

Oregon Science Assessment Peer Review Resubmission Evidence

Critical Element 5.3:
Literature Review and Study

June 2023



Literature Review

The Oregon Department of Education (ODE) relies on the same assessment vendor (i.e., Cambium Assessment) to administer statewide summative assessments in Oregon¹. These assessments include English language arts (ELA), mathematics, science (i.e., Next Generation Science Standards [NGSS]), and English language proficiency. Because each statewide summative assessment uses the same test information, administration, and delivery system from Cambium Assessment, they share similar embedded and non-embedded accommodations and supports. However, there are exceptions. Each respective assessment has a unique set of relevant accommodations and supports. The aim of this literature review and corresponding study is to explore the appropriateness and effectiveness of a specific set of accommodations and supports relevant to ODE’s NGSS assessment. The specific set of accommodations and supports explored in this study are: (a) embedded/non-embedded glossaries and dictionaries (both English and bilingual), (b) Spanish/English text-to-speech, and (c) translanguaging (i.e., the ability to toggle between English and Spanish versions of the test directions, stimulus, items, and tools—periodic table, calculator, etc.). For the embedded/non-embedded accommodations and supports common across ODE’s statewide summative assessments, we rely on the literature reviews by Pennock-Roman and Rivera (2012) and Laitusis, Buzick, Stone, Hansen, and Hakkinen (2012)² to support their appropriateness and effectiveness.

A brief note about embedded/non-embedded glossaries and dictionaries. The 2018-19 administration of ODE’s NGSS assessment did not include or allow the use of embedded/non-embedded glossaries and dictionaries in either English or bilingual. The rationale for excluding and prohibiting these glossaries and dictionaries was to: (1) mitigate any unintentional prompting of construct-relevant concepts from the use of glossaries and dictionaries (both embedded and non-embedded), and (2) reduce or eliminate differential access to non-embedded glossaries and dictionaries due to inequitable resources across Oregon schools and districts.

Despite our original concerns, ODE is considering the inclusion and use of embedded/non-embedded glossaries and dictionaries in a future administration of ODE’s NGSS assessment. The motivation behind this change in perspective is due to acknowledging that ODE includes and allows the use of embedded/non-embedded glossaries and dictionaries in other statewide summative assessments. For instance, ODE allows the use of a non-embedded English dictionary

¹ Behavioral Research and Teaching (BRT) at the University of Oregon is the vendor for ODE’s alternate ELA, mathematics, and science assessments.

² These literature reviews are *CE 5.3 EL Accommodations Literature Review* and *CE 5.3 IEP Accommodations Literature Review* in ODE’s peer review resubmission to the U.S. Department of Education.

in the full-write segment of the ELA performance task, and includes an embedded bilingual glossary for selected construct-irrelevant terms in the mathematics assessment.

We recognize that the development of embedded glossaries in multiple languages for construct-irrelevant terms will require a significant amount of time, resources, and collaboration across Cambium Assessment and partner states. Thus, in the meantime, ODE is submitting a request to the Oregon Accessibility Advisory Panel for the use of non-embedded English and bilingual dictionaries on the 2023-24 and subsequent administrations of ODE's NGSS assessment. After receiving official approval, ODE will update the Oregon Accessibility Manual³ and resubmit it to the U.S. Department of Education as evidence of meeting the requirements of this critical element.

Literature Review Methodology

This literature review is a brief narrative analysis of studies we found using various sources including (a) the National Center on Education Outcomes (NCEO) [Accommodations for English Learners Bibliography](#) (AELP), (b) *Google Scholar*, and (c) the reference lists of relevant studies. As part of our search for studies, we identified recent literature reviews exploring the same accommodations and supports (Rios, Ihlenfeldt, & Chavez, 2020; Yang, 2020; Pennock-Roman & Rivera, 2011; Kieffer, Lesaux, Rivera, & Francis, 2009). These literature reviews, along with the studies found in *Google Scholar* and the AELP, provided a reasonable selection of studies. One limitation of this literature review is most studies focus on ELA, mathematics, or a combination of content areas (but not exclusively science); thus, we assume the findings are generalizable to ODE's NGSS assessment.

Embedded/Non-embedded Glossaries and Dictionaries

We identified six studies focusing on the effectiveness of English and bilingual embedded/non-embedded glossaries and dictionaries. The results of the studies are the following:

- Abedi, Zhang, Rowe, and Lee (2020) found no significant effect for the use of an embedded English glossary by English learners on a 9th grade mathematics assessment. On the other hand, they found a significant negative effect for the use of an embedded bilingual glossary by English learners in the same grade and content area.
- The meta-analysis by Rios, Ihlenfeldt, and Chavez (2020) found no significant effects for the use of embedded/non-embedded glossaries and dictionaries (either English or bilingual) by English learners across 26 studies.

³ The current Oregon Accessibility Manual is *CE 5.4 2022-2023 OAM* in ODE's peer review resubmission to the U.S. Department of Education.

- Cohen, Tracy, and Cohen (2017) found significant negative effects for the use of embedded English glossaries with audio in 3rd and 7th grade mathematics, no significant effect in 3rd grade ELA, and a significant positive effect in 7th grade ELA.
- Wolf, Kim, and Kao (2012) did not find a significant positive effect for the use of English glossaries by English learners on a 9th grade mathematics assessment.
- The meta-analysis by Pennock-Roman and Rivera (2011) found significant positive effect sizes for the use of embedded English glossaries (when English learners have time constraints) and non-embedded English dictionaries and glossaries (when English learners have no time constraints); yet, they didn't find significant effect sizes for embedded/non-embedded bilingual dictionaries and glossaries with or without time constraints.
- The meta-analysis by Keiffer et al. (2009) found a significant positive effect size on large-scale standardized assessments (e.g., NAEP, TIMSS, etc.) for the use of non-embedded English dictionaries and glossaries by English learners; however, they did not find a significant effect size for non-embedded bilingual dictionaries and glossaries.

These studies point to a mixture of findings across the combinations of embedded, non-embedded, English, and bilingual dictionaries and glossaries. The findings are not consistent and, to some extent, suggest the need for further research. The exception is embedded/non-embedded bilingual dictionaries and glossaries, where no study found a significant and positive effect. Nonetheless, we do not believe there are sufficient studies to make claims in support or opposition of the use of embedded/non-embedded English/bilingual dictionaries and glossaries by English learners. ODE intends to conduct further research as well as gather relevant literature in order to explore and understand the appropriateness and effectiveness of embedded/non-embedded English/bilingual dictionaries and glossaries.

Spanish/English Text-to-Speech

We identified four studies focusing on the effectiveness of Spanish/English text-to-speech. The results of the studies are the following:

- Abedi, Zhang, Rowe, and Lee (2020) found no significant effect for the use of English text-to-speech by English learners by English learners on a 9th grade mathematics assessment.
- Wolf, Kim, and Kao (2012) found a mixture of effects for the use of English text-to-speech by English learners on a 9th grade mathematics assessment. Their study explored the effectiveness of English text-to-speech in two U.S. states. They found no significant effect in one state and a significant positive effect in another.
- The meta-analysis by Pennock-Roman and Rivera (2011) found no significant effect for the use of English text-to-speech by English learners; however, the effect sizes in their meta-analysis came from a single study.

- The meta-analysis by Keiffer et al. (2009) found no significant effect for the use of Spanish text-to-speech by English learners on large-scale standardized assessments (e.g., NAEP, TIMSS, etc.); yet, similar to Pennock-Roman and Rivera (2011), the effect sizes in their meta-analysis came from a single study.

The findings from these studies imply that there is no significant effect for the use of Spanish or English text-to-speech by English learners. The exception is the study by Wolf, Kim, and Kao (2012) and their finding in one U.S. state concerning the effectiveness of English text-to-speech (i.e., significant and positive effect). Similar to our conclusion with respect to embedded/non-embedded English/bilingual dictionaries and glossaries, we do not believe there are sufficient studies to make claims in support or opposition of the use of Spanish or English text-to-speech by English learners. ODE intends to conduct further research as well as gather relevant literature in order to explore and understand the appropriateness and effectiveness of Spanish or English text-to-speech.

Translanguaging between English and Spanish

There are few studies quantitatively focusing on the effectiveness of translanguaging between English and Spanish by English learners. Most studies qualitatively explore the development of test instruments (e.g., directions, stimulus, and items) and the use of translanguaging by English learners or linguistic minorities (Lopez, 2020; Lopez & Tolentino, 2020; Gandara & Randall, 2019; Guzman-Orth, Lopez, & Tolentino, 2019; Lopez, Guzman-Orth, & Turkan, 2019). A handful of studies qualitatively examined the appropriateness of translanguaging in various contexts (Gandara & Randall, 2019; Lopez, Guzman-Orth, & Turkan, 2019), and found translanguaging to be easy to use, matched the language of instruction, and allowed students to use their linguistic repertoire.

While we believe this evidence is supportive of the use of translanguaging between English and Spanish on ODE's NGSS assessment, ODE intends to continue gathering and reviewing studies examining the effectiveness of translanguaging between English and Spanish by English learners. Furthermore, ODE will conduct a series of studies at the student and item levels in order to understand whether translanguaging ODE's NGSS assessment benefits English learners. As part of this effort, we provide the results from a preliminary study focusing on the association between the frequency of translanguaging and science achievement on ODE's 5th grade NGSS assessment.

Summary of Accommodation and Support Usage

Tables 1 through 3 provide a summary of embedded accommodation and support usage by student group (i.e., all students, students with an IEP, and English learners) and grade on ODE's NGSS assessment during the 2018-19 school year. The tables display the number of students who used the specific accommodation and support at least once during their NGSS testing experience.

Table 1.

Number of all students using an embedded accommodation and support at least once.

Accommodation and Support	Student Action	Grade		
		5	8	11
Calculator	Student opened the calculator	15,342	9,843	26,168
Comment Dropdown	Student opened the comment dropdown	3,482	1,527	713
Comment Notepad	Student opened the notepad	4,905	2,080	1,011
Entity Collapse	Student collapsed the item	8,923	3,587	3,151
Entity Expand	Student expanded the item	9,946	4,307	3,615
Help Guide	Student opened the help guide	1,679	1,087	815
Highlighter Clear	Student removed highlighting from a selection	661	335	200
Highlighter Clear All	Student removed highlighting from the entire item	1,459	595	358
Highlighter Select	Student used the highlighter	3,223	1,661	1,397
Item Review Mark	Student marked an item for review	4,024	2,464	1,635
Item Review Unmark	Student unmarked an item for review	2,125	1,030	644
Line Reader	Student enabled the line reader	9,598	4,079	3,507
Mask Create	Student masked content	34	9	9
Mask Delete	Student unmasked content	34	8	10
Mask Disable	Student disabled the masking tool	69	14	19
Mask Enable	Student enabled the masking tool	76	15	20
Periodic Table	Student opened the periodic table	38	13,744	15,231
Print	Student printed the item	100	58	5
Print Page	Student printed the page	448	133	11
Strikethrough Off	Student disabled strikethrough	2,431	1,070	689
Strikethrough On	Student enabled strikethrough	4,320	2,587	2,124
System Dialog	A system warning/dialog box opened as a response to student action or inaction	1,362	858	878
Text-to-Speech Eng. All	Student used English text-to-speech for entire item	4,537	1,073	259
Text-to-Speech Eng. Select	Student used English text-to-speech for a selection	674	200	59
Text-to-Speech Esp. All	Student used Spanish text-to-speech for entire item	190	13	3
Text-to-Speech Esp. Select	Student used Spanish text-to-speech for a selection	38	4	0
Translanguage Alternate	Student toggled to English	609	363	50
Translanguage Primary	Student toggled to Spanish	459	246	41
Tutorial	Student opened the tutorial	6,528	5,194	3,535
Zoom In	Student zoomed in	8,970	3,660	2,173
Zoom Out	Student zoomed out	8,317	3,507	2,507

Note. Table excludes students with incomplete tests (i.e., tests with less than 18 items) and students not enrolled in an Oregon public school on the first school day in May 2019. Total number of students who used an embedded accommodation and support in 2018-19 are 30,835 students in 5th grade, 26,047 students in 8th grade, and 30,892 students in 11th grade.

ODE acknowledges that students often use accommodations and supports multiple times during the course of a single testing session. Tables 1 through 3 only display one type of usage; thus,

ODE intends to explore and report other types of usage in the future, including how often students use a particular accommodation or support (e.g., number of items, frequency of usage within items, etc.). Lastly, an important consideration is the number of English learners in 5th, 8th, and 11th grades. In general, there are more English learners in elementary grades than in middle or high school grades. This is due to English learners demonstrating English language proficiency and exiting the Title III English language development program. We mention this as caution when interpreting the accommodation and support usage data for English learners.

Table 2.

Number of students with an IEP using an embedded accommodation and support at least once.

Accommodation and Support	Student Action	Grade		
		5	8	11
Calculator	Student opened the calculator	2,107	1,020	2,074
Comment Dropdown	Student opened the comment dropdown	712	286	111
Comment Notepad	Student opened the notepad	710	318	118
Entity Collapse	Student collapsed the item	1,466	625	458
Entity Expand	Student expanded the item	1,650	758	537
Help Guide	Student opened the help guide	257	145	85
Highlighter Clear	Student removed highlighting from a selection	76	58	16
Highlighter Clear All	Student removed highlighting from the entire item	203	89	38
Highlighter Select	Student used the highlighter	408	207	109
Item Review Mark	Student marked an item for review	501	270	132
Item Review Unmark	Student unmarked an item for review	242	120	57
Line Reader	Student enabled the line reader	1,456	697	465
Mask Create	Student masked content	12	6	0
Mask Delete	Student unmasked content	12	5	0
Mask Disable	Student disabled the masking tool	23	10	4
Mask Enable	Student enabled the masking tool	25	12	4
Periodic Table	Student opened the periodic table	2	1,796	1,330
Print	Student printed the item	27	19	4
Print Page	Student printed the page	95	35	5
Strikethrough Off	Student disabled strikethrough	289	103	50
Strikethrough On	Student enabled strikethrough	480	197	90
System Dialog	A system warning/dialog box opened as a response to student action or inaction	402	242	157
Text-to-Speech Eng. All	Student used English text-to-speech for entire item	2,104	768	176
Text-to-Speech Eng. Select	Student used English text-to-speech for a selection	320	144	38
Text-to-Speech Esp. All	Student used Spanish text-to-speech for entire item	50	2	1
Text-to-Speech Esp. Select	Student used Spanish text-to-speech for a selection	7	0	0
Translanguage Alternate	Student toggled to English	62	15	8
Translanguage Primary	Student toggled to Spanish	45	6	5
Tutorial	Student opened the tutorial	1,076	780	426
Zoom In	Student zoomed in	1,425	590	320
Zoom Out	Student zoomed out	1,319	580	360

Note. Table excludes students with incomplete tests (i.e., tests with less than 18 items) and students not enrolled in an Oregon public school on the first school day in May 2019. Total number of students with IEPs who used an embedded accommodation and support in 2018-19 are 4,862 students in 5th grade, 3,473 students in 8th grade, and 2,995 students in 11th grade.

Table 3.

Number of English learners using an embedded accommodation and support at least once.

Accommodation and Support	Student Action	Grade		
		5	8	11
Calculator	Student opened the calculator	1,382	494	575
Comment Dropdown	Student opened the comment dropdown	366	111	29
Comment Notepad	Student opened the notepad	400	146	40
Entity Collapse	Student collapsed the item	962	340	122
Entity Expand	Student expanded the item	1,073	391	143
Help Guide	Student opened the help guide	151	63	28
Highlighter Clear	Student removed highlighting from a selection	55	24	5
Highlighter Clear All	Student removed highlighting from the entire item	155	50	10
Highlighter Select	Student used the highlighter	286	105	29
Item Review Mark	Student marked an item for review	322	160	48
Item Review Unmark	Student unmarked an item for review	152	67	18
Line Reader	Student enabled the line reader	902	317	130
Mask Create	Student masked content	6	3	0
Mask Delete	Student unmasked content	6	3	0
Mask Disable	Student disabled the masking tool	10	3	2
Mask Enable	Student enabled the masking tool	13	4	2
Periodic Table	Student opened the periodic table	2	869	433
Print	Student printed the item	37	10	2
Print Page	Student printed the page	113	24	0
Strikethrough Off	Student disabled strikethrough	163	58	9
Strikethrough On	Student enabled strikethrough	263	93	12
System Dialog	A system warning/dialog box opened as a response to student action or inaction	224	91	44
Text-to-Speech Eng. All	Student used English text-to-speech for entire item	997	181	24
Text-to-Speech Eng. Select	Student used English text-to-speech for a selection	139	33	8
Text-to-Speech Esp. All	Student used Spanish text-to-speech for entire item	137	13	1
Text-to-Speech Esp. Select	Student used Spanish text-to-speech for a selection	27	4	0
Translanguage Alternate	Student toggled to English	287	102	39
Translanguage Primary	Student toggled to Spanish	239	76	34
Tutorial	Student opened the tutorial	820	434	188
Zoom In	Student zoomed in	1,065	380	114
Zoom Out	Student zoomed out	988	353	119

Note. Table excludes students with incomplete tests (i.e., tests with less than 18 items) and students not enrolled in an Oregon public school on the first school day in May 2019. Total number of English learners who used an embedded accommodation and support in 2018-19 are 3,117 students in 5th grade, 1,706 students in 8th grade, and 868 students in 11th grade.

Translanguaging Study

This study explores the use of translanguaging by a sample of 283 English learners on ODE's 5th grade NGSS assessment. Specifically, we examine the association between the frequency of translanguaging (i.e., number of items) and science achievement while controlling for student characteristics (i.e., age, IEP status, migrant, mobility, and homeless), school attendance, years identified as an English learner, English language proficiency, and school fixed effects⁴. Our

⁴ School fixed effects represent observed and unobserved school characteristics.

analysis uses ordinary least squares (OLS) regression. Finally, the research question that guides our study is the following:

To what extent does the frequency of translanguageing have an association with science achievement?

Figure 1 displays the number of English learners who translanguageed between English and Spanish on the 5th grade NGSS assessment⁵. Translanguageing on ODE’s NGSS assessment refers to having access to test directions, stimulus, items, and tools (i.e., periodic table, calculator, and text-to-speech) in both English and Spanish. Students are able to toggle between languages in order to use their linguistic repertoire in both English and Spanish. The pattern we observe in figure 1 is very similar to the findings in Lopez (2020). That is, the bulk of the English learners (approximately 70 percent) either translanguageed at the beginning of their test (one to three items) or translanguageed to the end (16 to 18 items).

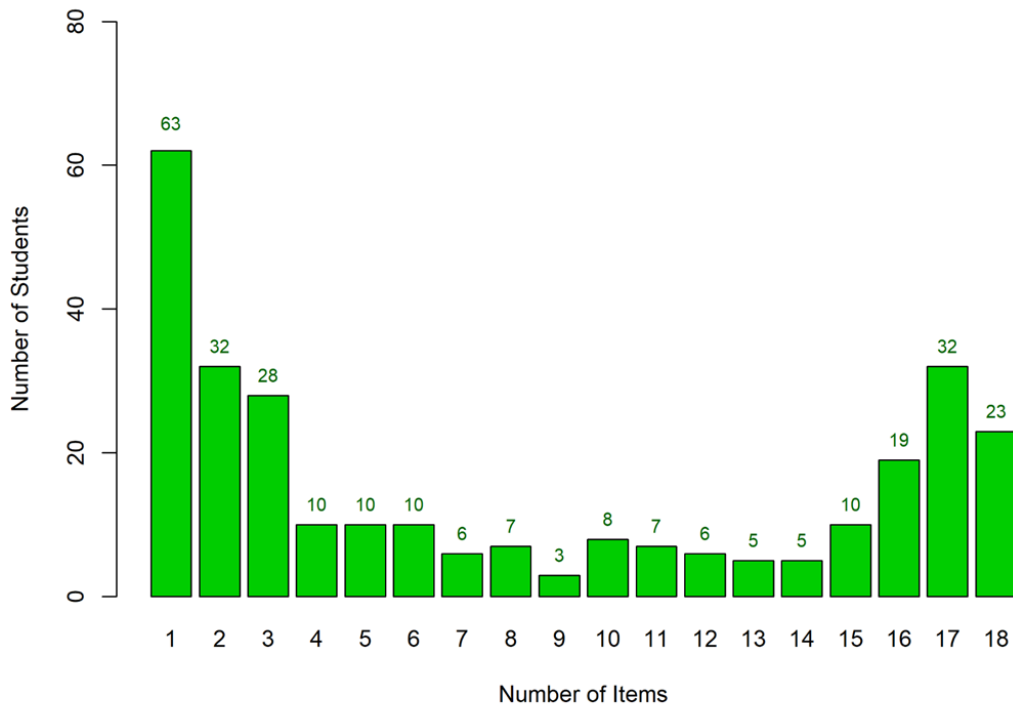


Figure 1. The number of items in which 5th grade English learners translanguageed between English and Spanish on ODE’s NGSS assessment.

⁵ There are 18 items on ODE’s NGSS assessment.

Table 4.
Results from OLS regression model.

Covariates	Estimate	Standard Error	T Statistic
Intercept	3011.490	48.899	61.586***
Age	-1.123	3.414	-0.329
IEP Status	-3.845	3.078	-1.249
Migrant	-2.868	2.671	-1.074
Mobility	0.608	4.880	0.125
Homeless	6.838	6.138	1.114
Years Identified as an English Learner	-4.981	1.091	-4.564***
English Language Proficiency	0.018	0.003	6.551***
Attendance Rate	0.433	0.257	1.683
Frequency of Translanguaging	0.730	0.193	3.786***

Note. $R^2 = 0.525$, $F(60, 222) = 4.082$, $p < 0.001$. Model includes fixed effects for 52 schools.

* is $p < 0.05$, ** is $p < 0.01$, and *** is $p < 0.001$.

Table 4 presents the results of the OLS regression model. We find a statistically significant association between the frequency of translanguaging and science achievement (after controlling for the covariates in the model). An increase in translanguaging by one item relates to an increase of less than a single scale score point. This is a very small association given that the standard deviation of the 5th grade NGSS assessment is 27 scale score points. On the other hand, an increase of 17 items (i.e., translanguaging on all 18 items) would result in an improvement of a little more than 12 points or around 46 percent of a standard deviation. This would represent a sizeable and meaningful increase in science achievement. While translanguaging does not appear harmful to English learners (in terms of science achievement), the findings suggest that the benefits of translanguaging are small unless English learners translanguage more frequently (e.g., more than a handful of items).

Figure 3 corroborates this finding by showing the scale score distributions for each of the 18 items where 5th grade English learners translanguage between English and Spanish. Relative to the average scale score, the boxplots for English learners who translanguage frequently (i.e., six or more items), are slightly higher than those for English learners who translanguage less frequently (i.e., five or fewer items). Although these differences are quite small, ODE believes translanguaging is important, and is considering further analyses to explore the association between the frequency of translanguaging and achievement on ODE's NGSS assessment.

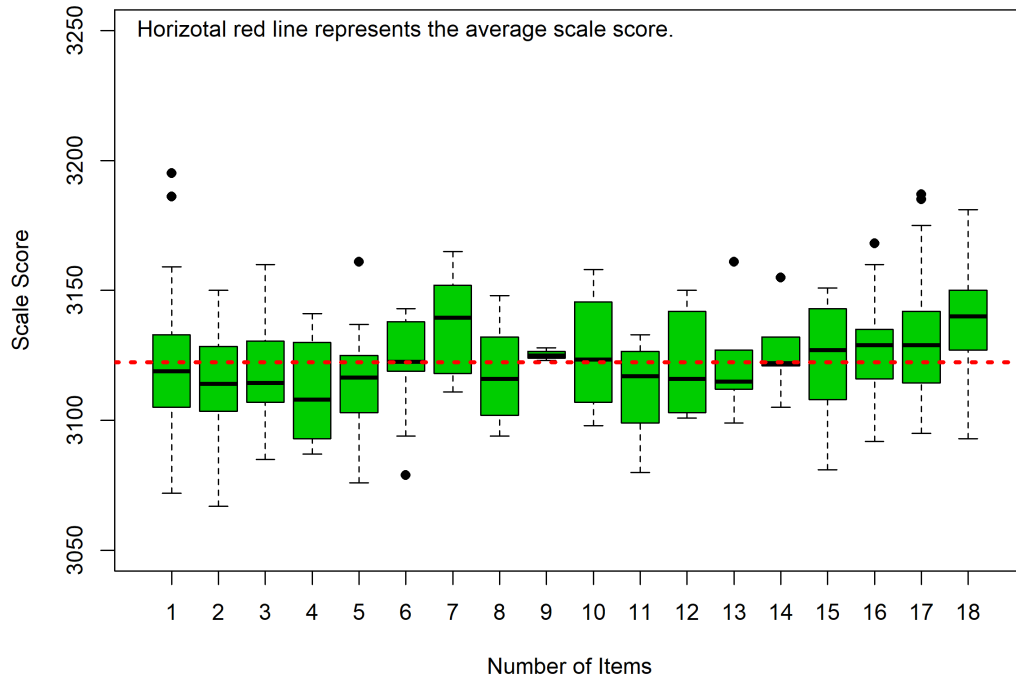


Figure 2. Boxplots representing the scale score distributions for the number of items in which 5th grade English learners translanguageated between English and Spanish.

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