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Audio Support Guidelines for Accessible Assessments: Insights From Cognitive Labs

By Laurene L. Christensen, Vitaliy Shyyan, Christopher Rogers, and Aleksis Kincaid

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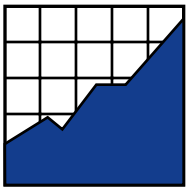
December 2014

Christensen, L. L., Shyyan, V., Rogers, C., & Kincaid, A. (2014). *Audio support guidelines for accessible assessments: Insights from cognitive labs*. Minneapolis, MN: University of Minnesota, Enhanced Assessment Grant (#S368A120006), U.S. Department of Education.



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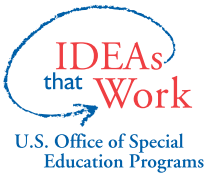
The contents of this document were developed at the National Center on Educational Outcomes (NCEO) under a subcontract from the Maryland Department of Education for an Enhanced Assessment Grant (#S368A120006) from the U.S. Department of Education. NCEO is supported, in part, through a Cooperative Agreement (#H326G110002) with the Research to Practice Division, Office of Special Education Programs, U.S. Department of Education; it is affiliated with the Institute on Community Integration at the College of Education and Human Development, University of Minnesota.The contents of this report do not necessarily represent the policy or opinions of the U.S. Department of Education or Offices within it. Readers should not assume endorsement by the federal government.



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Acknowledgments

The authors wish to thank Lisa Famularo, Jennifer Higgins, and Rachel Hall, all of Measured Progress, for their contributions to this report. In addition, the authors thank the Maryland Department of Education, especially Trinell Bowman, for their leadership on the Guidelines for Accessible Assessments Project.

Executive Summary

Some students, including students with print disabilities, students with low vision, and English language learners, may benefit from having test content read aloud. However, there have been challenges in standardizing the presentation of test content, including whether or not to read answer choices or to describe maps and cartoons, among many other issues. Technology-enhanced assessment offers the opportunity to provide standardized audio support delivered through the test platform. One goal of the Guidelines for Accessible Assessment Project (GAAP) was to develop a set of audio guidelines that could be used across states.

This report features the findings from cognitive labs conducted with students to gain their input and feedback on the proposed guidelines. A total of 46 students participated in the audio cognitive labs, including 22 students with print disabilities, 17 students with low vision, and seven students who are English language learners.

Key findings include:

- Findings were generally mixed, but some patterns emerged. Overall, students reported that audio support helped them understand test questions better. Students also typically preferred to have numbers read aloud in both the answer stem and answer choices. In several of the item sets, one item in the pair would have numbers read aloud, and in the other item, numbers would be read as "this number" or "equation." In all of these cases, students in all three demographic groups preferred the item where the numbers were included in the audio support.

- Students also had a slight preference for numbers with decimals to be read as numerals with "decimal point" rather than to be read with place value.

- Students were mixed in their preferences for audio support with the drag-and-drop. Students reported a range of experiences with this item type. For some students, this was a new item type. Other students were familiar with the drag-and-drop feature from computer games or instruction but had not encountered it in an assessment. A few students were familiar with this item type.

Overall, the findings from the cognitive labs support the need for taking an individualized approach in providing audio support for assessments. In developing online assessments, it is important to program audio support in ways that allow for multiple-approach (e.g., all parts of the item, a stimulus only, answer choices only, etc.) read aloud.

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Introduction

The Elementary and Secondary Education Act (ESEA) and the Individuals with Disabilities Education Improvement Act (IDEA) both require that accommodations be provided, as appropriate, to those students with disabilities who need them during assessments. If students' individual accessibility and accommodations needs are not addressed appropriately, such students are placed at a severe disadvantage in demonstrating what they know and can do on state assessments.

Many states and assessment consortia such as the Partnership for Assessment of Readiness for College and Careers (PARCC) and the Smarter Balanced Assessment Consortium (Smarter Balanced) have prepared guidelines regarding the roles and responsibilities of individuals who assist in the administration of accessibility features and accommodations. However, these guidelines often require additional detail to provide valid and equitable support for students who need audio-based accessibility features and accommodations. Furthermore, individuals who are tasked with reading aloud test content rarely see the test content in advance due to security restrictions. Therefore, they need to be empowered by comprehensive guidelines, as they often have to read content aloud on the spot.

The Guidelines for Accessible Assessment Project (GAAP) was implemented to meet the following goals:

1. to develop research-based audio guidelines that can be used across states, consortia, and assessment vendors to produce reliable and valid audio representations of assessment items and tasks for students with low vision or reading-based learning disabilities, and students who are English language learners (ELLs), and

2. to develop research-based sign guidelines that can be used across states, consortia, and assessment vendors to produce reliable and valid signed representations of assessment items and tasks for students who communicate using sign language.

The project was conducted to inform statewide assessments that are more accessible to ELLs and students with low vision or reading-based learning disabilities, than previous iterations. Data collected through student cognitive labs have implications for developing accessible tests for students with a variety of assessment needs. This report highlights evidence collected to address the first goal of the project: the development of research-based audio guidelines for use on statewide assessments. The following is the research question addressed in the report:

- What audio accessibility guidelines are the most usable and most effective for students to use on assessments?

This question was addressed by gathering input from state education agency personnel, including assessment and content experts. However, there is very little consensus on the best approaches to deliver audio support without violating the construct being measured. This report specifically addresses an additional component to this question: gathering input and feedback from students themselves on how assessment content should be read aloud.

Method

Cognitive labs were conducted with students at elementary, middle, and high school grade levels. Participating students came from states affiliated with PARCC, Smarter Balanced, and non-consortium-affiliated states. Students were selected based on having either a reading-based learning disability (LD-Reading), low vision, or having been identified as an ELL.

A total of 46 students completed the cognitive labs. As shown in Table 1, 29 students were male, and 17 were female. An equal number of students participated in the middle- and high-school (n=17) versions of the assessment, with 12 students participating in the elementary school version. The LD-Reading group was the largest (n=22), followed by students with low vision (n=17), and ELLs (n=7). Students were recruited from a total of three states for the audio support cognitive labs.

Students who participated in the audio support cognitive labs ranged in their experience with using audio support for instruction and assessment. When asked about their experiences with audio support, some students commented that they were unsure if they had received audio support for testing. Other students noted that they had just started using audio support as a testing accommodation. Two students commented that they had received audio support from a teacher who had read test questions aloud. They noted that they liked the teacher reading the test out loud to them.

Students were asked if they thought the audio support was helpful to them in understanding test questions. A total of four students stated that they thought the audio support was not helpful. One student did not give a response. The remaining 41 students stated that they thought the read aloud was helpful. Students' comments about how it was helpful included, "it makes more sense when they say it for you," "sometimes I can't really focus on what I'm reading," "I have more confidence that I know what is being asked," and "some stuff can't be put on braille maps or pictures, so it helps with understanding."

Each student was provided a brief test with isomorph item sets in which one feature of the item pair varied (e.g., in the first item, the cartoon was described, and in the second item, it was not). See Appendix A for the cognitive lab instruments used in this study. During the assessment,

two researchers observed students and took notes on their interactions with the items. The researchers were interested in how earnestly students were responding to test items. Students were observed to not answer test items earnestly if they reported that they guessed at the answer or if they responded to the item pair quickly, selecting the same answer choice for both items. In addition, the researchers noted how many times the student fully or partially replayed the audio for each item.

Following the completion of each item pair, students were asked several questions about the isomorph items, including how difficult they thought the item was, their item preference related to the variation between item pairs, and what aspects of the audio presentation for the items were helpful or not helpful.

Table 1. Student characteristics for the audio assessment

Characteristics	LD-Reading	ELL	Low Vision	Total
Sex				
Male	16	4	9	29
Female	6	3	8	17
Grade				
Elementary	5	4	3	12
Middle School	10	3	4	17
High School	7	0	10	17
TOTAL	**22**	**7**	**17**	

The results of this report are laid out in three sections. The first section covers responses from elementary school students, followed by middle school, then high school student responses. A synthesis of responses by student need across grade levels is provided at the end of the three sections.

Elementary School Assessment With Audio Support

The elementary school assessment with audio support included six questions regarding student preferences for how items were presented, including the following:

1. feedback on the level of detail of audio description of items,
2. feedback on drag-and-drop items,
3. whether mathematical expressions were read aloud,
4. whether shapes in figures were described,

5. whether answer options were read, and
6. whether students preferred numbers to be read in items.

Each issue is discussed below.

At the elementary school level, most students were observed to have answered the items earnestly. In one instance, a student with a reading-based learning disability answered immediately for both items, but was correct for both items, making it difficult to determine whether he knew the material or guessed correctly. In some instances, several students were observed to be taking their time to listen to the computer directions and drop the items into the boxes to match the item fraction.

Issue 1: Do students prefer that detailed information on coordinate grids be read aloud or prefer that the grid only be described more generally?

An item pair was developed in which the first item provided detailed information about the coordinate grid, while the second item provided a general description of the content.

Replaying Audio

Only one student, a student with low vision, replayed the audio for this item pair.

Reported Difficulty

After each item pair, elementary school students were asked about their perceptions related to the difficulty level of the items. Tables 2 and 3 show the reported difficulty of items in this set according to the elementary school students who responded to Item Set 1. Students were split about whether they thought the item sets were easy or difficult to complete. For students who responded to the question of item difficulty, half of ELLs and students with Low Vision reported that the items were easy, while the other half reported that the items were difficult.

Table 2. Student reported item difficulty for Item 1: detailed description

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	0	0	1	5
ELL (n=4)	2	0	2	0
Low Vision (n=3)	1	0	1	1
TOTAL (n=12)	**3**	**0**	**3**	**6**

Table 3. Student reported item difficulty for Item 2: general description

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	0	0	1	5
ELL (n=4)	2	0	2	0
Low Vision (n=3)	1	0	1	1
TOTAL (n=12)	**3**	**0**	**3**	**6**

Item Preferences

The majority of students preferred Item 1 (Table 4). However, students who had a reading-based learning disability preferred Item 2 (n=3) than Item 1 (n=2) about the same. For the other demographic categories, the majority of students preferred Item 1.

Table 4. Elementary school students' item preferences by participant group

Student Demographic Category	Preferred Item 1 (Detailed Description)	Preferred Item 2 (General Description)	No Preference
LD-Reading (n=5)	2	3	0
ELL (n=4)	3	0	1
Low Vision (n=3)	3	0	0
TOTAL (n=12)	**8**	**4**	**0**

Students who preferred Item 1 typically stated that they liked how the computer read the location of each house in the coordinate grid. Students who preferred the second item either stated that they liked that the read aloud ended quicker than in the first item, or that they had "become used to" the item and used this to help them answer the second item. The student without a preference did not notice any difference between the two items.

Issue 2: Do students prefer hearing audio feedback for drag-and-drop items (feedback tells the student what object was moved or what the drop area looks like with dragged objects)?

To answer this research question, an item pair was developed where students were asked to drop either soybeans or corn kernels into a grid to match a fraction in the item (for example, the first item tells students that a farmer planted three-quarters of his field with soybeans, and they have to drop the correct amount of soybeans into an eight-box grid to match the fraction). For the first item, the students were told when they had dropped a soybean in the field and how

many fields were planted. The second item did not provide feedback when students dropped corn into the boxes.

Replaying Audio

The majority of students did not replay any of the audio for Item Set 2, but one ELL and one student with low vision replayed Item 3. The same student with low vision replayed Item 4.

Reported Difficulty

Tables 5 and 6 show the reported difficulty level for items in Set 2. All students who reported a difficulty level for these two items found the items to be Easy.

Table 5. Student reported difficulty for Item 3: drag-and-drop audio feedback

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	1	0	1`	3
ELL (n=4)	3	0	0	1
Low Vision (n=3)	1	0	0	2
TOTAL (n=12)	**5**	**0**	**0**	**7**

Table 6. Student reported difficulty for Item 4: drag-and-drop no audio feedback

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	1	0	0	4
ELL (n=4)	3	0	0	1
Low Vision (n=3)	1	0	0	2
TOTAL (n=12)	**5**	**0**	**0**	**7**

Item Preferences

The majority of students preferred Item 3 to Item 4 (Table 7). However, student preference varied by need. Students with a reading-based learning disability were more likely to prefer Item 3 (n=3) than Item 4 (n=2). ELLs were evenly split on their preference for the two items. All students who had low vision preferred Item 3 (n=3), which tells the student when a seed is dropped into the box and how many seeds are in the boxes.

Table 7. Elementary school students' item preferences by participant group

Student Demographic Category	Preferred Item 3 (Drag-and-Drop Audio Feedback)	Preferred Item 4 (Drag-and-Drop no Audio Feedback)	No Preference
LD-Reading (n=5)	3	2	0
ELL (n=4)	2	2	0
Low Vision (n=3)	3	0	0
TOTAL (n=12)	**8**	**4**	**0**

The majority of students who preferred Item 3 stated that they liked that the computer affirmed when they had put a seed into the drag-and-drop region, and that it told them how many seeds were in the grid. Students who preferred the second item reported that they thought the computer voice was "annoying" when it updated them on how many seeds had been dropped into the grid, and that they liked how quickly they could complete Item 4 because the computer was not updating them with the count of seeds each time they dragged one into the grid.

Issue 3: Do students prefer that expressions and equations be read aloud?

To answer this question, an item pair was developed that contained one question in which the expressions and equations were read aloud and one question in which the expressions and equations were not read aloud.

Replaying Audio

One student with low vision replayed the audio for Item 5, where equations were read.

Reported Difficulty

Tables 8 and 9 show the reported difficulty levels for Item Set 3. Of the students who reported a difficulty level, more students thought the items were Easy. A total of three students reported both Item 5 and Item 6 to be Difficult.

Table 8. Student reported difficulty of Item 5: equations read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	1	0	1	3
ELL (n=4)	2	0	2	0
Low Vision (n=3)	1	1	0	1
TOTAL (n=12)	**4**	**1**	**3**	**3**

Table 9. Student reported difficulty of Item 6: equations not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	1	0	1	3
ELL (n=4)	2	0	2	0
Low Vision (n=3)	2	1	0	0
TOTAL (n=12)	**5**	**1**	**3**	**3**

Item Preferences

In general, students preferred the first item in the pair, where the expressions and equations were read aloud. Students with a reading-based learning disability were somewhat even in their preferences for both items. Other groups tended to prefer Item 5. Table 10 shows the preference for each item by student need.

Table 10. Elementary school students' item preferences by participant group for Item Set 3

Student Demographic Category	Preferred Item 5 (Equations Read)	Preferred Item 6 (Equations not Read)	No Preference
LD-Reading (n=5)	2	3	0
ELL (n=4)	2	1	1
Low Vision (n=3)	3	0	0
TOTAL (n=12)	**7**	**4**	**1**

Students who preferred Item 5 liked that the computer read the equation to them. One student commented that as the computer read the problem, he could think about it since they were not trying to read it. Another mentioned that the computer explained parts of the equation they did not understand. Students who preferred Item 6, where the equation was not read, stated that they understood the equation and did not need the computer to read it to them.

Issue 4: Do students prefer that diagrams be described?

An item pair was developed to answer whether students prefer that diagrams be described to them. In Item Set 4, the first item described three shapes that were in a diagram, while the second stated that there was a diagram and three shapes, but did not name the shapes.

Replaying Audio

For this item set, one student in the LD-Reading group replayed the audio for Item 8, where the shapes were not described.

Reported Difficulty

Tables 11 and 12 show the reported difficulty levels for Item Set 4. Only about half of the students reported a difficulty level for this item pair. Of those who reported a difficulty level, most found the items to be Easy.

Table 11. Student reported difficulty of Item 7: shapes described

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	3	0	0	2
ELL (n=4)	2	0	1	1
Low Vision (n=3)	1	0	0	2
TOTAL (n=12)	**5**	**0**	**1**	**6**

Table 12. Student reported difficulty of Item 8: shapes not described

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	2	0	1	2
ELL (n=4)	3	0	1	0
Low Vision (n=3)	1	0	0	2
TOTAL (n=12)	**5**	**0**	**2**	**5**

Item Preferences

As shown in Table 13, students were more likely to prefer Item 7, where the shapes within the diagram were described, than they were to prefer when the shapes were not described (Item 8). However, preferences varied by student need. Students with reading-based learning disabilities

were evenly split in item preference, or had no preference (n=1). ELLs and students with low vision were more likely to prefer Item 7 (n=3 and n=2, respectively).

Table 13. Elementary school students' item preferences by participant group

Student Demographic Category	Preferred Item 7 (Shapes Described)	Preferred Item 8 (Shapes not Described)	No Preference
LD-Reading (n=5)	2	2	1
ELL (n=4)	3	1	0
Low Vision (n=3)	2	1	0
TOTAL (n=12)	**7**	**4**	**1**

Students who preferred Item 7 stated that they liked how the computer voice read the shapes to them, which could help "a bit with getting the answer," and because they did not "have to think about what the shape is." One student who preferred Item 7 also mentioned that the slow speed of the read aloud can be helpful when items are difficult. Students who preferred Item 8 liked it because the read aloud finished faster, because they wanted to look at the shapes rather than have them described, or because they already knew their shapes and did not need the computer to tell them what each shape was.

Issue 5: Do students prefer that answer options with numerals be read aloud?

To answer whether students prefer that answer options with numerals be read aloud, an isomorph item set was developed. In Item Set 5, the first item read the numerals in the answer options aloud, while the second item did not read the numerals aloud.

Replaying Audio

For this item set, there were no students who replayed the read aloud after the item was initially heard.

Reported Difficulty

The reported difficulty level of Item Set 5 is shown in Tables 14 and 15. Most students who reported a difficulty level found these items to be Easy.

Table 14. Student reported difficulty of Item 9: numbers and answers read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	1	0	1	3
ELL (n=4)	3	0	0	1
Low Vision (n=3)	1	0	0	2
TOTAL (n=12)	**6**	**0**	**1**	**5**

Table 15. Student reported difficulty of Item 10: numbers and answers not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	1	0	1	3
ELL (n=4)	3	0	0	1
Low Vision (n=3)	1	0	0	2
TOTAL (n=12)	**6**	**0**	**1**	**5**

Item Preferences

Table 16 shows students' stated item preference by student category. Although the majority of students (n=8) preferred Item 9, where the numerals in the answer options were read aloud, there was some variation in preference by student need. Students with a reading-based learning disability were fairly evenly divided in their preference for the two items. For both ELLs and students with low vision, the majority preferred Item 9.

Table 16. Elementary school students' item preferences by participant group

Student Demographic Category	Preferred Item 9 (Numbers and Answers Read)	Preferred Item 10 (Numbers and Answers not Read)	No Preference
LD-Reading (n=5)	2	3	0
ELL (n=4)	3	1	0
Low Vision (n=3)	3	0	0
TOTAL (n=12)	**8**	**4**	**0**

All students who preferred Item 9 said that they liked having the computer read aloud the answer choice numbers. Some students mentioned that they were used to having the numbers read aloud on other tests, and others said it was easier for them to understand which option to choose because the voice had tied the number to the item answer choice. Students who preferred Item

10 either stated that they did not need the numbers read aloud, or that they liked the fact that the read aloud ended faster.

Issue 6: Do students prefer that large numbers within items be read aloud?

An item pair was developed in order to answer whether students prefer that large numbers within items be read aloud. In Item Set 6, for the first item, the computer read a large number (for example, “336”), while in the second item, the computer would simply say “this number,” when reading that part of the item.

Replaying Audio

The majority of students did not replay the audio in either of the items. One student with low vision replayed both Item 11 and 12.

Reported Difficulty

The reported difficulty level for Item Set 6 is shown in Tables 17 and 18. Fewer than half of the students reported a difficulty level for these items. Of those who did, they were closely divided between easy (n=3) and difficult (n=2).

Table 17. Student reported difficulty of Item 11: numbers read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	0	0	1	4
ELL (n=4)	3	0	0	1
Low Vision (n=3)	0	0	1	2
TOTAL (n=12)	**3**	**0**	**2**	**7**

Table 18. Student reported difficulty of Item 12: numbers not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=5)	0	0	1	4
ELL (n=4)	3	0	0	1
Low Vision (n=3)	0	0	1	2
TOTAL (n=12)	**3**	**0**	**2**	**7**

Item Preferences

Students from all demographic categories showed a strong preference for Item 11 (n=10), where the numbers were read aloud within the item (Table 19). Only students with a reading-based learning disability were split on item preference, with three students preferring when the numbers were read aloud, and two preferring that the computer simply read "this number."

Table 19. Elementary school students' item preferences by participant group

Student Demographic Category	Preferred Item 11 (Numbers Read)	Preferred Item 12 (Numbers not Read)	No Preference
LD-Reading (n=5)	3	2	0
ELL (n=4)	4	0	0
Low Vision (n=3)	3	0	0
TOTAL (n=12)	**10**	**2**	**0**

Students who preferred Item 11 stated that they liked that the computer read the numbers to them, and were frustrated that they had to read the numbers to themselves for Item 12. Some students commented that they "didn't like [the second item] at all," and that they could not rely on the read aloud while writing the problem down on scratch paper. Of the two students who preferred Item 12, one stated that the item felt "less stressful" when "this number" was read, rather than the actual number. The second student commented that they liked that the words were shaded during the read aloud of Item 12 (though word shading occurred for both items).

Middle School Assessment With Audio Support

The middle school assessment covered eight issues regarding how students preferred items be presented. The issues covered the following topics:

- what level of description should be included in an item read aloud,
- whether students want feedback for drag-and-drop items,
- whether item equations should be read aloud,
- whether diagrams should be described,
- whether fractional ratios should be read aloud,
- whether answer choice numerals should be read aloud,
- large numbers within items should be read aloud, and
- whether decimals should be read aloud using "decimal point" or place values (e.g., "five one-hundredths").

Each issue is described in greater detail below, with student responses and preferences. A total of 17 students participated in the middle school assessment with audio support. Most students appeared to have answered the items earnestly. On a few occasions, students were observed to have guessed one or both items in a given item set.

Issue 1: Do students prefer that detailed information on line graphs be read aloud or prefer that the graph only be described more generally?

To answer the question of whether students preferred that detailed information on line graphs be read aloud, an item pair was developed. In Item Set 1, the first item read the points on the graph aloud to the student (e.g., in 1997, 50 million people used the Internet), while the second item provided a description of the graph title and axes, but did not read the graph points to the student.

Replaying Audio

There were no students who replayed the audio for either item. One student skipped the audio and answered both questions before the audio was finished reading, and another student skipped the audio on the second portion and answered the question before the read aloud was complete.

Reported Difficulty

Tables 20 and 21 show the reported difficulty level for Item Set 1. All of the students who reported a difficulty level found the items in this set to be easy.

Table 20. Student reported difficulty for Item 1: detailed description

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	3	0	0	7
ELL (n=3)	2	0	0	1
Low Vision (n=4)	1	0	0	3
TOTAL (n=17)	**6**	**0**	**0**	**11**

Table 21. Student reported difficulty for Item 2: general description

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	3	0	0	7
ELL (n=3)	2	0	0	1
Low Vision (n=4)	1	0	0	3
TOTAL (n=17)	**6**	**0**	**0**	**11**

Item Preferences

Table 22 shows which item students preferred across demographic categories. Regardless of their demographic category, students preferred Item 1, where the coordinate information on the grid was read aloud. Two students preferred Item 2, and two students from the LD-Reading group had no preference.

Table 22. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 1 (Detailed Description)	Preferred Item 2 (General Description)	No Preference
LD-Reading (n=10)	8	0	2
ELL (n=3)	2	1	0
Low Vision (n=4)	3	1	0
TOTAL (n=17)	**13**	**2**	**2**

Students who preferred the first item stated that the read aloud was helpful because it read every part of the graph to them. One student with low vision commented that reading the points aloud was helpful because "otherwise my face is close to the screen and [I tend to] lose numbers." Another student stated that when the computer read the numbers aloud, it made it easier for them to answer the question. One of the students who preferred the second item stated that the computer confused them when it read all of the graph points, while the other student disliked audio help in general, and preferred the second item because of this. The two students who did not have a preference did not provide additional information about their choice.

Issue 2: Do students prefer hearing audio feedback for drag-and-drop items?

For this issue, an item pair was developed that required students to drag and drop items onto a number line to show the correct placement of fractions. In Item Set 2, the first item did not provide feedback when students dragged items onto the number line. The second item told the

students that they had dropped the fractional equation onto the number line and where they had placed it.

Replaying Audio

There was one student in the LD-Reading group who replayed both Item 3 and Item 4, and one student with low vision who replayed Item 4 only. In addition, one student was frustrated by the read aloud, and told it to "shut up" during the second equation.

Reported Difficulty

Tables 23 and 24 highlight the reported difficulty level for Item Set 2. In this set, most of the students who reported a difficulty level found the items to be Difficult.

Table 23. Student reported difficulty for Item 3: drag-and-drop no audio feedback

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	1	1	3	5
ELL (n=3)	0	0	3	0
Low Vision (n=4)	1	0	2	1
TOTAL (n=17)	**2**	**1**	**8**	**6**

Table 24. Student Reported Difficulty for Item 4: Drag-and-drop Audio Feedback

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	0	1	3	3
ELL (n=3)	0	0	3	0
Low Vision (n=4)	1	0	2	1
TOTAL (n=17)	**1**	**1**	**8**	**4**

Item Preferences

The majority of students preferred Item 4, where the computer read the equation to them and let them know a box on the number line was filled each time they put an equation on the number line (Table 25). This trend held across all groups of students, with relatively few either expressing a preference for Item 3, or not expressing a preference for either item.

Table 25. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 3 (Drag-and-Drop no Audio Feedback)	Preferred Item 4 (Drag-and-Drop Audio Feedback)	No Preference
LD-Reading (n=10)	3	4	3
ELL (n=3)	0	3	0
Low Vision (n=4)	1	3	0
TOTAL (n=17)	**3**	**11**	**3**

Students who preferred Item 3 stated that they liked how the item was read aloud. One student stated that it "gave you the info you need to know," when working on the item. Students who preferred the second item (Item 4) said they liked that the computer read the equation when it was dropped onto the number line. One student mentioned that students who have low vision would know what equation they had moved, and where they had placed it on the number line. Two of the students who had no preference did not provide additional information and one student said that they liked parts of Item 3 and Item 4. This student mentioned that they thought it was annoying when the numbers were re-read, but liked that the read aloud confirmed which box the student had placed the equation into.

Issue 3: Do students prefer that expressions and equations be read aloud?

In Item Set 3, students were presented with two items that had algebraic equations. For Item 5, the read aloud read the question and the equations. For Item 6, the read aloud read the question, but simply said "this expression" whenever an equation was highlighted. Students were required to determine which expressions in the answer choices were equal to the expression in the question.

Replaying Audio

There were three students, including one student with reading-related learning disabilities, one ELL, and one student with low vision replayed the audio for Item 5, where equations were read. One student with low vision began to complete the items before the read aloud had finished reading the problem to them. All other students waited until the read aloud was finished.

Reported Difficulty

Tables 26 and 27 show the reported difficulty level for Item Set 6. Most of the students who reported a difficulty level stated that the items were difficult (n=7). A small number of students (n=3) reported the items to be easy.

Table 26. Student reported difficulty for Item 5: equations read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	1	1	3	5
ELL (n=3)	1	0	2	0
Low Vision (n=4)	1	0	2	1
TOTAL (n=17)	**3**	**1**	**7**	**6**

Table 27. Student reported difficulty for Item 6: equations not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	2	1	3	4
ELL (n=3)	1	0	2	0
Low Vision (n=4)	1	0	2	1
TOTAL (n=17)	**3**	**1**	**7**	**6**

Item Preferences

The majority of students preferred Item 5 (n=13) where the equations were read aloud (see Table 28). Two students with reading-based learning disabilities preferred Item 5, and two had no preference. All students in the ELL and low vision groups preferred Item 5.

Table 28. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 5 (Equations Read)	Preferred Item 6 (Equations not Read)	No Preference
LD-Reading (n=10)	6	2	2
ELL (n=3)	3	0	0
Low Vision (n=4)	4	0	0
TOTAL (n=17)	**13**	**2**	**2**

Students who preferred Item 5 reported that they preferred hearing the equations read aloud to them. Some mentioned that when the equation was read aloud, they were able to recall it easier, while others mentioned that it helped them solve the equations. One of the two students preferred Item 6 because they disliked that the computer would say "open parentheses" and "end parentheses" when reading the equations, while the other student found the problems to be easy and did not think that having the equations read aloud was helpful. The two students who had no preference did not provide additional information about their choice.

Issue 4: Do students prefer that diagrams be described?

To discern whether students prefer that diagrams be described, an item pair (Item Set 4) was developed with layouts of a rectangular building with several rooms within. In Item 7, the computer read the title of the overall diagram, and then highlighted and read the name of each room. In Item 8, the title of the diagram was introduced, but individual rooms were not highlighted or read aloud. One student with a reading-based learning disability skipped the first item, and appeared to guess on the second.

Replaying Audio

Three students replayed the read aloud for this item set. One student with a reading-based learning disability activated a portion of the read aloud by accident when trying to select an answer for Item 7. One student with a reading-based learning disability used the read aloud to have the answer choices re-read. In addition, one ELL had the computer re-read the diagram, but did not have it re-read any part of Item 8.

Reported Difficulty

The reported difficulty level for Item Set 4 is shown in Tables 29 and 30. Of the students who reported a difficulty level, most said these items were easy.

Table 29. Student reported difficulty for Item 7: rooms read automatically

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	5	0	1	4
ELL (n=3)	2	1	0	0
Low Vision (n=4)	3	1	0	0
TOTAL (n=17)	**10**	**2**	**1**	**4**

Table 30. Student reported difficulty for Item 8: rooms not read automatically

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	4	0	0	6
ELL (n=3)	2	1	0	0
Low Vision (n=4)	3	1	0	0
TOTAL (n=17)	**9**	**2**	**0**	**6**

Item Preferences

As shown in Table 31, the majority of students preferred Item 7, where the rooms within the diagram were each read to the student by the computer. Two students from the LD-Reading group, and one student with low vision, preferred Item 8. A total of four students had no preference about how the items were presented.

Table 31. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 7 (Rooms Read Automatically)	Preferred Item 8 (Rooms not Read Automatically)	No Preference
LD-Reading (n=10)	4	3	3
ELL (n=3)	2	0	1
Low Vision (n=4)	3	1	0
TOTAL (n=17)	**10**	**3**	**4**

The majority of students who preferred Item 7 mentioned that they liked that the computer read the names of each room. One student with a reading-based learning disability mentioned that students who were blind might not know which room was which without the read aloud. One of the students with low vision corroborated the student's thought, mentioning that they would not know what the room labels were if the computer had not read them aloud. Students who preferred Item 8 stated that they liked that the read aloud finished faster, though some stated that the extended read aloud might be helpful for students who struggled with reading. Students with no preference thought the items were easy, and did not have a strong preference about how the items were presented.

Issue 5: Do students prefer that fractional ratios be read aloud?

To determine whether students prefer that fractions be read aloud, an item pair was developed. For items in Item Set 5, students were presented with a fraction and a list of answer options. They were required to select the answer option that was equal to the fraction in the problem. For

Item 9, the computer read the numbers in the numerator and denominator of the fraction and the numbers in the answer choices, while in Item 10, the computer simply said "this fraction is equal to…" and then presented the answer options without reading the numbers associated with that answer choice. One student with a reading-based learning disability skipped the first item and quickly answered the second item.

Replaying Audio

There were several students who replayed the audio during this item set. A total of six students replayed Item 9 and two of these students also replayed Item 10. Of these students, four students were in the LD-Reading group, one student had low vision, and one student was an ELL.

Reported Difficulty

Tables 32 and 33 show the reported difficulty level for Item Set 5. Most students did not report a difficulty level for this item set. Of those who did, there was no consensus on whether the items were easy, medium, or difficult.

Table 32. Student reported difficulty for Item 9: equation read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	0	0	1	9
ELL (n=3)	2	1	0	0
Low Vision (n=4)	0	0	0	4
TOTAL (n=17)	**2**	**1**	**1**	**13**

Table 33. Student reported difficulty for Item 10: equation not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	0	0	1	9
ELL (n=3)	1	1	1	0
Low Vision (n=4)	0	0	0	4
TOTAL (n=17)	**1**	**1**	**2**	**13**

Item Preferences

As shown in Table 34, students clearly preferred Item 9, where the equation was read aloud by the computer. Although a few students preferred Item 10, the majority of students from each demographic category preferred to have the computer read the numbers in the fraction to them.

Table 34. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 9 (Equation Read)	Preferred Item 10 (Equation not Read)	No Preference
LD-Reading (n=10)	8	2	0
ELL (n=3)	2	1	0
Low Vision (n=4)	3	1	0
TOTAL (n=17)	**13**	**4**	**0**

Students who preferred Item 9 stated that they liked when the computer read the equation to them. Some students commented that this helped because they could hear the order of the numbers. One student with low vision mentioned that when the equation is not read aloud, some people would need to guess because the computer only reads the answer choices [and they cannot see the equation]. Students who preferred Item 10 said that they either found the equation read aloud to be confusing, or that they could read faster than the read aloud, and were annoyed that it did not keep up with them.

Issue 6: Do students prefer that numerals in the answer options be read aloud?

To answer whether students prefer numerals to be read aloud in item questions and answer choices, an item pair was developed. In Item Set 6, Item 11 read the actual numbers to students while reading a word problem. For Item 12, students were presented with a similar problem, but rather than reading the numbers, the computer read aloud "this number" and only read the answer choices (i.e., A, B, C, D) to the student, rather than the numbers associated with each choice.

Replaying Audio

For this item set, two students with reading-based learning disabilities replayed the items. One student replayed both items, while the other replayed Item 12 (where the equation was not read aloud), and appeared to shake is head and chuckle when the computer read "this number" to the student.

Reported Difficulty

Tables 35 and 36 show the reported difficulty level for Item Set 6. Most students did not report a difficulty level for this item set. No students reported these items to be difficult. Students were somewhat mixed on whether the items were easy or medium.

Table 35. Student reported difficulty for Item 11: numbers read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	2	1	0	7
ELL (n=3)	0	1	0	2
Low Vision (n=4)	2	0	0	2
TOTAL (n=17)	**4**	**2**	**0**	**11**

Table 36. Student reported difficulty for Item 12: numbers not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	1	1	0	8
ELL (n=3)	0	1	0	2
Low Vision (n=4)	2	0	0	2
TOTAL (n=17)	**3**	**2**	**0**	**12**

Item Preferences

For this item set, students predominantly preferred Item 11, where the numerals in the question and answer choices were read aloud by the computer. This trend held across all demographic groups (Table 37).

Table 37. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 11 (Numbers Read)	Preferred Item 12 (Numbers not Read)	No Preference
LD-Reading (n=10)	8	1	1
ELL (n=3)	3	0	0
Low Vision (n=4)	4	0	0
TOTAL (n=17)	**15**	**1**	**1**

Students preferred Item 11 because it read the numbers aloud to them. This allowed students to write down the numbers in the question and answer choices so that they could start solving the problem while the computer was completing the read aloud. Several students who preferred Item 11 also mentioned that they disliked that the computer said "this number" for Item 12, rather than stating what the actual numbers were, with one student commenting that it is "unnatural not to have the numbers read aloud." The two students who either preferred Item 12, or had no preference, did not provide any additional pertinent information about their choice.

Issue 7: Do students prefer that large numbers within items be read aloud?

To determine whether students prefer that large numbers be read aloud, students were given two items with large numbers (e.g., 327,577,529). Item 13 read each of the large numbers to the student, while Item 14 read the item questions, but did not read the numbers within the item to the student. Three students did not answer Item Set 7, bringing the total count of students for this item set from 17 to 14 students.

Replaying Audio

One student with a reading-based learning disability replayed Item 14, where large numbers were not read.

Reported Difficulty

The reported difficulty level for Item Set 7 is shown in Tables 38 and 39. Most students did not report a difficulty level for these items. Of those who did report a difficulty level, the students were fairly evenly divided in reporting the items to be easy and difficult.

Table 38. Student reported difficulty for Item 13: large numbers read

Student Demographic Category		Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	0	1	0	9
ELL (n=3)	1	1	0	1
Low Vision (n=4)	1	0	2	2
TOTAL (n=17)	**2**	**1**	**2**	**12**

Table 39. Student reported difficulty for Item 14: large numbers not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	0	1	1	8
ELL (n=3)	2	0	0	1
Low Vision (n=4)	1	0	2	1
TOTAL (n=17)	**3**	**1**	**3**	**10**

Item Preferences

As shown in Table 40, students had a strong preference for Item 13, where the large numbers were read aloud. This trend held across all demographic groups.

Table 40. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 13 (Large Numbers Read)	Preferred Item 14 (Large Numbers not Read)	No Preference
LD-Reading (n=8)	6	2	0
ELL (n=2)	2	0	0
Low Vision (n=4)	3	0	1
TOTAL (n=14)	**12**	**1**	**1**

Students who preferred Item 13 stated that it was easier to follow the question because the computer read the large numbers aloud. One student mentioned that students with low vision might struggle to complete items where the numbers were not read aloud. One student mentioned that because the computer read the numbers aloud, they were able to start completing the problem in their head. One student with low vision stated that it was difficult to look up the numbers when the computer did not read them aloud. Neither student who preferred Item 14 or had no preference provided any additional information about their choice.

Issue 8: Do students prefer that decimals be read aloud using single digit names and the words "decimal point" or using their place value?

Item Set 8 was developed to answer whether students prefer that items with decimals be read with "decimal point" or using their place value. In Item 15, the computer read the problem aloud and used "decimal point" to indicate a decimal was following (e.g., 8.95 was read "eight decimal point nine five"). Item 16 presented the item by giving the student the place value of the decimals (e.g., 8.95 was read "eight and ninety-five hundredths"). Four students did not complete Item Set 8, bringing the total number of students for this item set down to 13 students.

Replaying Audio

One student with LD-Reading replayed the audio for Item 15, where the term “decimal point” was used. One student paused the audio before it had completed and answered the items without finishing the read aloud.

Reported Difficulty

Tables 41 and 42 highlight the reported difficulty level for Item Set 8. Most students did not report a difficulty level for these items. Of those who did, more students found the items to be easy. No students reported the items to be difficult.

Table 41. Student reported difficulty for Item 15:decimals

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	1	1	0	8
ELL (n=3)	1	1	0	1
Low Vision (n=4)	2	0	0	2
TOTAL (n=17)	**4**	**2**	**0**	**11**

Table 42. Student reported difficulty for Item 16: place value

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=10)	2	1	0	7
ELL (n=3)	0	1	0	2
Low Vision (n=4)	2	0	0	2
TOTAL (n=17)	**4**	**2**	**0**	**11**

Item Preferences

As shown in Table 43, the majority of students preferred Item 15, where the numbers were read with “decimal point” rather than their place value. This was true across demographic groups, with only four students preferring Item 16.

Table 43. Middle school students' item preferences by participant group

Student Demographic Category	Preferred Item 15 (Decimals)	Preferred Item 16 (Place Value)	No Preference
LD-Reading (n=7)	4	3	0
ELL (n=2)	2	0	0
Low Vision (n=4)	3	1	0
TOTAL (n=13)	**9**	**4**	**0**

Students who preferred Item 15 stated that they found Item 16 to be confusing. Five students mentioned that they preferred to hear "point" rather than "decimal point," because most of their teachers would present decimals using the former to indicate where the decimal point was placed. One student mentioned that "decimal point" was a long phrase to say. Students who preferred Item 16 either preferred it because they had gotten some practice with the first item, or could not provide additional information about their preference. Several students mentioned that they disliked Item 16 because the computer was perceived to mispronounce "millionths," sounding closer to "smillionths," which confused them.

High School Assessment With Audio Support

The high school assessment with audio support covered eight item sets. Similar to the elementary and middle school issues, the high school pairs of items covered a range of issues, including the following:

1. how students prefer decimals, equations, and fractional ratios be read aloud,
2. whether they wanted large numbers and audio feedback for drag-and-drop items read aloud,
3. whether students wanted detailed information on line graphs to be included in the read aloud.
4. whether students wanted political cartoons described, and
5. what level of detail students preferred when presented with information on maps.

There were no high school students classified as ELLs who participated in the study, so this category is not included in the tables below.

Most students were observed to have responded earnestly to the items at this grade school level. The researchers noted examples of students leaning in to read the question on the computer screen, asking for scratch paper, and making positive comments such as "I am totally loving this." One student with visual impairment was observed to not respond earnestly to the items. Two students with learning disabilities were noted to not respond earnestly to some of the items. Students who did not respond earnestly made comments such as "Just guessed." Also, students seemed

confused about how to answer, stating, “So does it mean you have to put words in the box or just numbers? I don’t know what to put in” and “How do I do it? I have no idea with this one.”

Issue 1: Do students prefer that decimals be read aloud using single digit names and the words “decimal point” or using their place value?

Item Set 1 was developed to answer whether students prefer that items with decimals be read with “decimal point” or using their place value. In Item 1, the computer read the problem aloud and used “decimal point” to indicate a decimal was following (e.g., 8.95 was read “eight decimal point nine five”). Item 2 presented the item by giving the student the place value of the decimals (e.g., 8.95 was read “eight and ninety-five hundredths”).

Replaying Audio

A total of three students replayed the audio in the items for this set. For Item 1, one student in the LD-Reading group and one student with low vision replayed the audio. The same student with low vision also replayed Item 2, and one additional student with low vision replayed Item 2.

Reported Difficulty

Tables 44 and 45 show the reported difficulty level for Item Set 1. Fewer than half of the students reported a difficulty level for these items. Of those who did, more students (n=4) reported the items to be difficult. Two students reported the items to be easy.

Table 44. Student reported difficulty for Item 1: decimals

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	2	0	4	4
TOTAL (n=17)	**2**	**0**	**4**	**11**

Table 45. Student reported difficulty for Item 2: place value

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	2	0	4	4
TOTAL (n=17)	**2**	**0**	**4**	**11**

Item Preferences

Table 46 includes student preferences for the two items. Students who preferred the first item noted that they preferred decimals over fractions. One student commented that "people can get mixed up with fractions." Students who preferred the second item commented that they find fractions easier than decimals. One student noted that the second item was "similar to how I was taught." One student mentioned that for both items, the audio presentation was helpful because "I can hear it and also read it."

Table 46. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 1 (Decimals)	Preferred Item 2 (Place Value)	No Preference
LD-Reading (n=7)	3	3	1
Low Vision (n=10)	8	2	0
TOTAL (n=17)	**10**	**5**	**1**

Issue 2: Do students prefer that expressions and equations be read aloud?

Item Set 2 addressed how expressions and equations were presented. In the first item, the numbers and expressions were read aloud. In the second item in the pair, the equation was read as "equation."

Replaying Audio

For Item Set 2, one student with a reading-related learning disability and one student with low vision replayed Item 3, where the equation was read. No students replayed the audio for Item 4, where the equation was not read.

Reported Difficulty

Tables 47 and 48 show the reported difficulty level for Item Set 2. Most students did not report a difficulty level for these items. Of those who reported a difficulty level, students were divided between reporting the items as easy and reporting them as difficult.

Table 47. Student reported difficulty for Item 3: equations read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	1	6
Low Vision (n=10)	3	0	2	5
TOTAL (n=17)	**3**	**0**	**3**	**11**

Table 48. Student reported difficulty for Item 4: equations not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	2	0	3	5
TOTAL (n=17)	**2**	**0**	**3**	**12**

Item Preferences

Table 49 shows which of the two items in Set 3 the respondents preferred. As shown in the table, the majority of students (n=15) preferred that equations be read aloud. Only two students (one in each demographic category) stated that they did not like this option.

Table 49. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 5 (Equations Read)	Preferred Item 6 (Equations not Read)	No Preference
LD-Reading (n=7)	6	1	0
Low Vision (n=10)	9	1	0
TOTAL (n=17)	**15**	**2**	**0**

Issue 3: Do students prefer that fractional ratios be read aloud?

Item Set 3 was developed to answer whether students prefer to have fractional ratios read aloud. In Item 5, the computer read the expression as a fraction, stating what was in the numerator and denominator. Item 6 was presented by reading the fractional ratio as "expression."

Replaying Audio

One student with a visual impairment and two students with visual impairments replayed the audio for Item 3.

Reported Difficulty

The reported difficulty level for Item Set 3 is given in Tables 50 and 51. Most students did not report a difficulty level for these items. Two students with low vision reported the items to be easy, and one student with low vision reported the items to be difficult.

Table 50. Student reported difficulty for Item 5: fractional ratios read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	2	0	1	7
TOTAL (n=17)	**2**	**0**	**1**	**14**

Table 51. Student reported difficulty for Item 6: fractional ratios not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	2	0	1	7
TOTAL (n=17)	**2**	**0**	**1**	**14**

Item Preferences

Table 52 shows high school students' preferences for Item Set 3. In this Item Set, students overwhelmingly preferred to have the fractional ratios read aloud. Students commented that it was "more helpful" to hear the equations read aloud.

Table 52. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 5 (Fractional Ratios Read)	Preferred Item 6 (Fractional Ratios not Read)	No Preference
LD-Reading (n=7)	7	0	0
Low Vision (n=10)	8	0	2
TOTAL (n=)	**15**	**0**	**2**

Issue 4: Do students prefer that large numbers within items be read aloud?

Item Set 6 was developed to address the question of whether students preferred to have large numbers read aloud or not. In this item pair, all numbers in the first item were read aloud, including numbers in the answer choices. In the second item, all of the numbers in both the stimulus and answer choices are referred to as "this number."

Replaying Audio

In this item set, no students replayed either test item.

Reported Difficulty

Only six students with low vision reported a difficulty level for the items in Item Set 4. Of these students, four found the items to be easy and two found the items to be medium. This was true for both items in the set. This information is reported in Tables 53 and 54.

Table 53. Student reported difficulty for Item 7: large numbers read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	4	2	0	4
TOTAL (n=17)	**4**	**2**	**0**	**11**

Table 54. Student reported difficulty for Item 8: large numbers not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	4	2	0	4
TOTAL (n=17)	**4**	**2**	**0**	**11**

Item Preferences

High school student preferences for Item Set 4 are shown in Table 55. According to the table, all high school students preferred the first item, in which the large numbers were read aloud.

Table 55. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 7 (Large Numbers Read)	Preferred Item 8 (Large Numbers not Read)	No Preference
LD-Reading (n=7)	7	0	0
Low Vision (n=10)	10	0	0
TOTAL (n=17)	**17**	**0**	**0**

When asked about why they preferred large numbers read aloud, one student noted, "It said 'this number' but I have no idea what the number is. People with no vision would not know what the number is." Another student explained, "When not hearing [the number], I have to pay attention and copy numbers off screen to scratch paper to work out an answer." In addition, students expressed frustration when the equations were not read aloud. One student stated, "oh my gosh, just read the number." Another explained, "My mind just naturally skips it, so I have to go back and re-read the expression." Still another noted, "It is annoying how it just says 'expression.' It should say what the expression is."

Issue 5: Do students prefer hearing audio feedback for drag-and-drop items (feedback tells the student what object was moved or what the drop area looks like with dragged objects)?

In Item Set 5, students completed technology-enhanced items that required them to drag and drop equations into boxes that reflected an answer range. In the first item, no audio feedback was provided when the student initiated the drag-and-drop. In the second item, students received audio feedback related to the equation chosen as well as audio description of the box the equa-

tion was dragged into. The purpose of this item pair was to elicit student preferences for audio support in the drag-and-drop.

Replaying Audio

For this item set, one student in the LD-Reading demographic group replayed Item 9, where no audio feedback was provided. No students replayed Item 10.

Reported Difficulty

Only three students, two with LD-Reading and one with low vision, reported a difficulty level for Item Set 5. All three students reported the items to be difficult. This information is reported in Tables 56 and 57.

Table 56. Student reported difficulty for Item 9: drag-and-drop not read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	2	5
Low Vision (n=10)	0	0	1	9
TOTAL (n=17)	**0**	**0**	**3**	**14**

Table 57. Student reported difficulty for Item 10: drag-and-drop read

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	1	6
Low Vision (n=10)	0	0	1	9
TOTAL (n=17)	**0**	**0**	**2**	**15**

Item Preferences

High school students' item preferences by demographic category are summarized in Table 58. The students in the LD-Reading group and Low Vision group are almost evenly divided in their item preferences, with one student with Low Vision expressing no preference for either item.

Table 58. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 9 (Drag-and-drop not Read)	Preferred Item 10 (Drag-and-drop Read)	No Preference
LD-Reading (n=7)	3	4	0
Low Vision (n=10)	3	6	1
TOTAL (n=17)	**7**	**9**	**1**

One student who found the audio support to be helpful liked "that it actually tells you what you are dragging—you don't want to grab the wrong thing." Another student liked it for a similar reason, "because you know where you move it." The student who did not like the drag-and-drop audio support noted that "it does not seem logical to hear where the item got moved because I moved it myself."

Issue 6: Do students prefer that detailed information on line graphs be read aloud or prefer that the graph only be described more generally?

An item pair was developed to answer the question of whether students preferred to have detailed information on line graphs read aloud or if students preferred to have the information described more generally. In Item 11, the graph is described in detail, including the titles for the x and y axis, and all of the points on the scatterplot are mentioned. In Item 12, only a general description of the graph is provided.

Replaying Audio

No students replayed the audio for the items in this set.

Reported Difficulty

The reported difficulty level for Item Set 6 is shown in Tables 59 and 60. Most students did not report a difficulty level for these items. Of those who did, most students reported the items to be Difficult. One student reported the items to be Easy.

Table 59. Student reported difficulty for Item 11: detailed description

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	1	4
Low Vision (n=10)	1	0	2	7
TOTAL (n=17)	**1**	**0**	**3**	**11**

Table 60. Student reported difficulty for Item 12: general description

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	0	7
Low Vision (n=10)	1	0	2	7
TOTAL (n=17)	**1**	**0**	**2**	**14**

Item Preferences

Table 61 summarizes the findings on students' preferences for Item Set 6. The majority of students (n=10) preferred the line graph read aloud, although students with reading-related learning disabilities appear to be more split in their preferences.

Table 61. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 11 (Detailed Description)	Preferred Item 12 (General Description)	No Preference	No Answer
LD-Reading (n=7)	4	3	0	0
Low Vision (n=10)	6	0	1	3
TOTAL (n=17)	**10**	**3**	**1**	**3**

One student noted that it is "easier" to have the detailed description, adding "people without vision could not read them so it is better to have it read." One student who preferred the general description of the line graph said that the more detailed description "took too long."

Issue 7: Do students prefer that political cartoons be described?

Item Set 7 was developed to address the question of whether or not students preferred to have political cartoons described. In Item 13, the political cartoon was described in detail. In Item 14, the political cartoon was not described.

Replaying Audio

One student with low vision replayed the audio for Item 13. No students replayed the audio for Item 14.

Reported Difficulty

Three students reported the items in Item Set 7 to be difficult. These results are reported in Tables 62 and 63.

Table 62. Student reported difficulty for Item 13: cartoon described

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	2	5
Low Vision (n=10)	0	0	1	9
TOTAL (n=17)	**0**	**0**	**3**	**14**

Table 63. Student reported difficulty for Item 14: cartoon not described

Student Demographic Category	Easy	Medium	Difficult	No Difficulty Reported
LD-Reading (n=7)	0	0	2	5
Low Vision (n=10)	0	0	1	9
TOTAL (n=17)	**0**	**0**	**3**	**14**

Item Preferences

Table 64 shows how students responded to the question about which item they preferred in Item Set 7. Most students (n=9) preferred the cartoon to be orally described. It should be noted here that five students did not respond to this question. One of the respondents stated, “I liked when it described the cartoon. It made it easier to understand the question.”

Table 64. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 13 (Cartoon Described)	Preferred Item 14 (Cartoon not Described)	No Preference	No Answer
LD-Reading (n=7)	4	2	0	1
Low Vision (n=10)	5	1	0	4
TOTAL (n=17)	**9**	**3**	**0**	**5**

Several students who preferred to have the political cartoon described noted that it was much easier to tell what was happening in the cartoon with the added description. One student noted that "People with low vision could see what is in the picture this way." Another student said, "I could tell what was happening."

Issue 8: Do students prefer that detailed information on maps be read aloud or prefer that the map only be described more generally?

Item Set 8 was developed to address the question of whether students preferred that detailed information on maps be read aloud or whether students preferred to have the information described more generally. Item 15 included a longer reading passage that included a detailed description of a map. Item 16 was a longer reading passage that included only a general description of a map.

Replaying Audio

No students replayed either item in this item set.

Reported Difficulty

No students reported a difficulty level for Items 15 and 16. However, it should be noted that several students experienced testing fatigue and did not complete these items. Several students commented that they felt impatient listening to the voice read the longer narrative passages.

Item Preferences

High school students' preferences for Item Set 8 are shown in Table 65. Most students with low vision preferred the map to be described with the audio support, while respondents with reading-related learning disabilities were more divided on this issue.

Table 65. High school students' item preferences by participant group

Student Demographic Category	Preferred Item 15 (Map Described)	Preferred Item 16 (Map not Described)	No Preference	No Answer
LD-Reading (n=7)	2	3	0	2
Low Vision (n=10)	5	1	0	4
TOTAL (n=17)	**7**	**4**	**0**	**6**

One of the students who liked the audio support stated the following, "I liked the one that read the map. It was better because it helps you visualize the picture in your head. It is better to have it read, especially if you have low vision." And a student who preferred the second item pointed out, "It is better to see a map and not have it described."

Discussion

The cognitive labs point to a number of findings related to the interactions of students with an assessment that has audio support. Overall, the findings from the study are mixed; the findings support the need to take an individual approach to assigning audio support as an accessibility feature or accommodation.

Students typically preferred to have numbers read aloud. In several of the item sets, one item in the pair would have numbers read aloud, and in the other item, numbers would be read as "this number" or "equation." In all of these cases, students in all three demographic groups preferred the item where the numbers were included in the audio support. This preference was strongest for students who had low vision. These students noted that it would be challenging to solve the problems without hearing the numbers read aloud. One student with in the LD-Reading group also noted that "some students might not be able to see the numbers, so how could they solve the problem?"

Students also had a slight preference for numbers with decimals to be read as numerals with "decimal point" rather than to be read with place value. Students with reading-related learning disabilities were more evenly divided in both middle and high school than their peers with low vision. Students commented that it "makes more sense" to hear the numbers as numerals with "decimal point."

Students were mixed in their preferences for audio support with the drag-and-drop. For some students, this was a new item type. Other students were familiar with the drag-and-drop feature from computer games or instruction but had not encountered it in an assessment. A few students were familiar with this item type. Elementary school students generally preferred having the

audio feedback with the drag-and-drop items. Middle school students also preferred to have the audio feedback when they were using drag and drop. High school students were evenly split about their preference on this feature. It should be noted that some students who also used magnification with these items experienced some difficulties in navigating on the screen and reported frustration related to the audio support speaking when students would mouse on the screen.

At the high school level, one item type addressed the description of political cartoons. Students generally preferred to have the cartoons described. Students commented that it would be easier for students with low vision to understand these items. Students in the LD-Reading group also preferred to have the cartoons described orally.

Students generally reported that audio support helped them understand test questions better; however, this study did not examine the performance of students on the assessment. Most students responded earnestly to the test items, but some students commented that they knew the test was "just for fun" and spent less time trying to solve the problems. Other students reported difficulty with math and struggled to answer the test items.

After the students completed the assessment, they were asked some additional questions about their preferences for how answer choices should be read aloud as well as their opinion of the computer-generated voice for the audio support. Students were asked if answer choices should be read as "Answer A," "Answer Option A," or simply as "A." Table 66 shows a summary of student responses to this question. Three students did not respond to this question. Of those students who gave a preference, a majority of students (n=31) preferred to have the answer choice read as "Answer A." Eight students preferred "Answer Option A," and three students preferred simply "A." One student stated a preference not to have the answer choices labeled at all.

Table 66. Student preferences about how answer choices should be read

	Elementary School	Middle School	High School	Total
Answer A	6	14	11	31
Answer Option A	3	1	4	8
A	1	2	0	3
Other (not reading answer labels)	0	0	1	1
Total	**10**	**17**	**16**	**43**

Students were also asked about their opinions of the computer voice used for the audio support in the cognitive labs. Generally, students thought the voice was acceptable. Some students commented that the voice sounded like a robot; others thought the quality was fine. One high school student noted, "The voice was decent—not too fast or slow. This voice is better than any other

voices I've heard using technology." Students were mixed in their evaluation of the speed of the voice. Some thought it was too slow; others thought it was too fast. Several students commented that they prefer a human voice over a computer voice. Some students commented that they would prefer to have a male voice instead of a female voice or have two genders take turns.

Limitations of the Study

There were some limitations related to the audio support cognitive labs. These cognitive labs were conducted in three states. At the time of data collection, two of these states were members of the PARCC consortium and one state was not a member of a consortium. Efforts were made to include students from a state involved in Smarter Balanced, however, due to the demands of spring testing in general as well as consortium-related field testing, it was not possible to gather data from additional states.

In addition, it was challenging to recruit ELLs to participate in the study. In many states, audio support is not a common accommodation for ELLs, and so it was difficult to secure district support for including ELLs in the study sample. Many of the ELLs who participated in the study commented that they found that the audio support helped them understand the test questions better. This points to a need for further consideration of audio support as an accessibility tool or accommodation for ELLs.

Another challenge in the study was that most of the items were math-related, and many students commented that they were not good at math. Some students reported that the test items appeared to be related to content they had not learned. This issue became somewhat of a limitation in two ways: 1) students were often more focused on the challenging content of the item than they were on how the audio support was helpful or not helpful, and 2) students sometimes began guessing at items and became less authentically engaged in the test itself.

A final limitation related to the high school cognitive labs was that the longer reading passages did not appear to engage students, and many students reported the audio support to be frustrating for the longer passages. Many students were less able to focus when the researchers got to these items and several students asked to skip these items. Thus, the sample for these items is much smaller than other items at the high school level.

Conclusion

The audio support cognitive labs administered as part of the Guidelines for Accessible Assessments Project were conducted with elementary, middle, and high school students with a range of individualized needs, including students who are ELLs, students who have low vision, and students who have a reading-related learning disability. The results of these cognitive labs

generally indicate that students prefer having more of the item content read aloud, including numbers in the stimulus and answer choices, as well as descriptions of pictures and graphics. However, in spite of these tendencies, the results were mixed overall. These findings support the general need to take an individualized approach to providing audio support for assessments. In developing online assessments, it is important to program audio support in ways that allow for multiple-approach (e.g., all parts of the item, a stimulus only, answer choices only, etc.) read aloud.

Appendix A: Study Instruments

School #: _____
Student #: _____
Grade (*circle one*): 3 4 5
Need (*circle all that apply*): Print Disability English Learner Low Vision
Student Gender (*circle one*): Male Female
Test Login ID: _____
Note Taker: _____
Date: _____

Grades 3-5 Audio

Thank you for participating in this study to understand more about how test questions are read aloud. We would like for you to view and answer 12 questions on the computer. Each question will be read to you, you can listen to all or parts of the item as many times as you like. We will ask you questions about what you are thinking as you answer the test questions.

Item Set One: Coordinate Grids

Observation Notes:

After #1 & #2:

Was the way this graph was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this graph was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this graph was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you just heard were presented differently. For the first question, the places of each house were read aloud. For the second question, places of each classroom were not read aloud. Which way do you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Two: Drag and Drop

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, you were told when you dropped a soybean in the field and how many fields were planted. For the second question, you were not told anything when you dropped a corn kernel on a field. Which way do you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Three: Equations

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you just heard were presented differently. For the first question, the equations were read aloud. In the second question, the equations were not read aloud. Which way do you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Four: Diagram Description

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you just heard were presented differently. For the first question, the three shapes were described. In the second question, the shapes were not described. Which way do you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Five: Answer Options with Numerals

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you just heard were presented differently. For the first question, the numbers in the answer options were read aloud. In the second question, the numbers in the answer options were not read aloud. Which way do you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Six: Large Numbers

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you just heard were presented differently. For the first question, the numbers were read. In the second question, "this number" was read instead of the numbers. Which way do you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

After the Audio Test:

When there were answer options, the read aloud said, “answer” before each answer option (like “Answer A, Answer B”). Was it clear what the answer options in each question were? Did you like having the word “answer” read aloud before the answer option, or would you prefer “Answer Option A, Answer Option B,” or just “A, B,” or nothing at all?

For how many years have you received a read aloud accommodation during testing?

Do you use a read aloud accommodation in the classroom (outside of testing)? Does someone read aloud to you at home? Do you use read aloud computer programs?

Do you believe that using a read aloud accommodation helps you understand test questions better?

What did you think about the voice of the read aloud we used today (quality, speed, etc.)?
School #: _____

Student #: _____
Grade (*circle one*): 6 7 8
Need (*circle all that apply*): Print Disability English Learner Low Vision
Student Gender (*circle one*): Male Female
Test Login ID: _____
Note Taker: _____
Date: _____

Grades 6-8 Audio

Thank you for participating in this study to understand more about how test questions are read aloud. We would like for you to view and answer 16 questions on the computer. Each question will be read to you, you can listen to all or parts of the item as many times as you like. We will ask you questions about what you are thinking as you answer the test questions.

Item Set One: Line Graphs

Observation Notes:

After #1 & #2:

Was the way this graph was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this graph was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this graph was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you just heard were presented differently. For the first question, the locations of each point were read aloud. For the second question, the locations of each point were not read aloud. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Two: Drag and Drop

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, you were not told anything when you dropped an equation in a box. For the second question, you were told when you dropped an equation in a box on the number line, and whether a box was empty or filled. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Three: Equations

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the equations were read aloud. In the second question, the equations were not read aloud. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Four: Diagram Description

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, each room was highlighted as it was read aloud. In the second question, the room names were only read aloud when you clicked on them. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Five: Fractional Ratios

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the equation was read aloud. For the second question, the equation was read as “this equation.” Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Six: Answer Options with Numerals

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the numbers in the answer options were read. In the second question, the numbers in the answer options were not read. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Seven: Large Numbers

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the numbers in the question and in the answer options were read aloud. In the second question, numbers were not read aloud. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Eight: Decimals

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the decimal numbers were read to you using their single digit names and the words "decimal point," for example, "eight decimal point nine five." In the second question, the numbers were read using their place value, for example, "eight and ninety five one hundredths." Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better? Would you prefer to hear just "point" instead of "decimal point"?

After the Audio Test:

When there were answer options, the read aloud said, "answer" before each answer option (like "Answer A, Answer B"). Was it clear what the answer options in each question were? Did you like having the word "answer" read before the answer option, or would you prefer "Answer Option A, Answer Option B," or just "A, B," or nothing at all?

For how many years have you received a read aloud accommodation during testing?

Do you use a read aloud accommodation in the classroom (outside of testing)? Does someone read aloud to you at home? Do you use read aloud computer programs?

Do you believe that using a read aloud accommodation helps you understand test questions better?

What did you think about the voice of the read aloud we used today (quality, speed, etc.)?

School #: _____

Student #: _____

Grade (*circle one*): 9 10 11 12

Need (*circle all that apply*): Print Disability English Learner Low Vision

Student Gender (*circle one*): Male Female

Test Login ID: _____

Note Taker: _____

Date: _____

Grades 9-12 Audio

Thank you for participating in this study to understand more about how test questions are read aloud. We would like for you to view and answer 16 questions on the computer. Each question will be read to you, you can listen to all or parts of the item as many times as you like. We will ask you questions about what you are thinking as you answer the test questions

Item Set One: Decimals

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the decimal numbers were read using their single digit names and the words “decimal point,” for example, twenty-eight decimal point three. In the second question, the numbers were read using their place value, for example, twenty-three and three-tenths. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better? Would you prefer to hear just “point” instead of “decimal point”?

Item Set Two: Equations

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the equation was read aloud. In the second question, the equation was read as “this equation.” Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Three: Fractional Ratios

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the equation was read aloud. For the second question, the equation was read as “this equation.” Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Four: Large Numbers

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the numbers were read aloud. In the second question, “this number” was read instead of the numbers. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Five: Drag and Drop

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, you were not told when you dropped an equation in a box. For the second question, you were told when you dropped an equation in a box, which box you dropped it into, and whether a box was empty or filled. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Item Set Six: Line Graphs

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the locations of each point were read aloud. For the second question, the locations of each point were not read aloud. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Political Cartoons

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, the picture was described. For the second question, the picture was not described. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

Maps

Observation Notes:

After #1 & #2:

Was the way this question was read to you helpful? Why or why not?

If necessary, probe:

Was there anything/anything else about how this question was read that was helpful? Can you please explain how the read aloud was helpful?

Was there anything/anything else about how this question was read that was not helpful? Can you please explain how the read aloud was not helpful?

Was anything/anything else difficult to understand in the read aloud? Please explain what that was.

Is there anything that you would change to make the read aloud better? Please explain what that would be.

After the set:

The two questions that you heard were presented differently. For the first question, each location on the map was read aloud. For the second question, a short general description was read aloud. Which way did you think helped you answer the question? Did you like one way better than the other? If so, why did you like one of them better?

After the Audio Test:

When there were answer options, the read aloud said, "answer" before each answer option (like "Answer A, Answer B"). Was it clear what the answer options in each question were? Did you like having the word "answer" read before the answer option, or would you prefer "Answer Option A, Answer Option B," or just "A, B," or nothing at all?

For how many years have you received a read aloud accommodation during testing?

Do you use a read aloud accommodation in the classroom (outside of testing)? Does someone read aloud to you at home? Do you use read aloud computer programs?

Do you believe that using a read aloud accommodation helps you understand test questions better?

What did you think about the voice of the read aloud we used today (quality, speed, etc.)?