BEGINNING HIGH SCHOOL TEACHERS' ORGANIZATION OF STUDENTS FOR LEARNING AND METHODS FOR TEACHING MATHEMATICS

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We observed eight beginning secondary mathematics teachers' classrooms to investigate ways in which they organized students for learning, uses of instructional methods, and how these may differ based on the level of course being taught. We found that beginning teachers frequently organize their students to learn, coupled with an abundance of teacher directed instruction. Differences in organizations, teaching methods, and associated learning opportunities between course levels also exist. Implications for supporting practicing teachers and preparing prospective teachers to establish collaborative learning environments and utilize student centered teaching methods are discussed.

Keywords: Opportunity to learn; Organizing students for learning; Teaching practices

Observamos las clases de ocho profesores noveles de matemáticas de secundaria para investigar las formas en que organizaban a los estudiantes, los usos de los métodos de instrucción y cómo estos pueden diferir según el nivel del curso. Descubrimos que los maestros noveles con frecuencia organizan a sus estudiantes para que aprendan colaborativamente, junto con numerosa instrucción directa por parte del profesor. También existen diferencias en la organización, los métodos de enseñanza y las oportunidades de aprendizaje asociadas entre los niveles del curso. Se discuten las implicaciones para apoyar a los profesores en ejercicio y preparar a los futuros profesores a establecer entornos de aprendizaje colaborativo y utilizar métodos de enseñanza centrados en el estudiante.

Palabras clave: Oportunidades de aprendizaje; Organización de los estudiantes para el aprendizaje; Prácticas docentes

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For more than twenty-five years, mathematics teachers have been encouraged to use a variety of instructional strategies to teach mathematics (National Council of Teachers of Mathematics, 1989, 1991, 2000, 2014). These strategies include but are not limited to using tasks that are of high cognitive demand, posing questions that probe and push students' thinking, and encouraging students to engage in whole class mathematical discussions (e.g., Perry, 2013; Stein et al., 1996; Stein & Smith, 2011). Despite research that suggests use of these strategies positively influences students' mathematical learning (e.g., Boston & Smith, 2009), teachers' instructional practices are slow to change (Rakes et al., 2010). Teacher education programs are encouraged to place strong emphasis on assuring prospective teachers understand the content they teach and that they are also able to implement instructional strategies that will have a positive impact on students' mathematics learning (Association of Mathematics Teacher Educators, 2017). The purpose of this study is to examine instructional practices used by beginning high school mathematics teachers who were prepared by one teacher education program that focuses on incorporating a variety of instructional practices.

Examining teachers' instructional practices has been a focus of study for some time. Fey (1979), synthesized results from three large-scale studies that suggest from 1955 to 1977, mathematics teachers of grades 7-12 tended to use whole class organizations most often (approximately half of the time), individual seatwork second, and small groups least often (17%-22%). Typical high school mathematics classrooms followed a predictable pattern of review, explain, then independent practice. Many years later, results published by Horizon Research (Weiss et al., 2003) noted that high school mathematics teachers used whole class instruction about 61% of the time, pairs or small groups 12%, and individual work 27%. These results were later updated (Banilower et al., 2013), where high school mathematics teachers used whole class instruction roughly 48% of time, pairs or small groups 22%, and individual work 22%. The remainder of class time was spent on non-instructional activities. Most recently, Horizon Research reported high school mathematics teachers indicated that they lecture at least once a week (95% of lessons) and use whole class discussions (84% or more of lessons) and use hands-on manipulatives in 20% of their classes (Horizon Research, 2019). Similar allocations of instructional time have also been noted in middle school classrooms (Hiebert et al., 2005; Jacobs et al., 2006). Otten et al. (2015) found that as much as one-fifth of class time in middle grades mathematics courses is allocated specifically for reviewing homework. These practices are not much different from those reported internationally. In particular, Kaur (2009) noted in an analysis of three middle school teachers in Singapore whole class demonstration, followed by individual seatwork, and whole class review of student work was the most common sequence of instructional activities.

Considering the teaching practices recommended by NCTM (1991, 2000) and results from national assessments that show high-poverty students underperform, McKinney and Frazier (2008) administered a survey to 64 middle school teachers

in high-poverty schools. While there was some evidence of the use of instructional practices recommended by NCTM (2000) such as using hands on learning (25%), and cooperative learning groups (23%), there was still evidence of lecturing and drill. In particular, 74% of teachers reported that they very frequently used drill and practice, 70% reported having students complete independent work, and 58% reported lecturing. Such teaching practices influence the type of mathematical thinking and reasoning in which students have the opportunity to engage.

The pattern of instructional practices Fey noticed – review, explain, independent practice –resembles practices Haberman (1991) described as the pedagogy of poverty. The pedagogy of poverty describes learning environments experienced in high poverty schools in which teachers are directors giving orders and students are expected to comply. This is consistent with instructional practices that focus on lecture, practice, and memorization. In these classrooms, students miss out on the opportunity to engage in problem solving and critical thinking. Missed opportunities to learn were suggested as early as the 1960s (e.g., Carroll, 1963). In 2000, Boaler et al. found fewer opportunities for students to learn when UK students were placed in ability-grouped classrooms. This was because of the ways teachers modified the curriculum and strategies used that were similar to the pedagogy of poverty. Taken together, ways in which mathematics teachers allocate time for independent practice, group/pair work, whole class discussion, and completing assessments influence students' opportunity to learn.

Theoretical Framework

Broadly, opportunity to learn (OTL) has been conceptualized in a variety of ways, such as exposure to content and time-on-task (Carroll, 1963), the relationship between content coverage compared to content assessed (Husén, 1967), and how one's learning environment affords action (Gee, 2008). Naturally, how OTL is conceived corresponds with views on learning. Gee (2008), aligns OTL with two prominent perspectives on learning- traditional and sociocultural. According to a traditional view of learning, students have had equitable OTL if they are exposed to the same content because a traditional perspective on learning considers ways in which information is represented as mental structures and how these structures are organized and reorganized in students' minds. Alternatively, sociocultural perspectives on learning acknowledge the important role of mental structures while simultaneously considering relationships between an individual and their environment. Thus, from this perspective, students have equitable OTL if their environment offers the same affordances for action based on relationships between objects in the environment and themselves. In a mathematics classroom, "objects" may include tasks, textbooks, and interactions with other people. Hence, as an example, students' OTL includes relationships between an individual students' prior knowledge of a certain topic and how a given task or collaboration with peers

affords that student opportunity to build from their foundation –act upon existing mental structures. Teachers have tremendous influence on students' OTL because they are primarily responsible for designing the learning environment by selecting tasks and deciding how interactions between individuals will take place.

While some have viewed OTL as how students take advantage of opportunities (Jones & Byrnes, 2006), our view is more in line with those which place focus on teachers' choices as the responsible provider of opportunities for students to participate in mathematically meaningful experiences (e.g., NCTM, 1991; Perry, 2013). Perry asserts that selecting and implementing high demand tasks is a minimum requirement for establishing equitable classroom spaces at an *emergent level* –Perry's lowest category of equitable classroom spaces for providing students with OTL. On the other hand, implementing high demand tasks and positioning students to publicize their thinking and solutions for peers and ask/answer questions of their peers is consistent with equitable classroom spaces at a *persistent level* –Perry's highest category of equitable classroom spaces for providing students with OTL. Perry studied three beginning high school mathematics teachers and compared OTL provided by each teacher in both an academic course and higher-level course. She found that teachers were more likely to implement high demand tasks and position students to share their thinking with peers while teaching advanced courses. However, providing students opportunities to present their thinking and ask/answer questions of peers was rare, and Perry concluded, "more successful opportunities to learn are not necessarily only appearing in accelerated courses" (p. 194). Although we are not concerned with cognitive demand of tasks used by teachers in our current study, we are interested in how teachers organize students for learning mathematics, the instructional methods used that contribute to students' OTL, and if there are course level differences in these practices.

Considering the criteria of positioning students to publicize their thinking as essential for establishing equitable OTL at a persistent level, the results by Fey (1979) and Horizon Research (2003, 2013) can be interpreted to view historical data showing substantial amounts of individual work in US classrooms (comprising at least one-fifth of class time since the 1950s) as providing limited OTL. Moreover, examining the nature of instruction during whole class and small group interactions, such as whether student thinking or teacher-prescribed strategies are foregrounded, would provide further evidence about the nature of students' OTL (see Tate, 1995 for a discussion about OTL and issues of equitable mathematics instruction). The teachers observed in this study were enrolled in or had completed a teacher preparation program at a research-focused university that encouraged instruction based on reform efforts and research, specifically focusing on student centered instruction. We were interested to know whether we would see different instructional methods and ways of organizing students than those reported by other researchers (e.g., Banilower et al., 2013; Fey, 1979; Haberman,

1991; Hiebert et al., 2005; Jacobs et al., 2006; Otten et al., 2015; Perry, 2013; Weiss et al., 2003).

METHODS

Research Questions

The purpose of this study is to investigate beginning high school mathematics teachers' potential for engineering OTL through Perry's notion of persistent equitable classroom spaces. To do so, we examined how participating teachers organize their students for learning and the methods for teaching mathematics they use. Specifically, we address the following research questions:

- In what ways do beginning teachers organize their students for learning and how frequently are various organizations utilized?
- What methods for teaching mathematics do beginning teachers use and how frequently do they use them?
- Are there differences in the ways teachers organize students for instruction and the methods teachers use when they are teaching different levels of mathematics courses (e.g., introductory, core, or advanced)?
- Additionally, a fourth research question emerged based on patterns noticed during our analyses of these first three questions – Are there differences in the instructional methods used or ways of organizing students between in-service teachers and student teachers?

Participants

Eight teachers, with six or fewer years of experience, were observed a total of 31 times during the 2016-2017 school year. These teachers were selected as participants because they graduated from the same teacher preparation program and were members of a scholarship program. This scholarship program provided additional field-based classroom experiences and coursework focusing on pedagogy and required completion of dual degrees in mathematics education and mathematics or statistics. As members of this scholarship program, teachers received specialized instruction and field experience opportunities where they were prepared to work in high-needs districts. All eight teachers taught in the same school district at the time of data collection. In this district, high school mathematics courses are sequenced Math 1, Math 2, and Math 3, where all three courses integrate topics from algebra, geometry, trigonometry, statistics, and probability. In addition to those core courses, each might have an introductory level version to aid those students who have struggled in math courses previously. Beyond those core courses are advanced options such as Advanced Functions and Modeling, Precalculus, Advanced Placement (AP) Calculus, and AP Statistics. Table 1 provides more information about the teachers who participated in the study. Teachers listed with zero years of teaching experience were observed during

their semester of student teaching. One teacher, assigned the pseudonym Lily, was observed both as a student teacher and during her first semester as an in-service teacher; she was the only teacher observed during both semesters of the study.

Table 1.
Participant Information

Name	Teaching Experience	Number of Observations	Courses Observed (Number of observations)
Mary	0	3	Math 2 (2), AP Statistics (1)
Lily	1	5*	Intro Math 1 (3), Math 2 (2)
Warren	0	5	Math 2 (2), AP Calculus (3)
Nicole	0	5	Math 2 (2), Precalculus (3)
Carrie	0	5	Math 1A (1), Math 3 (4)
Maddie	2	3	Math 2 (3)
Tina	1	3	Math 2 (3)
Ryan	6	2	AP Statistics (2)

Note: *Lily was observed as a student teacher (3 times) and as a first-year teacher (twice).

Data Collection and Analysis

Data collection took place in the form of classroom observations. Teachers were observed by a member of the research team multiple times (table 1), each for the duration of a class period (approximately 90 minutes). Observations typically occurred every three weeks with student teachers and roughly every month for in-service teachers. Classroom observations took place throughout each academic semester, so content covered included a snapshot of each courses' curriculum standards. An exception was made for Ryan, whose observations took place on two consecutive days and were video recorded because the re-search team was unable to be present for agreed upon observation days. These recordings were then coded later. In each observation, teachers' organizations of students into whole class (denoted by WC in tables and figures), small groups (denoted by SG in tables and figures), or as individuals (denoted by I in tables and figures) were documented in 5-minute intervals. In addition to how teachers organized students, detailed notes were taken to document instruction-al activities (e.g., warm-ups, taking notes, etc.) in 5-minute intervals.

Two of the authors conducted all classroom observations; one responsible for student teachers, the other for in-service teachers. The researcher conducting observations of student teachers also served as their university supervisor. Although the university supervisor was responsible for student teachers' evaluations, we believe the teaching practices reflected in our observations and data to be minimally influenced by this relationship because most observations

were unannounced. Prior to observing in-service teachers, these two researchers conducted two observations together to discuss the observation protocol, coding, and reliability. Observers took detailed field notes about classroom activities taking place during each 5-minute interval. The research team met multiple times to discuss coding and categorizing instructional methods to ensure reliability. Early in data collection the research team created 24 codes based on field notes indicating classroom activities taking place during observations (e.g., warm-ups, taking notes, collecting data, etc.). These codes were later collapsed into three categories –teacher directed, student centered, or assessing understanding– which we use to describe their instructional methods. These categories are defined inductively based on codes of classroom activities used creating them. Field notes for each of the 31 observations were then recoded where each 5-minute interval was ascribed one organization and one instructional method; however, classroom activities did not always align with 5-minute time increments. In these cases, we coded intervals based on the dominant organization and instructional method used. A total of 533 intervals were coded for this study, which serve as our unit of analysis.

The instructional method codes were collapsed into three categories: teacher directed, student centered, and assessing student understanding. We considered teacher directed work (denoted by TD in figures and tables) as activities such as taking notes and working problems using prescribed or teacher demonstrated strategies because these activities featured the teacher's (or textbook's) ways of completing work (e.g., NCTM, 2000, 2014). Activities where students worked non-routine problems, worked on projects, collected data, or explored were considered student centered (denoted by SC in figures and tables) because these activities featured the students' thinking and promoted autonomy and creativity (e.g., NCTM, 2000, 2014); and warm-ups, homework, tests, quizzes, or reviewing these types of assignments were considered assessing student understanding (denoted by AU in figures and tables). Categorizing teachers' instructional methods in this way is aligned with Perry's notion of OTL by indicating whose thinking is being publicized –students' or the teacher's. Therefore, considering ways in which teachers organized their students for learning together with instructional strategies used allows us to more thoroughly understand the potential for persistent OTL (Perry, 2013).

Information about the course being taught was also recorded. Further, we categorized courses into levels: introductory (Intro Math 1 and Math 1A), core (Math 2 and Math 3), and advanced (Precalculus, AP Calculus, and AP Statistics). We consider Math 1 to be a core course, though none of these teachers taught Math 1 during data collection. These data were then analyzed to address the stated research questions.

We were interested in examining teachers' uses of various organizations of students for learning (i.e. whole class, small group, or individual) and instructional methods (i.e. teacher directed, student centered, or assessing understanding) across

course levels (i.e. introductory, core, or advanced). Chi-squared tests allowed us to examine whether these categorical variables were independent.

Results and Discussion

Overall Organizations and Instructional Methods

These beginning teachers tended to organize their students as a whole class more frequently than in small groups or as individuals. When looking at how teachers organized students for learning, nearly half of instructional time was conducted with students organized as a whole class (48%); whereas, small groups were used 31% of instructional time and 21% of time was allocated for individual work (figure 1). Regarding instructional methods for the collective, teacher directed methods occurred during 51% of observed class time, assessing student understanding took place 27% of time, and roughly 22% of class time was devoted to student centered methods (figure 1). Figure 1 presents this information graphically to give a visual representation of how time was allocated during observations.

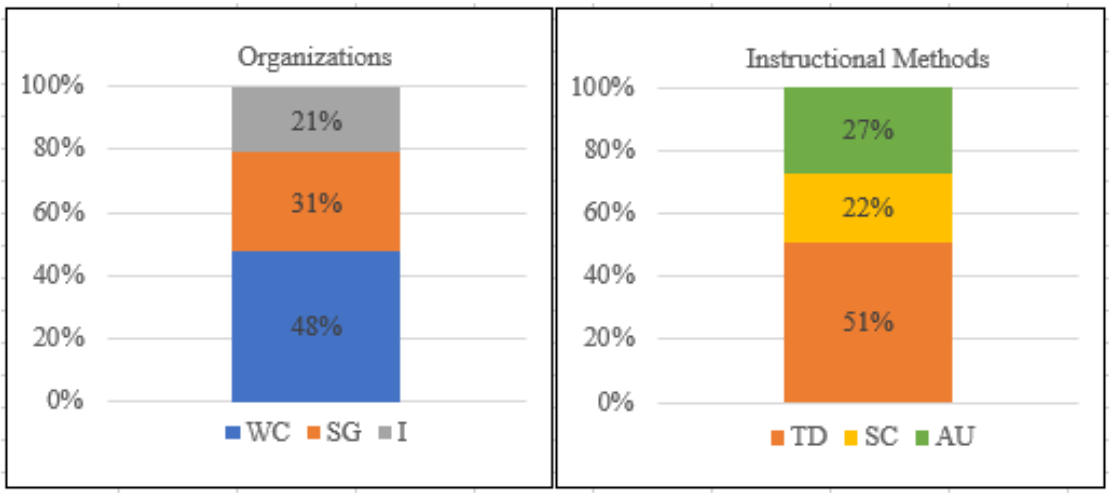

Figure 1. Frequencies of Organizations (left) and Instructional Methods (right) Used.

Table 2 shows how frequently teaching methods were used within various organizations of students. Teacher directed methods took up more than half of class time when students were organized as a whole class or in small groups, while assessing student understanding was the dominant method when students were organized as individuals. Teachers were observed using student centered methods roughly 21% of time when students were organized as a whole class. This time primarily consisted of working as a class on a project or sharing solutions from work on non-routine problems. Student centered methods were rarely used when students were organized as individuals (students were observed collecting data as individuals in preparation for a whole class discussion). Guided by Perry's (2013)

conceptualization of OTL, instances when students were organized as a whole class or in small groups coupled with student centered instructional methods would indicate intervals for which there was potential for persistent OTL. Roughly 19% of intervals observed for this study reflect such instances.

Table 2.
Proportions of instructional methods observed during each class organization type

	Assessing Understanding	Teacher Directed	Student Centered
Whole Class	0.25	0.54	0.21
Small Group	0.14	0.51	0.35
Individual	0.50	0.44	0.06

Not all teachers followed the pattern of organizing their students as a whole class most often, then in small groups, and as individuals least often. Mary, Lily, Warren, Nicole, and Carrie (Group 1) organized their students in small groups more frequently than as individuals, while Maddie, Tina, and Ryan (Group 2) were observed organizing their students as individuals more often than in small groups (see table 3). It is worth noting that all teachers in group 1 were observed as student teachers (Lily was also observed during her first semester as an in-service teacher), while teachers in group 2 were in-service teachers.

Table 3.
Individual teachers' proportions of class time allocated for various organizations.

Teacher (# observations)	WC	SG	I
Group 1. Student Teachers	0.46	0.35	0.19
Mary (3)	0.23	0.45	0.32
Lily (5)	0.47	0.29	0.24
Warren (5)	0.44	0.34	0.22
Nicole (5)	0.64	0.34	0.02
Carrie (5)	0.46	0.37	0.17
Group 2: In-service Teachers	0.50	0.19	0.31
Maddie (3)	0.34	0.28	0.38
Tina (3)	0.56	0.18	0.26
Ryan (2)	0.71	0.03	0.26

It was not our original intention to examine differences in organizations utilized by student teachers compared to in-service teachers. Instead, we continued to investigate similarities and differences in organizations used by all teachers in this study and two groups emerged, which happened to have this distinction. A chi-squared test for independence between group and organization was conducted and significant results were found ($\chi^2(2) = 16.17, p = 0.0003$). These results suggest that the ways in which the group of student teachers (group 1) organized their students for learning were different from ways the group of in-service teachers (group 2) organized their students. In this regard, the group of student teachers tended to position students to share their thinking with peers more often than the group of in-service teachers. The following sections compare instructional methods used by teachers in each group when students were organized in each setting.

Students Organized as Whole Class

In addition to allocating different amounts of time with students organized as a whole class, in small groups, and individually, each group of teachers also tended to utilize their time in these organizational settings with different teaching methods (table 4). When considering time with students organized as a whole class, both groups spent roughly the same proportion of time on assessing student understanding, a larger portion of time on teacher directed work, and lesser amounts of time with student centered instruction. Though, in-service teachers allocated more time for teacher directed instruction than student teachers, who allotted for comparatively more time with student centered instruction.

Students Organized as Small Groups

The two groups of teachers used class time with students organized in small groups very differently (table 4). In-service teachers, who tended to organize students individually more often than in small groups, used about two-thirds of this time on assessing student understanding and the remaining third on teacher directed instruction. On the other hand, student teachers, who tended to organize students in small groups more frequently than as individuals, used very little time with students organized in small groups for assessing student understanding. Instead, slightly more than half of this time was spent with teacher directed work and 41% on student centered work.

Students Organized as Individuals

Finally, considering time spent with students organized individually, the group of student teachers designated about half of this time for assessing student understanding and the other half on teacher directed work (table 4). The group of in-service teachers also used this time for assessing student understanding, but used less of it for teacher directed work than student teachers. In-service teachers used more time with students organized as individuals for student centered work

than student teachers. In fact, one major difference between these two groups of teachers (apart from the proportions of class time they allocated for each organization) is how they have students organized for learning while utilizing student centered instructional methods. Each group of teachers tended to allocate time for student centered instruction during times when they had students organized in their more preferred setting – between small groups or as individuals. Moreover, both groups of teachers rarely used student centered instructional methods during class time designated for their least used organizational setting. In other words, student teachers organized students as individuals least often and rarely used student centered instructional methods in that setting. Similarly, in-service teachers organized students in small groups least often and rarely used student centered instructional methods in that setting.

Table 4.
Comparing proportions of time allocated for each method within each organization

	Group 1. Student Teachers			Group 2. In-service Teachers		
Organization	AU	TD	SC	AU	TD	SC
WC	0.27	0.49	0.24	0.21	0.66	0.13
SG	0.05	0.54	0.41	0.64	0.36	0.00
I	0.45	0.54	0.01	0.59	0.27	0.15

Individual work occurring least often across the sample in this study is contrary to what Fey (1979) and Horizon Research (2003; 2013) reported as taking place in high school mathematics classrooms of the 1950s, 1960s, and 1970s, and 2000s, respectively, where teachers tended to utilize very little time for small groups. Though, it is interesting that such an abundance of time with students organized for potential collaboration (roughly 79% of class time allocated for whole class or small group; see figure 1-left) was coupled with such little time observed with teachers using student centered instructional methods (about 22%; see figure 1-right). Thus, beginning teachers organized students for learning through collaboration more often than for independent learning, but did not frequently utilize instructional methods to position students to engage in student centered work. This corroborates results described by Perry (2013), who also concluded that beginning teachers do not necessarily provide better opportunities to learn while teaching advanced courses. The next section presents results of beginning teachers' organizations and instructional methods based on the level of course being taught (i.e. introductory, core, or advanced), where some differences in organizations and instructional methods across levels emerged.

Organizations and Instructional Methods Across Course Levels

While teaching advanced courses (Pre-Calculus, AP Calculus, or AP Statistics), teachers in this study organized students as a whole class most often and spent the least amount of class time with students organized individually. Regarding teaching methods in advanced courses, roughly half of time was spent using teacher directed instruction and about one-third of time was allocated for student centered work. Only about one-fifth of class time was devoted to assessing student understanding during advanced courses.

Similarly, beginning mathematics teachers also tended to organize students as a whole class most often and spent the least amount of class time with students organized individually while teaching core courses (Math 2 or Math 3). Teacher directed instruction was the most frequent teaching method observed in core courses, accounting for more than half of class time. Teachers tended to allocate the least amount of time for student centered instruction while teaching core courses.

Lastly, we observed beginning teachers organizing students as a whole class more frequently than in small groups or as individuals while teaching introductory level courses (Intro Math 1 or Math 1A). In this case, individual organizations were utilized more than small groups. With respect to teaching methods during introductory courses, these beginning teachers were observed using student centered instruction roughly one-quarter of the time, and teacher directed work and assessing understanding were equifrequent for the remaining time.

To offer comparison across course levels, we observed that beginning mathematics teachers used less time with students organized as individuals while teaching advanced courses compared to core or introductory courses. While teaching advanced courses, teachers organized students as a whole class more often than while teaching core or introductory courses. Also, teachers organized students in small groups less often while teaching introductory courses than while teaching advanced or core courses (table 5).

With respect to instructional methods, beginning teachers designated less time on assessing student understanding in advanced courses compared to core and introductory courses. Student centered methods were used more often in advanced courses than in other courses. Interestingly, teachers spent less time using teacher directed methods and more time for student centered work in introductory courses compared to core courses. Teachers also spent less time using student centered instruction in core courses than in advanced courses. Our data suggests that teachers who tended to use teacher directed methods very frequently in core and advanced courses might reallocate this time towards assessing student understanding and student centered work when teaching introductory courses (table 5). This is also reflected in how these teachers organized their students for learning in introductory courses, where less time was spent in small groups.

Chi-squared tests for independence between course level and organization and between course level and instructional method were conducted. In both cases,

significant results were found ($\chi^2(4) = 15.74, p = 0.0034; \chi^2(4) = 30.32, p < 0.0001$; respectively), suggesting that organizations and instructional methods were utilized with significantly different frequency depending on the level of course being taught.

Table 5.
Frequencies of organization and instructional method by course level (proportions)

	Organization			Instructional Method		
Course Level	WC	SG	I	AU	TD	SC
Advanced	0.55	0.33	0.12	0.18	0.47	0.35
Core	0.44	0.32	0.23	0.30	0.56	0.25
Intro	0.46	0.21	0.32	0.35	0.39	0.26

Perry (2013) developed a framework for equitable classroom spaces by considering students' OTL based on cognitive demand of tasks and the nature of instruction during task implementation. In this regard, she suggests that at a minimum to establish equitable classroom spaces teachers need to implement high demand tasks; whereas, more (persistent) equitable spaces involve high demand tasks and positioning students to discuss solution strategies and ask/answer questions about each other's mathematics. She found that beginning high school mathematics teachers can establish equitable classroom spaces (even at the persistent-level), and that course level does not necessarily dictate the degree of equitability. This study argues for a theoretical connection between Perry's notion of OTL and teachers' ways of organizing students and instructional methods, and provides empirical evidence about the frequency with which teachers in our study positioned students to publicize their thinking.

We did not analyze the cognitive demand of tasks implemented by beginning teachers for this study; however, we consider teachers' organizations of students for learning and instructional methods as means for which teachers positioned students to publicize their thinking. From this perspective, students in advanced courses were positioned to discuss their thinking with peers more frequently than students in core or introductory courses based on differences in ways teachers organized students for learning across course levels. Specifically, teachers organized students for collaboration (i.e. as a whole class or in small groups) more frequently while teaching advanced courses than in other courses. Further, teachers allocated more time for student centered work and less time on assessing student understanding compared to the amount of time using these same methods in introductory or core courses, suggesting more opportunities for students to learn in advanced courses.

The amount of time designated for student centered work and assessing student understanding by beginning teachers in introductory and core courses was roughly similar. Though, more teacher directed instruction took place in core courses than in introductory courses. At the time of this study core courses administered state-mandated final exams while introductory courses did not. Perhaps testing explains some of the differences in teacher directed instruction between core and introductory courses. On the other hand, teachers were ob-served assessing student understanding more often in introductory courses than core and advanced courses even though these introductory courses do not have AP or state-mandated final exams.

Conclusion

Our results have shown that beginning teachers in this study tended to utilize whole class organizations more frequently than small groups or individuals. Organizing students to work individually was used least often. This result contrasts with results by Fey (1979) and Horizon Research (2003; 2013), where teachers in the past have been reported to use small group organizations least often. While investigating similarities and differences in organizations used by all teachers in this study, two groups emerged. One group, which happened to consist of student teachers (group 1), organized their students in small groups more frequently than as individuals. The second group, which happened to consist of in-service teachers (group 2), organized their students as individuals more often. Thus, in-service teachers in our study used similar organizational patterns described by previous researchers, while student teachers did not.

Teaching methods used by these two groups varied by organizational set-tings. In general, both groups used whole class organizations similarly, devoting more time for teacher directed work and less time for student centered activities. Instructional methods during small group and individual organizations differed between the two groups. Teachers in group 1 tended to use student centered instruction in small groups whereas teachers in group 2 tended to use student centered instruction when students were working individually. We note that each group of teachers situated student centered instruction in their more preferred organizational setting – between small groups and individual – and almost never used student centered methods in their least preferred organizational setting.

Beginning teachers used teacher directed instructional methods for a majority of class time. Further, although the cognitive demand of tasks implemented during observations was not considered for this study, the ways in which students were positioned to publicize their thinking based on teachers' instructional methods across course levels suggest beginning high school mathematics teachers need more training on establishing persistent equitable classroom spaces, fostering more opportunities for students to learn (Perry, 2013). Our results show that teacher

directed instruction took place less often in introductory courses than in core or advanced courses; however, the ways in which teachers organized students for learning in introductory courses do not promote student collaboration. Although student centered instructional methods took place more often in advanced courses, a very low amount of student centered instruction occurred across all course levels.

Reform efforts are pushing for more student centered work and collaboration (NCTM, 1989, 1991, 2000, 2014). Results presented suggest this may be quite rare in beginning mathematics teachers' classrooms. However, teachers who tended to organize their students in small groups more frequently than as individuals (group 1) used more time for student centered work. Interestingly, this group was composed of student teachers. A possible explanation for this trend in our results is that the researcher conducting classroom observations of student teachers also served as their university supervisor and was grading their performance. Perhaps student teachers used teaching methods suggested by reform efforts and emphasized in the teacher education program more than in-service teachers because of this relationship with the researcher. However, most observations of student teachers' classrooms were conducted at times unannounced to the student teacher, so we believe results presented reflect these teachers' typical practices. Future research should further investigate longitudinal trends in high school mathematics teachers' instructional practices as they progress from student teaching through the beginning of their careers.

Additionally, student teachers need support in continuing their use of small group organizations and student centered instruction as they transition to in-service teachers. The group of in-service teachers used more student centered instruction when students were organized as individuals, so the two groups of teachers – those transitioning into their careers and in-service teachers – could learn ways of using student centered instruction across various organizational settings. Incorporating more student centered instruction was also suggested by Haberman (1991) as a means for good teaching. Indeed, the in-service teachers in this study, because of their affiliation with the scholarship program, received extended support through program staff in the form of classroom visits, summer professional development institutes, and funds to attend conferences. The results of this study suggest that ongoing support for in-service teachers should include targeted efforts to assist teachers in continuing to implement student centered instruction throughout their lessons.

Trends in instructional practices are slow to change (Rakes et al., 2010). For decades middle grades and secondary mathematics teachers have been organizing students to learn individually, frequently utilizing teacher directed instructional methods (Banilower et al., 2013; Fey, 1979; Hiebert et al., 2005; Jacobs et al., 2006; Otten et al., 2015; Weiss et al., 2003). We documented beginning high school mathematics teachers' organizations of students for learning and instructional methods on 5-minute intervals live during classroom observations (except for the case of Ryan). Although these teachers did not frequently utilize

teaching methods to position students to engage in student centered work, results from this study demonstrate that beginning high school mathematics teachers are organizing students for collaborative learning, especially as student teachers.

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