

Effects of a Peer-Delivered System of Least Prompts Intervention and Adapted Science Read-Alouds on Listening Comprehension for Participants with Moderate Intellectual Disability

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Hudson, M. E., Browder, D. M., & Jimenez, B. (2014). Effects of a peer-delivered system of least prompts intervention and adapted science read-alouds on listening comprehension for participants with moderate intellectual disability. *Education and Training in Autism and Developmental Disabilities*, 49(1), 60-77.

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Abstract:

This study investigated the effects of a peer-delivered system of least prompts intervention and adapted grade-level science read-alouds on correct listening comprehension responses for participants with moderate intellectual disability. The intervention package included prompts in which selected text was read again. Participants directed the amount of assistance they received from peer tutors by asking for help when needed and self-monitored their independent correct responses. Text was adapted from fourth grade science curricula currently being used by the general education fourth grade class. A question template was used to create factual recall and inferential questions and a multiple probe design across participants was used to determine the functional relationship between the system of least prompts intervention and listening comprehension. Outcomes indicated that the intervention was effective for teaching listening comprehension for all participants, but intervention effects did not generalize to untrained lessons. The study's contributions to research, limitations, need for future research, and implications for practice are discussed.

Keywords: Special Education | Intellectual Disability | Instruction | Science Education | Read-alouds

Article:

Comprehension of text should be a strong focus of instruction for all students, including students with moderate and severe intellectual disability. In contrast, a comprehensive review of the literature on reading for these students found few studies measured or taught comprehension (Browder, Wakeman, Spooner, Ahlgrim-Delzell, & Algozzine, 2006). When students with

moderate and severe intellectual disability are nonreaders or read significantly below their grade level, they may need a reader to read the text aloud for them (e.g., read-alouds). Read-alouds are especially needed when the student's reading skills are at an early literacy level and the literature of their peer group is much higher (e.g., chapter books).

Shared story reading (or read-alouds) is an evidenced-based practice that has been used to improve comprehension of text for students with moderate and severe intellectual disability (for a review of this literature, see Hudson & Test, 2011). For example, Browder, Trela, and Jimenez (2007) used read-alouds of adapted middle school novels (e.g., *Call of the Wild*, London, 1903; *Island of the Blue Dolphin*, O'Dell, 1987) to teach students with moderate and severe intellectual disability and autism to answer comprehension questions.

Most shared story reading studies have used the system of least prompts as one part of the intervention package to teach participation skills (e.g., turn the page; find the title) and comprehension together (e.g., Browder, Mims, Spooner, Ahlgrim-Delzell, & Lee, 2008) or listening comprehension alone (e.g., Mims, Browder, Baker, Lee, & Spooner, 2009). The system of least prompts is a response prompting procedure commonly used to teach students with disabilities that involves (a) securing the learner's attention; (b) delivering a task direction; (c) delivering the next prompt from set prompt hierarchy if no independent response is provided during response interval; and (d) delivering consequences (Wolery, Ault, & Doyle, 1992). The system of least prompts uses a prompt hierarchy rather than a single prompt which gives interventionists the opportunity to use each prompt of the hierarchy during each instructional trial.

Typically, the system of least prompts provides increasing assistance for a student to make a motor response (e.g., completing the steps for making a sandwich, selecting the correct response card from an array). In contrast, when applied to listening comprehension, the prompt hierarchy can simplify the amount of text the student has to identify the answer. For instance, the teacher rereads a portion of the text to see if the student can identify the answer; if the student still needs help, the teacher rereads the sentence containing the answer.

Although multiple researchers (Mims et al., 2009; Mims, Hudson, & Browder, 2012) have demonstrated the shared story reading method in which a teacher or researcher reads the story aloud, poses comprehension questions, and uses a system of prompts to increase the number of correct comprehension responses, the applicability of this methodology in general education settings is unknown. One of the challenges in replicating this method in general education is determining who would conduct the read-aloud. Peers without disabilities may be good candidates because peer tutoring is a practice widely used in general education (e.g., McMaster, Fuchs, & Fuchs, 2006) that is effective for teaching academics to students with severe disabilities (for a review of this literature, see Winokur, Cobb, & Dugan, 2007). While peers could probably read text summaries aloud based on their own literature, they would also need to provide

instructional support for students with moderate and severe intellectual disability to learn to comprehend the text.

Results from a growing number of studies conducted in general education classrooms support the use of peer-delivered instruction as an effective strategy for student learning (e.g., Jameson, McDonnell, Polychronis, & Riesen, 2008). For example, Jameson et al. (2008) found that when peer tutors delivered embedded constant time delay instruction during health and art classes, three middle school participants with moderate intellectual disability learned facts about academic content (e.g., effects of smoking on the body, definitions related to hand building ceramic forms). In the Jameson et al. study, peers used a systematic prompting strategy with fidelity, but it is uncertain whether they could learn to do so when the prompt hierarchy requires presenting different amounts of text in each prompt level while keeping track of their place in a passage of text.

One way to make a peer tutoring strategy more effective could be to have the student with intellectual disability share in the instructional delivery. Specifically, the student might ask for the next prompt as needed and self-monitor correct responses. Multiple studies have demonstrated the benefits of involving students with intellectual disability in their own behavior change through self-monitoring (e.g., Copeland, Hughes, Agran, Wehmeyer, & Fowler, 2002; King-Sears, 2008). For example, Copeland et al. (2002) evaluated the effects of an intervention package that included self-monitoring on the academic performance of four high school students with mild to moderate intellectual disabilities (e.g., IQ 40 -70) in a cosmetology class. After intervention, three of four students improved their cosmetology grade. Likewise, King-Sears (2008) evaluated the effects of self-management on the on-task math behavior of a 10-year-old fourth grade boy with moderate intellectual disabilities. The student received self-management skill instruction in the special education classroom and the effects of instruction on his on-task math behavior was measured in a fourth grade math class. After self-management training, his independent on-task behaviors improved from 47% during baseline to 61% during training and 86% during independent use. While some research also supports having students with intellectual disability self-instruct (e.g., Agran & Wehmeyer, 2000; Konrad & Test, 2007), teaching students to direct the prompts they receive from peers would be a unique application of self-directed learning in which students learn to take action on their own in order to be more independent learners. Therefore, the purpose of this study was to evaluate the effects of a peer-delivered system of least prompts intervention and adapted science read-alouds on listening comprehension for students with moderate intellectual disability. Specific questions asked in this study were:

1. What was the effect of a peer-delivered system of least prompts intervention and adapted science read-alouds on correct listening comprehension responses (i.e., Correct)?

2. What was the effect of a peer-delivered system of least prompts intervention and adapted science read-alouds on independent correct listening comprehension responses (i.e., Independent Correct)?
3. Did peers' attitudes about students with disabilities improve after students with moderate intellectual disability attended general education science class?
4. Did stakeholders rate the procedures and outcomes as important for students with moderate intellectual disability?

Method

Participants

Participants with disabilities. Marcus, Adora, and Sophie, three upper elementary students with moderate intellectual disability participated in the study. Additionally, Adora had severe physical disabilities and used a wheel chair for ambulation and an eye-gaze board for communication. Participants received special education services in separate special education classrooms in a public K-5 elementary school located in a large, metropolitan city in the southeastern United States. Over 90% of the 1,000 students attending the school qualified for the free or reduced lunch program and were minority (i.e., 44.3% Hispanic, 41.2% African American, 5.2% Asian).

Marcus, Adora, and Sophie met the inclusion criteria established for the study which included: met the federal definition for intellectual disability (i.e., an intelligence quota of less than 55); made selections discriminatively from an array; attended school regularly (i.e., no more than two absences a month), and obtained signed parental informed consent to participate in the study. All participants had some emerging literacy skills but were essentially nonreaders. Two knew letter sounds; one recognized a few sight words; and one could read some connected text (early first grade level) with limited comprehension. Marcus and Adora used verbal speech to communicate and Sophie communicated responses to yes/no questions with an eye gaze board. Participants had some experience with read-alouds in the special education program and had individualized education program (IEP) goals for comprehension, but none had experience with read-alouds of grade-level adapted science content. In addition, while participants spent time with their peers with- out disabilities in special area classes (e.g., therapeutic dance class), none of the participants had worked with a peer tutor or at- tended a general education class for academic instruction until this study. None of the participants had a history of significant problem behavior.

Peer tutors. Peer tutors were selected from students who attended a fourth grade general education class in the same elementary school as the participants with moderate intellectual disability. To participate as peer tutors, students had (a) signed participant assent and parental informed consent, (b) general education teacher recommendation, (c) regular school attendance, and (d) passing grades in core content subjects. Three students met criteria and attended the

group introductory and individual training sessions. After individual training, students were evaluated on their ability to deliver the intervention during role-play sessions with the interventionist (i.e., first author). Two students, Elliot and Camila, met the inclusion criteria and the criteria for procedural fidelity. Elliot was a 10-year-old African American male and Camila was a 10-year-old Hispanic female. According to their general education fourth grade teacher, both students were above grade level in reading and science, and on-grade level in math. Neither had peer tutoring experience.

All fourth grade students. All students in the fourth grade class were invited to participate in the study by completing an attitude survey. Students who obtained signed informed parental consent completed a survey before the study began and after the study ended regarding their attitudes about students with disabilities.

General and special education teachers. One general education and two special education teachers participated in the study. The fourth grade general education teacher was certified in Elementary Education (K-6) and had eight years of teaching experience. He collaborated with the interventionist about the science content adapted for the study, nominated students to be peer tutors, communicated with students' parents about the purpose of study, facilitated the acquisition of informed parental consent, included participants with moderate intellectual disability during literacy work-shop/relooping time (the name used for the time general education teachers readdressed content or skills the students did not master or understand during regular instruction) and science class, administered the presurvey and postsurvey, and completed a social validity form after the study was completed.

The special education teachers held valid teaching licenses for students with mild, moderate, and severe intellectual disability. One teacher had two years of teaching experience and the other five. They nominated participants for the study, communicated with participants' parents about the purpose of study, facilitated the acquisition of informed parental consent, and completed social validity forms after the study was completed.

Settings

General education classroom. Twenty-four fourth grade students received instruction in the general education classroom each day. Peer-delivered instruction occurred in a one-to-one format at the end of literacy workshop and beginning of relooping time (i.e., 9:15-10:15 a.m.) in the fourth grade general education classroom. During this time, other students worked independently at their desks or in small groups. Because all students were involved in collaborative learning, the peer-delivered read-aloud intervention was not an unusual occurrence in the classroom. In addition to being part of the literacy workshop/relooping period, the special education participants returned to the general education classroom for science class from 1:00-2:00 p.m. when the general education teacher taught the content the special education students had previewed with their peer tutor throughout the study.

Special education classroom. The interventionist conducted pretraining, baseline, and intermittent probe sessions (i.e., generalization) with participants in a quiet location in one of two special education classrooms. Eleven other students with moderate or severe intellectual disability attended the special education programs. Both classrooms were similar in layout (e.g., approximately 30^ by 35^ with areas for individual, small group, and class-wide instruction) and materials. Besides the time spent in the fourth grade general education class for this study, the participants with moderate intellectual disability received all academic instruction in a separate special education program.

Other school locations (i.e., library, hallway, and front lobby). The introductory peer tutor training was conducted in a quiet place in the school's library. Individual peer tutor training sessions were conducted in the hallway outside the fourth grade classroom or at a table in the school's front lobby.

Materials

Comprehension questions. Six Wh- word (who, what, why, where) comprehension questions were created for each adapted lesson using a question template. Two questions required inference and four required factual recall of information stated directly in the text. See Table 1 for the Wh- word question template used to create the comprehension questions in this study. A university-level language arts expert reviewed the comprehension questions to ensure the questions represented a variety of comprehension levels (Bloom, Engelhart, Furst, Hill, & Krathwohl, 1956) and question type (i.e., inferential or factual recall). No changes were recommended by the expert.

Table 1 Wh- Word Template for Comprehension Questions

1. What type/kind of [noun] was/were in our lesson?
2. Who does/did [action]?
3. Where do/did [event take place]?
4. What happened before/after [event]?
5. Why is/was [noun] important?
6. Why [auxiliary verb] the [noun + adjective]?

Adapted grade-level science lessons. Seven science lessons were adapted from the Science North Carolina (2002) textbook and supplemental material available online (i.e., Arianna's Nutrition Expedition, 2010, www.dairymax.org/ariannas.aspx). Procedures for adapting text were modified from the procedures described by Browder et al. (2007) for adapting fictional literature. First, text summaries of each grade-level lesson were written to capture the main ideas of the text and definitions were added for important vocabulary words when needed. Then, text summaries were re-written at a second or third grade reading level (between 400-600 Lexile) using the Lexile analyzer (<http://www.lexile.com/analyzer/>), a free tool available online.

Response boards. Response boards were created for each science lesson. Each response board contained nine squares laid out in a 3 x 3 grid. The response option for requesting help was placed in the top row's middle box and the boxes on either side were blank. The six response options used during the lesson were placed in the boxes in the middle and bottom rows. The response options were created by pairing picture symbols with words using the symbol writing program Writing With Symbols 2000 version 2.5 (Mayer Johnson, 2000). Figure 1 contains an example of a response board for one of the science lessons. For Sophie, the participant with severe physical disabilities, response boards were modified for an eye gaze board by dividing the original response board into two 3-option boards. Whichever response board contained the correct response option was placed in the middle of the eye gaze board during intervention. The help response option was placed separately in the lower right corner and the yes and no response options were placed at the top left and right corners of the board where Sophie was used to finding them. The interventionist pointed to each of the three response options one at a time and asked, "Is this your answer?" Sophie responded by looking at either the yes, no, or help response options.

Peer tutor scripts and participant books. Peer tutor scripts were created for each lesson that included the system of least prompts, adapted text, and comprehension questions. Each script was a length peers could read aloud in approximately 10 min and was organized in a 3-ring binder by comprehension question. For participant books, the adapted text for each lesson was printed using 18-point font, placed in page protectors, and organized in 3-ring binders. Unlike previous research which paired key words with picture symbols (e.g., Browder et al., 2007), this study provided only the summarized text with one picture or illustration on the first page of each lesson.

Self-monitoring sheet. A self-monitoring sheet was created for participants to monitor their independent correct comprehension responses during intervention. The participants checked a box (i.e., made an "x") after each independent correct response. When six boxes were checked, students received a student-selected prize.

Research Design

A single-case multiple probe design across participants (Gast, 2010) was used to establish experimental control. A multiple probe design allowed for instruction to begin with one participant while collection of baseline data was conducted with all other participants. The multiple probe design decreased the threat of learning through prolonged testing and exposure to intervention materials and allowed for assessment of intervention effects (i.e., generalization) to be collected during intermittent baseline probe sessions. Study phases included baseline, intervention, and generalization. Participants were taught to ask for help and use a self-monitoring sheet before baseline probe sessions began. Baseline probe sessions began after all participants met the criteria established for pretraining.

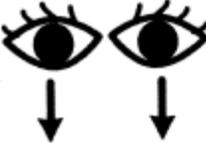
 More Help		
 so Adrianna would look at it	 Marcus could see in the dark	 Protein
 behind a rock wall	 Adrianna and Marcus	 They give you energy

Figure 1. Participant Response Board with help prompt.

A minimum of five data points were collected for each participant during baseline using randomly selected science lessons until performance data were low and stable or descending. The order adapted lessons were introduced varied across participants to control for order effects. Once a stable baseline was obtained for each participant, one participant began intervention and the other participants continued in baseline. A new participant entered intervention when a

change in level or trend for the primary dependent variable (i.e., Correct) was evident for the participant receiving intervention. Just prior to entering intervention, data were collected from each participant on the upcoming science lesson to be used next in the intervention (i.e., intermittent baseline data). Participants entered the intervention phase in a time-lagged manner until each participant received intervention. The intervention condition contained multiple lessons of grade-level adapted science content. Experimental control was demonstrated by a change in level or trend in correct comprehension responses from baseline to intervention condition across participants.

Dependent Variables and Data Collection Procedures

Dependent variables. The primary dependent variable, Correct, was collected to measure all correct responses, including correct responses after participants accessed the system of least prompts. One to five points were scored for correct responses based on the number of prompts delivered. This dependent variable indicated progress that would otherwise be masked by scoring only independent correct responses when participants asked for help (i.e., accessed the prompting system) and was the dependent variable used to make decisions about when a new participant began intervention. A secondary dependent variable, Independent Correct, was used to measure the number of independent correct responses. Independent correct responses were scored when participants provided the correct response after the first reading of the adapted text and had received no prompts.

Social validity. Two social validity measures were collected. The first was a peer attitude survey adapted for elementary students from an attitude survey developed by Haring, Breen, Pitts-Conway, Wilson, and Gaylord-Ross (1983). The general education teacher administered the survey before the intervention began and after the intervention ended. Second, after the study was finished, the general education teacher, special education teachers, and peer tutors completed a social validity form. Using a Likert scale (i.e., strongly agree, agree, not sure, disagree, strongly disagree), the teachers indicated the degree to which they agreed or disagreed with five statements about the study's outcomes and procedures. Similarly, peer tutors completed a social validity form that included four questions about their experience as peer tutors by selecting one of three options (e.g., yes, a little, no).

Data collection. Correct participant responses (i.e., Correct) were scored each session and points were given based on the number of prompts delivered. Independent correct responses scored five points, correct responses after one prompt scored four points, correct responses after two prompts scored three points, correct responses after three prompts scored two points, and correct responses after four prompts scored one point. Error or no responses scored zero points. Additionally, the number of independent correct responses (i.e., Independent Correct) were recorded each session and ranged from zero to six. For the purpose of graphing the primary dependent variable (i.e., Correct), the number of points for correct answers was summarized for each lesson. The maximum number of points possible was 30. For the purpose of graphing the

secondary dependent variable (i.e., Independent Correct), the number of independent correct responses was summarized for each lesson. The maximum number of points possible was six.

Interobserver agreement reliability. A member of the research team observed a minimum of 25% of baseline and intervention sessions for each participant and recorded comprehension scores for the purpose of calculating interobserver agreement (IOA) reliability. To collect IOA data, the interventionist and a member of the research team observed the intervention and separately scored the participants' comprehension responses. Each comprehension response was compared, response by response. An agreement (i.e., +) was recorded if the interventionist and researcher recorded the same comprehension score. A disagreement (i.e., -) was recorded if the two observers' responses were not the same. Inter-observer agreement was calculated by taking the number of agreements divided by the number of agreements plus disagreements and multiplying the quotient by 100. Criterion for IOA was 80% or above. IOA was also collected in a similar fashion by a member of the research team on procedural fidelity of the system of least prompts intervention. IOA reliability data are summarized in the results section.

Procedure

Peer tutor trainings. The study's purpose, peer tutor expectations and responsibilities, and an overview of the system of least prompts were described during the introductory peer tutor training. Students were also given a peer tutor manual that contained a sample peer script, prompts for inferential and factual recall questions, an example of a participant response board, and a participant self-monitoring sheet. After the group training, the interventionist met individually with students to practice the read-aloud intervention. Students read the scripted intervention aloud and the interventionist (in the role of participant with intellectual disability) provided a range of responses (i.e., selected correct and incorrect responses, requested help, failed to respond). Students practiced responding to a range of possible responses participants could make during instruction and received verbal feedback from the interventionist on their performance. Individual role-play sessions were used to assess procedural fidelity of the intervention. To meet procedural fidelity, students delivered the read-aloud intervention with no more than one error a session for two consecutive sessions. Two students met the criterion after three 30-min individual practice sessions.

Participant pretraining. Before baseline, participants with intellectual disability were taught to request help and to record independent correct responses on a self-monitoring sheet. All pretraining was conducted in a one-to-one format with the interventionist and participant sitting side-by-side at a table. The training for requesting help began by placing a wrapped package containing a special prize (e.g., bottle of bubbles, box of markers) and a response board on the table in front of the participant. A response board was created for each session as previously described. The interventionist reviewed the response options and taught unknown response options until participants pointed to each response option when asked. Participants verbally asked for help or pointed to the response board to get a prompt about the contents of the wrapped

package (e.g., there are eight of them in a box; they come in different colors; you can color with them). Each prompt gave more information about what was in the wrapped package. When participants identified the contents of the wrapped package, it was given to them. When participants gave an incorrect response or did not respond within 4 s, the interventionist pointed to the help prompt on the response board and told participants to ask for help when they needed it. Descriptive verbal praise was given each time the participant asked for help (e.g., Good job! You asked for help.) Procedures continued until participants identified the contents of the package and received the prize. The criterion for pre-training was no more than one verbal prompt to ask for help a session for two consecutive sessions.

To teach self-monitoring, the interventionist showed participants a blank self-monitoring sheet. When participants provided a correct response without help, they made an "x" in a box. When six boxes were checked, participants received a student-selected prize. Similar to the pretraining for requesting help, participants were given a response board that contained a prompt for requesting help and response options for comprehension questions about a read-aloud. The interventionist reviewed the response options and taught unknown response options until participants pointed to each response option when asked. Then the interventionist read a personalized story about each participant aloud and asked questions to which they could provide correct responses without help (e.g., What is your pet's name?) To assess if participants generalized asking for help during a read-aloud, the interventionist also asked some questions the participant was unlikely to know (e.g., What is the name of the teacher's pet?). When participants asked for help, a prompt was given. If participants did not ask for help or gave an incorrect response, the procedures described for requesting help were followed. A minimum criterion was not needed for self-monitoring because peer tutors prompted participants to record independent correct responses during intervention if they did not do so independently. The goal of pretraining was to familiarize participants with the self-monitoring sheet.

Baseline. The interventionist conducted baseline sessions individually with each participant in one of two special education classrooms. A response board, self-monitoring sheet, and participant book were placed on the table in front of participants. The interventionist reviewed response options and taught unknown response options until participants pointed to each response option when asked (i.e., Show me [response option]). The interventionist introduced the lesson (i.e., Today, we are going to read about electricity), then began reading. At predetermined points in the read-aloud, the interventionist asked one of six comprehension questions paired with the lesson and waited 4 s for a response. If the participant asked for help, the interventionist provided the next prompt in the system of least prompts, but did not ask participants if they wanted help after asking a question. Based on the level of assistance provided, correct responses were scored 1-5 points. If participants failed to respond or provided an incorrect response, zero points were scored. The interventionist continued the read-aloud until the lesson was read entirely and all comprehension questions were asked. Verbal praise for general work and

attention behaviors were given an average of every three responses (VR3) and participants selected a small prize after each session for participation.

Peer-delivered intervention. Peer tutors delivered the system of least prompts intervention and read-alouds of adapted science lessons in a one-to-one format. The same materials available during baseline were available during intervention (i.e., response board, self-monitoring sheet, participant book). To begin, peer tutors reviewed the response board, how to ask for help, and how to use the self-monitoring sheet as described for the baseline condition. After the lesson was introduced, peer tutors read the adapted text and paused at predetermined points in the lesson to ask one of six comprehension questions paired with the adapted text. After each question, peer tutors asked participants if they were ready to answer or wanted help. When participants asked for help (either verbally or by pointing to the response board), peer tutors delivered the next prompt in the system of least prompts. The hierarchy of prompts for factual recall comprehension questions was (a) read the text again; (b) read the sentence that contained correct answer again; (c) said the correct answer; and (d) said and pointed to the correct response option on the response board. For inferential comprehension questions, the first and last prompts were the same as factual recall questions, but the second and third prompts involved a think aloud (cf. van Kleeck, Vander Woude, & Hammett, 2006). For the second prompt, peer tutors asked participants to think about their experience with the situation (e.g., How do you feel when you haven't eaten since breakfast?). For the third prompt, peer tutors modeled how they related to the experience (e.g., I feel hungry when I haven't eaten since breakfast.)

Errors and no responses. Errors and no responses scored zero and were followed by a correction procedure. If participants made an error, peer tutors pointed to the help prompt on the response board and told participants to ask for help when they did not know the answer, then gave the fourth prompt (i.e., said and pointed to the correct answer on the response board). After an error correction procedure, the peer tutor turned to the next section in the script and continued the lesson.

When participants failed to respond within 4 s after a question was asked, the peer tutor pointed to the help prompt on the response board and reminded participants to ask for help when they did not know the answer, then delivered the next prompt in the system of least prompts. No points were scored when the participant did not respond, but participants continued to have access to the system of least prompts. If participants had two or more error or no response behaviors in a session, the interventionist reviewed the procedures for requesting help with the participant after the session was completed.

Intermittent baseline probe sessions. Generalization of intervention effects was assessed during intermittent baseline probe sessions throughout the intervention by recording the number of points scored for correct comprehension responses (i.e., Correct) during read-alouds of new lessons before they were used in intervention. The procedures for conducting intermittent baseline probe sessions were the same as baseline probe sessions.

Procedural fidelity. Procedural fidelity data were collected a minimum of 30% of baseline and intervention sessions for all participants. A trained second observer recorded the presence or absence of error during the delivery of the read-aloud intervention for the purpose of calculating procedural reliability. Each of six trials (i.e., one trial for each comprehension question) was scored for the following components: (a) correct comprehension question asked; (b) appropriate prompt(s) delivered; (c) error correction procedure delivered, if needed; (d) no response procedure delivered, if needed; and (e) verbal praise given. If all components of the trial were completed correctly, the trial was scored as occurring without error (^). If one or more of the components was completed incorrectly or omitted, the trial was scored as occurring with error (^). Procedural fidelity was calculated by dividing the number of trials presented without error by the total number of trials delivered and multiplying by 100 (Billingsley, White, & Munson, 1980). Criterion for acceptability was no more than one trial with error (i.e., 83%). If criterion fell below 83%, a member of the research team met with the peer tutor or interventionist to discuss discrepancies in intervention delivery so that the intervention would be delivered consistently.

Results

Agreement

Procedural fidelity for the system of least prompts intervention was collected for 48% of baseline and intervention sessions and was 95% (range of 50 -100%). Interobserver agreement (IOA) for participant comprehension responses was collected for 25% of baseline and intervention sessions and was 100%. Interobserver agreement was also collected on procedural fidelity for 30% of intervention sessions and was 100%.

Participant Data

Overall, participants responded to 432 comprehension questions and the mean percent of correct responses from baseline to intervention increased from 22% to 77%. Two-thirds of the responses (i.e., 288) were factual recall and one-third (i.e., 144) required inference. From baseline to intervention, the mean percent of correct responses for factual recall questions increased from 28% to 80%. Similarly, mean correct responses for inferential questions increased from 14% to 72%, but there were fewer correct responses for inferential questions than factual recall (i.e., 44% vs. 55%). Correct responses varied by type of Wh- word question. Participants responded correctly most often to what questions (58%); followed by where (54%); who (47%); and why (44%).

Correct responses. Correct comprehension responses for Marcus, Adora, and Sophie increased after intervention. Correct comprehension responses included correct responses after the first reading of the text and correct responses after participants accessed the system of least prompts. Their performance data are displayed in Figure 2. During baseline, Marcus responded correctly to 15 of 66 questions (i.e., 23%). The number of correct responses increased after intervention to

52 of 72 (i.e., 72%). Adora also increased the number of correct responses from 12 of 66 questions (i.e., 18%) during baseline to 49 of 78 (i.e., 63%) during intervention. Similarly, the number of correct responses for Sophie increased from 23 of 84 questions or 27% during baseline to 57 of 72 or 79% during intervention.

Independent Correct responses. Marcus, Adora, and Sophie also increased the number of independent correct comprehension responses after intervention (see Figure 3). Independent Correct responses were correct responses to comprehension questions after the first reading of the text in which participants did not receive any prompts from the interventionist. For Marcus, the number of independent correct responses increased from 15 of 66 questions (i.e., 23%) during baseline to 45 of 72 (i.e., 63%) during intervention. For Adora, the number of independent correct responses increased from 11 of 66 questions (i.e., 17%) during baseline to 19 of 78 (i.e., 24%) during intervention. For Sophie, the number of independent correct responses increased from 23 of 84 questions (i.e., 27%) during baseline to 56 of 72 (i.e., 78%) during intervention.

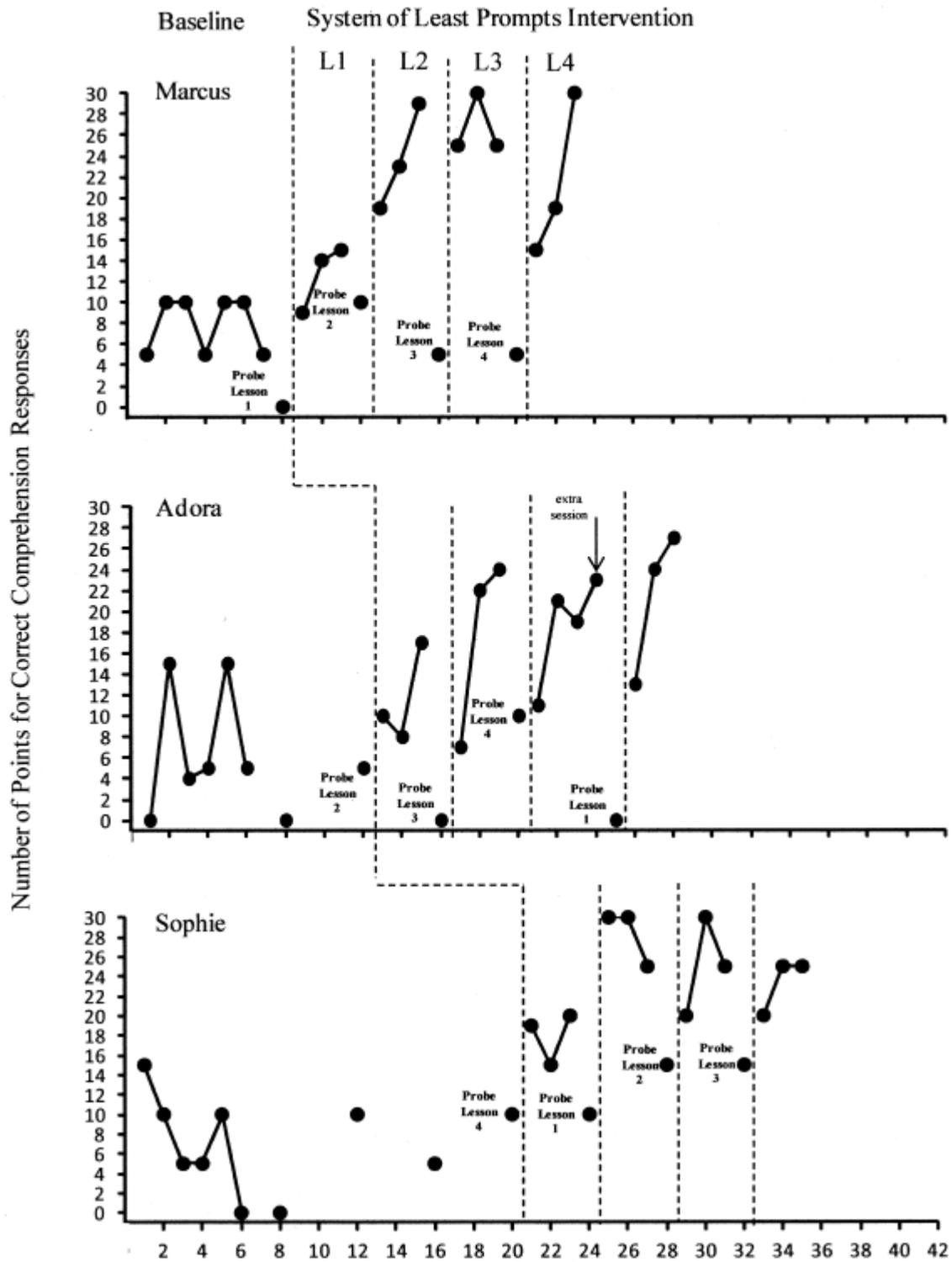


Figure 2. Number of points for correct responses is graphed and included correct responses after participants received assistance (i.e., accessed the system of least prompts). One to five points were given based on the number of prompts delivered. The maximum number of points possible

each session was 30. Four different lessons were used during intervention and changes in lessons are indicated by phase lines. Data points to the left of each phase line represent intermittent baseline probe session data of the next upcoming lesson before it was used in intervention.

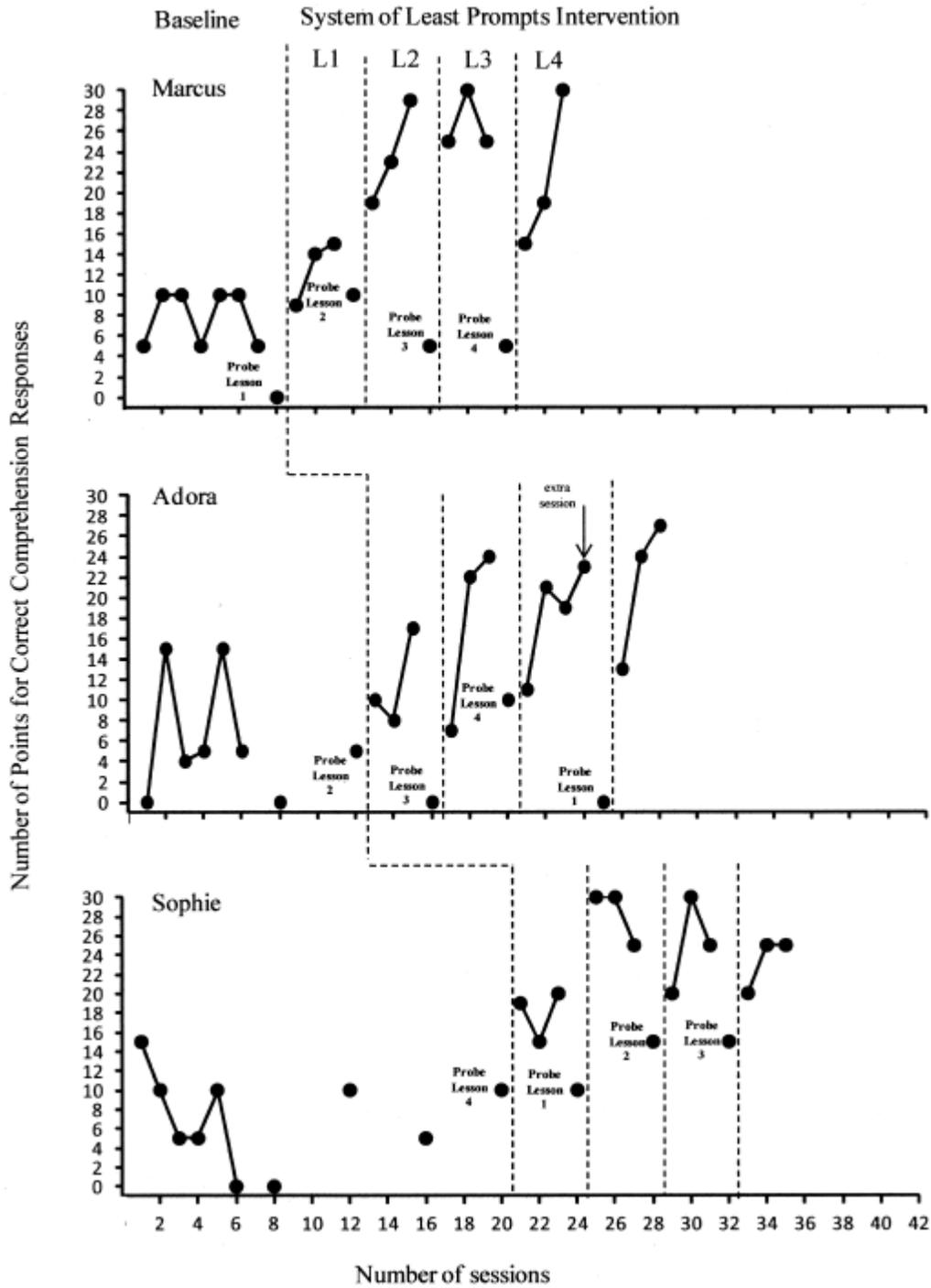


Figure 3. Number of independent correct listening comprehension responses is graphed. Independent correct responses were correct responses after the first reading of the text in which no prompts were given. The maximum number of independent unprompted correct responses available each session was six. Four science lessons were used during intervention and changes in lessons are indicated by phase lines. Data points to the left of each phase line represent intermittent baseline probe session data of the next upcoming lesson before it was used in intervention.

Generalization. Intermittent probe session data were collected on comprehension responses to questions about adapted science lessons before they were used in intervention to measure intervention effects to untrained science lessons. For Marcus, Adora, and Sophie, correct comprehension responses during intermittent probe sessions did not exceed baseline levels (see Figure 2).

Social Validity

Peer attitude surveys. The presurvey was completed by 18 peers and the postsurvey by 17 (one student moved during the course of the study). Presurvey data indicated peers had little direct contact with people with disabilities and 78% were undecided if they would talk to a student with disabilities at school. Data from the postsurvey indicated that peers were more willing to be involved with students with disabilities at school. For example, 82% indicated they would talk to students with disabilities at school (up 60% from the presurvey) and 71% indicated they would sit next to a student with disabilities in class and eat lunch with a student with disabilities.

Teacher social validity forms. All teachers indicated strong agreement with the following statements: (a) Students with moderate and severe disabilities can learn adapted academic content in the general education classroom, (b) I will use peer-delivered instruction again, and (c) I will recommend peer delivered instruction to other teachers who want to promote academic learning for students with moderate and severe disabilities. The general education teacher strongly agreed and the special education teachers agreed that peer-delivered instruction promoted academic learning for students with moderate and severe disabilities in the general education classroom, and the general education teacher and one special education teacher strongly agreed and one special education teacher agreed that students who participated as peer tutors benefited from the experience.

Peer tutor social validity forms. Peer tutors indicated they liked being a peer tutor a lot, they would be a peer tutor again, and they would recommend being a peer tutor to their friends. While one peer tutor indicated being a peer tutor was a lot of work, the other indicated it was a little work.

Discussion

The system of least prompts was part of the peer-delivered intervention in this study. The system of least prompts provided opportunities for participants to hear text read again and focused the amount of text read until a correct response was given. Participants heard the lesson read-aloud once a day for three days before a new lesson was introduced into the intervention. Each day the lesson was read aloud, participants answered six comprehension questions about the text. Because participants were given the correct responses on the first day of each new lesson, increases in correct comprehension responses on days two and three could have been due to remembering the correct answer from the first day of the lesson. For this reason, the strongest inference about a functional relationship between the intervention and listening comprehension can be made by considering the data on the first day of each lesson because participants were hearing the lesson for the first time and had not been given the answers to the questions. In Figure 2, changes in lessons are represented by phase lines. The data point to the left of each phase line represents the number of points for correct comprehension responses before the lesson was used in intervention (i.e., intermittent probes) and the data point to the right of the phase line represents the number of points for correct comprehension responses on the first day of the lesson.

Over the four different science lessons of the intervention, all participants increased the number of points earned for correct responses from the intermittent probe session to the first day of intervention. For Marcus, points for correct comprehension responses increased for lesson one (i.e., 0 -9 points), lesson two (i.e., 10 -19 points), lesson three (i.e., 5-25 points), and lesson four (i.e., 5-15 points). For Adora, points increased for lesson one (i.e., 0 -13 points), lesson two (i.e., 5-10 points), lesson three (i.e., 0 -7 points), and lesson four (i.e., 10 -11 points). For Sophie, points increased for lesson one (i.e., 15-20 points), lesson two (i.e., 15-20 points), lesson three (i.e., 10 -19 points), and lesson four (i.e., 19 -30 points). With additional readings on days two and three, participants' comprehension scores continued to increase.

Adora's comprehension growth was most evident in her ability to get the correct answer after repeated readings. It is important to note that even though Adora needed more readings to get correct answers than Marcus and Sophie, many times she got the correct answer after hearing only prompts that contained text. In other words, she did not need to be told or shown the answer to get it right. Adora was able to answer correctly after hearing the text (i.e., first prompt) or sentence (i.e., second prompt) containing the answer read again. She rarely needed either of the modeled prompts available to her in the system of least prompts (i.e., telling and showing the correct answer). Table 2 describes participant responses by the type of prompt given. Text only correct (TOC) responses were when participants provided the correct response after hearing only the text read again and had an equal chance of getting the answer right or wrong. Modeled correct (MC) responses were when participants were told or shown the answer (i.e., third and fourth prompts).

Most previous research on listening comprehension for students with moderate and severe disabilities using read-alouds and the system of least prompts have included modeled prompts in

the system of least prompts intervention. For example, in the Mims et al. (2009) and Mims et al. (2012) studies, the system of least prompts hierarchy included modeled prompts in which participants were told the correct response (i.e., verbal prompt), told and shown the correct response (i.e., model prompt), or physically guided to make the correct response (i.e., physical prompt). While these modeled prompts helped participants select correct responses to the listening comprehension questions paired with the text, it is unclear if increases in correct responding were due to increased comprehension of the text or from imitating and complying with the instructor. Therefore, the distinction between unmodeled text only correct responses and modeled correct responses is an important one. These data indicate that all participants improved their correct comprehension responses when given unmodeled, text only prompts. Future research should evaluate the use of unmodeled text only prompts in the system of least prompts for teaching comprehension.

This study adds to the growing number of experimental studies demonstrating the effectiveness of peer-delivered instruction for teaching academic content to students with moderate and severe intellectual disability in a general education classroom. Peer tutors have taught a variety of academic skills in inclusive classrooms, including letter writing (Collins et al., 2001); health and art content goals (e.g., Jameson et al., 2008); science vocabulary and concepts (Jimenez, Browder, Spooner, & DiBiase, 2012); spelling (McDonnell, Thorson, Allen, & Mathot-Buckner, 2000); algebra, PE, and history content (McDonnell, Mathot-Buckner, Thorson, & Fister, 2001); and sight word vocabulary and identification of correctly spelled words (Wolery, Werts, Snyder, & Caldwell, 1994). This study adds to the literature by demonstrating a model of instruction in which peers used a system of least prompts strategy that involved levels of rereading text and tutees with disabilities directed the amount of assistance they received from peers.

This study also adds to the research supporting the use of shared story reading (read-alouds) and the system of least prompts to improve listening comprehension of adapted grade-level text for students with moderate intellectual disability. Previous research has used age-appropriate adapted literature and the system of least prompts with other components to teach early communication and literacy skills as well as comprehension of text during shared story reading (e.g., Browder et al., 2007, 2008; Mims et al., 2009, 2012). For example, Mims et al. (2009) used the system of least prompts that included reread prompts, task-analyzed instruction, and actual objects as noun referents to improve correct listening comprehension responses for students with significant intellectual disability and visual impairments. Most prior research used factual recall questions as the focus of comprehension. This study is the second (besides Mims et al., 2012) to use a system of least prompts intervention to teach listening comprehension of inferential questions for students with moderate intellectual disability. This study built on the Mims et al. approach by including a model of a think-aloud for inferential questions in the prompt strategy.

Finally, this study adds to the literature by demonstrating how students with moderate intellectual disability can learn to direct the amount of assistance they receive during instruction.

Before beginning, participants were taught to request help using a prompt on their response board (see Figure 1). During intervention, participants were asked if they wanted help after each question and each time they asked for help, the next prompt in the system of least prompts was given. Participants were also taught to monitor their independent correct responses. Self-monitoring is an important skill for school success. For example, Gilberts, Agran, Hughes, and Wehmeyer (2001) found self-monitoring helped five middle school students with severe disabilities participate more successfully in Spanish, reading, art, and U.S. History classes.

Limitations and Suggestions for Future Research

The results of this study should be considered in light of several limitations. The first limitation of this study is that a member of the research team (i.e., interventionist) recorded participant response data during instructional sessions. Peer tutors needed to make decisions quickly based on participant responses (e.g., which prompt to deliver, when to move to the next section of the adapted lesson, when to deliver verbal praise). Given the peer tutors' young age, the complexity of the intervention, and the importance of recording accurate data, the interventionist recorded participant responses during instructional sessions. The peer tutors implemented the intervention with high fidelity (i.e., 95%), but because of the interventionist's presence, the fidelity with which peers would implement the sessions or collect participant data without adult supervision is unknown.

A second limitation of this research is that data were not collected on participants' comprehension responses during science class by the general education teacher. Peer tutoring sessions took place earlier in the day during literacy workshop and relooping time because it was a naturally occurring time in general education when peers worked together. To support the fourth grade teacher during the afternoon science lessons, the interventionist prepared similar comprehension questions and response boards for the students with disabilities. Although the students attended the afternoon science class in general education and the teacher reported using these questions and response boards, it was not possible to schedule direct observations during the fourth grade teacher's lessons because of a scheduling conflict for the interventionist. Future research should include generalization measures of comprehension in lessons delivered by the general education teacher.

A third limitation of this research is that baseline and intermittent probe sessions were conducted by the interventionist and peer tutors conducted the intervention sessions. Because different interventionists conducted these sessions, it cannot be determined how much impact the presence of the peer or peer tutoring had on participants' with disabilities requests for help. In the future, researchers might consider training peer tutors to conduct the baseline probe sessions as well as the intervention sessions. In a study by Collins, Branson and Hall (1995), high school peer tutors delivered both probe and instructional sessions to teach generalized cooking product labels to students with moderate intellectual disability. Teaching peer tutors to deliver both the probe and instructional sessions, however, would require that peer tutors understand the differences

between the two study conditions. For example, peer tutors would need to deliver descriptive verbal praise following correct participant responses during intervention sessions but only general verbal praise for work behaviors during baseline sessions.

Implications for Practice

The first implication for practice is that participants with moderate intellectual disability can improve their listening comprehension of adapted grade-level science text when given text-only prompts versus prompts in which they are told or shown the answer (i.e., modeled prompts). The participants in this study all improved correct listening comprehension responses when they were given text-only prompts (i.e., heard the passage or sentence containing the answer read again).

Another implication for practice is that peer tutors can teach listening comprehension in a general education classroom using summaries of the typical text. Most academic studies conducted in general education with this population have focused on skills connected or related to academic content areas (e.g., science vocabulary and concept statements; Jimenez et al., 2012), but this is the first to focus on teaching comprehension of adapted grade-level text.

While participants were able to improve their comprehension responses after hearing selected text read again, they failed to generalize comprehension skills to other adapted science lessons. One way to improve comprehension for students with moderate intellectual disability may be by teaching rules for answering Wh- word questions (Mims et al., 2012; Secan, Egel, & Tilley, 1989). Secan et al. (1989) found students with autism generalized skills in answering Wh- word questions (i.e., what, how, and why) to new storybook questions when a relevant cue was visible and Mims et al. (2012) found a rule for answering Wh- questions (e.g., When you hear what, listen for a thing) in the first prompt of system of least prompts helped three of four participants with severe developmental disabilities increase correct responses about new, untrained biographies. More research is needed that evaluates the effects of rules in a prompt hierarchy.

A third implication for practice is that peer tutors can deliver a system of least prompts intervention within the ongoing routines of a general education classroom. Most academic studies conducted in general education for students with moderate and severe disabilities have used constant time delay embedded into ongoing classroom activities to teach academic skills (for a review of this literature see Hudson, Browder, & Wood, 2013). While constant time delay and simultaneous prompting are effective teaching strategies for students with moderate a severe intellectual disability, the system of least prompts may be better for improving listening comprehension because opportunities to hear text again (i.e., reread prompts) and think-alouds can be added to the prompts.

In summary, this study evaluated the effects of a peer-delivered system of least prompts intervention and adapted science read-alouds on correct listening comprehension responses for three students with moderate intellectual disability. Results indicate that all three participants improved listening comprehension responses after the intervention, but intervention effects did

not generalize to new science lessons. In addition, findings from the study indicate that students with moderate intellectual disability can monitor their independent correct responses and direct the amount of assistance they receive from peer tutors during peer-delivered instruction. The ability to self-direct learning enables students to take action on their own in order to be more independent learners.

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Received: 10 May 2012

Initial Acceptance: 14 July 2012

Final Acceptance: 15 September 2012

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