Addition of Functional Content during Core Content Instruction with Students with Moderate Disabilities

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Abstract: The purpose of this investigation was to add functional content during core content instruction of language arts, science, and math. The investigation involved three middle school students with moderate disabilities who participated in the state's alternate assessment. During instruction using a constant time delay procedure to teach required grade level core content, the special education instructor added functional content as follows: (a) language arts—information found in the news added to grade level sight word vocabulary, (b) science—cooking skills or appropriate dress for weather conditions added to the properties of elements in the periodic table, and (c) math—computation of sales tax for items appearing in advertisements added to order of operations. The results showed that students could learn, maintain, and generalize both types of content presented within the same lesson.

The No Child Left Behind Act (NCLB) and the Individuals with Disabilities Education Act (IDEA) both mandate that all students, including those with moderate-severe disabilities (MSD) receive access to the general curriculum. Among researchers and practitioners in the field of special education, however, there is not an agreed upon definition of access to the general curriculum (Dymond, Renzaglia, Gilson, & Slagor, 2007). While questions remain regarding what exactly constitutes the general curriculum as well as what access means, often the discussion focuses on learning standards and the academic components of the general curriculum (Dymond et al.). This may be due, at least in part, to NCLB accountability measures that require states to report academic achievement for all students in the specific content areas of reading/language arts, math, and science. Students who are unable, even with appropriate accommodations, to participate in these tests are also assessed on these academic content areas but do so through participating in alternate assessments (Browder & Cooper-Duffy, 2003). Many students with MSD are eligible to participate in these alternate assessments that may be aligned with alternate academic achievement standards but still based on grade level achievement standards.

A particular challenge for teachers of students with MSD is providing instruction on the grade level general curriculum as well as addressing other needs the students may have that are not addressed in the general curriculum. IDEA requires that IEP goals address both academic and functional needs. While students with MSD can and should have access to content presented in general education settings, they often require substantially more time to reach criterion on skills targeted for instruction than is allowed in the unit approach used in most general education settings (Helmstetter, Curry, Brennan, & Sampson-Saul, 1998; Logan & Malone, 1998; McDonnell, Thorson, & McQuivey, 2000; McDonnell, Thorson, & McQuivey, 1998). Thus, special education teachers may find themselves in the position of needing to provide additional direct instruction on core content in addition to what is received in the general education setting if students are to master the content. Given the finite amount of instructional time available, two critical issues must be acknowledged and addressed. One is to...
provide instruction as effectively and efficiently as possible, and the other is to establish instructional priorities.

Regarding the first issue, effective and efficient instructional procedures, a large body of research has provided evidence that systematic instruction using response prompting procedures is an effective strategy to teach skills to students with MSD and other special needs (Collins, 2007; Wolery & Schuster, 1997). For example, the time delay procedure is an evidence-based response prompting procedure that has a long history of being effective in teaching both discrete skills and chained tasks to students with MSD across settings (Collins; Schuster et al., 1998; Wolery, Ault, & Doyle, 1992). The time delay procedure systematically increases the delay interval that students have to perform a correct response prior to being prompted, thus transferring stimulus control from the prompt to the natural stimulus. The progressive time delay (PTD) procedure increases the delay interval by small increments (e.g., 0 s, 1 s, 2 s, 3 s) while the constant time delay (CTD) procedure begins with a 0 s delay interval and then increases the delay to a set number of seconds (e.g., 3 s) for all remaining instructional trials. This procedure has been implemented by classroom teachers with a high degree of fidelity (Collins & Schuster, 2001).

Research-based strategies are thus available to increase the effectiveness of instruction, and there is also evidence to support teaching core content and functional content together, which addresses some of the issues of instructional priorities. IDEA requires that instructional priorities be established on an individual basis for students with disabilities, while also requiring that both academic and functional educational needs be targeted. Teaching core content and functional content together is one strategy to address these needs. While grade level core content is targeted, functional content based on individual needs is addressed within the same instructional setting.

In an investigation with students with moderate disabilities across age levels, Collins, Evans, Galloway, Karl, and Miller (2007) provided evidence that the students could acquire both functional and core content sight words when these were paired across settings and instructional formats. While their investigation targeted both functional and core content for instruction, other investigations with students with MSD have added functional information as nontargeted information, hoping that students would acquire at least some of the extra information to which they were exposed during systematic instruction. For example, Falkenstine, Collins, Schuster, and Kleinert (2009) added the nontargeted information of how to set a wristwatch during instruction on telling time and how to look up a word in the dictionary during instruction on identifying arts and humanities sight words. Instruction took place in a small group format with the nontargeted information presented as instructive feedback during the consequence portion of each instructional trial. Each of the students with MSD who participated in the investigation was able to acquire the targeted skills as well as much of the nontargeted information presented during the instructional trials. In addition, they acquired much of the targeted and nontargeted information presented to other students in the group through observational learning.

It is clear that a more efficient use of instructional time is to focus on more than one skill during instruction. The drawbacks to relying on presentation of skills as nontargeted information are that instructors do not collect formative data on this information in order to assess learning, they do not set specific criteria for mastery, and they do not make instructional modifications if students fail to acquire the extra information. Therefore, the best way to ensure that students master both core content and functional content is to target both for direct instruction and to collect formative data on student progress on both across instructional sessions.

In the present investigation, a special education teacher (the third author) and a para-professional implemented a CTD procedure to teach both functional and core content to middle school students with moderate disabilities who participated in the state alternate assessment. While the selected core content was required, the addition of related functional content provided a framework for presenting core content in a meaningful context. The research literature has shown that meaningful skills are likely to maintain and to gen-
eralize (Wolery et al., 1992) since meaningful skills are more likely to be needed in natural environments. In addition, instruction on content that is meaningful also may be more reinforcing to students, thus increasing appropriate behavior during instruction (Horner, Albin, Todd, & Sprague, 2006). Specifically, the research questions were (a) Will middle school students with moderate disabilities acquire both core content and a functional application through direct instruction? and (b) Will the students generalize that content across probe trials using novel materials and activities?

Method

Participants

Students. Three middle school students identified with functional mental disabilities (i.e., moderate to severe disabilities) participated in the investigation. The special education teacher selected these students because they would be participating in the state’s alternate assessment during the school year and, thus, would need alternate portfolio entries documenting the acquisition of required grade level core content in language arts, math, and science. In addition, she selected the students because they had a dependable record of school attendance and she anticipated that they had the ability to master targeted content within the 7-month timeframe for the investigation. The timeframe coincided with the beginning of the academic school year and the final date for submission of the state’s alternate assessment portfolios. Each of the students selected to participate had good receptive communication skills for following directions whether or not they had adequate expressive verbal communication for responding. In addition, all had a history with systematic direct instruction using response-prompting procedures, although this was not a prerequisite for inclusion in the investigation.

The middle school participants were Jason, Morgan, and Rena. Jason was a 14-yr old male with a reported IQ score of 55 on the WISC III (Wechsler, 1997) and a score of 56 on the Adaptive Behavior Assessment System (Harrison & Oakland, 2003). His IEP objectives included reading survival words, food and recipe words, and core content vocabulary; answering comprehension questions; typing documents and personal information; using touch math for addition, subtraction, and multiplication; maintaining the ability to count coins and use a next dollar strategy; and performing selected vocational tasks. Jason spent approximately 50–60% of his day in general education classes (e.g., science, social studies).

Morgan was a 14-yr old male with autism and a reported IQ score of 47 on the Universal Nonverbal Test of Intelligence (Bracken & McCallum, 1998). His IEP objectives included using a calculator to work with money, using touch math to count coins, following picture recipes, reading survival words, and maintaining the ability to use a schedule and follow 2- to 3-step directions. Morgan spent approximately 40% of his day in general education classes.

Rena was a 15-yr old female with Down syndrome and an IQ score of 41 on the Universal Nonverbal Test of Intelligence (Bracken & McCallum, 1998). Her IEP objectives included washing her hands, feet, and face; using a picture list to locate grocery items; following a picture recipe; using touch math to count coins; checking her schedule and making choices; reading food and recipe words, survival words, personal information, and core content; and identifying personal information. Rena spent approximately 40% of her day in general education classes.

Staff. A special education teacher conducted all instructional sessions in a special education resource room until she left for maternity leave at the end of the fifth month of the investigation. At that time, an experienced paraprofessional in the resource room who had participated in a previous study with the teacher (Collins et al., 2007) began conducting all instructional sessions. The special education teacher returned to school in time to conduct the final sessions with two of the students. The instructors also graphed and monitored all instructional data. The special education teacher had three years of teaching experience in the classroom as well as several years of experience as a paraprofessional in a secondary special education resource room for students with MSD. In addition, she was enrolled in a master’s degree program in MSD at the time of the investigation. The special
education teacher was responsible for training the paraprofessional to continue the investigation during her maternity leave. Training for the paraprofessional consisted of explaining the procedures, checking to make sure data collection procedures were clear, and observing during actual instruction to make sure the paraprofessional could conduct sessions and collect data with high fidelity.

Skill Selection

The special education teacher was responsible for screening and selecting the core content that would be taught during the investigation. Since all of the participants were participating in the state’s alternate assessment, the teacher selected required grade level core content aligned to state standards in language arts, science, and math. We (first and second authors) brainstormed with the teacher (third author) to identify functional applications for each of the selected standards. Once we identified both core content and functional applications for instruction, the teacher screened the students to identify specific items for instruction.

In language arts, the teacher selected the standard to identify meanings of words/phrases from a grade level passage. Specifically, she chose to teach reading grade level words found in the newspaper. While this content could be considered functional (i.e., useful and meaningful to the students), we decided to teach information related to the words as a functional application. The rationale was that the words were meaningless unless the students had a reference for applying them in the context of current events. The core content objective for Jason was to orally read the words president, representative, and governor, and the functional application objective was to verbally identify each (e.g., “The president of the United States is George Bush”). The core content objective for Morgan was to read and receptively identify (i.e., point to) the words mayor, county, and district. The functional application objective was to receptively identify corresponding information about each by pointing to the correct sight word card from a choice of three cards (e.g., point to United States of America when presented with a choice of three names of countries). The criterion for each of these objectives was 100% accuracy for three sessions.

In science, the teacher selected the standard to identify chemical and physical properties of elements and compounds and to categorize them by their properties. Specifically, she chose to teach three basic properties of elements in the Periodic Table: (a) gas, (b) liquid, and (c) solid. As a functional application, we decided to teach Jason to identify ways to change properties during cooking since objectives related to cooking were listed on his IEP. The core content objective for Jason was, when presented with the real items, to verbally state the properties of items used for cooking breakfast (i.e., butter is a solid, milk is a liquid, and the steam from boiling water is a gas). The objective for his functional application was to state ways to change the properties of these items (e.g., melt butter to change it from a solid to liquid, freeze milk to change it from liquid to solid, boil water to change it from liquid to gas). The objectives for Morgan and Rena were based on weather conditions rather than cooking since the teacher believed this knowledge would make them more independent. Specifically, their core content objective was, when presented with three choices, to point to pictures of elements of the weather that were solid (i.e., ice), liquid (i.e., rain), or neither (i.e., sunshine). In addition, their functional application objective was, when present with three choices, to point to pictures of clothing appropriate to each type of weather (i.e., ice—coat and mittens, rain—rain coat and umbrella, sunshine—swim suit). The criterion for each of these objectives was 100% accuracy for three sessions.

In math, the teacher selected the standard to apply the order of operations using addition and multiplication. Specifically, she chose to teach order of operations while teaching students to compute sales tax. While this core
content is functional, we decided to make it more applied by having students compute the sales tax for real items found in newspaper ads. The task analysis for Jason was to enter the amount of the item, press $X$, press 6, press %, write amount on paper, press clear, enter 1st amount, press +, enter amount of tax, press =, and write total amount on paper. The teacher adapted the task analysis for Morgan and Rena so they would not have to write. Their task analysis was to enter the amount of the item, press $X$, press 6, press %, press $M+$, press +, press =, and use a Bingo dabber to select the correct amount from three choices presented on a piece of paper. The criterion for each of these objectives was 100% accuracy for three sessions.

**Instructional Setting and Arrangement**

The special education teacher or paraprofessional conducted all instructional sessions in the special education resource room designated for students with functional mental disabilities (i.e., MSD) in a 1:1 format during the first hour of the school day before the students left for their inclusive classes. On most days, the special education teacher, two paraprofessionals, and four students were in the classroom during this time. During instruction, the instructor called one student at a time to a semi-circular table; the student took a seat opposite the instructor.

The teacher used a CTD procedure for instruction and conducted one trial per stimulus per session. She taught each subject area to criterion before proceeding to the next in the following sequence: (a) language arts, (b) science, and (c) math.

**Materials and Equipment**

As shown in Table 1, the teacher prepared two sets of materials: (a) one for instruction and (b) one for generalization assessment. For language arts, the core content instructional materials consisted of 3 in $\times$ 5 in white unlined flash cards with the sight words printed by hand in lower case letters with a black marker. The functional application instructional materials consisted of 5 in $\times$ 7 in white unlined cards with black computed-printed sight words. The sight word cards for Morgan and Rena also contained computer-generated color pictures paired with the words (e.g., a map of the United States and an American flag above America). Along with each target word card, the teacher presented two additional cards during each trial that contained distracters that had been selected at random from an array of choices (e.g., Canada, Japan, Philippines, Australia). To facilitate generalization, the teacher tuned over flashcards during trials to show abbreviated forms of words, as appropriate. For example, the abbreviation for representative was printed on the back of that card since the abbreviation was often used in newspaper articles when referring to the state representative. Generalization materials for Jason consisted of local newspapers on which the teacher had highlighted the target words with a pink marker. For example, one article showed a picture of the mayor with his name and title written in the picture’s caption. Generalization materials for Morgan and Rena consisted of 5 in $\times$ 7 in white unlined cards on which the teacher had pasted newspaper cuttings of the targeted words.

For science, the instructional materials consisted of real cooking ingredients for Jason (i.e., cup of milk, stick of butter, cup of steaming water). For Morgan and Rena, the core content instructional materials consisted of 5 in $\times$ 7 in unlined white cards on which the words solid, liquid, and neither had been printed in lower case letters with a black marker; 5 in $\times$ 7 in unlined white cards with computer-generated line drawings of ice cycles, rain falling from a cloud, and the sun with the corresponding words (i.e., ice, rainy, sunny) written in lower case letters under each picture with a black marker; and 3 in $\times$ 5 in unlined white cards with computer-generated line drawings of clothing appropriate to the weather conditions (i.e., bathing suits, coat and mittens, rain coat and umbrella). Generalization materials consisted 5 in $\times$ 7 in unlined white cards containing computer-printed target words in upper and lower case black letters with corresponding computer-generated color pictures (i.e., Solid with stack of blocks, Liquid with raindrops, Gas with gas tanks, Neither with symbol); 5 in $\times$ 7 in white unlined cards with color photographs of weather (i.e., icicles, rain puddles on the ground,
sunshine peering through clouds, snow on trees, ice on highway); and 5 in × 7 in unlined white cards with color photographs of clothing appropriate to the weather conditions.

For math, the instructional materials consisted of a calculator and 5 in × 5 in white unlined cards containing color ads cut from the newspaper (e.g., picture of jacket with $11.99 printed under it in black letters followed by a description of the item). In addition, the teacher presented Morgan and Rena with 8 ½ in × 11 in sheets of white unlined paper on which three prices had been written so they could use a Bingo dabber to indicate the appropriate price once sales tax was calculated.

### TABLE 1

**Instructional Objectives and Materials for Each Participant Across Content Areas**

<table>
<thead>
<tr>
<th>Student</th>
<th>Core Content Objective/Materials</th>
<th>Functional Application/Materials</th>
<th>Generalization/Materials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Jason</td>
<td>Orally read <em>president, representative, governor</em></td>
<td>Verbally identify each (e.g., <em>George Bush</em> in response to “Who is the president of the United States?”)</td>
<td>Orally read the target words in the context of a newspaper article</td>
</tr>
<tr>
<td>Morgan</td>
<td>Point to <em>mayor, county, district</em> from choice of three</td>
<td>Point to corresponding information (e.g., <em>6th</em> in response to “What is your district?”) from choice of three</td>
<td>Point to target words from newspaper pasted on cards from choice of three</td>
</tr>
<tr>
<td>Rena</td>
<td>Point to <em>country, state, city</em> from choice of three</td>
<td>Point to corresponding information (e.g., <em>United States</em> in response to “What country do you live in?”) from choice of three</td>
<td>Point to target words from newspaper pasted on cards from choice of three</td>
</tr>
</tbody>
</table>

**Language Arts: Grade Level Vocabulary**

- **Jason**
  - Verbally state property when presented with actual ingredients (e.g., butter is a solid)
  - Identify ways to change properties of these ingredients (e.g., melt butter to make it a liquid)
  - Verbally state property when presented with photographs of ingredients

- **Morgan**
  - Point to line drawing of elements of weather that were solid (i.e., ice), liquid (i.e., rain), or neither (i.e., sunshine) from choice of three

- **Rena**
  - Point to line drawing of clothing appropriate to each weather type (e.g., rain–raincoat and umbrella) from choice of three

**Science: Properties of Elements (Gas, Liquid, Solid)**

- **Jason**
  - Verbally state property when presented with actual ingredients (e.g., butter is a solid)
  - Identify ways to change properties of these ingredients (e.g., melt butter to make it a liquid)
  - Verbally state property when presented with photographs of ingredients

- **Morgan**
  - Point to line drawing of elements of weather that were solid (i.e., ice), liquid (i.e., rain), or neither (i.e., sunshine) from choice of three

- **Rena**
  - Point to line drawing of clothing appropriate to each weather type (e.g., rain–raincoat and umbrella) from choice of three

**Math: Order of Operations**

- **Jason**
  - Use a calculator to compute sales tax
  - Compute price with sales tax for items in newspaper ads

- **Morgan**
  - Compute price with sales tax using different ads/prices

- **Rena**
  - Compute price with sales tax using different ads/prices

### Baseline/Probe Procedures

The instructor conducted a minimum of three 1:1 baseline/probe sessions with the participants prior to intervention. For language arts and science baseline/probe sessions, she always followed the three probe trials for core content with three probe trials for functional applications. During probe trials, the teacher first obtained the student’s attention. This was a general attentional cue for Jason (e.g., “Look”) and a specific attentional cue for Morgan and Rena (e.g., pointed to each of three choices and waited for student to focus on each). She then gave the task direction and waited 3 s for the student to respond. She asked Jason to give an expressive verbal response, while she asked Morgan and Rena to
give a receptive response by pointing to the correct card out of three choices placed at random (e.g., unspecified order in a horizontal row or in a vertical row) on the table. For math, the teacher gave a general attentional cue to all students followed by the task direction. When a student made an incorrect response or failed to respond on a step of the task analysis, she ended the session (i.e., single opportunity trial). At the end of each session, she praised the student for working hard, whether or not there was a correct response. During baseline/probe trials, the instructor recorded a “+” for each correct response, a “−” for each incorrect response, and a “0” for each failure to respond. She also recorded a “0” for each of the steps of the math task analysis that students did not have the opportunity to perform.

**Instructional Procedures**

The instructor used a CTD procedure to teach the targeted tasks. She used the same attentional cues and task directions during instruction that she used during baseline/probe session. During the first session, she immediately prompted the student (0-s delay trial) through the correct response (i.e., identifying sight words, identifying properties of elements, computing sales tax, performing corresponding functional applications). During all subsequent sessions, she waited a 3-s delay interval before delivering a prompt. The controlling prompt for Jason consisted of verbal models for language arts and science content and verbal directions for steps of the math task analysis. The controlling prompts for Morgan and Rena consisted of verbal models paired with gestures (e.g., pointing to the correct card choice) during language arts and science sessions, and verbal directions paired with a model on an additional calculator during math sessions. For each correct response, the instructor delivered praise, and, for each incorrect or no response, the instructor provided a model of the correct response. During instruction, the instructor recorded a “+” for all unprompted and prompted correct responses, a “−” for all unprompted and prompted incorrect responses, and a “0” for all failures to respond following the prompt. Diagrams of typical session sequences for each of the tasks can be found in Table 2.

**Maintenance Procedures**

Once the participants reached criterion of a minimum of 3 sessions of 100% accuracy on a task, the instructor conducted intermittent maintenance trials on that word in the same manner as baseline probe/trials for the remainder of the investigation.

**Generalization Procedures**

The state alternate assessment required that each participating student complete probe trials on each standard prior to and following instruction. These probe trials could not be conducted in the same manner as instruction since the purpose was to assess conceptual understanding. (The alternate assessment also required that teachers submit work samples from instruction to provide evidence that the probe trial format was different.) Because these alternate assessment trials consisted of different materials or applications than those used during instruction, we considered them to be probes for generalization. The instructor conducted these generalization sessions for the three content areas in the fall prior to conducting baseline/probe sessions and again in the spring following instruction on each of the content areas. During each 1:1 probe for generalization, the instructor delivered an attentional cue (i.e., student’s name), delivered the task direction (i.e., What word?), and waited 5 s for a response. She did not provide a consequence since the state alternate assessment does not allow teachers to reinforce or correct responses during probe trials. The instructor conducted one generalization trial per content area at the beginning of the investigation and three trials per content area at the end of the investigation.

**Experimental Design**

The experimental design employed during the investigation was a multiple probe design across behaviors (i.e., tasks) replicated across participants (Holcombe, Wolery, & Gast, 1994; Tawney & Gast, 1984). While the language arts and science tasks contained trials...
on both core content and functional applications, the math task combined functional and core content in each trial. Thus, two separate data paths appear on the first two tiers of the graph while a single data path appears on the third tier (see Figures 1–3).

Reliability

Once per week per condition (i.e., total of 70 sessions), we (the first and second authors) collected reliability data on both the dependent and independent variables. We collected reliability data at the same time during 32.9% of the reliability sessions; otherwise, we took turns collecting reliability data. The overall reliability agreement between reliability data collectors was 100% for the dependent variable and 99.8% (range = 95–100%) for the independent variable.

We used a point-by-point method (Tawney & Gast, 1984) to calculate interobserver reliability agreement with the following formula:

\[
\text{Reliability} = \frac{\text{number of agreements}}{\text{number of agreements plus disagreements}} \times 100
\]

Functional Core Content / 29

<table>
<thead>
<tr>
<th>Trial Component</th>
<th>Language Arts</th>
<th>Science</th>
<th>Math</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Attentional Cue</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jason</td>
<td>General cue (“Look”)</td>
<td>General cue (“Look”)</td>
<td>General cue</td>
</tr>
<tr>
<td>Morgan and Rena</td>
<td>Specific cue (“Look” while pointing to choices)</td>
<td>Specific cue (“Look” while pointing to choices)</td>
<td>General cue</td>
</tr>
<tr>
<td><strong>Task Direction</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jason</td>
<td>“Tell me…” (expressive task)</td>
<td>“Tell me…” (expressive task)</td>
<td>“Compute the sales tax for…”</td>
</tr>
<tr>
<td>Morgan and Rena</td>
<td>“Show me…” (receptive tasks)</td>
<td>“Show me…” (receptive tasks)</td>
<td>“Compute the sales tax for…”</td>
</tr>
<tr>
<td><strong>Delay Interval</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jason, Morgan, and Rena</td>
<td>0 s during 1st session and 3 s during subsequent sessions</td>
<td>0 s during 1st session and 3 s during subsequent sessions</td>
<td>0 s during 1st session and 3 s during subsequent sessions</td>
</tr>
<tr>
<td><strong>Controlling Prompt</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jason</td>
<td>Verbal model</td>
<td>Verbal model</td>
<td>Verbal directions</td>
</tr>
<tr>
<td>Morgan and Rena</td>
<td>Verbal model with gesture</td>
<td>Verbal model with gesture</td>
<td>Verbal directions with model</td>
</tr>
<tr>
<td><strong>Consequence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Jason, Morgan, and Rena</td>
<td>Praise correct response or provide model for incorrect or no response</td>
<td>Praise correct response or provide model for incorrect or no response</td>
<td>Praise correct response or provide model for incorrect or no response</td>
</tr>
</tbody>
</table>

TABLE 2
Instructional Components for Each Participant Across Content Areas
tional sessions, and 100% during generalization sessions; independent variable reliability was 99.7% (range = 96–100%) during baseline and maintenance probe sessions; 99.4% (range = 95.5–100%) during instructional sessions, and 99% (range = 95–100%) during generalization sessions. Overall dependent variable reliability agreement was 100% for Jason, 99.5% (range = 90.9–100%) for Morgan, and 98.7% (range = 83–100%) for Rena; overall independent variable reliability agreement was 99.6% (range = 96.8–100%) for Jason, 99.5% (range = 95.5–100%) for Morgan, and 99.6% (range = 96.8–100%) for Rena.

**Results**

This investigation paired functional and core content during instruction using a CTD procedure with three students with moderate disabilities. As shown in Figures 1–3, all three students acquired the language arts and science core content. One student also acquired math content, while the two remaining stu-
Students had made minimal progress in math before the investigation ended due to time constraints. Although all three students were labeled as having moderate disabilities and qualified for the state’s alternate assessment, their learning curves were different in the amount of instructional time required and the types of modification needed to meet criterion.

Jason, whose reported IQ score placed him at the upper edge of the moderate disability range, mastered the target skills across all three content areas in the least amount of time. While Jason could not perform the target math skill prior to instruction, his data indicated that he was able to give correct responses during some of the trials on language arts and science content during baseline condition. He could not read the target core content newspaper words in language arts, but he could state 2 out of 3 of the functional pieces of information related to those words prior to instruction. In addition, he could identify an average of 75% of the core content in science although he could apply this to a functional activity with only 33% accuracy. Once instruction was implemented, Jason met criterion on language arts content in an average of 12.5 sessions, on science content in an average of 4 sessions, and on math content in an average of 19 sessions (grand mean = 11.8 sessions). The only difference in the acquisition of functional versus core content was in language arts where it took 4 additional sessions to acquire the core content reading words, which is not surprising since he had demonstrated that he already knew some of the functional content prior to instruction. Because Jason met criterion so quickly across content areas, his instructor chose to continue instruction while she thinned reinforcement to a schedule of VR3 for 2 days at 100% criterion, a practice.

Figure 2. Graphic data for Morgan. Closed circles indicate functional content and open circles indicate core content. Closed triangles indicate generalized functional content and open triangles indicate generalized core content. Unconnected data points indicate unscheduled breaks in instruction due to absences or scheduled breaks for maintenance.
that may have influenced maintenance data. Jason maintained language arts content with a mean of 92.5% accuracy (functional content = 88.3%, core content = 96.7%), he maintained science content with 99% accuracy (functional content = 100%, core content = 98%), and he maintained math content with 96.4% accuracy. During the generalization probes that Jason’s instructor conducted for his alternate assessment, Jason increased his ability to identify language arts core content from 0% to a mean of 88.7%, science core content from 27% to a mean of 100%, and math core content from 0% to a mean of 100%. Although functional content was not required in the alternate assessment, Jason increased his ability to identify language arts functional content from 66.6% to a mean of 100%, science functional content from 33.3% to a mean of 100%, and math functional content from 0% to a mean of 100%.

Unlike Jason, Morgan struggled to acquire the targeted content across curricular areas. While Morgan could not perform the target language arts or math skills prior to instruction, his data indicated that he was able to give correct responses during some of the trials on science content during baseline condition (functional content = 62.9%, core content = 11.1%). Once instruction was implemented, Morgan met criterion on language arts content in an average of 30 sessions (functional content = 24 sessions, core content = 36 sessions) and on science content in an average of

![Figure 3. Graphic data for Rena. Closed circles indicate functional content and open circles indicate core content. Closed triangles indicate generalized functional content and open triangles indicate generalized core content. Unconnected data points indicate unscheduled breaks in instruction due to absences or scheduled breaks for maintenance.](image-url)
36.5 sessions (functional content = 4 sessions, core content = 69 sessions). When Morgan struggled over time to reach criterion on core content in language arts and science, his instructor made modifications to the instructional procedure. In language arts, she began using differential reinforcement by delivering praise for correct responses before the prompt only and ignoring correct responses following the prompt. After this modification was implemented for four days, Morgan began to increase the number of correct responses before the prompt. In science, she added tokens to be exchanged for minutes of computer time in addition to praise as part of the differential reinforcement procedure when he failed to reach a third session of criterion after an extended period of instruction. After this modification was implemented for 14 days, Morgan finally reached criterion. Morgan’s instructor also continued instruction in language arts and science beyond criterion because she hoped that he would eventually meet three consecutive days of correct responding in both functional and core content during the same sessions.

Due to time constraints, we decided to begin instruction in a new area of content before instruction ended on a previous area of content. Even with this modification to the experimental design, Morgan failed to meet criterion in math prior to the end of the investigation, although his correct responses increased from 0% to 49% before instruction ended. Because of Morgan’s erratic performance during instruction, his instructor did not thin reinforcement once criterion was met. Morgan maintained language arts content with a mean of 75% accuracy (functional content = 76.2%, core content = 73.7%), and he maintained science content with 72.2% accuracy (functional content = 100%, core content = 44.4%). During generalization probes that Morgan’s instructor conducted for his alternate assessment, he increased his ability to identify language arts core content from 0% to a mean of 100% and science core content from 0% to a mean of 77.7%, but he failed to increase his math core content from 0%. Although functional content was not required in the alternate assessment, Morgan increased his ability to identify both language arts and science functional content from 0% to a mean of 100% during the alternate assessment probes.

Like Jason, Rena quickly acquired targeted content in language arts; but, like Morgan, she also struggled to acquire the targeted content in science. During baseline condition, Rena identified one piece of functional information during a single session in language arts, she was able to give correct responses during some of the trials on science content (functional content = 58.3%, core content = 20.8%), and she failed to make any correct responses on math content. Once instruction was implemented, Rena met criterion on language arts content in an average of 9 sessions (functional content = 10 sessions, core content = 8 sessions) and on science content in an average of 22 sessions (functional content = 32 sessions, core content = 12 sessions). Although the instructor continued instruction in language arts long enough to thin reinforcement to VR3 for two days, she continued instruction on science content without thinning reinforcement, hoping that Rena would reach criterion on both functional and core content on the same day; when this failed to occur after 18 additional sessions, she discontinued instruction in science and began instruction in math since the deadline for submission of alternate assessment portfolios was drawing near. When Rena failed to show progress in math over 13 sessions, the instructor discontinued instruction and conducted the alternate portfolio assessment probes. Rena maintained language arts content with a mean of 90.8% accuracy (functional content = 86.6%, core content = 95%), and she maintained science content (one session) with 66.6% accuracy (functional content = 33.3%, core content = 100%). During the generalization probes that Rena’s instructor conducted for her alternate assessment, Rena increased her ability to identify both language arts and science core content from 33.3% to a mean of 88.9%. In addition, she increased her ability to identify language arts functional content from 0% to a mean of 88.9% and her ability to identify science functional content from 33.3% to a mean of 100%. Although Rena was unable to perform any correct responses in math during the baseline probe session and showed no progress during intervention, she performed 22% percent of the
correct responses during a single post-intervention generalization probe session (mean = 7.3%).

**Discussion**

The purpose of this investigation was to teach both core and functional content simultaneously in a meaningful context. We did not seek to compare the acquisition of core content and functional content, but rather to teach them together so that the participants would (a) learn core content required for all students in the school, as well as (b) learn skills related to the required core content that would be meaningful to their lives. We made the assumption that learning core content would result in positive outcomes in the students’ alternate assessment. In the past, teachers of students with MSD often targeted functional academic skills for instruction based on an ecological assessment. In this study, we took another approach, beginning with grade level core content standards required in the state’s alternate assessment and then adding corresponding functional content in an effort to make the identified core content more meaningful to the students. Although students continued to have access to core content in the general education academic classes in which they were included, they received supplementary direct instruction on the skills targeted for this study in the special education resource room.

We sought to teach core content and functional content together in response to personal observations we have made since the state’s current alternate assessment, which targets core content, was mandated. These observations were made in multiple schools across the dozen districts in which we supervise student field experiences. Since the alternate assessment of core content standards identified by the state has become high stakes, we have repeatedly observed teachers teaching isolated bits of core content information out of context. Often students have been taught to make responses without being able to demonstrate that they have acquired understanding of an underlying concept. For example, one standard assessed requires the students to use the Pythagorean Theorem to solve a problem. We observed students as they were given a series of steps to follow (presented through pictures and symbols) that required them to put numbers into a calculator, press the correct symbol, and then match the number on the calculator to one of three choices. In other words, they were given the formula \(a^2 + b^2 = c^2\), given the amount of the first two variables, and directed to put them into the calculator in the correct order to solve for the third variable. In essence, this is a matching and a sequencing task. Students could successfully complete it even with no conceptual understanding of the Pythagorean Theorem. Many of these students had no conceptual understanding of the numbers, they simply followed the steps in order and matched the number on the calculator with one on the sheet. We observed daily instructional sessions targeting this isolated skill of solving for \(c^2\) that utilized a great deal of instructional time across the school year for what ultimately appeared to be little gain. Students clearly can learn to follow a series of instructions, but, if they cannot apply knowledge for practical purposes, the skill is of little use. The students were taught a response that would earn points on the assessment, but which is of no use in any other circumstance. While this is clearly not the intent of the alternate assessment, this is what we have observed and continue to observe in classrooms; therefore, it seems important to ensure that core content is taught in a meaningful context.

In addition, because many students with MSD have not been able to acquire the required core content as it is presented in general education classes (e.g., large group lectures, discovery learning) and because they need longer periods of intensive instruction than is typically provided in general education classes, we have observed teachers pulling students out of inclusive classes to provide daily instruction in a resource setting. In some cases, entire days across months have been devoted to instruction of single pieces of required core content. There is a finite amount of time available for instruction, and spending a large amount of it for instruction on isolated pieces of core content may prevent teachers from devoting time to functional skills that might be useful or important to the students’
daily lives when they transition out of the school setting.

Finally, we have received first-hand reports of administrators dictating that IEPs be written to contain core content only or that functional skills on IEPs be given minimal instruction time (e.g., 30 min once per week). Although the state in which we conducted this investigation may not represent national trends, the volume of classrooms in which we have observed has convinced us that we need to develop a way to provide more meaningful instruction on core content.

We struggled in indentifying functional applications of the core content targeted for this investigation. For this reason, we ruled out including some of the content in the investigation that the instructor was required to teach during the same year (i.e., identifying elements of short stories, using persuasive writing techniques, identifying the effects of straight line motion, identifying components of ecosystems).

For the language arts standard, we selected grade level sight words found in the newspaper for the following reasons: (a) the words would be useful in the social studies classes the students attended, (b) the students might encounter these words in their everyday lives; (c) the words might make them more aware of current events in their community; and (d) the words might allow them to engage in interactions with peers, family members, and community members. In selecting words from the news, we noted that general education classrooms in the region receive daily newspapers as part the educational mission of the local major newspaper and that teachers often use the newspaper to facilitate discussion of current events. Because we believed that recognition of the sight words out of context was meaningless, we added information related to the words as functional content. One of the problems encountered during the investigation was that the information changed as current events changed. For example, the governor was replaced by the opposition during the fall election. To address this, we began presenting nontargeted information as instructive feedback during the consequence of each trial. For example, the instructor would say, "Yes, Ernie Fletcher used to be the correct answer because he used to be the governor. Since the election, our new governor is Steve Beshear." This proved to be an effective intervention since the students began responding with the new information over time. Thus, we urge teachers to consider the dynamic nature of instructional targets that may be similar in nature and to make plans to use strategies to address such changes when they are necessary.

The science standard, although we did not anticipate this, proved more difficult to link to functional content. When we identified properties of the elements of the Periodic Table as the required middle school content to address in this investigation, we struggled to make this information relevant to the students. In time, we decided to use different functional applications across students. Since Jason had cooking identified for instruction on his IEP, we decided to link the properties of solid, liquid, and gas to this activity and to teach how these properties can be changed. Since the remaining participants did not engage in cooking, we selected weather conditions as examples of properties with which the remaining students might be more familiar. Instead of discussing how the properties of weather changes (e.g., rain turns to sleet, ice, or snow), we decided to link the weather to appropriate dress. This focus allowed us to teach only the two properties of solid and liquid. Since the alternate assessment required that students have three options during probes to decrease the likelihood of getting a correct answer by chance, we added a third response of "neither" and linked this to sunshine, allowing us to add additional options for dressing for sunny weather. In addition, while we required Jason to make an expressive verbal response, we chose to allow the remaining students to make receptive responses. Once instruction was designed, the targets for science differed as to whether the students were presented with concrete objects (e.g., cooking ingredients) versus pictures and as to the type of response (i.e., verbally state response versus make a choice from a selection of possible responses). In making functional links to core content, we recommend that teachers consider student differences and student IEP objectives, as well as what might be most meaningful for each student given their backgrounds and abilities, as well as their current and future environments.
Finally, although we anticipated that the math standard would be the most difficult skill to teach in a functional manner, this proved false. When we selected order of operations as the required core content, we found that it had many useful applications and that peers often learn math through solving word problems based on real world applications. Thus, instead of teaching core content and functional content as two separate targets for instruction, we were able to combine the two by teaching order of operations within the meaningful task of computing sales tax on items for purchase. Computing sales tax, however, proved to be more difficult than the other two identified tasks, likely because it was a chained task rather than a discrete task. To master the chained task, the students had to learn a sequence of linked responses instead of six single responses, and some of the steps of the task changed with each application (e.g., entering the price) since the price changed with each trial. Due to snow days, absences, and the extended time needed to master science content, we ran out of instructional time before two of the students mastered the math task. If instruction had not been limited by the time lag requirement of the experimental design, it is possible that these students might have mastered the math task. There were, however, no data to support this. The instructor was forced to conduct the alternate assessment probes without having devoted sufficient time to instruction in math for two of the students. When chained tasks are targeted, we recommend that teachers begin instruction early in the academic year so that there will be sufficient time for mastery.

The current investigation began in September and ended in April. We assumed that this timeframe would allow enough time to teach three sets of content across the three required subject areas by the time the alternate assessment portfolios were due. In the case of Jason, this timeframe was adequate. Jason, however, was at the upper end of eligibility for the alternate assessment. He quickly mastered both the functional and core content that was presented to him and maintained this with a high degree of accuracy over time.

Morgan and Rena had more difficulty mastering the content that was presented to them. Morgan, in particular, struggled with both language arts and science content. During instruction, he often watched the face of the instructor for feedback as his hand hovered over each potential response before he would point to a final choice. The instructor was careful to withhold smiles or praise until he made a final choice and to redirect his attention to looking at the choice instead looking at facial expressions. In addition, Morgan often waited for the prompt instead of making a choice. For this reason, we decided to use differential reinforcement. Thus, during language arts, the instructor began to praise Morgan for correct responses before the prompt only and to withhold praise for correct responses following the prompt. This resulted in an increase in correct responses before the prompt, although it still took several weeks for Morgan to reach criterion on both functional and core content. When Morgan demonstrated the same behavior in making correct responses on core content in science, we added tokens that could be traded for computer time to differential reinforcement. Again, it took several weeks for Morgan to reach criterion. Even then, Morgan proved to be inconsistent in making correct responses on core content during subsequent sessions. Hoping to make his responses more consistent, the instructor tried making the task more concrete for Morgan by having him feel an ice cube to see that it was a solid and to put his hand in water to feel that it was a liquid at the beginning of instructional sessions. Even with this addition to instruction, Morgan failed to consistently make the connection between a picture of ice and the word solid and a picture of rain and the word liquid.

Although Rena quickly mastered language arts content, she also struggled with science. Unlike Morgan, however, she had difficulty acquiring both functional and core content. As time passed, her ability to identify correct responses on core content increased while her ability to identify correct functional content decreased. The only variable that we could identify that seemed to affect her performance was her erratic attendance in school. In addition to missing days for snow, Rena also had 12 absences for illnesses while Morgan and Jason only had one absence each. Although Rena did not show progress during several weeks of math instruction, she per-
formed a few steps of the task correctly during generalization probes, which indicates that, given continued instruction, she eventually may have mastered this task.

A limitation of this investigation is that it used 1:1 instruction that prevented students from learning through observation, a practice that has been effective in the past (e.g., Palmer, Collins, & Schuster, 1999; Smith, Collins, Schuster, & Kleinert, 1999; Stonecipher, Schuster, Collins, & Grisham-Brown, 1999). Another limitation to this study is that it relied on instruction conducted in a segregated setting (i.e., the special education resource room). Balancing the need for direct instruction on required content and the benefits of participating in inclusive settings (e.g., Kennedy, Shukla, & Fryxell, 1997) is a difficult task for teachers. To keep instruction minimal so that students would not miss time in their inclusive classes, the instructors conducted sessions as soon as students arrived each morning and limited sessions to only three trials in language arts and science and only one trial in math. Thus, instructional sessions rarely, if ever, lasted more than 5 min each. It is possible that longer sessions with more instructional trials, as well as teaching in a small group format, would have decreased the number of sessions to criterion.

Often, teachers must decide which is more important—to score well on the alternate assessment or to be exposed to the social and communicative benefits of participation in inclusion even if students fail to acquire required academic content in those settings. Indeed, more research is needed to find ways to facilitate acquisition of core content for students with MSD in inclusive settings. For example, Collins et al. (2007) and Collins, Hall, Branson, and Holder (1999) found that ensuring that there is systematic daily exposure to targeted information in inclusive settings can result in acquisition even if direct instruction is not used. In addition, in some studies students learned core content (e.g., science vocabulary and core content) using direct instruction in inclusive settings (Jameson, McDonnell, Johnson, Riesen, & Polychronis, 2007; McDonnell et al., 2006); however, the instructional trials tended to be during transitions or breaks within the general education setting rather than during adapted general education activities. Other studies addressing instruction of students with MSD in inclusive settings reported positive outcomes, but they were for social and communication skills, not core content (e.g., Carter, Sisco, Melekoglu, & Kurkowski, 2007; Dymond et al., 2006). These are important outcomes, but it is also important to be clear regarding exactly what skills and knowledge students are acquiring in inclusive settings. It should be noted that the students who participated in this study also participated in academic classes (e.g., science, social studies) with their same age peers. The teacher, however, found it necessary to conduct direct instruction on core content identified for the alternate assessment in the resource room in addition to what the students received in the general education settings for the students to reach mastery.

Perhaps the major implication of this investigation is that it is possible, although challenging, to combine the instruction of core content with the instruction of functional skills. The data, however, show that we cannot assume the link between these two without intentional planning and instruction. It also is important to note that we only selected three pieces of the state’s required core content for alternate assessment to address in this investigation. The instructor also taught 12 additional targets for the alternate assessment to each of these students during the year that they participated in the investigation. At the same time, as noted in the overviews of the students’ IEP objectives, she also routinely taught functional skills as part of the students’ curriculum. This was possible because she was responsible for only four students during the academic year that this investigation was conducted. During the previous year, she had had 7 students on her caseload (a total of 95 alternate assessment standards to teach), which made it more difficult to address both functional and core content. Since teachers now are required to teach core content, it seems critical to ensure that it is relevant to the students who will be spending hours, days, and even months learning it, especially when some are likely to master only a few skills in an entire year, even with intensive instruction.

Several literature reviews have focused teaching core content to students with moderate and severe disabilities (i.e., significant
cognitive disabilities). Browder and Xin (1998) reviewed 48 studies on sight word instruction and recommended that further investigations needed to focus on teaching functional reading that students could apply in their daily routine. More recently, Browder, Wakeman, Spooner, Ahlgrim-Delzell, and Algozzine (2006) reviewed 128 studies on reading instruction and recommended that further investigation is needed on the types of instruction that is needed to teach a broader range of literacy skills than sight word recognition (e.g., comprehension). Courtade, Spooner, and Browder (2007) reviewed 11 studies on science instruction and recommended that further investigation needed to focus on teaching a broader scope of content linked to state standards. Browder, Spooner, Ahlgrim-Delzell, Harris, and Wakeman (2008) reviewed 54 studies on math instruction and recommended that further investigations needed to focus on teaching all components of math skills and ensuring that these skills generalize to real life applications.

The current investigation extends the literature reviewed by these authors while addressing their recommendations for future research. In summary, this investigation was successful in combining functional and core content in teaching skills to students with MSD. Continued research, however, is needed on this topic, especially since we encountered a number of challenges as the instruction continued across the academic year. All students, whether they have disabilities or not, can benefit from learning functional applications of core content that have relevance in their daily lives, thus, teaching core content in a more meaningful context was the purpose of this investigation.

References

Falkenstine, K. J., Collins, B. C., Schuster, J. W., & Kleinert, K. (2009). Presenting chained and dis-
crete tasks as nontargeted information when teaching discrete academic skills through small group instruction. *Education and Training in Developmental Disabilities, 44,* 127–142.


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