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Black and White advanced math students leave high school with disparate math skills. One possible explanation is that minority students are exposed to different learning opportunities, even when they are taking classes with the same title. Using a convenience sample of the Mathematics Survey of the Enacted Curriculum (SEC), this study found that math teachers in classrooms with a minority racial composition spend their instructional time emphasizing different topics and instructional tasks than teachers in classrooms that have a predominately White racial composition. Racial differences continue to exist when school socioeconomic level and teacher-reported classroom achievement level are included. Students in classrooms with minority racial compositions have different learning opportunities compared to those of their peers, which may explain racial differences in returns to advanced math course-taking.

Research continues to show that Black students have lower achievement levels than their White peers (Jencks & Phillips, 1998; Magnuson & Waldfogel, 2008). In examining the Black–White test score gap of high school students, Berends, Lucas, and Penaloza (2008) showed that the achievement gap between Black and White students in mathematics narrowed from the 1970s to the 1990s. However, the gap has remained steady since the early 1990s, with Black high school students continuing to have significantly lower math test scores than those of their White peers (Berends et al., 2008). One explanation for the continued achievement gap has focused on unequal opportunities to learn (i.e., specific situations that cultivate learning) as provided through school organizational factors, such as the types of courses students take (Lleras, 2008; Riegle-Crumb & Grodsky, 2010). However, few studies have examined the organization of the learning environment—the high school classroom.

Opportunities to learn (OTL) is a concept that has been used in a number of important studies. The National Research Council (2004) defined OTL as the "extent of coverage of curricular material" (p. 6). My use of OTL is broader. It is derived from the work of Sorensen and Hallinan's (1977) model of learning, where they define OTL as exposure to school activities such as the classroom, textbooks, teachers (behaviors and methods), curriculum, and time spent on teaching. In other research, OTL has been measured as teacher quality/characteristics (Covay Minor, Desimone, Phillips, & Spencer, 2015; Flores, 2007), course taking (Flores, 2007), whole class math instruction (Jackson, Garrison, Wilson, Gibbons, & Shahan, 2013),

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content in textbooks (Schiller, Schmidt, Muller, & Houang, 2010; Thompson, Senk, & Johnson, 2012), coverage of math topics, use of testing in math, and time spent on math (Covay Minor et al., 2015). Like other research on OTL, this article examines student experiences within the classroom (Covay Minor et al., 2015; Flores, 2007; Jackson et al., 2013; Sorensen & Hallinan, 1977). However, this article uses a more nuanced measure of the content that teachers cover in their classrooms and the instructional tasks that the teachers use to cover that content.

This study complements and expands the current research by examining the structure of students' OTL within the classroom for classes at the same level within the high school setting. Rather than focusing on student course-taking, this study goes a level deeper and examines the content to which students are exposed in their high school math classes as a measure of OTL. Courses with the same title give the appearance of similar learning opportunities; however, in practice there may be racial differences in OTL for students. Researchers will not know if racial differences exist for OTL unless they look at content for classes with the same titles.

More specifically, this study focuses on differences in content and instruction within upper-level courses in high school for multiple reasons. First, in the past 20 years, more and more high school students have enrolled in upper-level courses (National Science Board, 2008). Because taking and completing upper-level courses offers the greatest opportunities to build academic skills (e.g., Bozick, Ingels, & Owings, 2008; Catsambis, 1994; Gamoran, 1987; Gamoran & Hannigan, 2000), theoretically increases in upper-level math course-taking should reduce inequality by increasing students' exposure to advanced academic learning opportunities. Second, Riegle-Crumb and Grodsky (2010) found that the achievement gap was larger among upper-level math students than among students who took less demanding courses, suggesting that upper-level courses have more inequality than lower-level courses.

Finally, Larnell (2011) found evidence of the importance of high school math experiences for college math experiences. In his qualitative study of college math remediation courses, he found students who completed upper-level high school math courses such as calculus, precalculus, and trigonometry, but scored low on their college math placement test and were then placed in a remedial college math course. In other words, taking upper-level math courses in high school does not necessarily prepare students for college math. Taking remedial math in college is an important gate-keeper course for continuation into additional math courses in college (Larnell, 2011) and Black students are disproportionately in remedial college math courses (Attewell, Lavin, Domina, & Levey, 2006). If there are racial differences in exposure to OTL in upper-level high school math courses, this could help explain why students with upper-level math course-taking score low enough to be placed in remedial college math, especially Black students.

Examining the content and instruction to which students are exposed is a powerful mechanism for understanding what accounts for educational inequalities in skill levels and achievement scores in high school. Yet, there has been a noticeable lack of current sociological research on content and instruction as a mechanism to explain inequality (McEneaney & Meyer, 2000). This study measures the content and instruction in terms of which topics are covered, what instructional tasks students are asked to do (i.e., the demands of the task or operations needed to generate a product; see Doyle, 1983), and how much time is spent on various topics and tasks. Having a fuller understanding of how teachers organize their classroom learning environment through the specifics of content and instruction will help researchers and policymakers address sites of inequality in education and focus intervention in the appropriate places (Crosnoe & Schneider, 2010).

INEQUALITY IN COURSE-TAKING

A longstanding research tradition finds that students in academic or advanced curricular tracks have greater OTL than students in general or vocational curricular tracks (e.g., Carbonaro, 2005; Gamoran, 1987; Oakes, 1985). Access to course-taking is one explanation for racial differences in achievement. Research shows that Black students do not have equal access to course-taking (Catsambis, 1994; Kelly, 2009; Lleras, 2008; National Science Board, 2008; Riegle-Crumb & Grodsky, 2010). Catsambis showed that minority students in the eighth grade were overrepresented in lower-level math courses, which is consistent with work by Lleras. Additionally, Black students are less likely to have taken upper-level math courses as of their sophomore and senior years of high school, compared to White students (Kelly, 2009; Lleras, 2008; Riegle-Crumb & Grodsky, 2010). By the end of students' high school careers, 48% of Black students have taken upper-level math courses during high school, compared to 55% of White students (Riegle-Crumb & Grodsky, 2010).

Other evidence suggests that race and ethnicity are not strongly associated with upper-level course-taking. Once additional background characteristics are included, Black students are no longer less likely to take upper-level courses (Lleras, 2008). Kelly (2009) found that if Black and White students have the same background characteristics such as prior achievement and socioeconomic status (SES), Black students are not less likely than White students to be in upper-level courses. Yet, Black and White students do not have the same background characteristics, which means that most Black students do not have the same access to upper-level math course-taking.

Even when Black students are able to overcome the hurdle of access to upper-level math classes, this does not mean that learning opportunities are equal. Black students and White students do not build the same math skills from taking upper-level math courses; Black students benefit less than their White peers (Riegle-Crumb & Grodsky, 2010). One reason Black students receive fewer returns from upper-level math courses may be that they are exposed to different organizations of the learning environment through content and instruction. In other words, there may be differences in students' exposure to OTL.

Efforts have been made to homogenize student opportunity to learn through measures such as the establishment of academic standards so that, theoretically, what occurs in classrooms with the same title should not vary by the racial composition of the classroom. However, instructional standards do not ensure that all teachers are implementing the standards in the same manner (e.g., Porter, 1991; Spillane & Burch, 2006; Stecher, Hamilton, & Gonzalez, 2004). Although states prescribe the particular content that should be taught, there is variation at the classroom level in terms of emphasis on particular standards over others (Sandholtz, Ogawa, & Scribner, 2004), thus ensuring that academic standards may not be sufficient to reduce educational inequality in the classroom (Rowan, Correnti, Miller, & Camburn, 2009).

The localized school and classroom contexts influence how instruction is implemented (Diamond & Spillane, 2004). Classrooms are dynamic systems that involve teachers responding to the needs and abilities of their students (Grossman & Stodolsky, 1994). Teachers have the final say on what happens in the classroom, and there is considerable variation in the amount of time spent on various topics within classrooms. Teachers emphasize some topics more than others, and that emphasis is not consistent across teachers (Schmidt & McKnight, 2012). To understand inequality in exposure to OTL, the classroom should be examined within and across teachers. By examining the variation in the structure of the learning environment within and between classrooms, one will gain a deeper understanding of the extent of differences in exposure to OTL and the factors related to those differences.

A reason that Black and White students do not receive the same exposure to course content despite being enrolled in courses with the same title may be prior student achievement. Classroom instruction varies by the ability level of the students in the class (Hoffer, Moore, Quinn, & Suter, 1996; Smerdon, Burkham, & Lee, 1999) with students in lower-ability classes receiving less demanding instructional tasks (Hoffer et al., 1996). Therefore, teachers of upper-level math courses may adjust their instruction based on the ability level of their particular students—explaining the possible instructional differences by racial composition of the classroom. Because race and achievement are associated, it is important to see if content coverage differences are correlated with race separate from ability.

ORGANIZATION OF THE LEARNING ENVIRONMENT

Despite the appearance of equality of educational opportunity through course labels, there may be vast inequalities in the organization of the learning environment within the classroom, due to differences in content and instructional tasks. Although students may take courses with the same title (e.g., "Algebra II" or "Precalculus"), they may not be receiving the same content, same instruction, or both (Dougherty, Mellor, & Jian, 2006; Larnell, 2011; Schmidt & McKnight, 2012), because instruction is the translation of content into practice within the social context of the classroom (Schwille et al., 1983). Teachers are confronted with instructional choices related to the classroom context (Porter, 2002; Schmidt & McKnight, 1995), and teachers make adjustments to their courses because of the classroom context (Buckley, 2010; Doyle, 1983).

Over 30 years ago, Barr and Dreeben (1983) examined content as a measure of students' OTL and showed that the content covered in elementary classrooms is strongly related to student learning. For students to learn specific content, they must be exposed to that content (Schmidt & McKnight, 2012; Wang, 1998). As students experience more instructional time on content, their scores have been shown to increase (Aguirre-Munoz & Boscardin, 2008; Wang, 1998). However, there is considerable variation in the topics that teachers cover within their math classrooms and in the time spent on those topics. If students are not exposed to the same topics or at least to the same extent, students may not have the same OTL those topics (Schmidt & McKnight, 2012).

Although Barr and Dreeben (1983) provided a focus on instruction as the most immediate source of OTL, little recent sociological research examines action within the classroom level, especially at the high school level. A recent exception to this lack of examination of the high school classroom is the work of Schiller et al. (2010). They measured content exposure using high school mathematics textbooks and showed racial differences in textbooks used in high school math classes.

Although using textbooks gives us an idea of differences in potential content exposure, it is also important to examine the instructional tasks asked of students (Doyle, 1983). The intended curriculum from the textbooks may not be reflected in the enacted curriculum (Tarr, Grouws, Chavez, & Soria, 2013). Instructional tasks include asking students to perform tasks that use skills such as memorization, performing procedures, reasoning, and problem solving (Loveless, 2001; Schmidt & McKnight, 2012; Spillane & Zeuli, 1999). Often instructional tasks, which are a combination of both the features of the tasks and the cognitive demand of the task (Henningsen & Stein, 1997), are divided into two categories: procedural or traditional and conceptual or reform-oriented (Loveless, 2001). Procedural instruction includes tasks such as memorization and performing routine procedures (Loveless, 2001; Spillane & Zeuli, 1999). Essentially, procedural instruction involves asking students to perform tasks that involve practicing various mathematical rules (Loveless, 2001). These instructional tasks are less cognitively demanding of students than conceptual instructional tasks.

Conceptual instruction includes conjecture, problem-solving in multiple ways, reasoning, inquiry, sense-making, and inferences (Doyle, 1983; Loveless, 2001; Spillane & Zeuli, 1999). The goal of using conceptual instructional tasks is to help students to understand the underlying mathematical concepts and develop mathematical reasoning skills (Loveless, 2001). Past research has found that instruction that focuses on conceptual instructional tasks, such as conjecture or generalization, requires students to use higher-order thinking skills (Newman, 1991), which is related to increased student achievement (D. Cohen & Hill, 2000; Gamoran, Porter, Smithson, & White, 1997; Wenglinsky, 2002, 2003). Students learn more when more instructional time is spent on demanding instructional tasks (Gamoran et al., 1997).

INEQUALITY IN THE ORGANIZATION OF THE LEARNING ENVIRONMENT

The combination of content and instruction provides a rich measure of the organization of the learning environment as enacted by the teacher (Porter, 2004). One would not expect significant differences by race in the instructional time spent on topics such as trigonometry in teaching trigonometry or in the amount of instructional time spent on analysis in calculus class. Yet, prior research finds that Black and White students do not receive the same content and instruction (e.g., Darling-Hammond, 2004; Diamond, 2007; Lubienski, 2002; for recent research with mixed findings see Covay Minor et al., 2015). For example, Lubienski (2002) showed that Black students are more likely to say that math is about memorizing and finding the one way to solve a math problem, which suggests that Black students are being exposed to more procedural instruction and the lower level of instructional tasks.

As the aforementioned research shows, considerable research focuses on race differences in exposure to OTL. However, some may argue that the racial differences that researchers see in exposure to content and instruction are related to income differences, rather than race. Fryer and Levitt (2004) found that the Black–White achievement gap in early elementary school can be explained by a limited number of background characteristics including SES, so some may argue that racial differences in OTL is similar. Indeed, prior research does find that students from lower SES families tend to have fewer OTL (Covay Minor et al., 2015; Hallinan, 1992; Kelly, 2009; Oakes, 1985). More specifically, high school students from families with lower SES tend to be placed in lower-level courses (Kelly, 2009; Oakes, 1985). Moreover, recent research shows that the income achievement gap is the predominant achievement gap in the US because it has been growing during the same time that the Black–White achievement gap has stalled (Reardon, 2011).

Although SES may explain some or most of the Black–White achievement gap, depending on the grade span, other research finds that racial achievement gaps remain after taking into account SES (Covay Minor, 2011; Lleras, 2008). Even when examining race and SES together, racial differences emerge (Covay Minor et al., 2015; Gosa & Alexander, 2007). Middle-SES Black students have similar test scores to low-SES White students (Gosa & Alexander, 2007) suggesting that researchers need to look at race more closely. It is an empirical question as to whether differences in content and instructional tasks in courses with the same title are a story of race, income, or both. Lubienski (2002) found that within SES categories, Black students are still more likely to say that math is about memorizing and finding the one solution to the math problem. Additionally, Covay Minor et al. (2015) found that Black students have different learning opportunities compared to White students, even within SES categories. Because of the emerging research on the income achievement gap and the relationship between race and income, income must be part of the examination of racial differences in exposure to content and instruction.

This study examines the association between variation in content exposure, instruction, and racial classroom composition. More specifically, it asks:

1. To what extent do topic coverage and use of instructional tasks vary at the classroom level among upper-level math courses with the same title?
2. To what extent do topic coverage and use of instructional tasks vary at the classroom level, conditioning on classroom level minority composition, for courses of the same title?
3. To what extent is variation in topic coverage and use of instructional tasks by classroom minority composition explained by achievement level composition and/or socioeconomic status composition?

These questions are an important extension of the recent work that has examined racial differences in course-taking by providing insight into the organization of the learning environment through the content and instructional tasks within classrooms as a possible mechanism to explain Black–White test-score gaps. These research questions are a stepping stone to additional research that will make connections among the organization of the learning environment, student achievement, and the achievement gap. Before examining causal links, it is important to have a more complete understanding of the patterns that exist (e.g., Covay Minor et al., 2015), and this study is a step in that direction.

METHOD

Data

To look more closely at what happens in classrooms, this study takes advantage of the data from the Surveys of Enacted Curriculum (SEC), which offers a detailed record of teacher-reported organization of the classroom learning environment. In other words, the SEC provides a detailed description of what is taught—or the enacted curriculum (Porter, 2004). The SEC allows close examination of systematic differences in the organization of instructional time in terms of topic coverage and instructional tasks by the composition of the classroom.

The SEC includes a lengthy content matrix, which requires teachers to complete three steps. In the first step of the mathematics version of the SEC, teachers indicate the math topics that they covered to any extent in their target class during the year. There are 16 topic areas: number sense/properties/relationships, operations, measurement, consumer applications, basic algebra, advanced algebra, geometric concepts, advanced geometry, data displays, statistics, probability, analysis, trigonometry, special topics, functions, and instructional technology.

The large topic groups are divided further into more specific topics. For example, *number sense/properties/relationships* is subdivided into 19 subtopics such as place values, whole numbers, and operations. The second step asks the teachers to indicate the amount of instructional time spent on each subtopic in that year. There are a total of 183 subtopics in the math version of the SEC.

The last step asks teachers to indicate the amount of instructional time devoted to instructional tasks that students should be able to do or should know for each subtopic. There are five instructional tasks: memorize facts/definitions/formulas, perform procedures, demonstrate understanding of mathematical ideas, conjecture/generalize/prove, and solve nonroutine problems/make connections.

In addition to the content matrix of instructional time, teachers complete information about themselves and their classes. Both parts ask teachers to reflect on one target class (their first math class of the week) for the most recent school year (or if teachers complete the matrix after March 1, the current year).

Researchers have used other means, such as classroom observations and daily teacher logs, to obtain information on the organization of the learning environment. Classroom observations are impractical on a large scale and do not capture the enacted curriculum over the course for a semester or the year. Because the SEC is a survey, it can easily be distributed to a large number of teachers. In addition, the SEC asks teachers to consider the most recent school year when completing the content matrix, so that it captures the content and instruction covered throughout the school year. Daily teacher logs have better coverage than classroom observations as they can be used over the course of a semester, but they are expensive and place a large demand on teachers. The SEC requires less of a teacher's time because they are asked to complete it only once, not every day as required for a teaching log (Blank, Porter, & Smithson, 2001). The instrument developers found an

> agreement between observations and [teacher] logs on the days observed was high (correlations of .7 to .8). Agreement between daily logs aggregated to a full school year and end-of-semester surveys was quite good as well (correlations of .6 to .8 except in number, arithmetic, and measurement, where correlations were only .25 to .40). (Porter, 2002, p. 9)

Overall, the teacher reports in the SEC are valid measures of what teachers do in the classroom (Porter, 2002; Porter, Kirst, Osthoff, Smithson, & Schneider, 1993). In addition, Blank et al. (2001) found that teacher surveys of the enacted math curriculum and student surveys of the enacted math curriculum are significantly and positively correlated, which is additional evidence that surveys of the enacted curriculum are valid.

Although the SEC provides researchers with the ability to collect large amounts of data that would otherwise be difficult to capture through logs or observations, there are limitations. There may be self-report biases in surveys, but that is the case for logs, as well. Additionally, surveys are constrained by the amount of complexity that can be described and questioned (Porter, 2002).

Despite its limitations, the SEC has been used by researchers to answer important research questions. Gamoran et al. (1997) used the SEC to examine content exposure and achievement, finding that content exposure is positively related to achievement growth. The SEC has also been used to study the alignment of the intended, planned, and enacted curriculum (Kurz, Elliot, Wehby, & Smithson, 2010). Recently, researchers used the SEC to compare the Common Core Standards to the current enacted curriculum (Porter, McMaken, Hwang, & Yang, 2011). After comparing three tools to measure curricular alignment, Roach, Niebling, and Kurz (2008) concluded that "using the SEC allows us to obtain a quantitative and qualitative description of a teacher's instruction" (p. 172). The detailed data collected through the SEC allows researchers to see into the classroom in a thorough, cost-effective, valid, and reliable manner (Porter, 2002).

Sample

The SEC database is housed at the Wisconsin Center for Education Research. Each year, about 10,000 teachers across four subjects (math, science, English/language arts, and social studies) take the SEC. The data used in this particular analysis comes from 2010 and is a convenience sample resulting from a variety of quasi-experimental research projects and districts and schools using the SEC to improve their schools. About 80% of the sample of teachers used in this study completed the SEC as part of a program evaluation, voluntarily completing the SEC as part of a professional development activity. The other 20% of the sample completed the SEC as part of a school improvement or district initiative. The majority of the teachers in the sample come from the Midwest. Sixty percent of the teachers teach in a school in the Midwest. The remainder of the sample is divided evenly between the South and the Northeast. About 36% of the schools are in rural areas, 27% in towns, 25% in suburbs, and 12% in cities. This information was available for 81 of the schools. The information on whether the school is public or private was available for 90 schools. It was not possible to get this information for schools that were listed as control or not specified. Additionally, almost all of the schools (96%) are public schools.

The data in this study are limited to those teachers who identified their course as trigonometry, advanced math, or calculus in 2010. Once the SEC is limited to those teachers who took the math version and teach upper-level classes, the final analytic sample is an *N* of 100 teachers. The sample of 100 includes 20 trigonometry teachers, 60 advanced math teachers, and 20 calculus teachers. As the sample continues to be subdivided by other classroom characteristics, the *N*s get increasingly smaller, making it more difficult to detect statistical significance; however, the results will provide us the beginning of a better understanding of patterns for upper-level math course content and provide a springboard for future research.

Variables

The organization of the learning environment is measured in two ways: *topic coverage* and *instructional tasks*. Topic coverage is measured by the proportion of instructional time per year on each large topic area, as calculated for the SEC data. These topic areas are: number sense/properties/relationships, operations, measurement, consumer applications, basic algebra, advanced algebra, geometric concepts, advanced geometry, data displays, statistics, probability, analysis, trigonometry, special topics, functions, and instructional technology. Similarly, instructional tasks are measured by the proportion of instructional time for the year for each of the five tasks. These instructional tasks are: memorize facts, definitions, and/or formulas; perform mathematical procedures; demonstrate understanding of mathematical ideas; conjecture/generalize/prove; and solve nonroutine problems/make connections. The instructional tasks for memorizing and performing procedures fall into the category of procedural instruction. Demonstrating understanding of mathematical ideas, conjecturing, and solving nonroutine problems are considered conceptual instruction because these instructional tasks require students to make connections between concepts and demonstrate higher-order thinking.

To examine variation by classroom composition, three measures of composition are used. First, teachers are asked, "What percentage of the students in the target class are not Caucasian?" which is divided into three categories—less than 20% non-Caucasians, 20–70% non-Caucasians, and 70% and greater non-Caucasians. To have adequate cases in each category, classrooms are divided into predominately White racial composition (less than 20% non-Caucasians) and minority racial composition (greater than 20% non-Caucasians). Most upper-level math classrooms are predominately White with 74 upper-level math classrooms that have a predominately White racial composition and 26 upper-level math classrooms that have a minority racial composition.

The teacher is also asked, "What is the achievement level of most of the students in the target class, compared to national norms?" Teachers could respond high achievement levels, average achievement levels, low achievement levels, or mixed achievement levels. To maintain an adequate number of classrooms in each cell, high and average achievement level classrooms are combined, as are low and mixed. Although this measure of classroom achievement level is a subjective measure, the teacher rating of the classroom achievement level is appropriate to use in this analysis because the teacher will use his or her own perception of the classroom achievement level when developing lesson plans; however, it should be noted that teachers may vary in their ability to accurately perceive their students' abilities in comparison to national norms, especially by the level of the teachers' effectiveness.

Although the SEC database does not include information on the income level of the classroom or the school, the Common Core of Data (CCD) does provide this information at the school level from the 2009–2010 school year. When the 2009–2010 school year CCD data was not available, data from the next closest year was used if possible. To account for this substitution, a dummy variable to indicate the cases that used school demographic data from another year was included. This occurred for six teachers within three schools. Not every school could be found or matched with data in the CCD; however, there is additional school demographic data for about 84% of the schools for teachers in the sample. The percentage of free and reduced-price lunch students in the school is used as a proxy for the income level of the classroom. The average teacher in the sample teaches in a school in which 40.2% of students receive free or reduced-price lunch, with a range from 9.5% to 99.7%.

Analytic Plan

To address the research questions, multiple analytic strategies are used. First, to answer the research question of whether the topic coverage and instructional tasks vary for courses with the same title, means and ranges are used. A comparison of means will allow us to show what topics and instructional tasks are the foci of upper-level math courses. The examination of ranges will allow us to show how much variation there is within course titles. Next, mean differences are compared between classrooms with a predominately White racial composition and classrooms with a minority racial composition for each of the 16 topics and each of the five instructional tasks.

Given that the data is teachers nested within schools, hierarchical linear modeling (HLM) may be an appropriate analytic strategy. However, almost 70% of the schools only have one teacher in this study. Four is the maximum number of teachers in one school, and that is for one school. Therefore, ordinary least squares regression is used to predict the proportion of instructional time per year on each topic coverage and instructional task. The baseline models include only racial composition of the classroom. The subsequent models add teacher perception of the classroom achievement level and percentage of free and reduced-price lunch students as other possible explanations of variation in topic coverage and instructional task usage. The full models are reported.

Data Limitations

The goal of this study is to identify patterns in topic coverage and instructional tasks with particular attention paid to the racial composition of the classroom and as a step toward additional research. In other words, this is a descriptive and exploratory study; however, it is important to have such studies to identify patterns, to draw attention to the topic of differential content coverage and instructional tasks, and to spur additional research on the topic. Although this study addresses important questions to raise awareness to potential racial differences in experiences of OTL in upper-level math courses, it has limitations.

First, because the SEC used in this study is a convenience sample, the results cannot be generalized to upper-level math courses across the nation. Most of the teachers in the sample are in the Midwest, which limits the generalizability of the study, as does the fact that the sample is a convenience sample. An important extension of the current research would be to examine if the patterns that are present with this sample of teachers are present with a larger and broader sample of teachers with multiple teachers within a given school. With most schools only having one teacher in the study, this study is unable to examine between- and within-school differences in terms of differences in OTL. Nonetheless, this study will begin to provide important information researchers currently lack about disparities in organization of learning environments. It is important to identify these patterns to help spur additional research on how the organization of the learning environment is related to student learning outcomes. This article is one step in that direction.

A second limitation of this study is the limited number of additional variables. The SEC lacks student-level variables. Though lack of student data limits one's ability to describe an individual student's experience, it is still possible to describe the classroom setting and provide insight into how the organization of the learning environment differs. The class level is an appropriate unit of analysis, given that instruction occurs at the classroom level. Additionally, the information that I have about the particular schools used in the study comes from supplementing the data by adding information from the CCD. The focus of the SEC is on instructional content. Whereas other datasets like those collected by the National Center for Educational Statistics, such as the Early Childhood Longitudinal Study-Kindergarten Cohort or the Education Longitudinal Study, have a broad focus and capture a wide array of information, the SEC focuses questions on instruction. Although the narrow focus on instruction allows the researcher to have an in-depth understanding of a teacher's content coverage and instructional tasks, the additional information that can be helpful in understanding the processes is limited. Despite the limitations of having few control variables, this study describes patterns. The goal of the study is to be descriptive and to raise additional research on inequalities in OTL in upper-level math courses.

Finally, a third limitation of this study is the available categories used for variables included. In the database used for this study, there were only three categories for the racial composition of the class. Moreover, few classrooms had more than 70% minority students. As noted, only 26 classrooms had more than 20% minority students. Future work should purposefully recruit more teachers with a predominately minority classroom, as well as a racially mixed classroom to allow for more fine-grained comparisons.

RESULTS

Variation in Instruction for Courses With the Same Title

Math teachers of trigonometry, advanced math, and calculus in this sample tend to divide their instructional time among all of the 16 topics and the five types of instructional tasks. However, within each course there are topics that are emphasized more than others. Math teachers of trigonometry, on average, spend about 18% of their yearly instructional time covering the topic of trigonometry (see Table 1). There is a wide range in the amount of instructional time that is spent covering the topic of trigonometry within trigonometry classrooms, with half of math teachers of trigonometry spending less than 15% of their yearly instructional time on trigonometry. The range of yearly instructional time on trigonometry ranges from a low of 5% to a high of 45%.

There is also variation in the instructional tasks that math teachers of trigonometry ask their students to perform. On average, the math teachers of trigonometry in this study spend half of their yearly instructional time asking students to perform procedures and demonstrate understanding of mathematical concepts. All of the sample math teachers of trigonometry spend at least 20% of their instructional time asking students to perform procedures, but other math teachers of trigonometry spend nearly half of their yearly instructional time asking students to perform procedures alone. Additionally, the math teachers of trigonometry spend at least 14% of their instructional time asking students to demonstrate understanding, with some teachers spending over half of their yearly instructional time asking students to demonstrate understanding.

The average math teacher of advanced math in this study spends the largest part of his or her instructional time (14%) covering functions. However, some of the teachers of advanced math do not cover functions; others spend nearly half of their yearly instructional time covering

TABLE 1
Proportion of Instructional Time for Topics Covered and Instructional Tasks

	Trigonometry (N = 20)			*Advanced Math* (N = 60)			*Calculus* (N = 20)		
	Mean	*SD*	*Range*	*Mean*	SD	Range	*Mean*	SD	Range
Topic coverage									
Number sense	.087	.062	0–.199	.088	.143	0–1	.056	.067	0–.265
Operations	.060	.066	0–.218	.040	.061	0–.311	.039	.068	0–.279
Measurement	.065	.056	0–.211	.038	.050	0–.233	.051	.056	0–.194
Consumer applications	.011	.016	0–.065	.015	.015	0–.049	.010	.015	0–.042
Basic algebra	.133	.066	0–.239	.124	.097	0–.365	.075	.059	0–.196
Advanced algebra	.104	.079	.023–.364	.119	.089	0–.391	.050	.050	0–.171
Geometric concepts	.080	.057	0–.186	.049	.100	0–.534	.029	.036	0–.113
Advanced geometry	.015	.017	0–.065	.018	.026	0–.115	.029	.036	0–.111
Data displays	.037	.058	0–.256	.048	.075	0–.273	.024	.054	0–.233
Statistics	.020	.034	0–.135	.047	.079	0–.327	.009	.029	0–.124
Probability	.028	.051	0–.226	.062	.087	0–.406	.008	.028	0–.120
Analysis	.013	.015	0–.053	.038	.036	0–.122	.366	.260	.004–.857
Trigonometry	.175	.103	.045–.449	.103	.092	0–.362	.037	.053	0–.224
Special topics	.009	.013	0–.042	.021	.028	0–.167	.010	.019	0–.079
Functions	.123	.062	.025–.262	.141	.097	0–.471	.122	.094	0–.308
Instructional technology	.042	.025	.005–.106	.049	.026	0–.125	.088	.077	.015–.333
Instructional tasks									
Memorize	.194	.096	0–.441	.192	.119	0–.778	.156	.075	.020–.320
Perform procedures	.263	.081	.199–.476	.271	.110	.008–.657	.229	.102	.088–.558
Demonstrate understanding	.233	.084	.136–.545	.248	.127	.010–.975	.222	.049	.125–.327
Conjecture/Generalize/Prove	.160	.057	.028–.250	.146	.090	0–.555	.169	.080	0–.358
Solve nonroutine problems	.150	.074	.005–.249	.143	.083	0–.402	.225	.115	.038–.608

Note. $N = 19$ for operations in trigonometry and trigonometry in calculus.

functions. Study math teachers of advanced math spend about half of their instructional time asking students to memorize or perform procedures, with the rest of their instructional time divided among demonstrating understanding, conjecturing, and solving nonroutine problems. There is wide variation in the amount of instructional time spent on the various instructional tasks for advanced math courses. The range of instructional time spent on memorization is 0–78%. The most extreme range of instructional time is spent on demonstrating understanding: 1–97%. Some teachers of advanced math barely ask their students to demonstrate understanding while others spend a majority of their time asking students to demonstrate understanding.

By far, the topic that is emphasized the most in calculus in this study is analysis. Math teachers of calculus in this sample spend 37% of their instructional time over the course of the year on the topic of analysis. Yet some of the math teachers of calculus spend less than 1% of their time on analysis; others spend 86% of their instructional time on the topic of analysis. In terms of instructional tasks, the math teachers of calculus spend about 22% of their instructional time asking student to do each of these instructional tasks—perform procedures, demonstrate understanding, and solve nonroutine problems. The instructional task with the widest range is solving nonroutine problems, ranging 4–61% of instructional time.

Variation in Instruction by Racial Composition

Table 1 shows that there is variation in the instruction students receive despite taking courses with the same titles for this sample. The second research question asks whether there are differences in instruction between students in upper-level math classrooms with a predominately White racial composition and students in classrooms with a minority racial composition. Table 2 shows the mean differences for each topic and instructional task within each course by the racial composition of the classroom.

In this sample, math teachers of trigonometry in classrooms with a predominately White racial composition spend significantly more of their instructional time on trigonometry than math teachers of trigonometry in classrooms with a minority racial composition. The math teachers of trigonometry in classrooms with a predominately White racial composition spend 21% of their yearly instructional time on trigonometry; those in classrooms with a minority racial composition spend 12% of their instructional time on trigonometry. This is a difference of 9% of instructional time. Using Cohen's *d* (J. Cohen, 1988), the difference has an effect size of 0.92, which is a large effect size. Additionally, those in classrooms with a minority racial composition tend to spend significantly more time covering special topics (e.g., logic, permutations combinations) using 1.5% of their instructional time to do so, compared to the 0.5% of instructional time spent by math teachers of trigonometry in classrooms with a predominately White racial composition. This is an effect size of 0.76, which is a medium effect size. However, the difference is only 1% of yearly instructional time, with little time spent on special topics by the average math teacher of trigonometry in this sample.

The math teachers in trigonometry classrooms with a predominately White racial composition also spent significantly more of their instructional time asking their students to conjecture and solve nonroutine problems than those in classrooms with a minority racial composition. The math teachers of trigonometry classrooms with a predominately White racial composition spend about 18% of their instructional time asking students to conjecture and about 18% of their instructional time asking students to solve nonroutine problems. Math teachers of trigonometry classrooms with a minority racial composition in this sample spend 13% and 11% of their instructional time asking students to conjecture and solve nonroutine problems, respectively. These differences have large effect sizes. The effect size for the difference in use of conjecturing is 0.87 or 5% of their yearly instructional time, and the effect size for the difference for solving nonroutine problems is 1.23 or 7% of their yearly instructional time.

In supplemental analyses that map the combination of topic coverage and instructional tasks, the most prominent racial-composition difference is the instructional tasks that the math teachers of trigonometry use when teaching number sense and measurement. The math teachers of trigonometry classes with a predominately White racial composition tend to spend their instructional time on number sense and measurement asking their students to perform procedures, to demonstrate understanding, and to solve nonroutine problems; the math teachers of trigonometry classes with a minority racial composition spend more time asking their students to memorize information about number sense and measurement.

In the advanced math classrooms in this sample, there are medium effect sizes for the difference in the amount of instructional time math teachers spend on measurement and advanced algebra. The math teachers of advanced math classes with a predominately White racial composition spend 4.4% of their instructional time on measurement, which is significantly more than

TABLE 2
Mean Differences for Proportion of Instructional Time for Topics Covered and Instructional Tasks by Classroom Racial Composition

	Trigonometry (N = *20)*				*Advanced Math* (N = *60)*				*Calculus (N=20)*			
	Predominately White (N = *13)*		*Minority* (N = *7)*		*Predominately White* (N = *47)*		*Minority* (N = *13)*		*Predominately White* (N = *14)*		*Minority* (N = *6)*	
	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*	Mean	*SD*
Topic coverage												
Number sense	.076	.065	.106	.055	.078	.082	.125	.270	.062	.079	.041	.025
Operations	.047	.072	.088	.041	.040	.060	.038	.065	.018*	.036	.087	.102
Measurement	.069	.065	.057	.038	.044+	.054	.014	.019	.046	.058	.061	.057
Consumer applications	.007	.018	.019	.011	.015	.015	.015	.016	.008	.013	.015	.018
Basic algebra	.128	.077	.143	.038	.127	.098	.114	.094	.069	.066	.087	.041
Advanced algebra	.109	.096	.095	.037	.107*	.071	.162	.130	.047	.058	.057	.028
Geometric concepts	.085	.065	.071	.041	.060	.110	.011	.019	.017*	.032	.057	.031
Advanced geometry	.022	.016	.012	.018	.020	.027	.011	.020	.022	.030	.044	.044
Data displays	.040	.070	.031	.026	.053	.079	.029	.061	.010+	.021	.057	.092
Statistics	.018	.038	.023	.027	.046	.084	.049	.061	.001+	.004	.027	.050
Probability	.027	.061	.030	.028	.058	.081	.077	.110	.0002*	.0006	.027	.049
Analysis	.011	.017	.017	.010	.038	.037	.036	.035	.434+	.270	.206	.152
Trigonometry	.205+	.105	.120	.077	.110	.097	.078	.066	.038	.059	.035	.038
Special topics	.005+	.009	.015	.017	.022	.029	.020	.024	.009	.021	.012	.017
Functions	.118	.056	.133	.075	.136	.095	.161	.108	.120	.097	.127	.097
Instructional technology	.043	.027	.041	.023	.046	.024	.059	.032	.097	.091	.066	.017
Instructional tasks												
Memorize	.183	.065	.213	.143	.189	.090	.202	.195	.151	.081	.165	.065
Perform procedures	.241	.044	.303	.118	.281	.103	.237	.131	.242	.116	.198	.057
Demonstrate understanding	.223	.045	.251	.133	.240	.076	.275	.236	.224	.047	.218	.058
Conjecture/Generalize/Prove	.178+	.040	.127	.072	.144	.074	.153	.137	.177	.093	.151	.038
Solve nonroutine problems	.175*	.065	.105	.073	.145	.074	.133	.114	.206	.075	.268	.180

Note. $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$. $N = 19$ for operations in trigonometry and for trigonometry in calculus.

the 1.4% of instructional time spent on measurement by those teaching classes with a minority racial composition. The difference is an effect size of 0.74, or 3% of their yearly instructional time. The math teachers in advanced math classrooms with a minority racial composition spend 16% of their yearly instructional time on advanced algebra compared to the 11% of yearly instructional time spent by those in classrooms with a predominately White racial composition—an effect size of 0.53 and a difference of 5% of yearly instructional time.

In supplemental analyses that examine the intersection of topic and instructional tasks for the sample advanced math classrooms, there are sharp racial differences in the instructional tasks asked of students. Although the teachers in advanced math classrooms with a minority racial composition in this study spent their instructional time on number sense asking their students to memorize, those in classrooms with a predominately White racial composition spent their instructional time on number sense asking their students to perform procedures, demonstrate understanding, conjecture, and solve nonroutine problems.

In calculus classrooms in this study, several topics were emphasized differently in classes of predominately White students than to classes whose students are predominately members of racial minorities. The teachers in calculus classrooms with a predominately White racial composition spent 43% of their yearly instructional time on analysis, significantly more than the 21% of instructional time spent on analysis by teachers in calculus classrooms with a minority racial composition. The difference is a large effect size of 1.04 and a difference of 22% of yearly instructional time. For all of the other significant differences, the calculus teachers in classes with a minority racial composition spend significantly more time on the topics than those in calculus classrooms with a predominately White racial composition. These topics include operations, geometric concepts, data displays, statistics, and probability with differences in yearly instructional time ranging between 3% and 7%. The effect sizes for the differences related to these topics are 0.90, 1.20, 0.71, 0.75, and 0.78, respectively.

The racial composition differences in instructional time spent on topics and instructional tasks found for this sample may be explained by other classroom characteristics including the achievement level of the classroom and the income composition of the classroom. Once the achievement and income level of the classroom are included in the models, there are no longer significant differences in the amount of instructional time spent on various topics in trigonometry and calculus for this sample. That is not the case for the instruction of the math teachers of advanced math classrooms.

As shown in Table 3, the math teachers in advanced math classrooms with a minority racial composition spent significantly less instructional time on the topics of measurement, geometric concepts, and advanced geometry than those teaching classes with a predominately White racial composition, controlling for classroom achievement level and income level.[1] The former spent

[1]To check the robustness of these findings, I conducted a sensitivity analysis using a robustness of inference measure (see Frank, 2000). The robustness of inference measure indicates the percent of bias needed to be attributed to an omitted variable not captured by the covariates in the model. In other words, the measure indicates how much of the minority classroom coefficient is attributable to an omitted variable independent of achievement and income composition. With a robustness measure of 9%, it is quite plausible that the significant coefficient for minority classroom predicting the proportion of instructional time that teachers spend on geometric concepts and advanced geometry in advanced math could be explained by an omitted variable and that is independent of the achievement and SES composition of the classroom. This is not surprising, given that they are significant at the $p < .10$ level. For the other regressions presented in Tables 3 and 4, the robustness measures range from 13% to 34%, meaning that 13–34% of the classroom compositional differences would need to be explained by systematic bias that is independent of the achievement and SES composition.

TABLE 3
Instructional Time on Topics in Upper Level Math Classrooms

	Advanced Math			
	Measurement	*Geometric Concepts*	*Advanced Geometry*	*Instructional Technology*
Minority classroom	$-.040^{*}$(.017)	$-.074^{+}$(.038)	$-.019^{+}$(.010)	$.029^{**}$(.011)
Mixed/Low achievement classroom	−.021(.014)	−.046 (.031)	−.009 (.008)	.006 (.009)
Percent free or reduced-priced lunch	$.0009^{*}$(.0004)	$.002^{*}$ (.0009)	.0004 (.0002)	$-.0007^{*}$(.0003)
Constant	.016 (.015)	−.002 (.098)	.007 (.008)	$.063^{***}$(.009)
Adjusted R^2	.1173	.0867	.1377	.1166

Note. $N = 51$. Standard errors are in parentheses. A dummy variable to indicate if the school demographic information is from a year other than 2009–2010 is also included in these models. It was positive and significant at the 0.05 level for advanced geometry model; $^{+}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

significantly more instructional time on instructional technology than those teaching classes with a predominately White racial composition. Instruction technology includes topics such as use of calculators, computers, and spreadsheets.

In terms of instructional tasks, Table 4 shows that the teachers in trigonometry classrooms with a minority racial composition in this study spent significantly more of their instructional time asking students to perform procedures and less instructional time conjecturing than did teachers of classes with a predominately White racial composition, controlling for achievement and income. Interestingly, the teachers in calculus classrooms with a minority racial composition in this sample spent more of their instructional time asking students to solve nonroutine problems than did those teaching classes with a predominately White racial composition, controlling for achievement and income level.

In supplemental analyses, interactions between racial composition and achievement level composition are included in the models, along with income composition (full results are available upon request). These interactions allow us to see if the racial composition differences are the same at the two achievement levels or if they are concentrated within an achievement level. Only the math teachers of advanced math classrooms are used for this analysis because the other two courses have too few teachers for adequate numbers of classrooms in each of the four categories.

TABLE 4
Instructional Time on Instructional Tasks in Upper Level Math Classrooms

	Trigonometry (N=18)		*Calculus (N=15)*
	Perform Procedures	*Conjecture*	*Solve Nonroutine Problems*
Minority classroom	$.104^{*}$(.043)	$-.082^{*}$(.033)	$.276^{**}$(.086)
Mixed/Low achievement classroom	.035 (.049)	.008 (.038)	−.127 (.092)
Percent free or reduced-price lunch	−.001 (.001)	.0008 (.0009)	$-.004^{*}$(.001)
Constant	$.281^{***}$(.063)	$.146^{**}$(.042)	$.332^{*}$(.055)
Adjusted R^2	.2654	.1428	.3698

Note. Standard errors are in parentheses. A dummy variable to indicate if the school demographic information is from a year other than 2009–2010 is also included in these models. It was negative and significant at the 0.10 level for the perform procedures model; $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

The teachers of advanced math classes with a minority racial composition and with mixed or low achievement levels in this study spent significantly less instructional time on consumer applications and basic algebra but more instructional time on probability than did teachers of advanced math teaching classes with a minority racial composition and average or high achievement levels. Additionally, the teachers in advanced math classrooms with a minority racial composition and with average or high achievement levels spent significantly less instructional time on special topics but more instructional time on functions and instructional technology than those of classes with a predominately White racial composition and with the same achievement level. There were no significant differences in instructional time spent on topics among the teachers of advanced math classrooms with a predominately White racial composition and with varying achievement levels for all of the topics except trigonometry, for which the teachers in classes with a predominately White racial composition and mixed or low achievement spent less instructional time on trigonometry than those in classes with a predominately White racial composition and average or high achievement.

The math teachers of advanced math classrooms with a minority racial composition and with average/high achievement levels in this sample spent significantly less of their instructional time asking students to memorize and perform procedures than the math teachers of advanced math classrooms with a minority composition and mixed/low achievement levels and the math teachers of advanced math classrooms with a predominately White composition and average/high achievement levels. However, the teachers of advanced math classrooms with a minority composition and average or high achievement levels spent significantly more time asking their students to conjecture than the teachers of advanced math classrooms with predominately White composition of both achievement levels and minority composition with mixed or low achievement levels.

DISCUSSION

The main objectives for this study are to examine variation in the organization of the learning environment between classrooms for courses with the same titles and to ask whether there is variation in the organization of the learning environment by the racial composition of the classrooms, with a particular focus on upper-level math courses as a starting point for additional research. If the organization of upper-level math learning environments varies by classroom in upper level courses, equality of educational opportunity may be an illusion, with disparities in OTL in practice. Variation in the organization of the learning environment in upper-level classes, where there is less variability (Schmidt & McKnight, 2012), will also lead one to question the extent of variation in lower-level courses, where one would expect greater variation. Indeed, this study finds some evidence of variation in the organization of the learning environment for courses with the same titles, and within those courses there is variation by the racial composition of the classroom. These findings and their implications are discussed in this section.

Variation in Instruction for Courses With the Same Title

In upper-level math courses in this sample, teachers divide their instructional time among many different topics, emphasizing some more than others. Although upper-level math courses have the same label, there is considerable variation in the instructional time used to emphasize particular math topics and spent on instructional tasks. On average, teachers of upper-level math courses included in this study ask their students to perform both procedural and conceptual instructional tasks, which is consistent with the National Math Advisory Panel's recommendations. The National Math Advisory Panel (2008) stated that students should be asked to do both procedural and conceptual instructional tasks because students need procedural skills to build their conceptual skills. However, the panel does not indicate the ideal amount of instructional time on each.

Teachers of trigonometry and advanced math in this study spent slightly less than half of their instructional time asking students to perform procedural instructional tasks and slightly more than half of their instructional time asking students to perform conceptual instructional tasks. Teachers of calculus spent more instructional time asking students to perform conceptual instructional tasks. However, there were wide ranges in the instructional time spent on these tasks, meaning students in different classrooms may have had uneven opportunities to build their math skills.

Variation in the amount of instructional time spent on various topics in upper-level math high school courses is consistent with the work done by Schmidt and McKnight (2012). Students may experience different OTL particular content within courses of the same title. In other words, in this sample there appears to be course differentiation within curricular tracks, like that found by Schiller et al. (2010). Educational reforms that require an intensification of high school curriculum by requiring more courses do not necessarily translate into an intensification of the enacted curriculum. The curricular intensification policies often ignore the organization of the learning environment within the classroom and may not necessarily reduce educational inequalities on their own.

Whether the different experiences within courses of the same title in this study are good or bad cannot be tested with this data because it is not connected to student achievement data. However, past research (e.g., Bozick, Ingels, & Owings, 2008; Catsambis, 1994; D. Cohen & Hill, 2000; Gamoran, 1987; Gamoran & Hannigan, 2000; Gamoran et al., 1997; Wenglinsky, 2002, 2003) has found that more rigorous course work provides greater OTL skills and that time spent on instruction is related to student achievement. Theoretically, the differences in the rigor of the enacted curriculum through the time spent on various topics and instructional tasks found in this study are likely to be related to differences in student achievement outcomes, and my future research will address this question directly. Even with policies for curricular standards in place, teachers may implement those standards differently by the amount of instructional time spent on various topics and instructional tasks. If the organization of the learning environment varies systematically by the racial composition of the classroom, these differences in the learning environment could explain racial differences in skill level and achievement scores.

Variation in Instruction by Racial Composition

In this sample of teachers in upper-level math classrooms, most of the classrooms have a racial composition of less than 20% minority students. In other words, predominately, White students are taking the upper-level math classes in this sample. This study finds differences in the organization of the learning environment by racial composition for the study classrooms. Of note, the teachers in trigonometry classrooms with a predominately White racial composition tended to spend more time on the topic of trigonometry and more time asking their students to perform conceptual instructional tasks than did teachers in trigonometry classrooms with a minority racial composition. The teachers of advanced math classes with a minority racial composition in this sample spent more time on advanced algebra than did those teaching classes with a predominately White racial composition. The teachers of calculus classes with a minority racial composition included in this study spent less time on analysis but more time on operations, geometric concepts, data displays, statistics, and probability compared to those teaching calculus classes with a predominately White racial composition. The differences in the amount of instructional time spent on these topics and instructional tasks are statistically significant with medium to large effect sizes. In this study, math teachers of upper level math classes with minority racial compositions are emphasizing different topics than teachers of classes with predominately White racial compositions.

Significant differences between classes with different racial compositions for the classes in this sample remain when socioeconomic level and teacher perception of the classroom achievement level are included in the models presented here. Although some racial differences in topic emphasis and instructional tasks are explained by other classroom characteristics, the teachers of upper-level math classes with minority racial compositions included in this study still emphasize topics and instructional tasks differently than teachers of upper-level math classrooms with predominately White racial compositions. Most of the racial differences in the organization of the learning environment found here are differences between classrooms with a minority racial composition and low or mixed achievement and classrooms with predominately White racial compositions and average or high achievement levels. Interestingly, teachers of upper-level math classes with minority racial compositions and with average or high achievement levels in this sample ask their students to do significantly more conceptual instructional tasks than teachers of upper-level math classrooms with a predominately White racial composition and with similar achievement levels. The students in these upper-level math classrooms with minority racial compositions that are high achieving may benefit from the increase in instructional time spent on conceptual instructional tasks, because these tasks have been shown to increase student achievement. This is an important finding as it is contrary to what one would expect, given past research on racial differences in exposure to instructional tasks.

It is possible that a teacher of predominately minority, high-achieving students sees this as an opportunity to challenge the students and attempt to reduce the oft discussed subgroup gap by focusing on conceptual instructional tasks. It is likely that the type of classroom described previously is in a predominately minority school, where this classroom is simply the school's most advanced math course; upper level math courses tend to have higher levels of conceptual instructional tasks. To explore this hypothesis, future research should examine all of the math classrooms within the same school in order to compare within-school differences in the extent to which conceptual versus procedural instructional tasks vary by level of math course.

An additional factor that may explain these differences is whether or not a school has more than one section of these upper-level math courses. If so, there may be ability differences between the sections, allowing teachers to use more cognitively demanding tasks for those sections with higher ability. If there is only one section, the teachers may not be able to use the same level of cognitive demands. In future research, it will be important to gain a fuller understanding of teacher instructional decision-making and effectiveness, as well as more information about the school and classroom context.

Teacher effectiveness may explain this finding if it is the case that more effective teachers are teaching in high-achieving minority classrooms. Yet, past research often finds that minority students tend to have less effective teachers. Using data from the Measures of Effective Teaching Longitudinal Database, Covay Minor (2014) found that minority elementary students are more likely to have less effective teachers than White students. However, Kelly (2004) also found evidence of teacher sorting, with more experienced teachers and teachers with master's degrees being more likely to teach upper-level courses. Once again, by examining all of the math classrooms within the school, along with teacher effectiveness data, future research can compare relative teacher effectiveness.

Essentially, these explanations all question whether there is teacher sorting. Unfortunately, I do not have data to get at these questions. The available information about the teachers, as part of the SEC surveys and as part of my data, is about professional development experiences, instructional practices, and beliefs rather than effectiveness. To dig into this question, it would be helpful to have information about teacher effectiveness and content knowledge, as well as student characteristics. Perhaps future research could use the Measures of Effective Teaching longitudinal database (White & Rowan, 2012), which includes multiple measures of teacher effectiveness, a measure of content knowledge and student information, as well as a subset of teachers who took the SEC. Other work using the MET data has found evidence of teacher sorting with minority students being in classrooms with less effective teachers (Covay Minor, 2014).

Based on previous research examining the relationship between instruction and achievement (e.g., Bozick et al., 2008; Catsambis, 1994; D. Cohen & Hill, 2000; Gamoran, 1987; Gamoran & Hannigan, 2000; Gamoran et al., 1997; Wenglinsky, 2002, 2003), the instruction in trigonometry and advanced math classes with minority racial compositions in this study is less rigorous than the instruction in similar classes with predominately White racial compositions. The instruction in the trigonometry and advanced math classrooms with a minority racial composition that are part of this sample is focused on skills such as using calculators and computers and procedural instructional tasks. An exception is in calculus. Instruction in the calculus classrooms with minority racial compositions includes more time spent on conceptual instruction, which, research shows, increases student learning (Gamoran et al., 1997). As with the previous finding, this finding suggests that minority students may be advantaged by exposure to more conceptual instruction, but future research would need to connect these instructional tasks to achievement to see if there is an achievement benefit. Nonetheless, these finding suggest that there are likely racial differences in OTL within courses of the same title.

One explanation for the remaining racial differences in the OTL within classes with the same title may be differences in adopted textbooks. Schiller et al. (2010) found racial differences in the curricular rigor of the adopted textbooks used within the same curricular tracks. Black students tend to be taught using textbooks with a more rigorous curriculum within the same math level. The textbooks provide a measure of the potential curricular content to be covered or the intended curriculum (Porter, 2002). In other words, racial differences in the intended curriculum could explain some of the racial differences in instructional content. However, we do not know if teachers used supplemental material or the extent to which they followed the adopted textbook.

Another explanation for the racial differences in OTL in this study could be the actual skills that students bring with them to the classrooms. Although teacher perception of classroom achievement compared to the national norms is included in the model, students may be missing particular skills that are required to move to more upper-level math topics. Teachers may be making their decisions about their instructional time based on whether or not students have mastered particular content.

Nonetheless, these results provide some beginning evidence that students in classrooms with a minority racial composition have different OTL despite being in classrooms with the same course label as students in classrooms with a predominately White racial composition. The minority students in these upper-level math classes have overcome the hurdle of gaining access to upper-level math courses, but they may still not receive the same OTL in reality. These differences in OTL may help to explain the Black–White achievement gap and may influence how well the students are prepared for future math courses in college, because math concepts are hierarchical, even though on transcripts it appears that students should be equally prepared. Although the current study is limited by its sample and generalizability, the results should spur additional research on inequality in exposure to OTL within upper-level math courses. Examining the relationship between these differences in opportunity to learn and math knowledge and skill is an important next step for understanding why there are racial differences in returns from upper-level math course-taking as well as examining these research questions on a larger scale.

Future research should use a larger sample of teachers with multiple teachers within a school. With multiple teachers within a given school, researchers could examine not only between- and within-school differences in exposure to OTL but also examine patterns of teacher sorting. In other words, factors not captured in the current study that are related to which students get which teacher may help to explain differences in OTL. Moreover, future research should focus on recruitment of teachers in classrooms with a predominately minority composition as well as racially mixed composition.

An additional path to examine in future research is why there are differences in the organization of the learning environment by the racial composition of the classroom beyond differences in teacher self-reports of classroom achievement and income level of the school. Future research should explore why teachers are making the instructional decisions that they are making about the amount of instructional time spent on various topics and emphasis on particular instructional tasks and how these instructional decisions are related to differences in achievement outcomes.

Overall, this study improves the understanding of variation in student OTL in upper-level math courses. All students should have access to OTL not only in theory but also in practice. However, there are racial differences in exposure to OTL in this descriptive analysis. Disparities in the organization of the learning environment within courses of the same title are a subtle form of inequality that masks important differences in OTL and can help explain the Black–White achievement gap. Understanding why uneven course returns occur will help shape interventions to address disparities in math skills and improve classroom functioning.

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