



Enhanced Item Types Cognitive Labs: Summary of Findings

June 30, 2015

Purpose

This memo provides a summary of the cognitive laboratory (cog lab) results conducted by the Center for Applied Linguistics (CAL) for enhanced item types for reading and writing items. The reading cog labs were conducted on June 2-3, 2015 by Bridget Mullan, Jenny Dodson, and Landon Anderson. The writing cog labs were conducted on June 4, 2015 by Landon Anderson and Glenn Abastillas. The purpose of the interviews was to address the following research questions:

Reading

1. Is the student training on enhanced features (i.e., drag and drop, hotspot) effective for students, including those who are at the lowest proficiency levels?
2. Do students know what to do when presented with drag & drop and hotspot item types?
3. Are students comfortable interacting with different item types in the same assessment?

Writing

1. Is the student training on enhanced features (i.e., click to enlarge, tabbing) effective for students, including those who are at the lowest proficiency levels?
2. Are students able to interact successfully with the enhanced features?

Part I: Enhanced Item Types for Reading

Participants

The Reading cog labs were conducted with eight Tier B grade 1 students at E.W. Stokes, a pre-K through sixth grade charter school in Washington, D.C.

Data Collection

Each interview session lasted approximately 30-45 minutes and was conducted in English. No student demonstrated difficulty in communicating with the interviewer. Table 2 summarizes the structure of the sessions.

Cognitive Lab Session Structure	
Introduction	Introduction of interviewer and observer, purpose of activity. Interviewer asked student about computer use habits.
Part 1: Test Practice (instructional training), and practice items, and interview	Student watched and listened to computerized instructions and practiced responding to sample items. After the practice, the interviewer and observer followed up with questions regarding difficulties or confusion demonstrated by the student.
Part 2: Folder 1	The student independently completed a reading folder comprised of three items in the following order: hot spot, drag and drop, and multiple choice.

Part 3: Folder 2 and interview	The student independently completed a reading folder comprised of three items in the following order: hot spot, multiple choice, drag and drop. After the student completed both folders, the interviewer directed the student to examine each screen again and asked the student questions about the items. Then interviewer and observer asked additional questions based on student behavior during folders (demonstrated difficulties, confusion, etc.) and answered the student’s questions.
Part 4: General interview	Student may have been asked follow-up questions about computer usage and familiarity with computerized testing if not already discussed as part of folder interview. Student was thanked for participation and dismissed.

Table 1. Structure of Reading cognitive labs

Data Analysis

Based on the observer notes from the cognitive lab sessions, researchers developed codes to capture student behaviors and interview responses. Codes were grouped into the following categories:

- *Clicking*: Codes for observed student successes and problems dragging and/or clicking on items and areas of the screen
- *Interaction with Content*: Codes for student use of stimulus content, including text and graphics
- *Using the Mouse*: Codes for student difficulties with the mouse and use of the trackpad
- *Computer Use*: Codes for student use of computers at home, in school, and for testing purposes
- *Posture*: Codes for student behavior, in terms of fidgeting and leaning toward the computer screen
- *Miscellaneous*: Codes for information on software issues and observer intervention necessitated during administration

Key Findings

Table 2 summarizes students’ interactions with the different item types in the practice opportunities and the test items. Overall, by the end of the practice opportunities, students were able to proceed to respond to the test items that followed, though some students displayed difficulty on the hotspot and drag and drop item types.

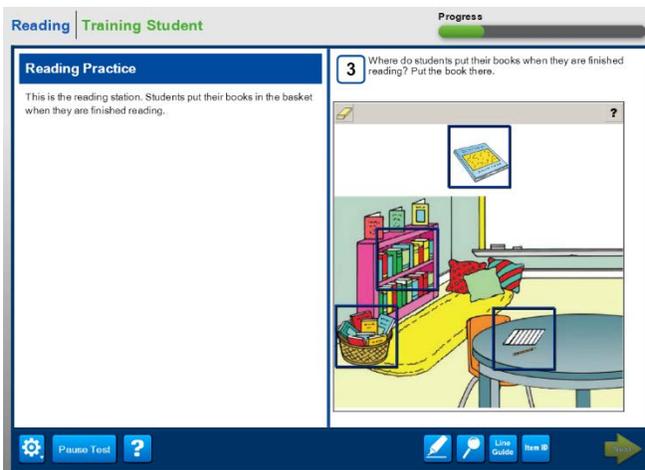
Item Type	Practices or Test Items	Clicked/responded with no issues	No specific notes on issues	Clicked in unexpected parts of the screens	Showed difficulty using the mouse
Traditional Multiple Choice	Practices	63%	12%	25%	0%
	Items	88%	12%	0%	0%
Hotspot	Practices	63%	37%	0%	0%
	Items	44%	31%	13%	19%
Drag and Drop	Practices	38%	12%	50%	0%
	Items	69%	19%	12%	0%

Table 2. Summary of students’ interactions with different Item types.

On **hotspot** items, 13% of the time students clicked inactive parts of the screen, and 19% of the time, students experienced difficulty with the mouse (e.g., student had to click multiple times before selecting target successfully).

Students interacted with **drag and drop** items with mixed results. In their initial interaction with drag and drop items, half of the students treated them as hot spot items. In the practice set, half of the students first attempted to click in the target rectangles rather than drag the book to the targets. Students who did this tended to attempt these clicks multiple times before either figuring out that they should drag the book (50%) or requiring adult intervention (50%). It should be noted that for one student no evidence was recorded of their interaction with the item.

Sample screen shot:



Sample data from interview:

Observer notes: Student tried clicking in all of the target squares first. Then tried clicking on Next.

Student: It's stuck.

Interviewer: Does anything happen when you click in the squares?

Student: No

Interviewer: Try reading the question and see if it gives you any clues about how to answer.

Observer note: Student read question.

Student: Oh, I have to put the book.

Observer notes: Tried to click the book several times, and eventually with additional support

from Interviewer was able to drag book to one of the squares (didn't answer correctly).

Additionally, some students interacted with the direction and practice in ways that may also need to be addressed. For example, **some students attempted to interact with practice questions during the directions section**, i.e., before the practice questions were active, and **some students did not read or use the stimulus text** in the left panel of the screen to find the answer.

Next Steps

Table 3 summarizes the revisions that are planned for refining the Reading Test Practices for Series 400.

Issue	Immediate Revisions
Students were not always clear on how to answer the Hotspot versus Drag and Drop item types.	CAL will revise the directions to be more explicit about what to do and how the item types are different from one another.
The Drag and Drop item type was not easily identifiable as requiring “dragging”.	CAL will make the dragger box border a different color from the target box borders and provide more explicit directions on what to do.

Students tried to click on answers during the directions section.	Make more explicit that first students will just read and listen and then they will practice later.
Students sometimes did not read the stimulus text in the practice items.	<p>While keeping the items easy, CAL will revise the practice item stimulus text so that students need to read, not just look at the picture, to get the answer.</p> <p>CAL will add to the directions explicit statements and arrows pointing to the text that the student should read before selecting an answer.</p>

Table 3. Planned revisions to address key findings.

In addition to making the revisions described in Table 3, CAL proposes to make more significant changes to the Reading Test Practices during the course of the 2015-16 year, in preparation for Series 401. The proposed changes will allow for a more streamlined, clear experience for the student. These changes would need to be tried out with students prior to operational use.

Changes will include:

- Using synced audio and highlights to show student different parts of a screen, without having to click next to see and hear each direction
- Rather than separating the directions from the practice entirely, use a “show – do; show – do” approach where the student see and hears the directions for answering an item type, then practices one time; then see and hears the directions for answering a different item type, then practices one time, and so forth. (The student would still practice three items in a row on his/her own after completing the directions section.)

In the future, WIDA and CAL may also want to explore different layouts of the Listening and Reading items that go beyond the constraints of DRC’s “iframe”, in order to have a more streamlined, intuitive interaction with the item question, text, supporting images and answer choices.

Part II – Enhanced Features in Writing Tasks

Participants

The cog labs were conducted with one Grade 4 (Tier A) and two Grade 5 (Tier B/C) students at E.W. Stokes, a pre-K through sixth grade charter school in Washington, D.C.

Methodology

The items had one of two innovation features: tabbed browsing or click-to-enlarge (see screen shots). Table 4 summarizes the structure of the Writing cognitive labs. Each interview session lasted approximately 30 minutes. The table below summarizes the structure of the sessions.

Cognitive Lab Session Structure	
Introduction	Introduction of interviewer and observer, purpose of activity.
Part 1: Writing Practice	Student watched and listened to computerized instructions on where to enter their typed response. Then, students had the opportunity to practice by typing their names in the text box.
Part 2: Writing Item	The item content played screen by screen. Then an animated sequence showed the innovative feature (tabbed browsing or click-to-enlarge) and explained how students could use it to revisit information, plan their writing, and check their work. Finally, students worked on the task independently while observer and interviewer took notes.
Part 3: Interview	The interviewer asked student about the writing item with specific attention to the particular innovative feature. Interviewer also asked general questions about student's computer use and writing habits. Interviewer/observer asked questions to follow up behaviors demonstrated by student during task.

Table 4. Structure of Writing cognitive labs

Sample Screen shot: Tabbed Browsing

Writing Training Student Progress

Life in Early America

Shelter | Food | Transportation | Fun | Plan Your Writing | Check Your Writing

Chenoa lived with her family in a wigwam, which was a shelter made from small trees. There was only one room, and the floor was made from dirt. Each morning, Chenoa rolled up her sleeping mat to make more room in the wigwam.

1 Write an essay that compares and contrasts your life today with Chenoa's life long ago. Use details to support your ideas.

Pause Test ? [Copy] [Paste] [Underline] [Line Guide] [Item ID] [Back] [Next]

Sample Screen Shot: Click to Enlarge

The screenshot shows a digital writing practice interface. At the top left, it says 'Writing Training Student' with a green progress bar. The main content area is titled 'Life In Early America' and features four illustrations of early American life: a family inside a wigwam, a group of people in a field, a boat on a river, and a group of people sitting on the ground. To the right of the illustrations is a prompt: '1 Write an essay that compares and contrasts your life today with Chenoa's life long ago. Use details to support your ideas.' Below the prompt is a large text area for writing. At the bottom of the interface, there are several buttons: 'Plan Your Writing', 'Check Your Writing', 'Pause Test', and navigation arrows labeled 'Back' and 'Next'. There are also icons for a pencil, a document, a magnifying glass, and 'Line Guide' and 'Item ID' buttons.

Observation Summary

Overall, students interacted smoothly with the practice and tasks. At times, students also attempted to click on inactive parts of the screen during the Writing Practice. For example, one student clicked “where the big yellow arrow pointed” and asked interviewer “where to click to continue once audio stopped at the end of the first screen.” The Tier A student seemed to understand that the tabs contained additional information, and she could click them to help her write, but the student did not seem to have the proficiency to provide a response, so she did not return to the tabs.

One Tier B/C Student received the tabbed browsing item and used the tabs to review the story while writing their response. The other Tier B/C student received the click-to-enlarge item and reported remembering the story and “didn’t need to click the pictures.” **The only issue revealed in the cog labs was that both of the Tier B/C students responded to the scaffolding questions from “Plan Your Writing” rather than the prompt itself (see screen shot.)**

The screenshot shows a writing interface with a blue header titled "Life in Early America". Below the header is a navigation bar with six buttons: "Shelter", "Food", "Transportation", "Fun", "Plan Your Writing", and "Check Your Writing". The "Plan Your Writing" button is highlighted. Below the navigation bar is a "Plan Your Writing" section with the text "Think about these questions:" followed by three bullet points:

- How is your life today similar to Chenoa's life long ago?
- How is your life today different from Chenoa's life long ago?
- Why are your lives similar in some ways, but different in other ways?

 To the right of the navigation bar is a task instruction box with a large number "1" and the text: "Write an essay that compares and contrasts your life today with Chenoa's life long ago. Use details to support your ideas." Below the instruction box is a toolbar with icons for erasing, undo, redo, and underlining, followed by a large empty text area for writing.

Both students reported that their in-class writing experience involved both handwriting and computer use, though hand-writing was more common. One student reported that “Check Your Writing” questions were part of in-class writing, but that he did not find them useful in this item.

Next Steps

At this time, it seems that the new features are working well. CAL may want to look into the role of the Plan Your Writing questions to further investigate how students are using them and if there is a way to support planning more effectively, but we are not recommending immediate changes at this time.