Measuring Opportunities to Learn Mathematics and Science in a Mathematics and Science Partnership Program

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Abstract

The primary purpose of this study was to describe the reliability of a student self-report instrument designed to determine the level of opportunities to learn mathematics and science and preliminary results of its administration. The instrument was administered to students in a New England middle school where teachers were engaged in professional development in mathematics content and pedagogy through a U. S. Department of Education Mathematics and Science Partnership Program beginning in 2015. Results indicated acceptable reliability of the instrument and significant differences in perceived opportunities to learn in groups of students disaggregated by gender, grade level, family background and special learning needs. A secondary purpose was to determine the relationship of student perception of changes in opportunity to learn and performance on an assessment of mathematics. Following the 2015 baseline year, 2016 survey results showed that students at grade 6 increased positive perceptions of opportunities to learn (total scale) by slightly more than a standard deviation. In addition, concurrent with the measurement of change in opportunities to learn, students in each of five grade level cohorts significantly increased their MCAS scaled scores.

Introduction

Opportunity to learn (OTL) is an evolving concept. For the purpose of this paper OTL is defined as the mix of learning experiences and perceptions **necessary for a quality education for all students.** "For 30 years, opportunity to learn has been a potent concept for researchers conducting international comparative studies….." The foregoing statement was written by Guiton and Oakes in 1995. It followed extensive work by Burstein and others in the late 1980's and early 1990's. (Burstein, Oakes and Guiton, 1993). Some twenty years later researchers are still reviewing what is now fifty years of attempts to understand what opportunities to learn really are, how they are related to what students learn, and what can be done to enhance their relationship to equality of educational opportunity. Concern about the measurement of OTL helps focus the inquiry about opportunity to learn as it relates to the dimensions of instructional time (defined as active engagement in learning); content coverage (defined as the alignment relationship between the content engaged by students and the content that is assessed for equity purposes); and, instructional quality (the utilization of empirically supported teaching practices) (Kurtz, 2011). These three dimensions have been central concerns in the attempts to change school organization and practices described in such change strategies as the Concerns Based Model (CBAM), Hall and Hord, (2011), Fullan and Quinn, (2016), and Joyce and Calhoun (2010).

Framework

Combining all three dimensions of opportunity to learn in the measurement of teaching practice offers a more inclusive framework to capture the measurement of teacher interventions that may make the prediction of student achievement more efficient at the same time it offers strategies to achieve better equity. For example, understanding the effects of curricular tracking on the limitation of opportunity to learn can be done by mapping the intended (general) against the enacted curriculum (delivered by teachers in any given classroom) against the assessed curriculum (tested) and the engaged curriculum (engaged time during instruction of the enacted curriculum.) (Kurz et al., 2010; Petty & Green, 2007). With the curricular mapping as a tool and alignment as a goal, programs such as the SEC (Surveys of Enacted Curriculum) (Porter, Smithson, Blank, & Zeidner, 2007) provided a methodology to enable teachers to achieve better alignment of curriculum with opportunities for all students.

Adding measures of student engagement can be done with a variety of measures stemming from the research on effective teaching. Measuring student engagement in classroom instruction has taken the forms of direct observation of student behavior at the individual student level. The Behavioral Observation of Students in Schools (BOSS) or, at the classroom level the Instructional Practices Inventory (IPI) are examples of instruments that have been validated as engagement measures.

However, these approaches require substantial investment of time and training in order to yield reliable data. (Fredericks, et. al., 2011). Kurtz (2011) observes that the use of such measures is ordinarily confined to "well-funded research projects." Most of the measures identified for the opportunity to learn framework of content, engagement and quality are confined to classroom level data. The opportunity to identify the relative equity experienced by groups of students formed by gender, family background, special needs for learning, race and language has therefore been limited to the more easily obtainable measures. The present study utilized a modified instrument originally developed for The More Effective Schools/Teaching Project Spencerport School Survey in 1994 (Meyers, et al, 1994).

Linking Effective Schools research and opportunities to learn research (Meyers, et al, 1994) provides a framework for professional learning interventions which characterize some of the Mathematics and Science Partnership (MSP) programs that seek to improve teaching practice and student achievement. Many of the MSP professional development courses and support activities provide both mathematics or science content as well as pedagogical practices intended to increase several of the practices and strategies measured by the More Effective Schools Teacher Survey. When integrated with the courses and mentoring for teachers supported by the MSP project, OTL survey results provide an opportunity for teachers to learn about how their instruction may affect students' opportunities to learn. It also provides an opportunity to observe how, over time, students' perceptions may change coincident with their teachers' participation in the MSP program. The knowledge that teachers may change their practices in response to student change in performance is at least partially grounded in the research on time on task by Stallings (1980).

Purpose

The purpose of the following narrative is to describe the development and study results of the pre and post measurement of opportunities to learn for students in a New England middle school participating in a U. S. Department of Education Mathematics and Science Partnership Program beginning in 2015. The MSP program as delivered to a small New England district by a Massachusetts university consists of thirty-three credit hours of study focused on mathematics content in number theory, algebra, geometry, calculus and statistics. The Master's degree course of study also includes two courses in meeting the needs of diverse learners and assessment. Data that teachers generate from their own assessments, state assessments and program evaluation including the OTL survey were integrated with the professional development curriculum.

The study of opportunities to learn supported by the survey sought to answer the following questions:

1. Could student perception of opportunities to learn mathematics be reliably measured by a student questionnaire?
2. What differences in opportunities to learn would be reported by groups of students formed by IEP status, eligibility for free or reduced lunch, and gender at the baseline year of 2015?

3. Will students who are taught by teachers participating in the MSP professional development intervention report significant changes in opportunities to learn after one year of instruction?
4. Will students who are taught by teachers who have enhanced their mathematics knowledge and pedagogy through a mathematics professional development program perform better on standardized tests coincident with their perception of enhanced opportunities to learn?

Methods

Participants. In June, 2015 the Student Learning Opportunities in Mathematics and Science Questionnaire, a 16 item scale, was administered to 454 students in grades 5 through 8 at a New England Middle School.

Evaluation Design and Instrument. The study was a quasi-experimental evaluation of the potential effects of the MSP professional development on the student perceived opportunities to learn and student performance on a standardized test of mathematics. Students were selected for intervention and control groups based on whether or not their teachers were participating in the first year of professional development; approximately fifty percent of the teachers participated in year 1 of the professional development program and their students made up the intervention group. The school population in grades five through eight present in school on the day of the survey (88%) participated in the Student Learning Opportunities in Mathematics and Science Questionnaire. The survey instrument was developed from items drawn from the More Effective Schools/Teaching Project Spencerport School Survey. (Meyers, et.al., 1994). In June of 2016, following a year of coursework in mathematics content and pedagogy for participating teachers, a second administration was given to all students for matching to the initial administration. A final administration of the survey occurred in May of 2017 following a second year of course work for participating teachers.

In addition to the measurement of opportunity to learn student mathematics performance was measured using scaled scores taken from the annual administration of the Massachusetts Comprehensive Assessment System (MCAS). Baseline measures of student mathematics performance on the Massachusetts Comprehensive Assessment System/Partnership for Assessment of Readiness for College and Careers (MCAS/PARCC) were obtained from the Massachusetts Department of Education in order to establish the equivalence of intervention and control groups. Each grade level tested in 2015 formed a cohort of students whose test scores were matched across the three-year period.

Data Collection Procedures. Student questionnaires were distributed by school staff during the week of May 17-25, 2015. Questionnaires were collected within about twenty minutes, returned to the office of the principal, and subsequently returned to the evaluator. Questionnaires were entered into a spreadsheet and exported to SPSS for analysis. The survey was re-administered to the same students during June, 2016 and again in 2017 with the same procedures followed. MCAS scores were obtained from a student level data file provided by the Massachusetts

Department of Education under procedures protecting student confidentiality and meeting Family Education Rights and Privacy (FERPA) standards.

Data Analysis Procedures. Evaluation question 1, concerning reliability was evaluated with internal consistency analysis (Cronbach alpha) coefficients for all items and the overall scale. Evaluation question 2, concerning group differences was evaluated by subjecting groups of OTL mean scores to analysis of variance. Likewise, MCAS scores for each grade cohort were matched by student and analyzed with paired t-tests (SPSS).

Results

1. *Response Rate.* All students (96% of students present on the day of the survey) responded to the survey of opportunity to learn mathematics and science resulting in a census survey of 88% of the school population.
2. *Findings.*
    a. Question 1: Could opportunities to learn mathematics be reliably measured by a student questionnaire? The reliability of the Student Learning Opportunities in Mathematics Questionnaire scale as measured by Cronbach's alpha is acceptable (total alpha= .86) for the standardized item coefficient. No items were rejected in the analysis.
    b. Question 2: What differences in opportunities to learn would be reported by groups of students formed by IEP status, eligibility for free or reduced lunch, and gender at the baseline year of 2015? The differences among groups are summarized below and described on the charts which follow. ("favored" means that the group had a higher, more positive favorability ranking) See Table 2, below.
        - There was a 14% gap between free or reduced lunch eligible students and non-eligible students which favored the non-eligible students.
        - There was an 8% gap between males and females which favored the females.
        - There was a 30% gap between high to moderate special needs students and other students which favored the other students.
        - There were gaps between perceptions of student groups that ranged from 0% (grades 5 v 7) to 14% (grades 5 v 8).
        - There were no significant gaps between groups of students taught by project-enrolled teachers and other teachers on any of the individual questions or the total scale at the baseline year.

Table 1
Baseline
Mean Values by Group
Student Learning Opportunities in Mathematics Questionnaire

Variable	Group	Mean Value
Free/Reduced Lunch*	Others	48
	Free + Reduced	45
Gender*	Male	46
	Female	48
MSP Intervention	Yes	46
	No	47
Grade*	5	48
	6	46
	7	48
	8	45
IEP*	High Need	37
	No Need	47
OTL Scale	Reliability Alpha	0.86
	Minimum	0
	Maximum	90
	Overall Mean	47
	Standard Deviation	9.6

* Significant Differences

- There are no significant differences between the intervention group (students taught by teachers who took the professional development courses), and the control group students taught by teachers who did not take the courses for the baseline year.
- There are significant differences between groups of students formed by grade (grades 5 and 7 are significantly more positive on the OTL scale than grade 8.) ($F=2.47$, $P<.04$).
- There are large significant differences between subgroups of high need Individualized Education Program (IEP) students and no need IEP students. High need students are far more negative on the OTL scale than no need students. The expectation from an equity perspective is that these gaps will narrow next year. ($F=4.25$, $P<.002$)
- There are small but significant differences between males and females; with females being more positive on the OTL scale than males. Again, from an

equity perspective it is expected that these gaps will narrow with both males and females indicating enhanced opportunity to learn. ($F=5.36$, $P<.02$)

There are fairly large and significant differences between free and reduced lunch eligible students and non-eligible students. This seems to signal opportunity for improving the opportunities to learn and possibly increasing achievement.

c. Question 3: Will students who are taught by teachers participating in the MSP professional development intervention report significant changes in opportunities to learn after two years of instruction? Testing these relationships after two years of program intervention revealed the following:

   The summary finding for the comparison of scores on the OTL scores from 2015 to 2017 was that overall, matched pairs of students who completed the OTL Questionnaire gained a significant amount of positive attitude about their opportunities to learn mathematics. The overall score for a group of matched pairs of 165 students who were tested in 2015 and again in 2017 increased from 47.42 to 49.34. This increase in positive attitude was statistically significant ($t=-2.28$, 164df, $p<.03$).

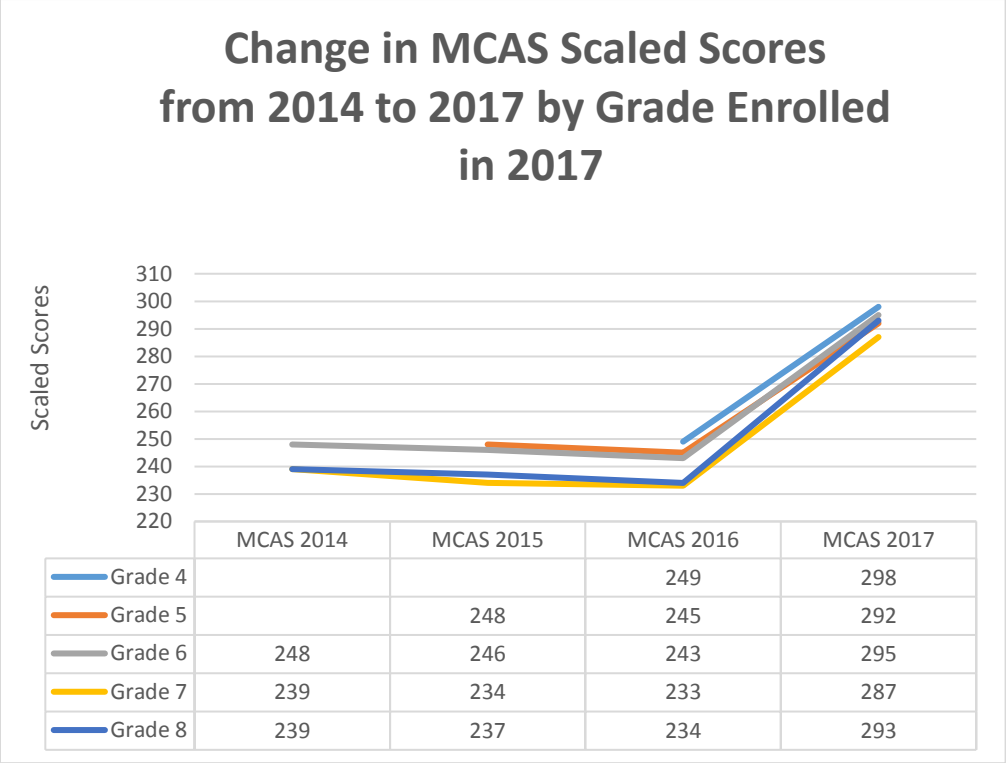
   The tables in the appendix indicate the mean differences from 2015 to 2017 on sixteen pairs of items. Six of the sixteen items significantly increased in value during this three-year span. These items included: (1) Preparation, (2) Time to Learn, (5) My Teacher Believes in Me, (7) I have access to a Computer when I need one, (9) My Teacher Returns Work and (10) I feel safe and comfortable in this room. All but three items increased in magnitude. Differences in pre and post for those three items were not statistically significant.

   In addition to changes in overall OTL scores for all students from 2015 to 2017 scores on individual items for groups of students formed by gender, income status (free or reduced lunch eligibility) and special needs eligibility were also disaggregated. With respect to gender, females, while generally scoring higher than males, increased their positive views of teachers asking about work and feeling safe in the classroom. Males generally scored lower than females but increased their scores on all of the scales related to teachers asking about work, safety, talking with family about school, real world application of math and expecting to earn a higher level of education. Perhaps the most noteworthy finding of the changes in scores for low income students was that they significantly increased their scores on scales related to completing homework, understanding new material and family expectations. At the same time, the gaps between low income students and their peers while closing were still significant. Students eligible for IEP's reported that their teachers enabled them to work on class projects more in 2017 than in 2015. Similar gains were made in IEP students' perceptions of the importance of their courses, their teachers' interest in them, understanding of new reading material and their expectations for completing higher levels of education. Gaps appeared to be narrowing but not as much as the gaps appear to have narrowed for low income students.

d. Question 4: Will students who are taught by teachers who have enhanced opportunities to learn through a mathematics professional development program perform better on standardized tests coincident with their perception of enhanced opportunities to learn?

- There were no statistically significant differences between groups of MCAS scores obtained for each grade level cohort prior to the baseline OTL measurement year and the 2017 MCAS testing. However, there were statistically significant differences observed between groups of scaled scores formed by test year for each grade level cohort between grades 3 and 8 for the years 2016 and 2017. Mean differences in student performance ranged between 47.40 to 58.99 across the 5 cohort groups. All scaled score differences between 2016 and 2017 were statistically significant at p<.01. Tables with values for each cohort including mean differences and significance levels are presented in the Appendix. See Chart 1, below:

Chart 1
Scaled MCAS Scores for Grade Level Cohorts
from 2014 through 2017



	MCAS 2014	MCAS 2015	MCAS 2016	MCAS 2017
Grade 4			249	298
Grade 5		248	245	292
Grade 6	248	246	243	295
Grade 7	239	234	233	287
Grade 8	239	237	234	293

- Note: Students in Grade 4 in 2017 were tested with the MCAS at Grade 3 in 2016. Each grade cohort was measured with the Student Opportunity to Learn Mathematics Questionnaire in the spring of 2015 and again in the spring of 2016 and 2017. All score increases from 2016 to 2017 were statistically significant (P<.01). See Appendix.

Discussion

The measurement of opportunity to learn provided a baseline of student response, prior to intervention, which will enable an estimate of the extent to which opportunity to learn mathematics increases as teachers learn new mathematics content and methods. Specifically, the gaps revealed in the baseline assessment indicate that there was adequate room for improvement in opportunity to learn as reported by students of different economic background, genders, IEP status and grades. While the total scores for the questionnaire signalled overall perceived OTL differences it was really the more specific questions concerning each opportunity to learn measure that provided an indication of specific actions which may be taken. For example, in the case of free and reduced lunch group differences, increasing homework completion, understanding of new material and family expectations for free lunch eligible students could increase opportunity to learn for them as well as other students.

In recent literature, there is considerable evidence that when students experience and express feelings of self- efficacy and when they are provided with opportunity to learn that is equal or exceeds that of their peers they will learn and perform in ways that mitigate the learning gaps that have historically plagued American schools (Yeh, 2105). This study provided additional evidence that not only can teachers provide equity in opportunity to learn but that students will respond with significant and important gains in performance.

A principle of good evaluation that supports the use of data in program implementation is the triangulation of multiple measures of both interventions and outcomes. Each measure can provide a lens with which to see opportunities for change. Each dimension of the project can provide the basis for developing new strategies by which to create a synergy of intervention that can broaden and deepen the efforts made on behalf of all students. Because each school, each classroom and each student have both similar and unique characteristics to be addressed by teachers it becomes necessary to have an array of strategies that can be selected from a repertoire. Opportunities to learn were identified in the mix of characteristics that were common to effective schools, effective classrooms and effective teachers. When asked, students can provide teachers, principals and parents with guidance about how to help them learn better. We should ask students about their opportunities to learn and respond to their needs.

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Appendix Tables and Charts

Question 1: Could opportunities to learn mathematics be reliably measured by a student questionnaire?

The attached Table 1, (far right column) indicates the consistency in alpha coefficients across all items. Findings for the assessment of questionnaire reliability and baseline of student responses for year 1 (2014-15) are indicated in Table 1,below.

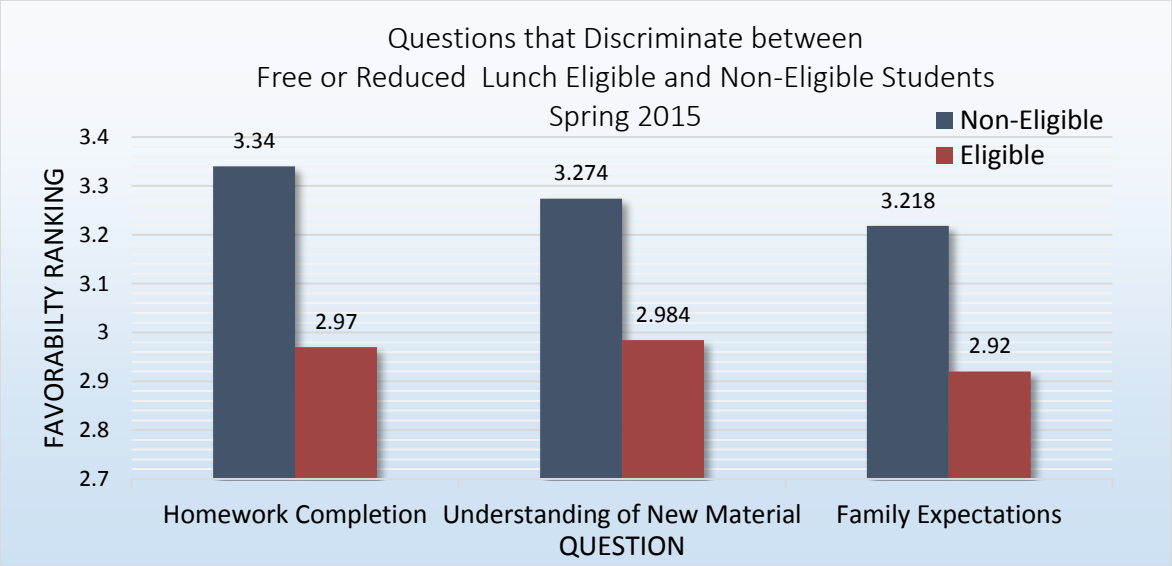
Table 2
Item-Total Statistics
Student Opportunity to Learn Mathematics Questionnaire

	Scale Mean if Item Deleted	Scale Variance if Item Deleted	Corrected Item-Total Correlation	Squared Multiple Correlation	Cronbach's Alpha if Item Deleted
Question 1	41.709	77.686	.588	.427	.808
Question 2	43.387	84.464	.128	.079	.828
Question 3	41.721	77.735	.488	.304	.812
Question 4	42.708	77.925	.369	.188	.818
Question 5	41.500	76.409	.644	.522	.805
Question 6	41.686	74.506	.334	.153	.827
Question 7	42.947	80.681	.247	.098	.825
Question 8	41.792	77.022	.584	.470	.808
Question 9	41.712	76.437	.593	.508	.807
Question 10	41.811	75.183	.621	.433	.804
Question 11	42.654	76.543	.487	.368	.811
Question 12	41.816	75.719	.562	.422	.807
Question 13	41.670	76.448	.626	.451	.806
Question 14	42.448	73.652	.244	.087	.847
Question 15	42.088	75.643	.569	.380	.807
Question 16	41.989	76.975	.486	.288	.811

Cronbach's Alpha Based on Standardized Items	N of Items
.857	16

Question 2: What differences in opportunities to learn would be reported by groups of students formed by IEP status, eligibility for free or reduced lunch, and gender at the baseline year of 2015?

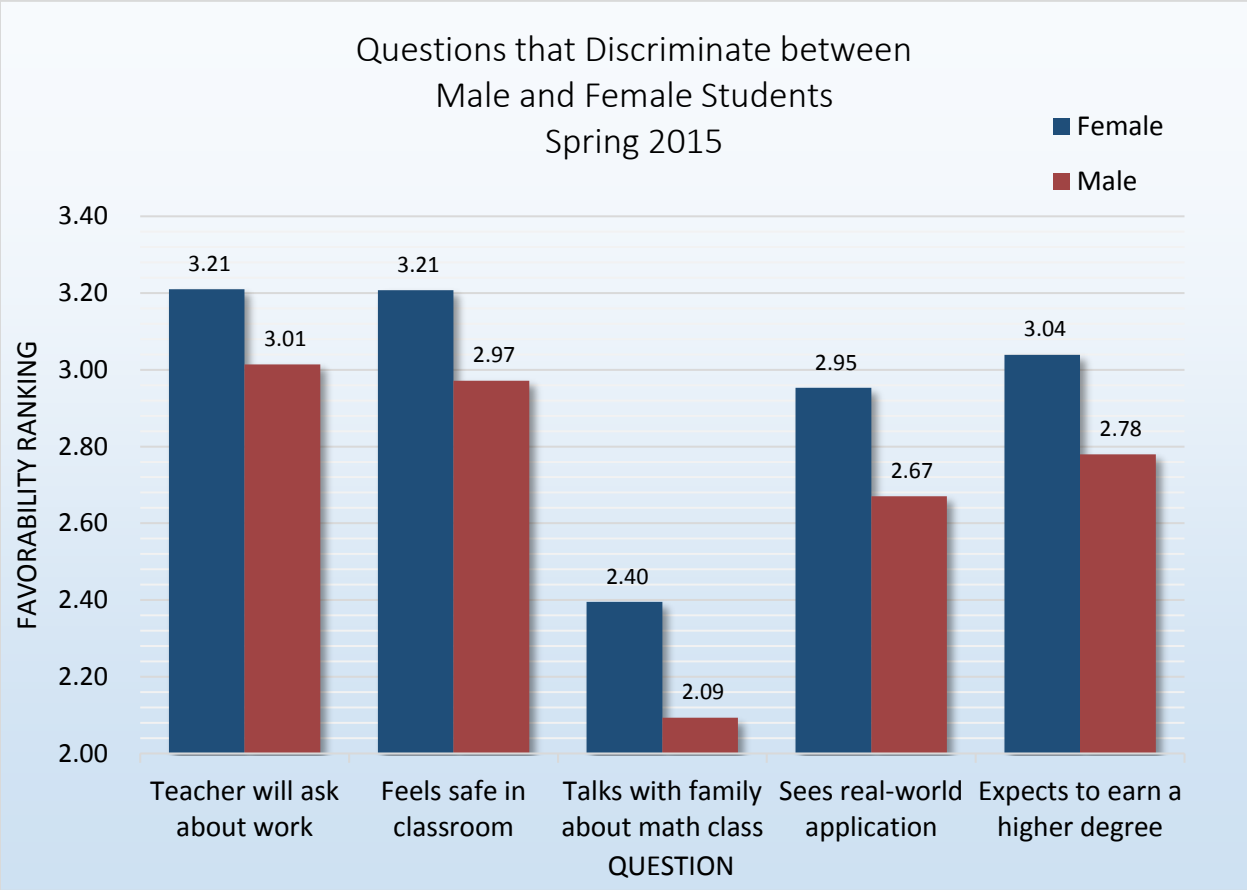
Chart 2
Questions that Discriminate between Free or Reduced Eligible and Non-Eligible Students



Free or Reduced Lunch Gap Analysis Significant and substantial differences included:

3. I usually come to class with my homework completed from the last class.
6. When my teacher is teaching new math lessons, I understand what he/she is teaching.
12. At least one member of my family is interested in how I am doing in math.

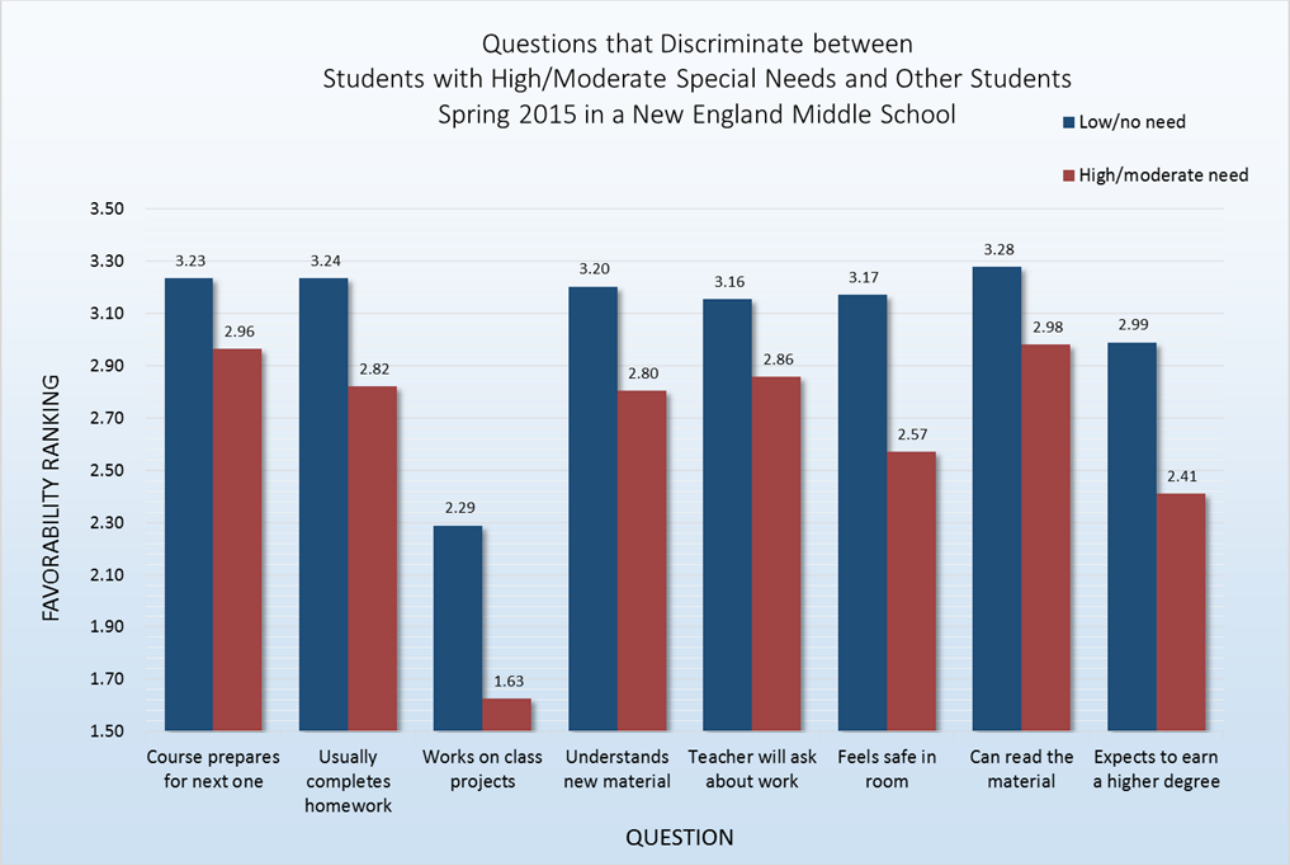
Chart 3
Questions that Discriminate between Male and Female Students



Gender Gap Analysis. Several questions that produced significant differences:

8. When I am working on math in class I know that my teacher will be asking me questions about my work.
10. When I am working on math in class I feel safe and comfortable in this room.
11. When I am at home after school I talk with at least one family member about my day in math.
15. The math we are using in my math class is also used outside of class in the "real world".
16. How much education do you think you will complete?

Chart 3
Questions that Discriminate between Students with High/Moderate Special Needs and Other Students
Spring 2015



Special Needs Gap Analysis.

Special needs gaps are among the widest and most extensive gaps of opportunity to learn. Eight of the OTL questions discriminated between students with moderate to high needs and low need students. About twelve percent of the middle school students were identified as moderate to high need. The following questions statistically discriminated between those two groups:

1. My current (math) course is preparing me for the next course in math I will take.
3. I usually come to class with my homework completed from the last class.
4. When I think about what happens in my (math) class I am usually working on a class project.
6. When my teacher is teaching new math lessons I understand what he/she is teaching.
8. When I am working on math in class I know that my teacher will be asking me questions about my work.
10. When I am working on math in class I feel safe and comfortable in this room.
13. I can read the math materials we are using in math class.
16. How much education do you think you will complete?

Question 3: Will students who are taught by teachers participating in the MSP professional development intervention report significant changes in opportunities to learn after one year of instruction?

Table 3
Paired Samples Test for Total Scale OTL
from 2015 to 2017

		Mean	N	Std. Deviation
Pair 1	OTL 2015	47.4242	165	10.03722
	OTL 2017	49.3424	165	6.83557

Paired Samples Test of Significance

PAIR	Paired Differences		t	df	Sig. (2-tailed)
	Mean	Std. Deviation			
OTL 2015 – OTL 2017	1.91818	10.83106	-2.275	164	.024

Table 4
Paired Samples Test for Individual Items on the OTL Scale from 2015 to 2017

	Year and Question	Mean	N	Std. Deviation
Pair 1	2015Q1	3.235	166	.8522
Preparation	2017Q1	3.43	166	.663
Pair 2	2015Q2	3.458	166	.8917
Time to Learn	2017Q2	3.648	166	.5701
Pair 3	2015Q3	3.27	166	.973
Homework Completed	2017Q3	3.19	166	.873
Pair 4	2015Q4	2.25	166	1.162
Class Project	2017Q4	2.223	166	.9104
Pair 5	2015Q5	3.35	166	.852
Teacher Believes in Me	2017Q5	3.66	166	.600
Pair 6	2015Q6	3.178	166	.9079
I Understand Math	2017Q6	3.211	166	.7770
Pair 7	2015Q7	1.840	166	.9909
I have access to Computer	2017Q7	2.48	166	.932
Pair 8	2015Q8	3.20	166	.929
Class Participation	2017Q8	3.25	166	.639
Pair 9	2015Q9	3.12	166	.920
Teacher Returns Work	2017Q9	3.47	166	.610
Pair 10	2015Q10	3.102	166	.9638
Safe and Comfortable	2017Q10	3.367	166	.7409
Pair 11	2015Q11	2.385	165	1.0843
Family Supports 1	2017Q11	2.352	165	.9227
Pair 12	2015Q12	3.160	166	1.0474

Family Supports 2	2017Q12	3.283	166	.8728
Pair 13	2015Q13	3.331	166	.9038
I Can Read Math	2017Q13	3.380	166	.6656
Pair 14	2015Q14	2.590	166	3.1834
My Class is Good	2017Q14	2.37	166	.910
Pair 15	2015Q15	3.000	166	1.0030
Math Class is Real World	2017Q15	2.922	166	.9276
Pair 16	2015Q16	2.958	166	1.0349
High Expectations	2017Q16	3.114	166	.8628

Paired Samples of Test of Significance

Year and Question		Mean	STD. Dev.	df	Sig. (2-tailed)
Pair 1	2015Q1 - 2017Q1	-.1928	1.0145	165	.015
Pair 2	2015Q2 - 2017Q2	-.1898	1.0159	165	.017
Pair 3	2015Q3 - 2017Q3	.072	1.120	165	.407
Pair 4	2015Q4 - 2017Q4	.0241	1.3392	165	.817
Pair 5	2015Q5 - 2017Q5	-.307	.983	165	.000
Pair 6	2015Q6 - 2017Q6	-.0331	1.0242	165	.677
Pair 7	2015Q7 - 2017Q7	-.6416	1.3793	165	.000
Pair 8	2015Q8 - 2017Q8	-.054	1.023	165	.495
Pair 9	2015Q9 - 2017Q9	-.349	1.072	165	.000
Pair 10	2015Q10 - 2017Q10	-.2651	1.0396	165	.001
Pair 11	2015Q11 - 2017Q11	.0333	1.1073	164	.699
Pair 12	2015Q12 - 2017Q12	-.1235	1.0695	165	.139
Pair 13	2015Q13 - 2017Q13	-.0482	1.0491	165	.555
Pair 14	2015Q14 - 2017Q14	.2229	3.2518	165	.378
Pair 15	2015Q15 - 2017Q15	.0783	1.1651	165	.388
Pair 16	2015Q16 - 2017Q16	-.1566	1.2932	165	.121

Disaggregating 2015 and 2017 OTL results according to the variables of gender, low-income status and IEP status revealed the following:

Chart 4

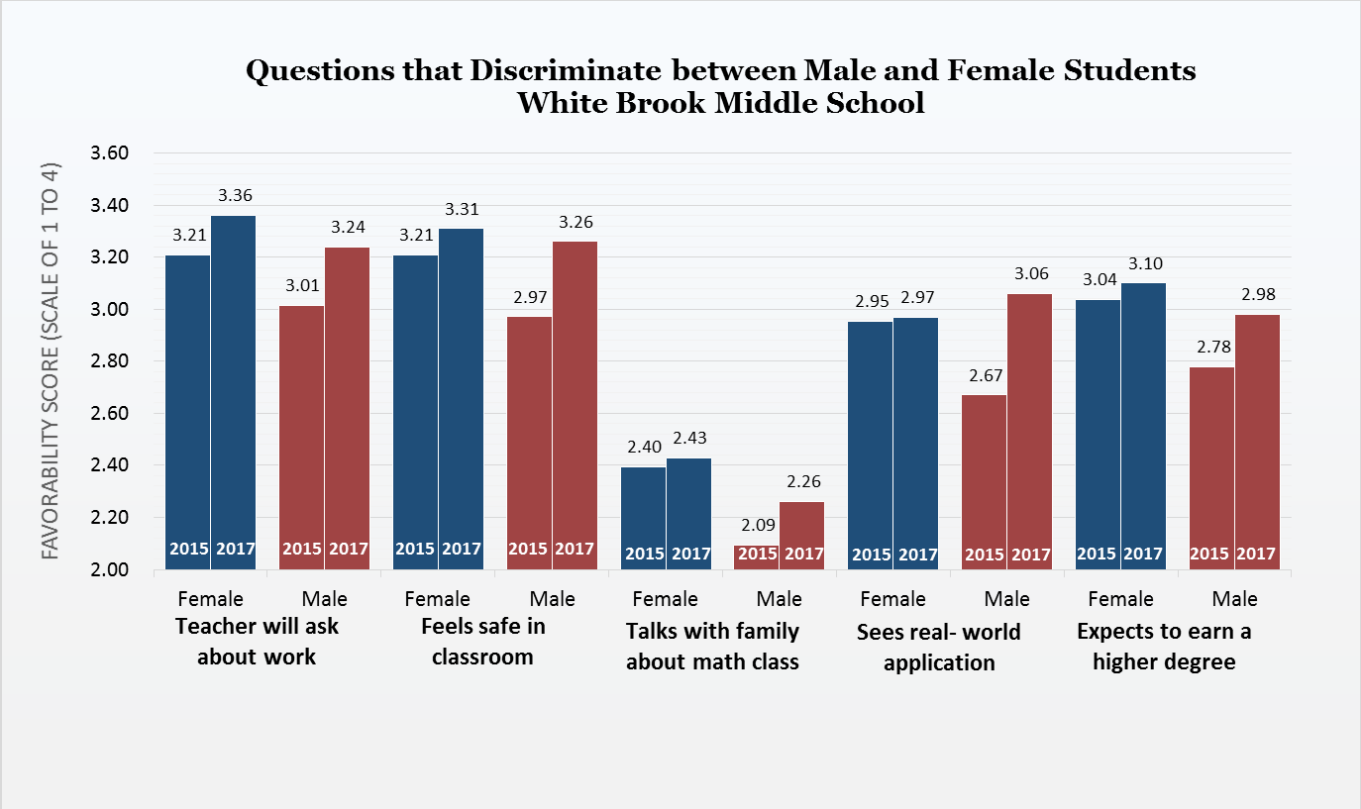


Chart 5

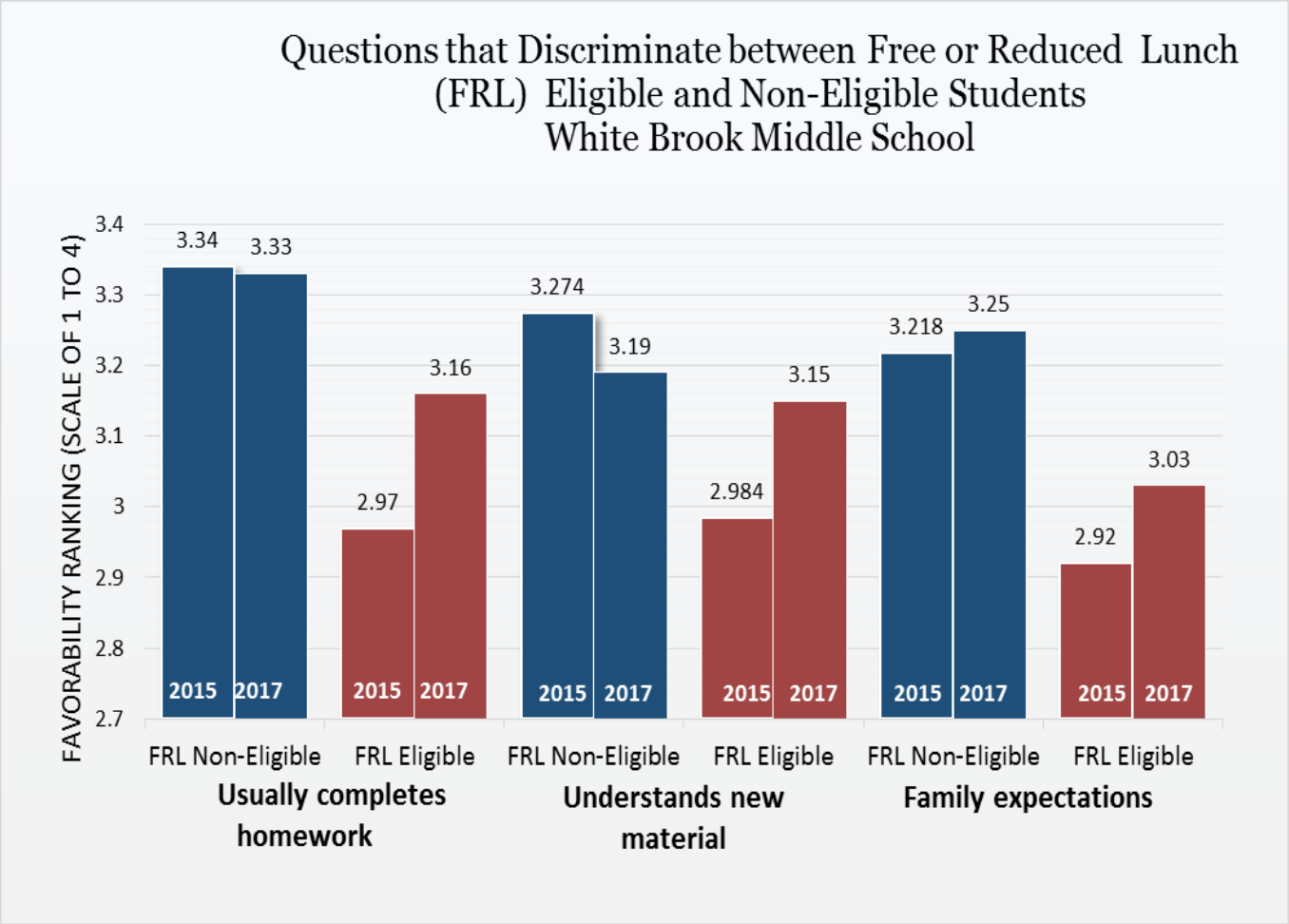
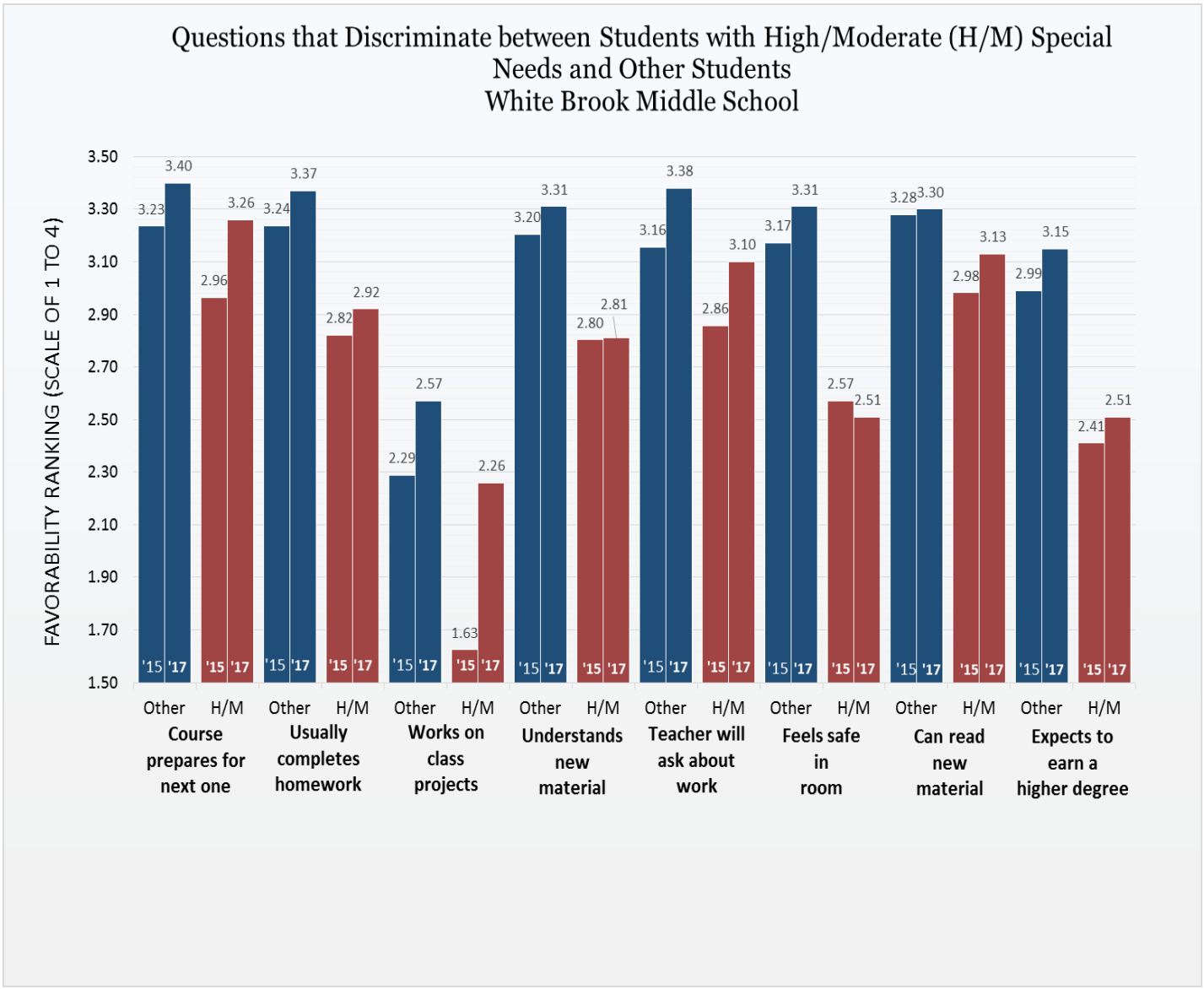

Questions that Discriminate between Free or Reduced Lunch (FRL) Eligible and Non-Eligible Students
White Brook Middle School
FAVORABILITY RANKING (SCALE OF 1 TO 4)
3.4
3.3
3.2
3.1
3
2.9
2.8
2.7
3.34
3.33
2.97
3.16
3.274
3.19
2.984
3.15
3.218
3.25
2.92
3.03
2015
2017
FRL Non-Eligible
FRL Eligible
Usually completes homework
Understands new material
Family expectations

Chart 6


Questions that Discriminate between Students with High/Moderate (H/M) Special Needs and Other Students
White Brook Middle School
FAVORABILITY RANKING (SCALE OF 1 TO 4)
3.50
3.30
3.10
2.90
2.70
2.50
2.30
2.10
1.90
1.70
1.50
3.23
3.40
2.96
3.26
3.24
3.37
2.82
2.92
2.29
2.57
1.63
2.26
3.20
3.31
2.80
2.81
3.16
3.38
2.86
3.10
3.17
3.31
2.57
2.51
3.28
3.30
2.98
3.13
2.99
3.15
2.41
2.51
'15 '17
Other H/M
Course prepares for next one
Usually completes homework
Works on class projects
Understands new material
Teacher will ask about work
Feels safe in room
Can read new material
Expects to earn a higher degree

Question 4: Will students who are taught by teachers who have enhanced opportunities to learn through a mathematics professional development program perform better on standardized tests coincident with their perception of enhanced opportunities to learn?

Table 5
Cohort Comparisons of MCAS Scaled Scores
Grades 4 through 8
2015 – 2017

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 3	mscaleds2016	248.86	119	18.315	1.679
	Mscaleds2017	297.7563	119	21.06888	1.93138

a. grade = 4

Paired Samples Test[a]

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 3	mscaleds2016 – mscaleds2017	-48.89916	13.19309	1.20941	-40.432	118	0.000

a. grade = 4

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 2	mscaleds2015	247.59	98	18.476	1.866
	mscaleds2016	244.86	98	18.939	1.913
Pair 3	mscaleds2016	244.93	101	18.765	1.867
	Mscaleds2017	292.3366	101	18.72874	1.86358

a. grade = 5

Paired Samples Test[a]

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 2	mscaleds2015 - mscaleds2016	2.735	11.503	1.162	2.353	97	0.021
Pair 3	mscaleds2016 – mscaleds2017	-47.40594	11.90309	1.18440	-40.025	100	0.000

a. grade = 5

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	mscaleds2014	247.68	94	15.342	1.582
	mscaleds2015	246.13	94	13.949	1.439
Pair 2	mscaleds2015	246.44	95	13.955	1.432
	mscaleds2016	243.33	95	16.491	1.692
Pair 3	mscaleds2016	243.33	95	16.491	1.692
	Mscaleds2017	295.0632	95	17.97564	1.84426

a. grade = 6

Paired Samples Test[a]

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	mscaleds2014 - mscaleds2015	1.553	10.165	1.048	1.481	93	0.142
Pair 2	mscaleds2015 - mscaleds2016	3.116	9.909	1.017	3.065	94	0.003
Pair 3	mscaleds2016 – mscaleds2017	-51.73684	9.67252	0.99238	-52.134	94	0.000

a. grade = 6

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	mscaleds2014	239.26	119	16.067	1.473
	mscaleds2015	234.29	119	15.869	1.455
Pair 2	mscaleds2015	234.42	119	16.183	1.483
	mscaleds2016	233.55	119	16.144	1.480
Pair 3	mscaleds2016	233.37	121	16.314	1.483
	Mscaleds2017	287.1240	121	17.06242	1.55113

a. grade = 7

Paired Samples Test[a]

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	mscaleds2014 - mscaleds2015	4.975	9.780	0.897	5.549	118	0.000
Pair 2	mscaleds2015 - mscaleds2016	0.874	9.022	0.827	1.057	118	0.293
Pair 3	mscaleds2016 – mscaleds2017	-53.75207	10.72091	0.97463	-55.151	120	0.000

a. grade = 7

Paired Samples Statistics[a]

		Mean	N	Std. Deviation	Std. Error Mean
Pair 1	mscaleds2014	238.82	97	18.366	1.865
	mscaleds2015	236.91	97	17.098	1.736
Pair 2	mscaleds2015	236.95	101	17.269	1.718
	mscaleds2016	234.16	101	19.045	1.895
Pair 3	mscaleds2016	233.73	104	18.974	1.861
	Mscaleds2017	292.7212	104	20.57780	2.01782

a. grade = 8

Paired Samples Test[a]

		Paired Differences			t	df	Sig. (2-tailed)
		Mean	Std. Deviation	Std. Error Mean			
Pair 1	mscaleds2014 - mscaleds2015	1.918	8.509	0.864	2.219	96	0.029
Pair 2	mscaleds2015 - mscaleds2016	2.792	9.415	0.937	2.980	100	0.004
Pair 3	mscaleds2016 – mscaleds2017	-58.99038	10.96818	1.07552	-54.848	103	0.000

a. grade = 8

Student Learning Opportunities in Mathematics Questionnaire

Please Circle your choice below each question:

1. My current (math) course is preparing me for the next course in math I will take.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

2. When I arrive at math class we usually get started on our work within…

5 Minutes	10 Minutes	20 Minutes	40 Minutes
4	3	2	1

3. I usually come to class with my homework completed from the last class.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

4. When I think about what happens in my (math) class I am usually working on a class project….

50% of the Time	30% of the Time	10% of the Time	None of the Time
4	3	2	1

5. My teacher in math believes that I can learn the math we are studying.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

6. When my teacher is teaching new math lessons I understand what he/she is teaching.

All of the Time	Half of the Time	25% of the Time	None of the Time
4	3	2	1

7. When I need to use a computer to work on a class project I can use one right away.

I don't use a computer	I sometimes have to wait for a computer	I can use a computer in a special room at school	I have a computer whenever I want one
1	2	3	4

8. When I am working on math in class I know that my teacher will be asking me questions about my work.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

9. When I am working on math in class I know that my teacher will collect and return the work of all students in my class.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

10. When I am working on math in class I feel safe and comfortable in this room.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

11. When I am at home after school I talk with at least one family member about my day in math.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

12. At least one member of my family is interested in how I am doing in math.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

13. I can read the math materials we are using in math class.

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

14. When I talk with other students in other math classes I learn that my math class is compares with others:

Not as Good As	As Good As	A little Better Than	A Lot Better Than
1	2	3	4

15. The math we are using in my math class is also used outside of class in the “real world”

Strongly Disagree	Disagree	Agree	Strongly Agree
1	2	3	4

16. How much education do you think you will complete?

I don’t know	I will complete high school	I will go to college	I will go to graduate school
1	2	3	4