades3–5)" was created from the expectation of the NCTM *Principles and Standards for School Mathematics* mentioned above. The content area subdomain was Number and Operations. The next element in the title was the code for the NCTM expectation being addressed, A3, in which "A" referred to the second standard in the Number and Operations subdomain, and the "3" referred to the third expectation within that first standard.[1] The final element of the title was the grade-level range, grades 3–5.

The summary provides more detail about the scope or breadth of knowledge and skills to be addressed in the *Design Pattern*. To operationalize this attribute, the AAD-M project used the verbatim wording of the expectation from the NCTM *Principles and Standards for School Mathematics*. For instance, the summary for Number and Operations A3 (grades3–5) was "**Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers,**" which is the exact wording of the NCTM expectation.

Note that although the AAD-M project chose to use the NCTM standards and expectations to guide the work, other standards, including the state's extended standards or the Common Core State Standards, could serve as the base for the ECD approach.

Step 2. Add Relevant Educational Standards

In the AAD-M project, prior to developing the *Design Pattern*, the co-design team engaged an expert in mathematics to create a crosswalk linking NCTM expectations to state extended standards. Extended standards from Utah, Idaho, and Florida related to the NCTM expectation were included in the *Design Pattern* as a reference to show what mathematics content and skills each state identified as essential for students with significant cognitive disabilities.

[1] The NCTM does not label specific standards and expectations within or across domains using the naming conventions described above (i.e., A3). This naming convention was a creation of the AAD-M project to distinguish among various standards and expectations within an NCTM subdomain (e.g., Number and Operations).

Step 3. Develop Rationale Statement

The Rationale identifies why the construct(s) identified in the summary are important to assess. Creating a rationale statement requires input from a math content expert, who can situate the mathematics constructs targeted by the *Design Pattern* within the broader domain of mathematics. For instance, the rationale statement for Number and Operations A3 (grades3–5) was "**Fractions represent a significant extension of children's knowledge about numbers. When children possess a sound understanding of fractions, they can use this knowledge to describe real world phenomena and apply it to problems involving measurement, probability, and statistics.**"

Step 4. Identify Focal Knowledge, Skills, and Abilities (Focal KSAs)

Standards are often written at a grain-size that is too large for assessment purposes. Focal KSAs reflect the standard when it is further unpacked into its essential, assessable elements. The content expert(s) on the co-design team draft Focal KSAs by reviewing the standard. In co-design meetings, Focal KSAs are discussed and further refined.

The focus and grain-size of the Focal KSAs need to be agreed upon by the co-design team. It is possible to generate multiple standards-based Focal KSAs, each of which only addresses one facet of a standard. For example, Number and Operations A3 (grades3–5), included six Focal KSAs each of which addresses a component of the expectation:

(1) Ability to recognize a whole and divide it into or recognize equal parts (e.g., halves, thirds, or quarters)

(2) Ability to identify fractions by the number of parts in the whole and in the fractional amount

(3) Ability to identify a collection as a whole, and consider groups of objects in the collection as parts of the whole

(4) Knowledge that fractions are numbers and identify points on the number line corresponding to particular fractions, between 0 and 1, and greater than 1

(5) Knowledge that a division operation may not have a whole number result

(6) Ability to solve problems involving fractions

It is critical to take the time with the co-design team to consider how the content or skills in the standard should be parsed because Focal KSAs will influence other attributes of the *Design Pattern*. Focal KSAs may be refined or deleted after their influence with respect to other attributes of the *Design Pattern* becomes more apparent. For example, in Step 4 Focal KSAs are "operationalized" when observations of student behaviors that are likely to provide evidence of each Focal KSA are specified. At this point the co-design team may realize that a Focal KSA is too vague or too complex to create these observations. If this occurs, the co-design team should revisit Step 3 and refine the Focal KSA. The co-design may also go back and add new Focal KSAs as they progress through the design steps.

Step 5. Develop Potential Observations and Potential Work Products

Potential Observations help to make each Focal KSA more concrete by describing the evidence (in the form of a specific student behavior) that indicates that a student has acquired the KSA. Potential Observations are phrased to describe the highest quality of student performance

that demonstrates evidence of the Focal KSA. Qualifiers such as "accurate" and "correct" are used in all Potential Observation statements. Co-design teams also may find it helpful to generate specific examples for each Potential Observation (i.e., given a particular mathematics problem or context, describe the observed behavior). In constructing *Design Patterns* for the AAD-M project, the extended standards from each participating state also were considered when determining the range and qualities of behaviors that would likely be observed for students with significant cognitive disabilities. See Table 3 for examples of Potential Observations.

Potential Work Products are descriptions of the form of the information that can be gathered from students (e.g., written explanation or selection of a response). When possible, work products should be stated such that they do not reflect bias in how students express their response. Often, Potential Observations can be expressed in multiple ways (e.g., in speech or in writing). Thus, the Potential Work Product "Expression of a mathematical pattern" is preferable to "Student writes the mathematical pattern," since not all students can write. However, in some cases, a Potential Work Product must be specific to a particular mode of expression for a Potential Observation. In these cases, additional Potential Observations and associated Potential Work Products should be specified that reflect alternate modes of expression. See Table 3 for examples of Potential Work Products.

A "horizontal view" of the *Design Pattern* is used during co-design meetings to make the connections among each Focal KSA and its associated Potential Observations and Potential Work Products explicit. Table 3 shows an excerpt of the "horizontal view" for Number and Operations A3 (grades3–5).

Table 3. "Horizontal View" of Excerpt from Number and Operations A3 (grades 3–5) Design Pattern Focal KSAs, Potential Observations and Potential Work Products

Focal KSAs	Potential Observations	Potential Work Products
Ability to recognize a whole and divide it into or recognize equal parts (e.g., halves, thirds, or quarters)	Student correctly divides an object into a specified number of equal parts Student correctly identifies a pictorial representation of a fraction Student correctly distinguishes a whole from fractions of a whole	Student worksheet with multiple pictorial representations of fractions A whole object divided into fractional pieces Selection of a whole orange and fractional pieces of it

Step 6. Develop Characteristic Features of Tasks

In reviewing the Focal KSAs, Potential Observations and Potential Work Products, the co-design team identifies the key features of tasks that will be developed using a particular *Design Pattern*. These Characteristic Features must apply to all tasks created from a *Design Pattern*. For example, one Characteristic Feature developed for the Number and Operations A3 (grades3–5) *Design Pattern* is "**All problems will involve the use of fractions.**" In addition, Characteristic Features can define ways to constrain tasks in relation to the content (e.g., limitations on which numbers should be used). Characteristic Features also can pertain to more general task features desired in tasks associated with a *Design Pattern*. These may include task features such as prompting for individual student responses (not group responses), allowing accommodations, and involving a test administrator who knows the student's comprehensive/response abilities.

Step 7. Identify Cognitive Background Knowledge Additional KSAs

Steps 2–6 make explicit relationships among the standard (or, in the case of the AAD-M project, the NCTM expectation), the Focal KSAs, student behaviors and work products that provide evidence of the Focal KSAs, and characteristic features of tasks to elicit the desired student behaviors. In Step 7 the co-design team describes the Additional KSAs that are not construct relevant but may be required for successful performance on tasks associated with a particular *Design Pattern*.

To determine the Cognitive Background Knowledge Additional KSAs, the co-design team must consider the prerequisite knowledge and skills that may be needed for each Focal KSA. For example, the Number and Operations A3 (grades3–5) *Design Pattern* includes the Focal KSA, **Ability to recognize a whole and divide it into or recognize equal parts (e.g., halves, thirds, or quarters)**. In order for students to be able to demonstrate this ability, the co-design team determined that students may need additional background KSAs, such as:

- Ability to count using whole numbers
- Ability to use a number line to model whole numbers and operations on them
- Knowledge that there is "space" on the number line between each whole number
- Ability to perform division operations (e.g., grouping)

Step 8. Create Cognitive Background Knowledge Variable Features of Tasks

In order to prevent Cognitive Background Knowledge Additional KSAs from impinging on a student's ability to demonstrate what they know about the Focal KSAs, the co-design team considers how these Additional KSAs may be supported. These supports are Cognitive Background Knowledge Variable Features. For example, for Number and Operations A3 (grades3–5), the following Cognitive Background Knowledge Variable Features were identified:

- Provision of a table, chart, or tactile reminder of the numbers to support understanding that numbers occur in a specified sequence
- Supports for use of a number line (supported, unsupported, degree of support) (e.g., provide a number line, model use of a number line, re-teaching use of a number line just prior to assessment)
- Supports for division skills (supported, unsupported, degree of support) (e.g., provide a calculator, use number line to provide visual representation of division, counters, counter mats)

Step 9. Review and Select UDL Additional KSAs and Variable Features

In the AAD-M project six categories of UDL were used: (1) Perceptual (Receptive), (2) Skill and Fluency (Expressive), (3) Language and Symbols, (4) Cognitive, (5) Executive, and (6) Affective. UDL Additional KSAs are nonconstruct relevant knowledge, skills, and abilities in these categories that may be required for successful performance on tasks associated with a *Design Pattern*. UDL Variable Features are used to support student abilities associated with perceiving task stimuli, expressing responses to tasks, comprehending linguistic components of tasks, information processing, executive functioning, and engagement. Unlike the Cognitive Background Knowledge Additional KSAs and Variable Features, which are created afresh for each Design Pattern, the UDL Additional KSAs and associated Variable Features have been standardized and are prepopulated in each Design Pattern (see Table 4). The co-design team is responsible for reviewing this standardized list and selecting those Additional KSAs and associated Variable Features that are most relevant for the task.

Table 4. Linkage Between Additional KSAs and Variable Features

Additional KSAs	Linked to:	Variable Features
Perceptual (Receptive)		
• AP1. Ability to perceive the linguistic components of the stimulus material and question (e.g., through print, objects, audio, Braille)	(P1, P2, P3)	• P1. Delivery mechanisms by which the question is perceived (e.g., read aloud verbatim/read aloud paraphrase, pictures, large print, printed text, Braille, text, symbols, concrete objects, description of objects or images, text to speech, signing, auditory amplification, CCTV – close circuit TV, to increase size of font, vary contrast, etc.) • P2. Supports for the use of equipment required for the task (e.g., communication board, CD player) • P3. Delivery parameters for oral presentation of material (e.g., speed of reading, volume, amount of expression used, student ability to pause, stop, and/or repeat information read aloud)
• AP2. Ability to perceive images in the stimulus material and question (e.g., through print, objects, holistic description, Braille)	(P1, P2, P3)	
• AP3. Ability to perceive physical objects required for the task (e.g., see physical objects and manipulatives)	(P1, P2)	

Table 4. Linkage Between Additional KSAs and Variable Features, continued

Additional KSAs	Linked to:	Variable Features
Skill and Fluency (Expressive)		
• AS1. Ability to communicate response (e.g., respond verbally, by using pictures, by making a selection from a group)	(S1, S2, S3, S4, S5, S6)	• S1. Response mode options (e.g., pointing, speech and verbalization, writing, signing, switch or other assistive device/augmentative communication device, eye gaze, for lowest functioning students – predictable behavioral response, tolerate assistance – e.g., hand over hand) • S2. Supports for composing a response in text (e.g., speech to text, written by teacher, keyboarding) • S3. Supports for manipulating physical materials (e.g., use of velcro, size of materials, teacher manipulation of materials) • S4. Supports for manipulating digital/electronic equipment (e.g., pointers, teacher manipulation of equipment, spoken commands, stylus for input, larger keyboard/buttons, adaptive mouse) • S5. Practice tutorials with unfamiliar physical materials or digital/electronic equipment • S6. Practice with familiar equipment
• AS2. Ability to compose or express a response in text (e.g., by writing, using Braille)	(S1, S2, S3, S4, S5, S6)	
• AS3. Ability to manipulate physical materials (e.g., dexterity, strength and mobility)	(S1, S2, S3, S4, S5, S6)	
• AS4. Ability to manipulate digital/electronic equipment	(S1, S4, S5, S6)	
• AS5. Knowledge of how to use physical materials or digital/electronic equipment (e.g., familiarity)	(S5, S6)	
Language and Symbols		
• AL1. Ability to recognize text, symbols, or images	(L2, L4, L5, L8, L9, L10, L11)	• L1. Level of abstraction required of student (e.g., concrete objects, images, text) • L2. New vs. pre-taught vocabulary and symbols • L3. Embedded support for vocabulary and symbols (e.g., technical and non-technical glossary, hyperlinks/footnotes to definitions, illustrations, background knowledge) • L4. All key information in the dominant language (e.g., English) is also available in prevalent first languages (e.g., Spanish) • L5. All key information in sign language for students who utilize this mode of communication • L6. Use of multiple representations (e.g., physical models, demonstrations, acting out scenarios)
• AL2. Ability to decode text, symbols, or images	(L1, L2, L3, L4, L5, L8, L9, L10, L11)	

Table 4. Linkage Between Additional KSAs and Variable Features, continued

Additional KSAs	Linked to:	Variable Features
Language and Symbols		
• AL3. Ability to comprehend text, symbols, or images	(L1, L2, L3, L4, L5, L6, L7, L8)	• L7. Alternate syntactic levels (simplified text) • L8. Highlight essential elements, words, or phrases • L9. Digital text with automatic text to speech • L10. Digital Braille with automatic Braille to speech • L11. Read language and symbols aloud
• AL4. Ability to understand English vocabulary and syntax	(L2, L3, L4, L5, L7, L8)	
Cognitive		
• AC1. Ability to attend to stimuli (DOK level 1)	(C37, C38, C39, C40, C41, C42, C43, C44, C45, C46)	• **C1. Depth of knowledge of the content – SELECTED IN EVERY DESIGN PATTERN AND TASK** • **C2. Complexity of the content (e.g., length of scenario , number of supporting details included, richness of context) – SELECTED IN EVERY DESIGN PATTERN AND TASK** • C3. Item/task format (selected response vs. constructed response, performance, etc.) • C4. Adjustable levels of challenge (teacher able to adjust) • Options for supporting background knowledge: o C5. Pre-teach background content (pre-teach definitions of unfamiliar words or concepts unrelated to the standard; pre-teach means teaching a student for the first time the definition of a word or concept that is included in the narrative of a test item but not part of the construct being measured) o C6. Provide analogies and examples o C7. Provide hyperlinks to multi-media o C8. Provide links to related information o C9. Provide links to familiar materials o C10. Provide concept maps o C11. Remind student of prior experiences o C12. Remind student of materials or activities used to teach foundational math skills
• AC2. Ability to recall related knowledge (DOK level 2)	(C5, C6, C7, C8, C9, C10, C11, C12)	

Table 4. Linkage Between Additional KSAs and Variable Features, continued

Additional KSAs	Linked to:	Variable Features
Cognitive		
• AC3. Ability to perform (e.g., answer questions, solve simple problems, measureDOK level 3)	(C11, C12, C13, C19, C20, C29, C30, C33)	• Options for supporting critical features, big ideas, and relations: o C13. Provide graphic organizers o C14. Outline information o C15. Highlight information o C16. Provide alternative forms of key concepts o C17. Provide multi-media glossaries o C18. Provide translation tools o C19. Provide modeled prompts (on non-construct relevant content) o C20. Provide a response template o C21. Remind student of the function of tools/features designed to aide comprehension and processing of information (e.g., highlighting, graphic organizers, captions, and headings) o construct relevant content) o C30. Provide a practice item or task • C31. Provide a guide or checklist for prioritization of steps in multi-step problems
• AC4. Ability to comprehend (e.g., explain, sort, extend a pattern) (DOK level 4)	(C5, C6, C7, C8, C9, C10, C11, C12, C13, C14, C15, C16, C17, C18, C19)	
• AC5. Ability to apply information (e.g., organize, collect, solve complex problems) (DOK level 5)	(C13, C14, C15, C16, C17, C18, C19, C20, C21)	
• AC6. Ability to analyze, synthesize, or evaluate information (compare, contrast, interpret data) (DOK level 6)	(C13, C14, C15, C16, C17, C18, C19, C20, C21, C22, C23, C24, C25, C26, C27, C28, C29, C30, C31)	•
• AC7. Ability to understand the meaning of an example	(C16, C24)	•
• AC8. Ability to process multi-step problems	(C13, C14, C15, C20, C22, C23, C24, C25, C26, C27, C28, C31, C32, C34, C35)	•
• AC9. Ability to recall and use information presented in a task/item (working memory)	(C32, C33, C34, C35, C36)	

Table 4. Linkage Between Additional KSAs and Variable Features, continued

Additional KSAs	Linked to:	Variable Features
Cognitive		
• AC10. Ability to understand the structure of "organizers" used to present information or to scaffold responses (e.g., understand meaning of table headings, labeling of axis,)	(C11, C21, C24, C29, C30)	• Options for supporting memory and transfer: o C32. Note-taking o C33. Mnemonic aids o C34. Locate items near relevant text o C35. Reread question/stimulus o C36. Present items as a discrete unit or embed in a scenario • Teacher options for providing supports for attention: • C37. Cover up part of text so student isn't overwhelmed • C38. Prompt student to engage/re-engage • C39. Provide verbal/gestural prompts • C40. Provide feedback to support attention • C41. Provide supports to reduce student frustration (e.g., noise reduction, extended test taking time, contingencies, number of items administered at one time) • C42. Provide optimal student positioning (positions which encourage alertness, not recumbent) • C43. Administer assessment at optimal time of day for student engagement • Task options to support student attention (task refers to the assessment items, scenario, and materials): • C44. Enhance relevance, value, and authenticity of tasks • C45. Heighten salience • C46. Variety of stimuli
• AC11. Ability to understand the purpose of highlighted features in text or illustrations	(C21, C25)	
Executive		
• AE1. Ability to set goals and expectations	(E1, E4, E5)	• E1. Prompts and scaffolds to estimate effort, resources, and difficulty • E2. Prompts, scaffolds, and questions to monitor progress, to "stop and think", and for categorizing and systematizing • E3. Representations of progress (e.g., before and after photos, graphs and charts) • E4. Guides, checklists, graphic organizers, and/or templates for goal setting, prioritizing, breaking long-term objectives into reachable short-term goals, self-reflection, and self-assessment • E5. Adjust levels of challenge and support (e.g., adjustable leveling and embedded support, alternative levels of difficulty, alternative points of entry)
• AE2. Ability to monitor goals and progress	(E1, E2, E3, E4, E5)	
• AE3. Ability to plan and sequence	(E1, E4, E5)	
• AE4. Ability to self-regulate and reflect during problem solving	(E1, E2, E3, E4, E5)	

Table 4. Linkage Between Additional KSAs and Variable Features, concluded

Additional KSAs	Linked to:	Variable Features
Affective		

• AA1. Ability to engage (e.g., task-specific motivation)	(A1, A2, A3, A4, A5, A6, A7, A8, A11, A12, A13, A14, A15)	• Teacher options for providing supports for attention and engagement:
		  • A1. Cover up part of text so student isn't overwhelmed
		  • A2. Prompt student to engage/re-engage
		  • A3. Provide verbal/gestural prompts
		  • A4. Provide feedback to support engagement
		  • A5. Provide supports to reduce student frustration (e.g., noise reduction, extended test taking time, contingencies, number of items administered at one time)
		  • A6. Provide varied levels of challenge and support
		  • A7. Provide optimal student positioning (positions which encourage alertness, not recumbent)
		  • A8. Administer assessment at optimal time of day for student engagement
		• Task options for engagement (task refers to the assessment items, scenario, and materials):
		  • A9. Provide students with choices for personal control of age-appropriate content when construct is not impacted (e.g., choice of topic or theme) MAY NOT BE APPLICABLE FOR STATEWIDE ASSESSMENTS
		  • A10. Provide students with choices for personal control of task context when construct is not impacted NOT MAY NOT BE APPLICABLE FOR STATEWIDE ASSESSMENTS
		  • A11. Enhance relevance, value, and authenticity of tasks
		  • A12. Heighten salience
		  • A13. Variety of stimuli
		  • A14. Vary amount of context supporting tasks (e.g., discrete tasks vs. scenarios)
		  • A15. Item/task format (selected response vs. constructed response, performance, etc.)

• AA2. Ability to persist and sustain effort	(A1, A2, A3, A4, A5, A6, A7, A8, A11, A12, A13, A14, A15)	

Part II: Procedures for Creating *Development Specifications and Exemplar Task Templates*

Part II of this manual focuses on the processes, procedures, and considerations associated with the *Development Specifications and Exemplar Task Template*. With clearly specified links to the *Design Pattern*, the *Development Specifications and Exemplar Task Template* guides assessment designers in making principled decisions about task design for the range of students who have significant cognitive disabilities. The template also includes fields for creating all elements of exemplar tasks. The *Development Specifications and Exemplar Task Template* is presented in Appendix B; the *Development Specifications and Exemplar Task Template* attributes and their definitions are displayed in Table 5.

The *Development Specifications and Exemplar Task Template* is used to document each of the important considerations and decisions made during the task design process. The template is divided into three sections, Sections A, B, and C, as shown in Table 5. Section A includes the title, summary (in AAD-M, this is the NCTM expectation), and rationale. It also includes context about grade-level performance. The information within Section B depicts the attributes of the *Design Pattern* that will be used in the process of producing the task. These attributes include the construct to be assessed (a Focal KSA for Items 1 and 2; an Additional KSA for Items 3a and 3b), behaviors that should reveal that construct (Potential Observations), and the statements or products created by students (Potential Work Products). Furthermore, this section contains a description of the Characteristic Features and Potential Variable Features associated with the *Design Pattern* (Mislevy, et al., 2003). The information in Sections A and B (with the exception of the grade-level information) is drawn from the associated *Design Pattern,* which must be produced before developing the *Development Specifications and Exemplar Task Template.* Section C depicts specific details about the exemplar items including the Item Directives, the Correct Answer for each item, the Description of Stimulus Items for students, and the Materials for Examiners to administer the items. These four attributes become the exemplar task and provide all the information an examiner would need to administer the items. Section C also includes selected Variable Features and Scaffolding, Variable Features for Administration to Individual Students, and a Notes field.

Table 5. *Development Specifications and Exemplar Task Template* Attributes and Definitions

Task Template Section	*Task Template* Attribute	Attribute Definition
Section A	**Title**	Short name for the *Design Pattern* (DP)
	Summary	Brief description of the **family of tasks** implied by the DP
	Rationale	Nature of the KSAs of interest and why they are important
	Grade-Level Standards	Background information about grade-level expectations for general education students
Section B	**Focal Knowledge, Skills, and Abilities (KSA)**	Focal KSA from DP for Items 1 and 2; Additional KSA from DP for Items 3a and 3b
	Potential Observations from DP	Observed behaviors of students that can provide evidence of the Focal KSA
	Potential Work Products	What students say, do, or make that provides evidence about the Focal KSA
	Characteristic Features	Aspects of assessment situations likely to evoke the desired evidence
	Potential Variable Features/Scaffolding	Features that could be changed to impact item difficulty
Section C	**Selected Variable Features/Scaffolding for the Item**	From Items 1 to 3: • Reduce depth of knowledge (DOK) • Reduce scope • Increase scaffolding/supports
	Item Directive	The stem or question (includes description and number of distractors if applicable)
	Correct Answer	Correct answer for the item
	Description of Stimulus Items	Description of the graphics or objects used in administration of the task
	Materials for Examiner	Materials required to administer, document, and score the task (e.g., worksheet, camera to take picture of product, manipulatives)
	Variable Features for Administration to Individual Students	Features that could be changed to impact item **accessibility** for individual student needs (e.g., as specified in the student's Individual Education Program [IEP])
	Notes	Notes regarding the task

Each *Development Specifications and Exemplar Task Template* is designed to facilitate the creation of 4 items. These items are intended to target the range of functional abilities within the target population. This approach allows items developed to be accessible to students with varying levels of cognitive functioning and communication capabilities. In addition, if the items are administered to the same students over time, the hierarchical sequence could help to provide some evidence of student growth. The 6-point depth of knowledge (DOK) scale developed by Flowers and colleagues (Flowers, Wakeman, Browder, & Karvonen, 2007) was adopted for

determining the DOK to be targeted for each item. This scale, developed as part of Links for Academic Learning, was designed to accommodate the unique learning characteristics of students with significant cognitive disabilities deemed eligible to take alternate assessments based on alternate achievements standards (AA-AAS). The 6-point DOK scale is shown in Table 6.

- Item 1 of the *Development Specifications and Exemplar Task Template* is the most sophisticated (in terms of complexity, DOK, scope of content covered, and level of scaffolding/supports), is closest to grade level, and targets the higher functioning students within the population. Item 1 targets the selected Focal KSA most comprehensively.
- Item 2 also aims to assess the selected Focal KSA, but is less complex and is designed to address a lower DOK.
- Item 3 is made up of two items: Items 3a and 3b. These are the least sophisticated and target the lowest functioning students within the population. Item 3a targets the recall or memorize level of the 6-point DOK scale, and Item 3b targets the attention level. If a student does not respond or responds incorrectly to Item 3a, then Item 3b can be administered. Item 3b extends below the recall/memorize DOK level in an effort to ensure that every student from the 1% population can participate in the task and experience success with content, age, and grade-appropriate stimulus materials. Because Items 3a and 3b are intended to address a less sophisticated DOK, an Additional KSA (i.e., a prerequisite or foundational skill) from the associated *Design Pattern* that is most closely related to the selected Focal KSA is used to develop these items.

Table 6. 6-point Depth of Knowledge (DOK) Scale

Item in Template	Depth of Knowledge
3b	***1. Attention*** (touch, look, vocalize, respond, attend)
2, 3a	***2. Memorize/recall*** (list, describe [facts], identify, state, define, label, recognize, record, match, recall, relate)
1, 2	***3. Performance*** (perform, demonstrate, follow, count, locate, read)
1	***4. Comprehension*** (explain, conclude, group/categorize, restate, review, translate, describe [concepts], paraphrase, infer, summarize, illustrate)
1	***5. Application*** (compute, organize, collect, apply, classify, construct, solve, use, order, develop, generate, interact with text, implement)
1	***6. Analysis, Synthesis, Evaluation*** (pattern, analyze, compare, contrast, compose, predict, extend, plan, judge, evaluate, interpret, cause/effect, investigate, examine, distinguish, differentiate, generate)

Development Specifications and Exemplar Task Template Development Guidelines

Once a *Design Pattern* has been reviewed and finalized, the creation of the *Development Specifications and Exemplar Task Template* can commence. In this section the methodology involved in this enterprise is described. Specifically, the following section provides guidelines and suggestions for the development of tasks.[2] Appendix B includes an example *Development Specifications and Exemplar Task Template* for Number and Operations A3 (grades 3–5).

Step 1. Pre-populate Section A of the Development Specifications and Exemplar Task Template

Step 1 involves pre-populating some of the attributes within the *Development Specifications and Exemplar Task Template* with information taken directly from the *Design Pattern*. The first three attributes (Title, Summary, and Rationale) come directly from the associated *Design Pattern*.

Grade-Level Standards are included to provide background information about what general education children should be able to do in light of specific standards or expectations and at certain grade levels. For example, the following Grade-Level Standards information was included for Number and Operations A3 (grades 3–5), which focuses on understanding fractions:

- Understand the structure of numbers and the relationships among numbers
- Explore a variety of models of fractions focused on familiar fractions: halves, thirds, fourths, fifths, sixths, eighths, and tenths
- Develop strategies for ordering and comparing fractions using benchmark fractions such as ½ and 1
- Use parallel number lines to show a unit fraction and its multiples

Whether this information is extracted from a standards document or generated for the project, the informed perspective of a math education or content expert is required. The co-design teams refer to this information as they build items that are accessible and appropriate for the 1% population, while considering alignment to grade-level expectations for the general education population.

Step 2. Pre-populate Section B of the Development Specifications and Exemplar Task Template

Step 2 involves pre-populating the attributes within Section B of the *Development Specifications and Exemplar Task Template* with information taken directly from the *Design Pattern*. In this step all Focal KSAs, Cognitive Background Knowledge Additional KSAs, Potential Observations, Potential Work Products, and Characteristic Features are copied from the associate *Design Pattern* into the *Development Specifications and Exemplar Task Template*.

Finally, the UDL Variable Features selected in the *Design Pattern* as most relevant for the task are copied into the Potential Variable Features section of the *Development Specifications and Exemplar Task Template.* These Variable Features will be "set" as part of the item development process to document precisely how task features are manipulated to influence item

2 The methodology we describe here is a result of our experiences in developing the AAD-M project's task design and development specifications template. Although there may be minor variations among different co-design teams in their implementation, these are the general guidelines that were followed.

difficulty. For instance, in Number and Operations A3, grades 3–5, the Potential Variable Features included:

- Number of representations presented to the student
- Models (fraction circles, card board representations, other manipulatives) and pictures
- Types of representation (fractions or wholes)
- Presentation of fraction (verbal, symbolic)
- Size of the denominator (2, 3, or 4)
- DOK of the content (e.g., fractions used [halves, thirds, quarters, etc.])

Step 3. Review and/or Revise the Pre-populated Attributes in Section B

It is an important and necessary step to review the pre-populated components of the template, as well as reflect again on the extended standards aligned to the standard/expectation being addressed. This reflection provides a sense of how and if the participating states are currently assessing content related to the expectation and also helps to shed light on how the emphases placed on a particular expectation may vary by state.

From among the Focal KSAs, the co-design team will select the Focal KSA that will serve as the foundation for Items 1 and 2. The choice of the Focal KSA can depend on several factors:

- Alignment of the particular focal KSA to the intended emphases of the state's extended standards.
- Complexity of the KSA (e.g., number of steps involved, level of cognitive skill required, and whether this level is appropriate for the target population). During the ECD design pattern process, the expectation is deconstructed into a set of distinct focal KSAs. Some co-design teams may prefer to select more fine-grained or more comprehensive Focal KSAs.
- Clarity or relative simplicity of the intended KSA to be assessed.
- Feasibility for developing tasks that can be "worked down"[3] (Browder et al., 2007) to encourage content accessibility for a wider spectrum of the target population.

Once the Focal KSA is selected, the next step is to determine the Potential Observations and Potential Work Products that will be targeted for Items 1 and 2. Within the design pattern each Focal KSA is associated with one or more Potential Observations (i.e., which represent different ways of gathering evidence of the focal KSA) and one or more corresponding Potential Work Products. A decision must be made about which Potential Observation and Potential Work Product will be used to provide evidence about the chosen Focal KSA. Although it is usually the case that the Potential Observation for Items 1 and 2 is selected from the list of Potential Observations detailed in the *Design Pattern* for the chosen Focal KSA, the co-design team may identify others at this point. If there is not a Potential Observation and/or Potential Work Product within the list from the *Design Pattern*, then a more appropriate Potential Observation and/or Potential Work Product that embodies the Focal KSA can be suggested, selected, and subsequently added to the *Development Specifications and Exemplar Task Template*. The

[3] Browder uses the phrase "work it down" to describe how to develop alternate assessments (AA) for students with significant cognitive disabilities that are linked to grade-level academic content standards. She suggests starting with content standards at grade level then considering how items can be translated so that students at different levels of functioning or communication would be able to access it.

selection of the Potential Observation and Potential Work Product may depend on several factors including:

- Cognitive complexity of the observed behavior for the target population (e.g., number of steps or skills involved in providing an answer)
- How characteristics of students from this population might limit their ability to demonstrate evidence about their knowledge in a specific way

Once the Focal KSA, Potential Observation, and Potential Work Product are decided upon, Characteristic Features are reviewed to remind the co-design team about the critical task features that must be present. Potential Variable Features are also reviewed so that the co-design team can consider possible ways to vary the four items. It is possible that the co-design team will propose additional Characteristic Features and Potential Variable Features. If it is determined that a proposed Characteristic Feature (not already within the *Design Pattern*) applies to all tasks created from a *Design Pattern*, it should be added.

For consistency the co-design team should update the *Design Pattern* by adding any new Potential Observations, Potential Work Products, Characteristic Features, and Variable Features that are generated during the task development process. Consistency of content between the *Design Pattern* and *Development Specifications and Exemplar Task Template* is critical. Note that this reconsideration or revision to the *Design Pattern* illustrates the iterative nature of the ECD process for developing both *Design Patterns* and *Development Specifications and Exemplar Task Templates*.

Step 4. Determine the Task Requirements for the Item

As items are created it is important to keep the following considerations in mind:

- **Presence of context**—A decision must be made about whether to include a context or to present the task in a decontextualized fashion. For example, if the Focal KSA aims to assess the students' ability to calculate summary statistics, a contextualized item can be developed, "In a recycling contest, students collected aluminum cans. This data table shows how many aluminum cans each student collected. What is the mean number of cans collected?" Alternatively, a decontextualized item can be developed, "Using these 10 data points, calculate the mean." Including context can make an item more interesting and engaging to students, but it can also increase the cognitive demand in a nonconstruct relevant way. If the decision is to have context present, here are further considerations in choosing one that is appropriate:
  - Choose a context that is grade-level appropriate and respectful. For instance, when targeting students in the grade 9–12 range, a recycling contest was the chosen context for students to demonstrate their ability to answer a question about data by identifying, creating, and using a graphical display, and calculating and using a summary statistic. Although the use of a marbles contest could allow the assessment of the same mathematical skill, it would not have been grade-level appropriate.
  - Establish a context that is realistic where possible. For example, if inches of rainfall during the year is the chosen context, the data points included should reflect what is typical and realistic.
  - Ensure concrete examples are used in the context where possible. For example, discuss mathematical relations in the context of everyday situations.

  - Use a context that is generalized where possible. For example, when discussing rainfall, instead of referring specifically to rainfall within a particular state (e.g., Hawaii or Florida), it is important to discuss rainfall in general so that the technical accuracy of the information (i.e., knowing the amount of rainfall that occurs in a particular state) is not the subject of the question.
  - Choose a context that is clear and unambiguous.
- **Student response mode**—A decision must be made about whether students will be asked to *select* the correct response from a set of response options or whether the student will be asked to *construct* the correct response on their own. If the student is asked to construct the correct response, another decision must be made about whether students would be asked to construct a verbal response, a graphical representation, a computer generated response, a concrete representation of their response, or a written response. The assessment designer must consider the relationship between the response mode required and the specific cognitive limitations of the students. It is possible that although an item may be designed with a particular response mode in mind, it may need to be modified by the test administrator at the time of administration given a particular student's capabilities.
- **Presence of data**—A decision must be made about whether data will accompany the text, and if so, the following questions should be considered:
  - Should the data be presented within a table, graphically, or in a list?
  - If data is presented graphically, what type of display should be used (e.g., line graph, pie chart, bar graph)?
  - Should the data be rich enough to allow the assessment designers to ask a range of nontrivial or interesting questions or should the data be limited to a specific question without extraneous information, relationships, or variables illustrated?
  - How many data points should be presented?
  - Should single and/or double-digit numbers be included (e.g., 9, 14)?
  - Should categorical and/or numerical data be presented? ;
  - How complex should the highlighted relationship be in the data distribution?
- **Number of questions within an item**—A decision must be made about whether one question or multiple questions should be asked of the student. This may depend on the complexity of the Focal KSA and on the approaches states are using and whether item interdependency can be addressed in their measurement model.
  - If multiple questions are asked, should they be asked in the same context and/or data set or should multiple contexts and/or data sets be progressively built into the items?
  - Should an overall framing or thematic question be included when multiple questions are asked?
- **Number of steps to the solution**—A decision must be made about how many steps should be involved in getting to the final solution.

Step 5. Develop the Item Directive

In Section C of the template specific task information is generated and recorded. This information will be recorded for each of the 4 items within the task. It is suggested that co-design teams work through steps 5–9 for Item 1, then go back and repeat these steps for Item 2, and finally go through them again to create Items 3a and 3b.

The Item Directive segment of the template includes the item prompt or question, the item description and distracters when applicable, and specific instructions that will be presented to students for each item. For the AAD-M project the convention was adopted that text in bold was to be read aloud by the examiner. The Item Directive does not detail specific individual adjustments that can be made (and that are acceptable) in the task administration. This information concerning individual adjustments is presented in the Variable Features for Administration to Individual Students section of the template (described in detail in step 9).

The mathematics expert within the co-design team typically suggests an idea for the Item Directive, taking into consideration the Focal KSA, the decisions made about the task requirements, their experience in the classroom, and the best way to assess the mathematics concepts targeted.

After drafting an initial representation of the idea for the Item Directive, the team discusses and modifies the Item Directive based on insights from differing perspectives, such as the principles of ECD, mathematics education, and classroom experience with special education students. The concerns addressed in these discussions should include:

- Capabilities of students in the target population
- Construct relevant and irrelevant details elicited by the proposed Item Directive:
  - Whether the proposed Item Directive adheres to the Focal KSA
  - What Additional KSAs might be required by the task
  - How to minimize or support the Additional KSAs within the design of the Item Directive
- Evaluation of the content of the Item Directive:
  - Context (see criteria in step 4)
  - Data presentation (see criteria in step 4)

To illustrate this process, the following is an example of the Item Directive for Item 1 of Number and Operations A3 (grades 3–5), which will be further elaborated in steps 6–7. The examiner presents students with three drawings of pizzas/pies and says, "**Here are three drawings of parts of a pizza**." The examiner then presents a card with the numeric fraction "¾", places it on the table in front of the student, and then asks, "**Which drawing shows three-fourths of a pizza?**" (Note: Some items may include multiple options for context information. These options are placed within square brackets [ ]. They are provided within the Item Directive to allow for maximum flexibility and appropriateness according to specific characteristics of the population. For instance, a board game [as opposed to a video game] may be a more appropriate example of a prize for populations from lower socioeconomic backgrounds; hence, it is provided as a possible replacement option).

Step 6. Document the Correct Answer

After the co-design team has reached consensus on the Item Directive, they next document the Correct Answer. The answer can be a number, graph, or description. The team should also specify whether alternative versions of the stated correct answer are also acceptable. For example, for the item created for Number and Operations A3, grades 3–5, the Correct Answer to the Item Directive (e.g., Which drawing shows three-fourths of a pizza?) is "**Student indicates the picture of ¾ of a pizza**."

Step 7. Describe the Stimulus Items and Materials for the Examiner

The Description of the Stimulus Items is a depiction or detailed description of the graphics, objects, or tools to be used in task administration. This might include a table of data presented to the student with which they must create graphics or interpret, synthesize, and/or calculate statistics. If there are multiple questions within an item, there will be a description of the stimulus materials for each question. The Stimulus Materials for Item 1 of Number and Operations A3, grades 3–5 include:

- Illustration of three pizzas divided into quarters; one has two quarters remaining, one has one quarter remaining, and the third has three quarters remaining
- Note card with the numeric fraction ¾

The Materials for the Examiner is a description of the materials examiners will need to administer, document, and score an item (e.g., worksheet, camera with which to take a picture of product, or a manipulative). It includes the task worksheet that describes the item and delivery instructions and task data sheet or other method to record the student's response.

Step 8. Update Selected Variable Features

The co-design team must return to the Selected Variable Features to update the information based on the selections made for the finalized Item Directive. The team first decides on the DOK level for the item. Using the 6-point DOK scale (Flowers, et al., 2007), the team decides which level best exemplifies the DOK required by the Item Directive created for the item. This decision is based on a number of factors including:

- **Understanding of the structure** of the DOK levels and the verbs used to exemplify each level, including how each level and verb can be operationalized generally in the context of mathematics and more specifically in the context of the item. For instance, an item that asks students to explain and/or make a conclusion is considered to be at the comprehension level.
- **Determining the mathematical sophistication** of what is elicited by the item based on the abstract nature of the mathematics concept being probed based on (1) the amount of prior mathematics knowledge that has to be drawn upon, (2) the number of mathematical principles required for the solution, and (3) whether the question can be answered with a procedure or routine.
- **Determining the complexity** of what is elicited by the item based on (1) whether the student has to extend or produce novel findings, (2) whether the item has multiple questions or requires multiple or integrated skills, and (3) whether the answer is a constructed response or selected response. In addition, the distracters in a selected response item can be written to impact the item's complexity.

If the DOK assigned to Item 1 is lower than desired, the team may decide to use Item 1 as an Item 2 or may revise the Item Directive to increase the DOK level of the item.

The co-design team should explicitly detail the decisions made for each Variable Feature selected to create the Item Directive. For instance, if the co-design team chooses to ask students to create a histogram (rather than a scatter plot or box plot), then they must document this decision.

Step 9. Document Variable Features for Administration to Individual Students

Variable Features for Administration to Individual Students specify task features that could be changed to impact item accessibility according to individual student needs (e.g., large print, Braille for those with visual impairments). Although the Item Directive will not be modified, it is possible that certain students will require specific accommodations in addition to the accessibility and scaffolding features built in to the design of the item. The boundaries of this category will be determined in part by accommodation policies in individual states. However, it is certain that these Variable Features should not compromise the construct (Focal KSA) targeted. Currently, two types of Variable Features for Administration to Individual Students have been consistently noted in the *Development Specifications and Exemplar Task Template*: (1) the freedom to vary the format of the question presentation (e.g., presented in sign language with Braille, auditory, or with or without gestural prompts) and (2) the students' response format individualized based on their communication system. States need to specify which accommodations or formats are and are not allowed

Step 10. Repeat Steps 5–9 to Develop Item 2

The co-design team should repeat Steps 5–9 to develop Item 2. Item 2 must assess the same Focal KSA as Item 1, but it involves skills that are considered to be at a lower DOK level. In addition, Item 2 is typically less complex, more narrow in scope, and more heavily scaffolded or supported. In creating Item 2, the modifications below should be kept in mind. These modifications help to ensure that the DOK and scope have been appropriately decreased and that supports or scaffolding have been appropriately increased relative to Item 1 while still preserving the Focal KSA.

- **Reduce DOK Levels:**
  - If Item 1 required students to *construct* a response (a higher DOK level), in Item 2 students can be asked to *select* the appropriate answer from a set of response options (a lower DOK level).
- **Reduce Complexity:**
  - If Item 1 asked students to *create a scatter plot or box plot,* Item 2 can ask for the *creation of a histogram*, which is technically less sophisticated. A histogram is focused on the frequency of one variable, while a scatter plot is about the relationship between two variables.
  - If Item 1 presents *20 data points* to be mathematically represented, Item 2 could present only *10 data points*.
  - If Item 1 contains *4 subquestions* (i.e., a, b, c, and d), Item 2 could contain only *2 questions* (i.e., a, b).
- **Narrow the Scope of Content to Be Assessed:** If Item 1 assessed *a composite set of skills* (e.g., students determine the appropriate representation to be used to answer a research question, create that representation, and then use the representation to answer the research question), then Item 2 should *assess fewer components of those skills* (e.g., perhaps students just create and use the representation).
- **Increase Scaffolding or Support:** If the Focal KSA is about creating mathematical representations, Item 1 might ask students to create the representation with little support. Item 2 will increase the amounts and kinds of scaffolding within the design of the item. For instance, students could be provided graph paper to support the creation of a graphical

representation (e.g., histogram) and/or students could be provided with key elements of the graph already completed (e.g., axes, labeled axes, and bins).

Step 11. Repeat Steps 5–9 to Develop Items 3a and 3b

Steps 5–9 also should be followed to complete Items 3a and 3b to ensure systematic development and documentation of design decisions for these items. However, recall that for these items an Additional KSA (not the Focal KSA) is targeted.

Some important considerations developing Item 3a are as follows:

- For consistency, select an Additional KSA that is aligned to the selected Focal KSA.
- The choice and use of an Additional KSA (or prerequisite skill) that is narrowly focused increases the likelihood that the item is less sophisticated than Items 1 and 2.
- Ensure that students at the lower functioning end of the spectrum of students with significant disabilities are taken into account in the design of this item.

Item 3b targets the attention DOK level. This usually involves removing all distracters from Item 3a and leaving only the correct answer for the student. The student is asked to point to or otherwise indicate the remaining stimulus item. This item is included in an effort to ensure that all students, including those with the most severe cognitive disabilities, will be able to participate in the testing experience and encounter some success.

Pilot Testing

Following the steps described in these guidelines doesn't ensure the validity and reliability of the assessment tasks. It is imperative that assessment designers gather empirical data from the appropriate population of students to establish the viability of the assessment tasks and their technical qualities. Assessment designers should pilot-test the newly developed assessment tasks with teachers administering them to students eligible to take state AA-AAS. The focus of the pilot should be to collect information about task variability and the appropriateness of the tasks to measure a range of student performance levels.

Task Viability. Pilot tests of the tasks should be undertaken to judge the viability of the tasks. Can the four items associated with a design pattern be administered as designed? Are the task instructions and materials clear to the teacher? Are they clear to the student? Data can be collected through a teacher questionnaire and/or observations of task administration.

Task Appropriateness. It is recommended that tasks be administered to students with significant cognitive disabilities with differing levels of functioning so that the tasks measure a range of student performance levels. Which students perform successfully on Item 1 (most complex item)? Which students perform successfully on Items 2, 3a, and 3b (decreasingly complex items)?

Data from the pilot testing can be used to inform modification of items so that all or most students can gain access to at least one item associated with each design pattern.

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Appendix A: Design Pattern

Design Pattern
Number & Operations A3 (grades 3-5)

	Attribute	Definition	Design Pattern (DP)	Notes/Guidance
1	Title	Short name for the DP	Number & Operations A3 (grades 3-5)	
2	Summary	Brief description of the **family of tasks** implied by the DP	Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers	
3	Rationale	Nature of the KSAs of interest and why they are important	Fractions represent a significant extension of children's knowledge about numbers. When children possess a sound understanding of fractions, they can use this knowledge to describe real world phenomena and apply it to problems involving measurement, probability, and statistics.	This expectation reflects extended standards for all 3 states as a critical element in the mathematics curriculum
4	Focal KSAs	The primary KSAs targeted by this DP	Ability to recognize a whole and divide it into or recognize equal parts (e.g., halves, thirds, or quarters) Ability to identify fractions by the number of parts in the whole and in the fractional amount Ability to identify a collection as a whole, and consider groups of objects in the collection as parts of the whole Knowledge that fractions are numbers and identify points on the number line corresponding to particular fractions, between 0 and 1, and greater than 1 Knowledge that a division operation may not have a whole number result Ability to solve problems involving fractions	• Link to grade level academic content • Include variety in depth of knowledge so that all students are appropriately challenged • Do not include prerequisite KSAs • Note: While the extended content standards have been taken into account, the Focal KSAs have been selected to represent the content in the NCTM expectation being addressed. NCTM expectations represent the commonality between the extended standards of the 3 consortium states.
5	Additional KSAs	Other KSAs that may be required by tasks from this DP, some of which can be supported by universal design for learning (UDL) and accommodations	**Cognitive Background Knowledge** • Ability to count using whole numbers • Ability to use a number line to model whole numbers and operations on them • Knowledge that there is "space" on the number line between each whole number • Ability to perform division operations (e.g., grouping)	• May include prerequisite background knowledge (KSAs) • Additional KSAs organized by 6 UDL categories • Content related Additional KSAs are addressed in the Cognitive Background Knowledge category • Create Technology Appendix organized by focus of Design Pattern

Appendix A: Design Pattern

	Attribute	Definition	Design Pattern (DP)	Notes/Guidance
			Perceptual (Receptive) • Ability to perceive the linguistic components of the question (e.g., through print, objects, audio, Braille/Nemeth code, sign language) • Ability to perceive images in the question (e.g., through print, objects, holistic description, through Braille/Nemeth code description, tactile graphics) • Ability to perceive physical objects required for the task (e.g., see/feel hatch marks on a number line) **Skill and Fluency (Expressive)** • Ability to communicate response (e.g., "communication board/device, switch, signs, voice, AAC device, eye gaze) • Ability to compose or express a response in text (e.g., by writing, using Braille/Nemeth code) • Ability to express a response verbally or by signing • Ability to manipulate physical or virtual materials (e.g., dexterity, strength, computer access, and mobility) • Ability to manipulate digital/electronic equipment • Knowledge of how to use physical materials or digital/electronic equipment (e.g., familiarity) **Language and Symbols** • Ability to recognize text, symbols, numbers, or images • Ability to decode text, symbols, numbers, or images • Ability to comprehend text, symbols, numbers, or images • Ability to understand English vocabulary and syntax **Cognitive** • Ability to attend to stimuli • Ability to recall related background knowledge • Ability to perform (e.g., answer questions, solve simple problems) • Ability to provide an explanation • Ability to organize information • Ability to synthesize information	(e.g., fractions)

Appendix A: Design Pattern

	Attribute	Definition	Design Pattern (DP)	Notes/Guidance
			• Ability to understand the meaning of an example • Ability to process multi-step problems • Ability to recall and use information presented in a task/item (working memory) • Ability to understand the structure of "organizers" used to present information or to scaffold responses (e.g., how to complete a table) • Ability to understand the purpose of highlighted features in text or illustrations **Executive** • Ability to understand goals and expectations • Ability to monitor goals and progress • Ability to plan and sequence • Ability to self-regulate and reflect during problem solving **Affective** • Ability to engage (e.g., task-specific motivation) • Ability to persist and sustain effort	
6	Potential Observations	Observed behaviors of students that can provide evidence of Focal KSAs	• Student correctly divides an object into a specified number of equal parts • Student correctly identifies a pictorial representation of a fraction • Student correctly distinguishes a whole from fractions of a whole • Students correctly matches fraction to pictorial or object representation of that amount • Students correctly names the fraction represented by a picture or object • Student correctly distinguishes between the whole and its component parts • Student correctly indicates that a collection (of objects, people, etc.) is whole when all component elements are present • Student correctly indicates that a collection (of objects, people, etc.) is not whole when any component elements are missing	• Each Potential Observation includes a qualifier (e.g., correctly, accurately, appropriately) that specifies the judgment about a behavior that will provide evidence about a student's knowledge, skill, or ability

Appendix A: Design Pattern

	Attribute	Definition	Design Pattern (DP)	Notes/Guidance
			• Student correctly identifies the point on a number line between 0 and 1 that corresponds to a fraction • Student correctly identifies the point on a number line greater than 1 that corresponds to a fraction • Student correctly reads fractional values (between 0 and 1 and greater that 1) indicated on a number line • Student correctly solves division problems with a remainder • Student correctly solves addition and subtraction problems involving fractions • Student correctly creates halves, quarters using physical objects	
7	Potential Work Products	What students say, do, or make that provides evidence about the Focal KSAs	Products may be written, verbal, demonstrations, and may be audio or video recorded or recorded by teacher, e.g.: • Student worksheet with multiple pictorial representations of fractions • A whole object divided into fractional pieces • Selection of a whole orange and fractional pieces of it • Student worksheet that depicts one half, one quarter, and three quarters of a pizza and student indicates which picture represents ¾ • Student worksheet with one picture of a portion of a pizza in slices and student indicates fraction represented • Student worksheet that includes various whole and incomplete collections; student indicates which are whole and incomplete • Student selects number of apple quarters to comprise a whole apple • Demonstration of point on a number line corresponding to a fraction • Worksheet presenting fractions and number lines and student marks the point representing each fraction on the associated number line • Worksheet with number lines shaded to represent various fractions (between 0 and 1 and greater than 1) and student indicates fractional values	• Illustrate types of work products that could be gathered as part of the assessment to provide evidence of Focal KSAs • Create concrete examples of work products • **Menu** of options – not required work products (e.g., if user only uses paper/pencil tasks, why include multiple options for work products? We want users to think broadly; this document can be used if assessments change in the future) • Do not include qualifying words (e.g., appropriate) • Worksheet can include electronic worksheets or screenshot of work in computer math skill program

Appendix A: Design Pattern

	Attribute	Definition	Design Pattern (DP)	Notes/Guidance
			• Student creates a number line • Indication of number of pairs of students in a class of 9 children • Student groups a number of objects into equal piles with a remainder (e.g., 17 blocks grouped into five equal piles of 3 blocks and one pile with 2 blocks remaining) • Worksheet/screenshot with simple addition and subtraction problems involving fractions (e.g., ½ plus ½ = 1) • A sheet of paper folded to indicate one half, one quarter, one third, etc. • A cookie divided in halves, quarters, or thirds	
8	Potential Rubrics	Some evaluation techniques that may apply	• Dichotomous (0,1) • Partial credit (0,1, 2, 3) • Consistency of proficiency (# times student gets correct response over multiple trials) • Scores based on independence of student's response	• Rubrics unique to states should be identified • Ways tasks may be scored • How to apply so assessment is rich, not confined
9	Characteristic Features	Aspects of assessment situations likely to evoke the desired evidence	• All problems will involve the use of fractions • Preteach the vocabulary used to direct students through the task and test • Providing practice for navigating through the steps of the problem • Individual student responses, not group responses • Tasks are individually administered by a teacher or trained administrator • Accommodations allowed • Test administrator knows student and his/her comprehensive/response abilities • Periodic collection of work samples (for portfolios)	• Features tasks must include to evoke the desired response • Consider cost/benefit of adding "story" information or authentic context to problems (increase relevance) vs. limiting extraneous information (minimize ambiguity and reduce cognitive load)

10	Variable Features	Aspects of assessment situations that can be varied in order to control difficulty or target emphasis on various KSAs	**Cognitive Background Knowledge** • Provision of a table, chart, or tactile reminder of the numbers to support understanding that numbers occur in a specified sequence [NOTE: could be a characteristic feature if used on all items] • Supports for use of a number line (supported, unsupported, degree of support) (e.g., provide a number line, model use of a number line, re-teaching use of a number line just prior to assessment) • Supports for division skills (supported, unsupported, degree of support) (e.g., provide a calculator, use number line to provide visual representation of division, counters, counter mats) **Perceptual (Receptive)** • Delivery mechanisms by which the question is perceived (e.g., read aloud verbatim/read aloud paraphrase, pictures, large print, printed text, Braille/Nemeth code, signing, auditory amplification, symbols, concrete objects, description of objects or images, text to speech, CCTV – close circuit TV, to increase size of font, vary contrast, etc.) • Supports for the use of objects required for the task (e.g., speaking calculator, size of calculator, size of number line) **Skill and Fluency (Expressive)** • Response mode options (e.g., pointing, speech and verbalization, writing, Braille/Nemeth code, signing, switch or other assistive device/augmentative communication device, scanning software, switch or other assistive device/augmentative communication device, eye gaze, for lowest functioning students – predictable behavioral response, tolerate assistance – e.g., hand over hand) • Supports for composing a response in text (e.g., written by student, speech to text, written by teacher, keyboarding) • Supports for manipulating physical materials (e.g., use of	• Special consideration required of the variable features of “story” problems. Adding story information can increase relevance but also adds ambiguity and increases cognitive load. • For multi-step problems, use of executive management supports will be essential.

			velcro, size of materials, teacher/peer manipulation of materials) • Supporting for manipulating digital/electronic equipment (pointers, teacher/peer manipulation of equipment, spoken commands, stylus for input, larger keyboard/buttons, adaptive mouse) • Practice tutorials with unfamiliar physical materials or digital/electronic equipment **Language and Symbols** • Level of abstraction required of student (e.g., concrete objects, images, text) • Embedded support for vocabulary, numbers, and symbols (e.g., technical glossary, picture glossary with speech, hyperlinks/footnotes to definitions, illustrations, background knowledge, number line) • All key information in the dominant language (e.g., English) is also available in prevalent first languages (e.g., Spanish) for second language learners and in sign language for students who are deaf • Use of multiple representations (e.g., physical models, demonstrations, acting out scenarios) • Alternate syntactic levels (simplified text) • Highlight essential elements, words, or phrases • Digital text with automatic text to speech • Digital Braille with automatic Braille to speech **Cognitive** • Depth of knowledge of the content • Level of complexity of the content (e.g., fractions used (halves, thirds, quarters, etc.) • Prompts to explain sequential steps used to solve the problem • Item/task format (selected response vs. constructed response, performance, etc.) • Adjustable levels of challenge (teacher able to adjust) o Provides the opportunity for successive approximations of the task o Utilizes back-chaining technique	

			• Options for supporting background knowledge: o Pre-teach background content o Provide analogies and examples o Provide hyperlinks to multi-media o Provide links to related information o Provide links to familiar materials o Provide concept maps o Remind student of prior experiences o Remind student of materials or activities used to teach foundational math skills • Options for supporting critical features, big ideas, and relations: o Provide graphic organizers o Outline information o Highlight information o Provide alternative forms of key concepts o Provide multi-media glossaries o Provide translation tools o Provide modeled prompts o Provide a response template • Options for guiding exploration and information processing: o Provide multiple entry points o Allow viewing of stimuli from previous stages and parts o Use familiar materials o Use consistent signals/cues o Provide sequential highlighting o Chunk information into smaller elements o Mask part of the information o Mask incorrect answer options o Provide modeled prompts o Provide a practice item or task o Provide a calculator, talking calculator, on-screen electronic calculator o Provide a number line, electronic number line • Options for supporting memory and transfer: o Note-taking o Mnemonic aids	

			o Locate items near relevant text o Reread question o Present items as a discrete unit or embed in a scenario o Videotape lesson **<u>Executive</u>** • Prompts and scaffolds to estimate effort, resources, and difficulty • Prompts, scaffolds, and questions to monitor progress, to "stop and think", and for categorizing and systematizing • Representations of progress (e.g., before and after photos, graphs and charts) • Guides, checklists, graphic organizers, and/or templates for goal setting, prioritizing, breaking long-term objectives into reachable short-term goals, self-reflection, and self-assessment • Adjust levels of challenge and support (e.g., adjustable leveling and embedded support, alternative levels of difficulty, alternative points of entry) **<u>Affective</u>** • Teacher options for providing supports for attention and engagement: • Cover up part of text so student isn't overwhelmed • Prompt student to re-engage • Hierarchical prompt structure to promote engagement and reengagement • Provide verbal/gestural prompts • Provide feedback to support engagement • Provide supports to reduce student frustration (e.g., noise reduction, extended test taking time, contingencies, number of items administered at one time) • Provide varied levels of challenge and support • Provide optimal student positioning (positions which encourage alertness, not recumbent) • Administer assessment at optimal time of day for	

			student engagement • Provides the opportunity for successive approximations of the task • Utilizes back-chaining technique • Task options for engagement: • Provide students with choices for personal control of age-appropriate content when construct is not impacted (e.g., choice of topic or theme) • Provide students with choices for personal control of task context when construct is not impacted • Enhance relevance, value, and authenticity of tasks • Heighten salience • Variety of stimuli • Vary amount of context supporting tasks (e.g., discrete tasks vs. scenarios) • Item/task format (selected response vs. constructed response, performance, etc.)	
11	Educational Standards	State extended math standards related to selected NCTM expectation	**Florida:** Grade 3: A.2.In.a. Represent half and whole using area and sets of objects. A.2.Su.a. Recognize part and whole using area and sets of objects. A.2.Pa.a. Recognize parts of whole objects and parts of sets of objects. A.2.In.b. Identify the relationship between half and whole. Grade 4: A.2.In.b. Express and represent fractions, including halves and fourths, as parts of whole and parts of a set using objects, pictures, and number names. A.2.Su.b. Represent half and whole using area and sets of objects. A.2.Pa.b. Distinguish parts of objects from whole objects. A.6.In.c. Identify the relationship between halves, fourths, and a whole. A.6.Su.d. Identify the relationship between half and whole. A.6.Pa.c. Match parts to whole objects. Grade 5: A.2.In.a. Express and represent fractions, including halves	

			and fourths, and thirds as parts of a whole and as parts of a set using number names. A.2.Su.a. Express, represent, and use fractions, including halves and fourths, as parts of a whole and as parts of a set, using number names. A.2.Pa.a. Identify parts of a whole using a set of objects or a whole object. **<u>Idaho:</u>** Grade 4: 1.2.4A. Identify that "a whole" can be divided to create "smaller pieces" (fractions) and the pieces can be added to create a whole again. Grade 5: 1.2.2 A Identify that numbers with decimals as a part of a whole (e.g., money using coins and dollars). 1.2.4 A Recognize common small pieces or fractions to fourths can be subtracted from the whole. **<u>Utah:</u>** Grade 3: Ib. Use fractions to identify or describe parts of the whole (half, third, fourth) (e.g., divide geometric shapes into 2, 3, an 4 equal parts; match the unit fraction ½, 1/3, and ¼ with objects, pictures, words, or symbols; fold a paper in half. Share a cookie with another person or with 2 friends.) Grade 4: Ib. Use area, set, or linear (number line) models to identify, order, or compare whole numbers and fractions (1/2, 1/3, ¼), mixed numbers (e.g., 1 ½) (e.g., show part of the set & whole set; show 3 equal parts of the whole set; find 1 ½ on number line). Grade 5: Ib. Use area, set, or linear (number line) models to identify, order, or compare whole numbers, fractions (1/2, 1/3, ¼), mixed numbers (e.g., 1 ½) (e.g., show part of the set & whole set; show 3 equal parts of the whole set; find 1 ½ on number line).	

Appendix B: Blank Task Template

	Attributes	General Information			
Section A	Title				
	Summary				
	Rationale				
	Grade level standards (from National Council of Teachers of Mathematics)				
	Design Pattern Attributes	**Definitions**	**Item 1** Application/Comprehension/Performance	**Item 2** Performance/Recall	**Item 3** Recall/Attention
Section B	Focal KSA	Focal KSA from DP for Items 1 & 2; Add'l KSA from DP for Item 3			
	Potential Observations from DP	Observed behaviors of students that can provide evidence of the Focal KSA			
	Potential Work Products	What students say, do, or make that provides evidence about the Focal KSA			
	Characteristic Features	Aspects of assessment situations likely to evoke the desired evidence			
	Potential Variable Features/ Scaffolding	Features that could be changed to impact item difficulty			
Section C	Selected Variable Features/ Scaffolding for the Item	From Item 1 to Item 3: • Reduce DOK • Reduce scope • Increase scaffolding/ supports			
	Item Directive	The stem or question (includes description and number of distractors if applicable)			
	Correct Answer	Correct answer for the item			
	Description of Stimulus Items	Description of the *graphics or objects* used in administration of the task			
	Materials for Examiner	Materials required to administer, document, and score the task (e.g., worksheet, camera to take picture of product, manipulatives)			
	Variable Features for Administration to Individual Students	Features that could be changed to impact item **accessibility** for individual student needs (e.g., as specified in the student's IEP)			
	Notes				

Appendix C: Task/Item Development

Task/Item Development
Number & Operations A3 (grades 3-5)

Attributes	General Information			
Title	Number & Operations A3 (grades 3-5)			
Summary	Develop understanding of fractions as parts of unit wholes, as parts of a collection, as locations on number lines, and as divisions of whole numbers			
Rationale	Fractions represent a significant extension of children's knowledge about numbers. When children possess a sound understanding of fractions, they can use this knowledge to describe real world phenomena and apply it to problems involving measurement, probability, and statistics.			
Grade level standards (from NCTM)	Understand the structure of numbers and the relationships among numbers. Explore a variety of models of fractions focused on familiar fractions: halves, thirds, fourths, fifths, sixths, eighths, and tenths. Develop strategies for ordering and comparing fractions using benchmark fractions such as ½ and 1. Use parallel number lines show a unit fraction and its multiples.			
		Item 1	**Item 2**	**Item 3a/3b**
Attributes	**Definition**	Application/Comprehension/ Performance	Performance/Recall	Recall/Attention
Focal KSA	Focal KSA from DP for Items 1 & 2; Add'l KSA from DP for Item 3	Ability to identify fractions by the number of parts in the whole and in the fractional amount. (This focal KSA deals with both the numerator and the denominator)		• Knowledge that a whole number can be divided into fractions of the whole.
Potential Observations from DP	Observed behaviors of students that can provide evidence of the Focal KSA	• Student correctly matches fraction to pictorial or object representation of that amount • Student correctly names the fraction represented by a picture or object		*Not addressed in DP*
Potential Work Products	What students say, do, or make that provides evidence about the Focal KSA	• Student worksheet that depicts one half, one quarter, and three quarters of a pizza and student indicates which picture represents ¾ • Student worksheet with one picture of a portion of a pizza in slices and student indicates fraction represented		*Not addressed in DP*
Characteristic Features	Aspects of assessment situations likely to evoke the desired evidence	• All problems will involve the use of fractions		

Appendix C: Task/Item Development

Attributes	Definition	Item 1 Application/Comprehension/ Performance	Item 2 Performance/Recall	Item 3a/3b Recall/Attention
Potential Variable Features/ Scaffolding	Features that could be changed to impact item difficulty and scope	• The number of representations presented to the student. • Models (fraction circles, card board representations, other manipulatives) pictures. • Types of representation: Presents fractions or wholes. • Presentation of fraction: Verbal, symbolic • Size of the denominator (2, 3, or 4) • Depth of knowledge of the content (e.g., fractions used (halves, thirds, quarters, etc.)	• The number of representations presented to the student. • Models (fraction circles, card board representations, other manipulatives) pictures. • Types of representation: Presents fractions or wholes. • Presentation of fraction: Verbal, symbolic • Size of the denominator (2, 3, or 4) • Depth of knowledge of the content (e.g., fractions used (halves, thirds, quarters, etc.)	• The number of representations presented to the student. • Models (fraction circles, card board representations, other manipulatives) pictures • Types of representation: Presents fractions or wholes. • Presentation of fraction: Verbal, symbolic • Size of the denominator (2, 3, or 4) • Depth of knowledge of the content (e.g., fractions used (halves, thirds, quarters, etc.)
Selected Variable Features/ Scaffolding for the Item	From Item 1 to Item 3: • Reduce DOK • Reduce scope • Increase scaffolding	• 3 representations presented • Model: Drawing of fraction circles • Presents 3 models each of which is a fraction • Presents verbal and symbolic representations of numeric fractions • DOK math content: ¼, 2/4, ¾ • DOK level: Comprehension (Translate) • Scaffolding: - Use of a diagram - Multiple representations of fractions	• 2 representations presented • Model: Photograph of pizza/pie • Presents 2 models one of which one is a fraction and one is a whole • Presents verbal and symbolic representations of numeric fractions • DOK math content: ½ and 1 whole • DOK level: Performance (Locate) • Scaffolding: - Use of photograph of familiar stimuli - Multiple representations of fractions	• 2 representations presented • Model: Photograph of pizza/pie • Does not present verbal and symbolic representations of numeric fractions • Presents verbal and symbolic representation of part versus whole • DOK math content: 1 whole versus part of a whole (1/4, ½, ¾) • DOK level: Recall (Identify “not a whole”) • Scaffolding: - Use of photograph of familiar stimuli - Multiple representation of part vs. whole

Appendix C: Task/Item Development

Attributes	Definition	Item 1 Application/Comprehension/ Performance	Item 2 Performance/Recall	Item 3a/3b Recall/Attention
Item Directive	The stem or question (includes description and number of distractors if applicable)	Examiner presents student with three drawings of pizzas/pies and says, "**Here are three drawings of parts of a pizza/pie**." Examiner then presents a card with the numeric fraction "¾" down on the table in front of the student and says, "**Which drawing shows three fourths of a pizza/pie?**"	Examiner presents students with two photos, one with a whole pizza/pie and the other with a half of a pizza/pie. Examiner says, **"Here are two photos of pizzas/pies."** Examiner then presents a card with the numeric fraction "½"down on the table in front of the student and says, **"Show me which photo shows half of a pizza/pie."**	3a) Examiner presents two unlabeled pizza/pies in a row to student and says, **"Here are two photos of pizza/pie (a whole pizza/pie and part of a pizza/pie). Show me the photo that is a part of a pizza/pie."** 3b) If student cannot respond, remove all stimuli but the photo of part of a pizza/pie. Teacher says, **"Look at/touch the photo of part of the pizza/pie."**
Correct Answers	Correct answer for the item	Student indicates ¾ of a pizza/pie picture on the worksheet	Student indicates ½ pizza/pie picture	3a) Student indicates the picture that is not a whole pizza/pie. 3b) Student looks/touch the picture of a half of pizza/pie
Description of Stimulus Items	Description of the *graphics or objects* used in administration of the task	Three **unlabeled** drawings of three pizzas/pies presented in a row (these are bird's eye view of the pizza/pie, not a side view with perspective). Each pizza/pie is divided into four slices. One has 2 of the four remaining, one has one of the four remaining, and the third has three of the four remaining. Every pizza/pie shows the quarters outlined with a dotted line. Every pizza/pie has four sections outlines even if they are missing. The teacher has a card with ¾ on it.	Two **unlabeled** photos of two pizzas/pies presented in a row (these are bird's eye view of the pizza/pie, not a side view with perspective). Teacher has card with ½ on it. One photo is of a whole pizza/pie and the other photo is of a half of pizza/pie.	Two **unlabeled** photos of two pizza/pies presented in a row (these are bird's eye view of the pizza/pie, not a side view with perspective). One photo is of a whole pizza/pie. The second photo is of half of pizza/pie.

Appendix C: Task/Item Development

Attributes	Definition	Item 1 Application/Comprehension/ Performance	Item 2 Performance/Recall	Item 3a/3b Recall/Attention
Materials for Examiner	Materials required to administer, document, and score the task (e.g., worksheet, camera to take picture)	3 pictures of pizzas/pies (Illustration 1) 1 card with numeric ¾ (Illustration 2) Recording sheet for teacher to complete	2 photographs of pizzas/pies (Illustration 1) 1 card with numeric ½ (Illustration 2) Recording sheet for teacher to complete	2 photographs of pizzas/pies (Illustration 1 and 2) Recording sheet for teacher to complete
Variable Features for Administration to Individual Students	Features that could be changed to impact item accessibility for individual student needs (e.g., as specified in the student's IEP)	• Question presentation individualized (e.g., related in sign language) • Response format individualized based on student communication system • Remind student of prior experiences • Verbal/gestural prompts individualized • Use of tactile graphics	• Question presentation individualized (e.g., related in sign language) • Response format individualized based on student communication system • Remind student of prior experiences • Verbal/gestural prompts individualized • Use of tactile graphics	• Question presentation individualized (e.g., related in sign language) • Response format individualized based on student communication system • Remind student of prior experiences • Verbal/gestural prompts individualized • Use of tactile graphics

Updated Flowers/Browder Math DOK[4]:

(1) **Attention:** touch, look, listen, repeat what the teacher said, vocalize, respond, attend, recognize

(2) **Memorize/recall:** list, describe (facts), state math facts, identify, state, define, match, recognize, label, follow a pattern

(3) **Performance:** answer, follow 1 step directions, find answer, present, read, separate, spell, tell time, map, model demonstration, perform, demonstrate, follow, choose, count, locate, group by given attributes, solve simple (one computation skill) problems, measure

(4) **Comprehension:** understand, extend a pattern, sketch, ask and answer questions, categorize/group by unknown attributes, explain, conclude, group, restate, review, translate, classify/sort with understanding, simplify (equivalent forms)

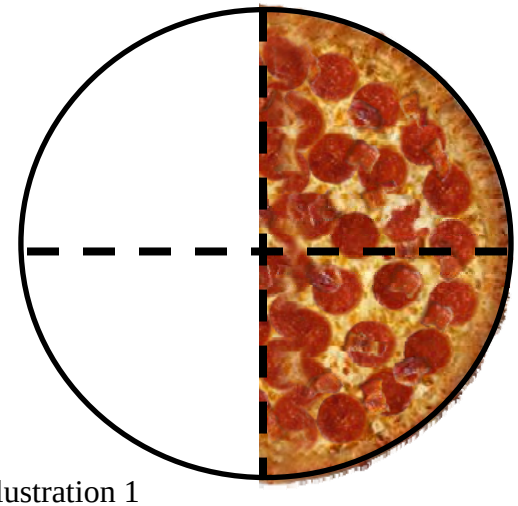
(5) **Application:** compute, organize, collect (such as data), apply, revise, construct, solve complex (multiple computation skills) problems, use given formulas in novel situations (formula may or may not be identified), explain a process, conduct research

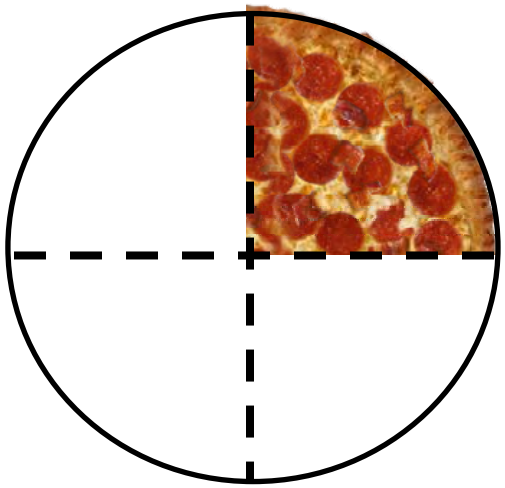
(6) **Analysis, Synthesis, Evaluation:** create a complex pattern, analyze, compare, contrast, compose, predict, plan, judge, evaluate, interpret data, generalize findings, create hypotheses

[4] Bechard, S., Almond, P., Karvonen, M., Wakeman, S., Turner, C., Bowen, T., & Turner, L. (2009). *Hitting a moving target: A discussion of ten alignment studies for AA-AAS.* Paper presented at the National Conference on Student Assessment. Los Angeles, CA June 23, 2009.

Materials for Examiner:

Item 1:





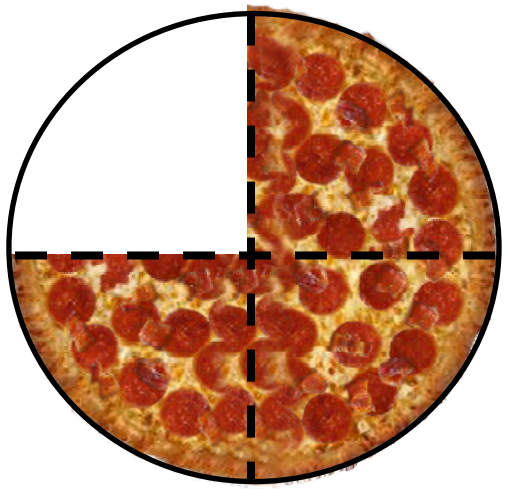


Illustration 1

$\frac{3}{4}$

Illustration 2

Item 2:

Illustration 1

1/2

Illustration 2

Appendix C: Task/Item Development

Item 3:

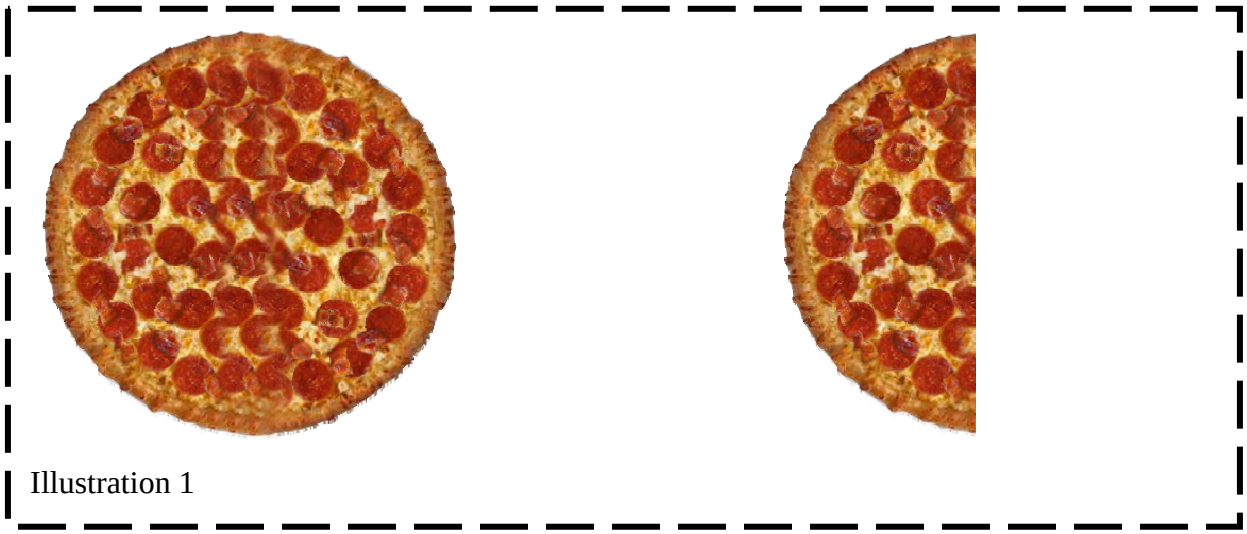


Illustration 1

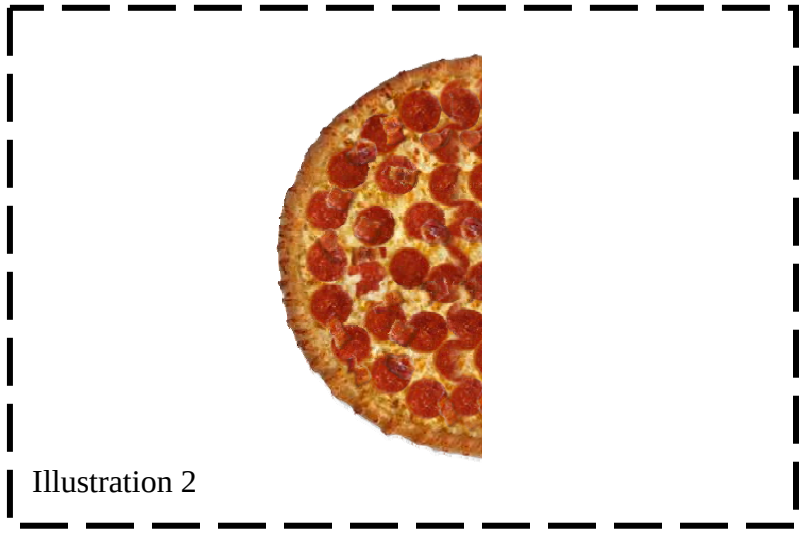


Illustration 2