

Symposium Proposal

Content and Language, Rigor and Accommodation: Tensions and Trade-offs of STEM Access for English Learners

*NOTE: This is the non-blind version of our proposal, and has been updated to include information about our session discussant. Changes are **highlighted**, and only affect the overall session description; the individual paper abstracts are unchanged.*

Symposium Justification:

Chair: Molly Faulkner-Bond, Institute of Education Sciences

Discussant: Matthew Linick, Cleveland Metropolitan School District

English learners (ELs) are students who are learning the English language at the same time that they learn academic content in areas like mathematics and science. Teachers and schools are required by various laws to ensure that ELs have access to the general curriculum, and EL students are expected to meet the same standards of academic performance to which all students are held. A central tension in EL education is balancing these high expectations with the reality that these students are still learning the language in which they are taught and assessed. Specifically, educators must find ways to reduce unnecessary linguistic barriers for EL students without reducing the rigor of the content they convey. What are the best ways to accomplish this balancing act?

In this symposium, three research teams will present findings from studies of materials designed to reduce this tension between language and content for ELs in secondary STEM settings.

- The first presenter will report on a randomized-control trial to evaluate a mathematics intervention for sixth grade EL students. This multimedia intervention was designed to enable sixth-grade Spanish-speaking ELs to acquire the skills and knowledge they need to meet more rigorous state standards in math and literacy, and involves extensive scaffolds to support both language and content learning.
- The second presenter will share results from a large-scale pilot study of technology-based classroom assessments that reduce the overall English language load typically associated with the more difficult knowledge, skills, and abilities in middle school math and science.
- The third team will present findings from a large-scale pilot of a summative, computer-based assessment system that measures middle-school math and provides accessible and appropriate accommodations for EL students.

Together, the three projects cover a range of educational and decision-making contexts – i.e., instruction, classroom-based assessment, and summative assessment – and have leveraged technology as a means to reduce linguistic barriers while maintaining rigor.

Following the three intervention presentations, a fourth team will present findings that speak to the larger impacts of STEM access and achievement on EL students' academic trajectories. Using data from a large school district, this team will show how prior achievement, advising, and EL status can lead students toward or away from the general curriculum and affect ELs' achievement and opportunity to learn over time. Their findings will underscore the urgency of ensuring that EL students maintain access to rigorous STEM content.

The symposium will close with a discussant from the practitioner side of this issue. **This individual, who is the Executive Director of Research and Evaluation for a large, urban school district,** will synthesize the presenters' findings and consider them from the perspective of someone who must make decisions about product use, course placement, and a host of other issues related to ELs' education. How do findings and products such as these help this individual do her job well? What additional findings or products would contribute even more? The discussant will consider such questions and invite discussion from the presenters and audience.

Word count: 493

Paper #1: Evidence of promise for a scaffolded math curriculum for middle school English Learners

Authors: Diane August*, American Institutes for Research; Chris Barr, University of Houston

Background/Context

This presentation presents findings from an initial evaluation of an intervention called MELD (Mathematics and English Language Development) for English learners (ELs). Current mathematics instruction is not meeting the needs of students who are learning English while also learning mathematics. Research suggests that ELs are provided fewer opportunities to engage in challenging mathematical work than their non-EL counterparts (Abedi & Herman, 2010) and ELs' mathematics instruction is characterized by over-emphasis on lower-level content (Gándara, & Contreras, 2009; Varley, Gutiérrez, Willey, & Khisty, 2011). In addition, ELs have scored significantly below non-ELs on NAEP mathematics assessments (Kena et al., 2016). Furthermore, while the integration of language and content during lessons has been linked to opportunities for ELs to learn mathematics (e.g., Baker et al., 2014; Chval, Pinnow, & Thomas, 2014), many schools address ELs' needs by separating language work from mathematics work (Firestone, Martinez, & Polovsky, 2006).

Purpose

The goal of the three-year study is to enable sixth-grade Spanish-speaking ELs to acquire the skills and knowledge they need to meet rigorous state standards in math, English language arts and English language proficiency. The primary research questions addressed in this presentation are the following:

- *RQ1. To what extent can the MELD intervention be implemented successfully?*
- *RQ2. How does the MELD intervention affect students' mathematics learning and development of academic language compared with the control condition?*

Setting

The study took place in sixth grade classrooms in five middle schools in a school district located in the Rio Grande Valley, Texas. All schools had high percentages of ELs and students from low-income families.

Subjects

All sixth-grade students in the five district middle schools who had been designated as needing additional math support at the end of fifth grade participated in the study ($N = 208$, including 98 current and monitored ELs).

Intervention

Students in the treatment condition ($N = 92$) received an extra period of math using MELD curriculum and instructional practices; students in the control condition ($N = 116$) received an extra period of math using the district's curriculum and instructional practices. Course content in both treatment and control conditions were aligned with state standards and the district scope and sequence. The MELD intervention used as a base an open-access math curriculum developed for English proficient students. Starting with this base curriculum, the investigators added supports for ELs (see Table 1); supported ELs in acquiring foundational math skills and knowledge at the same time they were acquiring grade-level math knowledge and skills; and provided additional professional development for teachers. The duration of the intervention was three months. Students in both conditions received approximately 270 minutes of instruction weekly.

Research Design

This presentation focuses on the third year of the three-year study. For the first two years, the study iteratively developed and piloted the intervention. In the third year, the intervention was pilot tested. Students in three of the schools were assigned to the treatment condition; students in the other two schools were assigned to the control condition. Schools were demographically similar.

Data Collection and Analysis

MELD consisted of two units that together spanned a semester. Treatment students were pre- and post-tested before and after each unit, while students in the control group were tested at the beginning and end of the semester. All students were assessed on measures of math and academic language. Math items covered content taught in both the MELD and control math classes and were items released from state math assessments. A foundational math assessment was also administered at pretest. The academic language test assessed general academic vocabulary as well as discipline-specific vocabulary related to the math core content. The study team conducted weekly observations in all seven MELD intervention classrooms. The average length of each observation was 48 minutes.

For both math and academic vocabulary, to assess if students participating in MELD classrooms made greater gains than students participating in control classrooms, we fit a generalized linear mixed effects model in which item performance on the assessment was the outcome. Items were nested within student and student nested within classroom. For math, item performance was predicted by foundational mathematical skills, unit, EL status, wave, treatment status, and all two-way and three-way interactions for wave treatment and EL status. For academic vocabulary, item performance was predicted by unit, EL status, wave, treatment, and all two-way and three-way interactions for wave treatment and EL status. For both sets of analyses we controlled for school level fixed effects.

Findings

Gains in math were larger for the MELD treatment group full sample, as well as the subsamples of English proficient students and ELs compared with students in the control group. For the full sample, treatment group students gained 13% ($d=.67$) more than control group students. For English proficient students the gains were 10% ($d=.49$) greater for MELD treatment group students compared with control students. For ELs, MELD treatment group student gains were 16 % greater ($d=.86$) than gains for control students. See Tables 2 and 3. Gains in academic vocabulary were also larger for the MELD treatment group full sample, as well as subsamples of English proficient students and ELs compared with students in the control group. For the full sample, MELD treatment group students gained 8% ($d = .5$) more than control students. For English proficient students, the gains were 11% ($d = .72$) greater for MELD treatment group students than for control students. For ELs, MELD treatment group student gains were 7 percent greater ($d = .38$) than for control ELs. See Tables 4 and 5.

Conclusions

A limitation of the study is that schools were not randomly assigned to treatment or control conditions. However, the demographics of the schools were similar. Additionally, we controlled for both school and level fixed effects, and made our primary outcome of interest gains, as opposed to absolute posttest scores. Findings from this small pilot study are consistent with research that indicates ELs benefit from additional support in acquiring course content delivered in English (National Academy of Sciences, 2017).

Word count: 997

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Table 1. Scaffolds used to support ELs learning of the base Math Curriculum

MELD Scaffolds
<ol style="list-style-type: none"> 1. Scripted teaching notes and PowerPoint slides for teachers to guide instruction; Power Point slides provided visual support for students. 2. Student guides that tracked teacher PowerPoint presentations (frame by frame) that required students to engage with teaching moves 3. Spanish language support in the form of student glossaries and bilingual student guides 4. Student glossaries that contained key general and math academic words, writing practice, a Spanish translation, an English definition, a Spanish definition, and an example, and partner talk activities that required students engage with the target vocabulary. 5. Opportunities for student partner work together to solve math problems 6. Exit tickets that required students to demonstrate mastery of key concepts learned in the lesson; information in exit tickets provided formative assessment data for teachers 7. Additional in-school and home practice problems that included worked examples for each problem type to support student learning. 8. Visual supports such as graphic organizers and tables to elucidate math concepts.

Table 2. MELD Supplemental Versus District Supplemental Intervention: Mathematics Outcomes

Effect	Num DF	Den DF	F-Value	Pr > F
MELD unit	1	4,212	4.01	0.0452
Foundational mathematics	1	4,212	26.73	< 0.0001
EL status	1	4,212	7.37	0.0067
Wave	1	4,212	33.26	< 0.0001
Wave*EL status	1	4,212	0.39	0.5305
Treatment	1	4,212	0.60	0.4390
EL status*Treatment	1	4,212	1.08	0.2995
Wave*Treatment	1	4,212	8.80	0.0030
Wave*EL status*Treatment	1	4,212	1.54	0.2147

Table 3. Percent Correct Gains for MELD Supplemental Versus District Supplemental Intervention: Mathematics Outcomes

Sample Students	Group	Mean Gain	SD
Full sample	District extra mathematics	0.07	0.19
	MELD	0.20	0.20
English proficient	District extra mathematics	0.07	0.20
	MELD	0.17	0.21
EL	District extra mathematics	0.07	0.17
	MELD	0.23	0.20

Table 4. MELD Supplemental Versus District Supplemental Intervention: Academic Vocabulary Outcomes

Effect	Num <i>DF</i>	Den <i>DF</i>	<i>F</i> -Value	<i>Pr</i> > <i>F</i>
MELD unit	1	6,568	91.16	< 0.0001
EL status	1	6,568	0.11	0.7384
Wave	1	6,568	77.95	< 0.0001
Wave*EL status	1	6,568	1.23	0.2671
Treatment	1	6,568	4.76	0.0292
EL status*Treatment	1	6,568	0.03	0.8711
Wave*Treatment	1	6,568	18.68	< 0.0001
Wave*EL status*Treatment	1	6,568	0.48	0.4885

Table 5. Percent Correct Gains for MELD Supplemental and District Supplemental Intervention: Academic Vocabulary Outcomes

Sample	Group	Mean Gain	SD
Full sample	District extra mathematics	0.09	0.14
	MELD	0.17	0.18
English proficient	District extra mathematics	0.09	0.12
	MELD	0.20	0.18
EL	District extra mathematics	0.08	0.18
	MELD	0.15	0.19

Paper #2: Assessing English Learners' Mathematical Understandings with Challenging Multisemiotic Classroom Assessment Tasks

Authors: Laura Wright*, University of Wisconsin Madison; Rebecca Kopriva, University of Wisconsin Madison

Background

Numerous studies have documented significant achievement gaps between English Learners (ELs) and English proficient students on standardized content tests (e.g., National Assessment for Educational Progress, 2015). Gaps are partially attributed to assessments confounding language proficiency and content knowledge, especially when challenging material is being measured (Abedi & Lord, 2001; Kieffer, Lesaux, Rivera, & Francis, 2009; Kopriva, 2008; Martiniello, 2008). Recently, Abedi (2017) and others have argued that classroom content assessments are often guilty of this same trend.

To date, the typical approach to supporting ELs has been to use accommodations on top of existing test forms. However, for a variety of reasons, accommodation research results for this population have been mixed (Sireci, Li, & Scarpatti, 2003; Pennock-Roman & Rivera, 2011), and the research reviews have brought to light serious research design flaws that need to be addressed. This work and its use in practice have also clarified that more than supplementary accommodations are needed for some students, especially those with lower proficiency in English and developing literacy (Kopriva, 2008).

Purpose & Research Questions

The purpose of this study was to research and develop innovative multisemiotic (Kress & van Leeuwen, 2006; O'Halloran, 2004) assessment tasks that utilize visuals, action, sound, and language to communicate to and from students in the assessment environment. Using a variety of communicative methods reflect the varied ways students learn and reason in mathematics classrooms and address access needs of ELs (Kopriva, 2008; Logan-Terry & Wright, 2010). The assessment, called ONPAR, has demonstrated success in addressing the linguistic and cultural barriers encountered by low-English proficient ELs on assessments for large-scale, summative purposes, such as annual state accountability measures. Research has shown that ONPAR items can successfully measure challenging mathematics concepts and skills of ELs' using novel computer-interactive techniques that largely redirect the language comprehension and production loads to multisemiotic representations. The present study developed seven mathematics assessment tasks to assess ELs in a classroom context. The project hypothesizes that the multisemiotic methodology provides a more valid way of assessing ELs' mathematics content abilities and opportunity to diagnose learning needs.

Setting

This study presents results from a pilot conducted during the 2017-2018 school year with 18 middle school mathematics teachers across the United States and their 1,500 students. The population consisted of approximately 200 ELs of varying English proficiency and linguistic backgrounds and 1,300 non-ELs.

Program

ONPAR's dynamic computer-based assessment tasks are designed to measure more complex content by making items accessible as they are being written; linguistically complex information is replaced with an array of multisemiotic resources (Kress & van Leeuwen, 2001). By using different modalities, the assessment tasks minimize linguistic challenges and provide alternative means to "access meaning, solve problems, and demonstrate solutions without lessening the rigor of the item or changing the construct being measured" (Carr & Kopriva, 2007; p. 8).

Research Design

Seven ONPAR mathematics performance tasks aligned to seventh grade proportional reasoning and geometry Common Core State Standards were developed and piloted alongside traditional test items measuring similar content. Participating teachers implemented tasks during regular instructional time embedded within each respective unit; assessments were automatically scored and online diagnostic reports provided immediate feedback to help teachers monitor and direct ongoing learning. Teachers varied in implementation time approximately between two and six weeks per unit.

Data Collection and Analysis

Participating teachers planned for their individual testing times depending on when they were teaching relevant mathematics units. Project staff oriented teachers to the assessments and relevant standards in online meetings prior to the testing window. Teachers administered assessment tasks after training. Teachers were also sent student content ability questionnaires to provide another perspective on student mathematics abilities, and a survey focused on usability and feasibility of tasks and materials. A sample of teachers were interviewed to further investigate usability and feasibility issues highlighted on surveys. Finally, school, teacher, and student information, state English language proficiency (ELP) test results for ELs, and state assessment scores in reading, math were also collected. A 2-PL IRT model was used to calibrate the dichotomous ONPAR and traditional test items and the graded response model was used for the polytomous items. All items for tasks in each unit were calibrated together to determine how ELs at different levels of language proficiency and non-ELs respond to traditional and novel ONPAR tasks. To investigate the usability and feasibility of the tasks and supporting materials for classroom use, the study analyzed post-implementation surveys and teacher interview feedback qualitatively for relevant themes and comments.

Results

Assessment results indicate that the ONPAR assessments, aligned with Common Core State Standards, were more difficult than traditional mathematics items typically used in classrooms. Results also indicated that non-ELs scored more poorly on ONPAR than on traditional items. However, even the lowest proficiency ELs rose to the challenge and scored similarly to the traditional items despite the fact that the ONPAR items were more cognitively complex. Thus, ONPAR seems to have reduced some of the access barriers that traditional assessments pose for ELs.

Further, qualitative results from the usability and feasibility survey indicate that the educators had an overwhelmingly positive experience and, given the chance, that they would use assessment materials

again. Educators highlighted several challenges that may have affected outcomes including a learning curve in using a new assessment methodology, assessing rigorous content, and utilizing diagnostic information. The paper will discuss quantitative and qualitative results, as well as considerations in developing and using multisemiotic assessments to assess ELs' conceptual understanding of mathematics.

Conclusion

The multisemiotic approach employed by ONPAR allows students multiple, complementary paths that support their understanding and shows the promise of designing tests that allow students a variety of approaches to communicate. The multisemiotic approach affords ELs new opportunities for communication, which, in turn, can provide new opportunities for them to show their understanding. As the districts, schools, and teachers seek ways to fairly include and assess ELs in classrooms, these insights are particularly relevant.

Word count: 980

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Paper #3: A Comprehensive Research-Based Computer Assessment and Accommodation System for English Language Learner Students

Authors: Jamal Abedi*, University of California Davis; Mikyung Wolf, Educational Testing Service; Fereshteh Hejri, Advance Research & Data Analyses Center

Context

Studies on accommodations for ELLs have identified at least 73 different types of accommodations that are used by different states many of which are adopted from the pool of accommodations created and used for students with disabilities and may not be relevant for this group of students. ELL students need assistance in the language of instruction and assessment to successfully assimilate into the mainstream instruction and assessment; therefore, language-based accommodations would be most relevant for these students. On the other hand, not all language-based accommodations can be used for ELLs because some of these accommodations may provide unfair advantage to the recipients and can invalidate the accommodated assessment outcomes. For example, commercial dictionary is one of the most commonly used language-based accommodation in the nation. While dictionary help overcome ELL students' language barriers, it provides content definition as well which is unfair to non-recipients of this accommodation.

Purpose and Research Questions

The study aimed to address the following research questions:

1. Does providing a certain accommodation increase ELL students' performance in a math assessment as compared to the standard testing condition (effectiveness)?
2. Does providing a certain accommodation alter the focal construct (validity)?

Based on the review of literature, we identified five different language-based accommodations that do not provide unfair advantage to the recipients and may be effective in making assessments more linguistically accessible to ELLs and as the same time do not alter the focal construct (mathematics in this study). We selected mathematics as the content because the focal construct is mathematics not language. We emphasized in our report that these accommodations are not relevant for assessment of language construct such as English language arts.

Setting and Subjects

For measuring the students' mathematic knowledge, we developed a 65-items mathematics test base on the grade 8 Common Core mathematics Standards. From these items, we created two parallel forms of 35 items (with some items common across the two forms) and field tested the two forms on a group of 700 grade 8/9 students. Based on the results of the field test (content and psychometric properties), we created a final version of the test to be used for measuring students' mathematics knowledge as the main dependent variable for this study. We administered this form on a sample of approximately 3,000 grade 9 students under different types of accommodations early in the fall of 2016.

Intervention/Practice

The accommodations used in this study were: (1) linguistically modified version of the mathematics test, (2) English glossary of non-content terms, (3) read-aloud test items, (4) Spanish version of the test, and (5) Spanish glossary for the test.

Research Design

In a computer-based system, accommodation were assigned based on students' level of English and Spanish proficiency and randomly within accommodations that are available for students who are fluent in either languages. For examining the effectiveness of the accommodations used in this study, we compared performance of ELL students under accommodated with their performance under non-accommodated groups. For examining validity of the accommodations used, we compared performance of non-ELL students under the accommodated and non-accommodation conditions.

Data Collection and Analysis

ANCOVA analysis was conducted to obtain the pooled within cell variance for conducting a series of a priori comparisons for examining the validity of accommodations used in this study. A Regression Discontinuity Design (RDD) was used to identify a cutoff score from a post-hoc approach. We used confirmatory factor analysis to investigate the underlying structure of the standard and LM forms of mathematics assessment to better understand the impact of language complexity embedded in the math items on students' performance.

Findings and Conclusions

The ANCOVA analysis showed that the pattern of results for non-ELLs and ELLs was similar except that the mean math test score is slightly higher for non-ELLs compared to the ELLs. We compared the differences between all English accommodation (e.g., linguistic modified, English glossary and English read aloud) with math standard test condition for the non-ELL students. We found a large effect for the covariate English Timer ($F_{1,1233} = 126.9, p < .000$). We also found the accommodations' impact is significant but small ($F_{1,1233} = 2.9, p = .034$).

For the CFA, the single-factor model was used as the baseline model for the standard form and bifactor Model was chosen for the linguistic modified form. Only one factor of "general mathematics skills" emerged in the standard form whereas two factors of "general mathematics skills" and "language complexity" were extracted from the linguistic modified form. In a *Random-intercept-and-slope model*, we found a significant effect for ELL status. When holding condition and pretest score constant, non-ELL students, scored .90 points higher than ELL students on math test score. The proportion variance explained at level 1 is .002 (Cohen, 1998; Selya et al., 2012). The inclusion of level-2 predictor of ELL status increases the intercept variance on the teachers' level by 2.29%.

In the RDD analysis we found no significant discontinuity in the regression line across the three types of accommodation system for current ELLs. However, there were significant discontinuities in the regression lines in the glossary condition for all ELLs ($b = 3.72, p < 0.05$) and overall population ($b = 3.76, p < 0.05$) as well as in the linguistically modified condition for overall population ($b = 2.44, p < 0.05$). As a result, we found that the glossary condition may have a positive impact for ELL students who are

proficient in English on their math skills. Also, we found that the linguistically modified condition may have a positive impact for students who are proficient in English on their math skills. Another major finding is the evidence that none of the accommodations used in this study altered the focal construct; therefore, they are considered as valid accommodations.

Word count: 951

Paper #4: Patterns of EL Math and Science Coursetaking in Grades 6-9: First Year Findings from a Researcher-Practitioner Partnership Project

Authors: Elizabeth A. Sanders*, Anna W. Van Windekens, Manka M. Varghese, University of Washington

Background

Although the U.S. English learner (EL) student population has been growing, ELs are less likely to access the math and science courses crucial for four-year college admittance (Callahan, 2005; Callahan, Wilkinson & Muller, 2010; Kanno & Cromley, 2012; Kanno & Harklau, 2012; Mosqueda, 2007). Washington State is among the top seven with the highest EL enrollment (Ruiz Soto, Hooker, & Batalova, 2015). Over the past ten years, EL enrollment in Washington has increased 57%, whereas the overall student population has only increased 3% (OSPI Report Card, 2015); further, ELs in Washington significantly underperform in math and science (OSPI, 2013). Within Washington, Seattle Public Schools (SPS) is the largest district with the highest EL enrollment. In 2015, 29% of SPS ELs met eighth grade math standards (compared to 64% overall), and 23% met tenth grade science standards (compared to 70% overall) (OSPI, 2015). This disparity, combined with recognition that math and science are gateways for postsecondary access and desire to improve EL student outcomes, brought university researchers and SPS district leaders together for a two-year partnership project investigating malleable factors involved in EL access and achievement in math and science.

Purpose and Research Questions

The present paper will share preliminary, first-year, findings about grade 6-9 math and science coursetaking for SPS's graduating class of 2016, and results from a district-wide survey of SPS high school teachers and counselors on perceptions of math and science coursetaking. Our research questions are:

1. Did EL students differ from non-ELs on math and science courses grades 6-9?
2. Across both EL and non-ELs, which grade 6-7 math and science courses best predict grade 9 advanced math and science, and is this relationship moderated by EL status?
3. Does advanced grade 9 coursetaking predict enrollment in a four-year college?
4. What are school staff perceptions of EL math and science coursetaking and advising?

Data Collection and Analyses

Existing student coursetaking data. Extant data for the graduating class of 2016 were provided by SPS and included demographics, math/science coursetaking grades 6-12, EL test data, and 2017 postsecondary enrollment. Of the 4,551 students from 21 middle and 11 high schools, 947 (19%) were classified as ever-EL based on the presence of EL test data. For math, 3,475 students (76%) had at least one math course record and 3,705 (81%) with at least one science course record. Importantly, each course at each grade level was classified as "special ed," "EL," "regular," "honors," and "advanced." We defined "regular" grade 9 math and science coursetaking as algebra I and physical science, respectively. We coded a course as completed if the student earned at least a D-. Preliminary analyses included chi-square tests and multiple logistic regressions; final analyses will incorporate school membership.

Coursetaking perceptions survey data. The survey data was collected by university researchers in spring 2018 using an anonymous online survey of all high school math and science teachers, EL teachers, and school counselors in the district. The questionnaire was developed collaboratively by university researchers (PI, co-PIs, and graduate research assistant) and district content-area leaders (research and evaluation, EL, math, science, and school counseling). Of the 321 staff invited to participate from 11 schools, 82 (26%) responded. For math items, there were 55 participants (37 math teachers, 10 counselors, and 8 EL teachers); for science, there were 48 participants (26 science teachers, 10 counselors, and 12 EL teachers). Descriptive statistics and multiple regressions were conducted.

Results

Existing student coursetaking data. Table 1 displays the proportions of course completion rates by EL status. In grades 7-8, ELs were more likely to complete advanced math coursework than non-ELs, yet in grade 9 the reverse was true; ELs were also generally less likely to take honors math courses. For science, ELs were less likely to take advanced coursework across grades. Grade 6 honors math was the best predictor of advanced grade 9 math *and* science coursetaking. Multiple logistic regression results showed that the effect of grade 6 honors math on advanced grade 9 math was present for both EL and non-ELs (97 and 99% predicted probabilities, respectively). In contrast, the benefit of grade 6 honors math on grade 9 advanced science was only present for non-ELs. Finally, both grade 6 honors math and advanced grade 9 math had significant positive effects on likelihood of college enrollment; with these two courses taken into account, EL status did *not* predict college enrollment.

Coursetaking perceptions survey data. Survey results show that both ELs and non-ELs students were expected to take up to algebra 2, but ELs were significantly less likely to be expected to take pre-calculus in high school; there were similar expectations for science coursetaking. Both ELs and non-ELs were expected to be advised by content teachers and counselors; however, ELs were also expected to be advised by EL teachers (Figure 1). The major perception about how SPS schools are improving EL access to higher math courses was that ELs needed to take added coursework; for science the modal response was “don’t know” (Figure 2).

Conclusions

The present paper offers insight into a recent cohort of EL student math and science coursetaking patterns during grades 6-9 in a large, diverse public school district, as well as how key high school staff perceive EL and non-EL advising. Consistent with earlier research, our findings indicate that ELs are less likely to take grade 6 honors math and grade 9 advanced math, both of which are associated with the likelihood of attending a four-year college. In addition, our survey data show that school staff perceive that EL students may need to take added coursework to catch up to non-ELs, and that EL teachers may be an important resource for EL students’ coursetaking decision-making. In Year 2 of the project, we are conducting focus group and individual interviews, as well as observations, to provide insight into how particular school contexts, policies, and practices shape math and science for EL students.

Word count: 981

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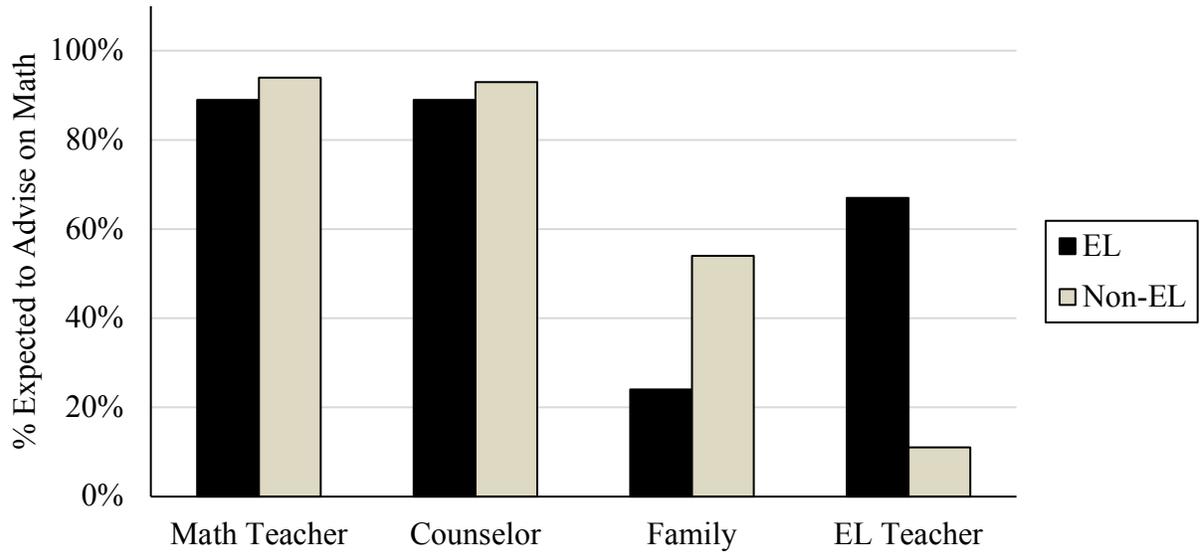
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Table 1. *Math and Science Coursetaking Patterns for EL and non-EL Students*

Grade	Math Course	EL	Non-EL	EL v. Non-EL	Grade	Science Course	EL	Non-EL	EL v. Non-EL
Grade 6	Special Ed Math	11%	8%	3% *	Grade 6	Special Ed Science	1%	2%	-1%
	EL-specific Math	15%	2%	13% ***		EL-specific Science	2%	0%	2% ***
	Grade 6 Math	77%	82%	-4% *		General Science	99%	98%	1%
	Honors Math	14%	25%	-11% ***		Honors Science	1%	7%	-6% ***
	Advanced Math	4%	13%	-9% ***		Advanced Science	0%	0%	0%
Grade 7	Special Ed Math	4%	9%	-5% ***	Grade 7	Special Ed Science	1%	1%	1%
	EL-specific Math	3%	2%	1%		EL-specific Science	3%	0%	3% ***
	Grade 7 Math	86%	79%	8% ***		General Science	94%	90%	5% ***
	Honors Math	9%	15%	-5% ***		Honors Science	3%	1%	2% **
	Advanced Math	24%	19%	5% **		Advanced Science	1%	5%	-4% ***
Grade 8	Special Ed Math	12%	10%	2%	Grade 8	Special Ed Science	2%	1%	1% *
	EL-specific Math	3%	3%	0%		EL-specific Science	1%	0%	1% **
	Grade 8 Math	37%	54%	-18% ***		General Science	94%	90%	4% ***
	Honors Math	3%	3%	0%		Honors Science	0%	0%	0%
	Advanced Math	56%	40%	15% ***		Advanced Science	4%	8%	-4% ***
Grade 9	Special Ed Math	11%	11%	1%	Grade 9	Special Ed Science	4%	3%	1%
	EL-specific Math	6%	8%	-2% *		EL-specific Science	3%	0%	2% ***
	Algebra I	47%	35%	12% ***		Physical Science	72%	58%	14% ***
	Honors Math	28%	33%	-5% **		Honors Science	10%	18%	-8% ***
	Advanced Math	39%	52%	-13% ***		Advanced Science	18%	30%	-13% ***

Note. Sample size varies by grade and content; 2016 graduating class includes 4,551 students from 21 middle schools and 11 high schools; 947 (19%) classified as EL based on the presence of EL test data; 3,475 (76%) with at least one math course record and 3,705 (81%) with at least one science course record; 2,395 (53%) had at least one math and science record; a course was considered successfully completed if the student earned a passing or D- grade or better for at least one term. Categories can add to more than 100% from dual classifications. Chi-square test *p*-values are unadjusted for multiple comparisons. * *p* < .05, ** *p* < .01, *** *p* < .001.

Panel A



Panel B

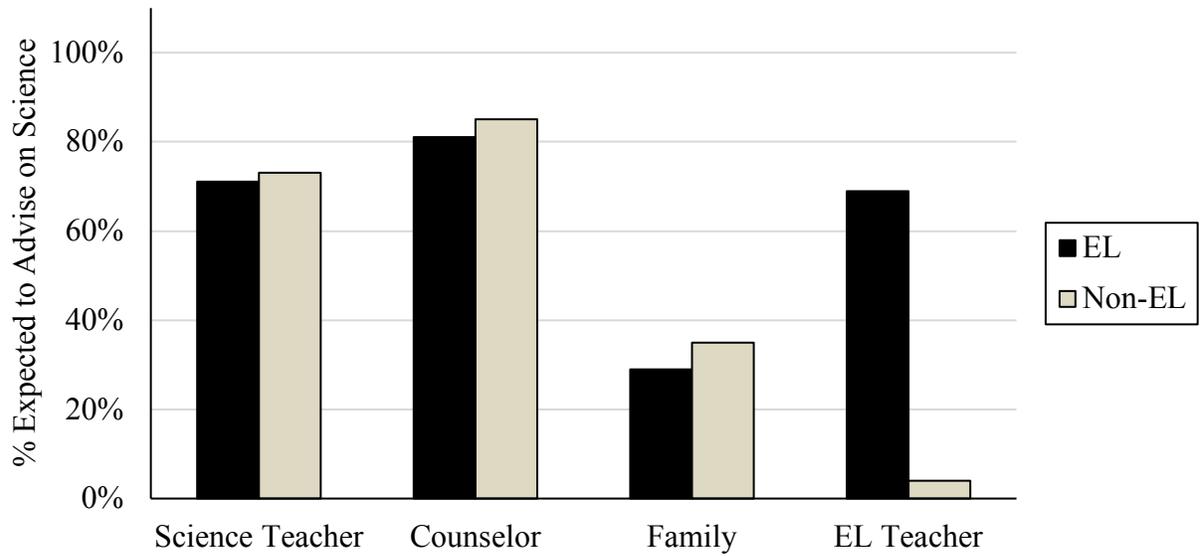


Figure 1. Expectations of Who Advises Students on Science Coursetaking

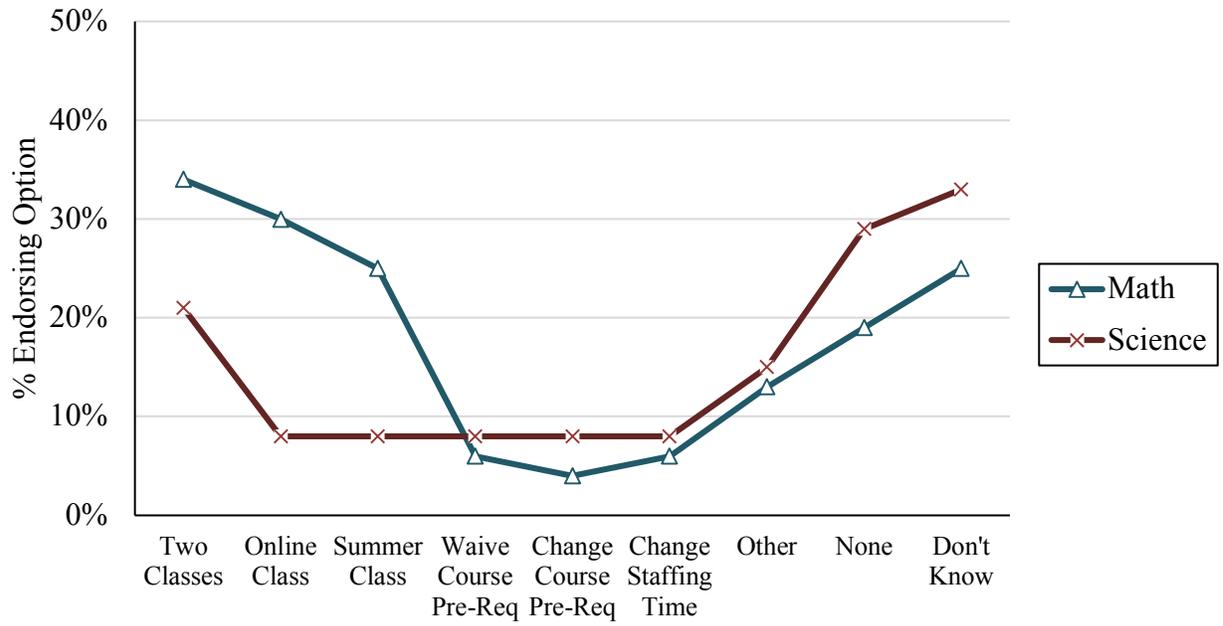


Figure 2. Perceptions of Ways Schools Attempt to Increase EL Enrollment in Math and Science