ALGEBRA 1 TEACHERS' CLASSROOM CIRCULATION PATTERNS: A LAY OF THE LAND

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In this report, we share classroom data focused on 51 teachers' circulation patterns and interview data addressing the teachers' justifications for how they circulate and initiate discussions during student work time. We found the majority of teachers were up and moving (circulating) as students worked and they engaged in both proactive and reactive initiation of conversations with students. The teachers shared varied justifications for their circulation and initiation patterns, indicating that the rationale for circulation may be more valuable than the mere practice of it. Implications of these findings are discussed.

Keywords: Algebra, Classroom Discourse, Instructional Activities and Practices

Teacher circulation, the practice of teachers moving around the classroom while students work individually or in groups (Clarke, 2004), is ubiquitous in many K–12 classrooms. Yet, minimal research exists on the nature of teacher circulation and its impact on students' learning. We searched various indexes using the terms "teacher circulation" and "classroom circulation" and were surprised to find minimal literature. Expanding out to related terms, we found studies of teacher's between-desk instruction (Clarke, 2004; O'Keefe et al., 2006) and specific purposes of circulation such as monitoring student work (Smith & Stein, 2011), facilitating group work dynamics (Ehrenfeld & Horn, 2020) and classroom management via "proximity" (Rock & Thead, 2009), but none focused on broad patterns in circulation.

We add to the literature by examining broad patterns in how and why teachers circulate. We ask two research questions: (1) How do Algebra teachers circulate and initiate discussions during student work time? And (2) What are Algebra teachers' justifications for engaging in various circulation and initiation patterns while students work independently on mathematics problems?

Conceptual Framing

To parse classroom activities, we used Otten et al.'s (2018; 2023) instructional framework, which focuses on structural aspects of mathematics lessons and distinguishes two types of student work time: *independent work time* (wherein students work on material related to the lesson individually or in voluntary groups) and *group work time* (wherein students are explicitly expected to collaborate with peers). The present study focuses on these work time lesson segments because the framework attends to *teacher circulation* (the teacher's physical movements around the room or lack thereof, e.g., if the teacher sits at their desk) and *teacher initiation* of interactions with students (whether the teacher reacts to students' raised hands or proactively checks in or questions students). Given the framework's focus, and due to limitations in data collection (focusing solely on the teacher), we attended only to the manner in which

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teacher-student interactions were initiated.

We did, however, examine teachers' rationales for their circulation and initiation actions. Using practical rationality (Herbst & Chazan, 2011), we view teachers as professionals who must balance a complex network of obligations and who have meaningful reasons for their practices and decisions. This framework is designed to guard against researchers imposing their own instructional goals or inferred reasons for teacher actions, and this stance is aligned with our broader project where we seek to provide teachers with instructional suggestions that fit their current realities rather than imposing our scholarly vision of instruction (Otten et al., 2022; 2025). A major component of the practical rationality framework is categorizing teachers' justifications for certain actions, with categories focused on managing the interaction space, meeting individual student needs, adhering to institutional expectations or meeting the teacher's own needs, and attending to dynamics of the mathematics discipline.

Method

This study is part of a multi-year, multi-state, incremental professional development (PD) project for Algebra teachers. Data for this report came from the baseline year (prior to the PD intervention) and included three lesson observations in each of the 51 teachers' classrooms (n=153) using Swivl video recording that tracks the teacher (Wonsavage et al., 2024). Our lesson observation protocol enumerated the lesson segments defined above—whole-class discourse, independent work time, group work time, and non-instructional time. In addition, we conducted individual Zoom interviews with all the teachers (approx. 45 mins) focusing on their typical Algebra instruction. The teachers varied in their professional experience (1–15 years of teaching) and social demographics (e.g., racial, gender, and ethnic identities). The analysis reported here focuses on the patterns of teacher circulation and initiation during individual and group work time and the teachers' responses to the question of "what [they] do while students work independently in small groups or individually."

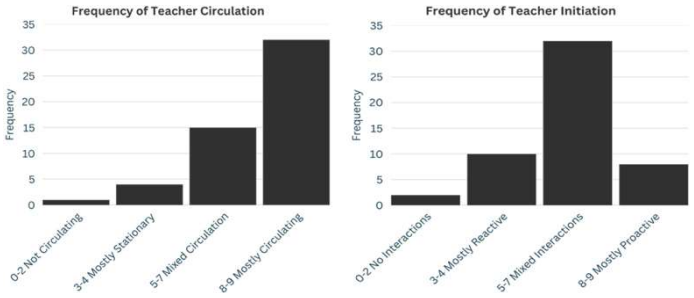
For each observation, two researchers independently coded the lesson and then met to reconcile. For circulation, we assigned a code based on the preponderance of teacher movement: 0 No Circulation, 1 Stationary (mostly stayed at one or two spots), 2 Mix (an even combination of stationary and circulating), and 3 Circulating (mostly moving between students or around the room). For initiation, again we assigned a code based on the preponderance of teacher-student interactions: 0 No Interactions, 1 Reactive (teacher responds to student questions as they arise), 2 Mix (an even combination of reactive and proactive interactions), and 3 Proactive (teacher interacts with students without student raising a hand or calling for teacher). While 3 was used for circulating and proactive, these should not be interpreted as "better" scores. The numbering was arbitrary and 3 could have instead been used for stationary and reactive codes. More importantly, a 2, in either case, represents a combination of the two endpoints.

To analyze the observation data, we took the sum of the three observation scores (0 to 9) and reported descriptive statistics for each variable of interest. Teachers scoring 0–2 were labelled as not circulating/interacting, 3–4 as mostly stationary/reactive, 8–9 as mostly circulating/proactive, while 5–7 signified a mix of circulation and initiation types. Analysis of the transcribed interview data involved two phases by multiple authors. First, we read the entire transcripts and identified segments where the teachers described and justified their typical circulation and initiation patterns. Phase two involved emergent coding (Saldaña, 2016), wherein we noted the justifications (Herbst & Chazan, 2011) the teachers gave.

Findings

For RQ1, across the 153 observations, there were 9,387 minutes of classroom instruction, (3020 mins (32%) of independent work time; 1009 (11%) of group work time). Thus, 43% of the data was used for this analysis. The average class length was 59 minutes, with 20 minutes devoted to independent work time and 7 minutes to group work. For all 51 Algebra I teachers we examined their type of circulation (*M=7.44, SD=1.81*) and initiation (*M=5.7, SD=1.76*), depicted in Figure 1. Teachers were generally more likely to be up and moving (circulating) than stationary. Their initiation was more varied, with most engaging in mixed interactions.

Figure 1: Bar Graph of Teacher Circulation and Initiation



For RQ2, three themes emerged from the teachers' justifications for their circulation: ensuring student engagement, meeting student needs, and meeting teacher needs.
A majority of the teachers stated that their reasons for circulating and initiating interactions were tied to ensuring that students are engaged and staying on task. Erin said:

> I walk around at the beginning just to make sure they're all on task until I'm called to one area, and I try not to stay there too long because I do not want them to think, you know, "[The teacher] is not here now, I don't have to do any work."

For Erin, she *proactively circulates* to ensure that "all [students] are on task," unless some students request specific help, which she *reactively* offers, but not for long, lest other students get disengaged. A similar reason was given by Losos who said he *circulates proactively* to "make sure that they [students] are not doodling or daydreaming."

Other teachers reported that they circulate to formatively assess students. For example, Marcello said he *reactively circulates* to ensure that students "get that immediate feedback if they're right or wrong." For Julia, *proactive circulation* allows her to observe students' work and take note of "which processes are correctly done," which ones are not, and the reasons for the wrong answers so that she can make a good decision about what ideas to address later.

Although most teachers circulate, one teacher, Lucy, said that she is normally *stationary* but still describes a *proactive* approach, wherein she mandates students to check in with her, "after the first 2 or 3 problems…just make sure that everybody is on track."

Another justification for (non)circulation relates to meeting the needs of students who are struggling. For example, Margie said she *proactively* "checks in [with specific] kids that I know struggle" to offer support. Marcus said he *circulates reactively* to students who "raise their hands more" and those who are "really vocal because they do not understand and want to advocate for more help." Another teacher, Julia, said she sometimes stays *stationary* and *proactive* if "it's a topic or something I know [students] might feel more comfortable coming to talk to me, rather than me coming to them." We see this as an implicit justification of meeting students' needs by

honoring their agency and comfort levels of seeking the teacher's help. Note that Julia also mentioned that on most occasions she would proactively circulate to ensure students are getting correct answers, indicating that her circulation patterns differ based on her formative assessment of students' understanding of the topic.

A final justification given by a few teachers was related to being stationary. Both by teachers who tended to be *stationary reactive* and those who were *stationary proactive* use student work time to catch up on other things like grading, preparing future lessons, taking attendance, and checking emails. For example, Rachel said that student work time allows her to "get ready for the next class" and meet other mandated school needs like "setting up standard assessments," which relate to institutional obligations in the practical rationality framework. Musa reported that his circulation patterns vary depending on students' activity format:

> I like to use group work time to observe the students…to see what they are doing and how they are talking to each other…Because when they are doing independent practice, I do not get time to do that because I am having to help them so frequently.

Musa highlighted that he observes students in an intentional way during group work because that is the time he can *proactively* monitor group dynamics (Ehrenfeld & Horn, 2020). Notice, though, that he alluded to the fact that he would reactively circulate to help students when they work individually. The framing, overall, is about the formative assessment needs that he has as a teacher, which is subtly different than justifying the circulation based directly on student needs.

Discussion

Student work was 43% of the class time we observed, so we sought to better understand patterns and reasons for teacher circulation. We do not advocate for any specific teacher actions but encourage teachers to critically examine their circulation rationales and make decisions that fit their classroom dynamics (e.g., deciding when proactive initiation is useful versus when it may distract students who are on task). Teachers' justifications show that, although circulating is valuable for student engagement and meeting student needs, being stationary can also be valuable or, at times, necessary. Indeed, most teachers reported varying their circulation and initiation patterns depending on the class mood or tasks for the day.

The study was in Algebra classes and is not representative of all K–12 levels, however, they resonate with other research findings that situate classroom circulation as a ubiquitous teacher practice (e.g., Clarke, 2004; O'Keefe et al., 2006). Given the current scarcity of empirical research on circulation, we argue that it is worthwhile for scholars to explore the various impacts and relationships between circulation and other classroom factors or student outcomes. Circulation is common, but is it always worth the effort in relation to student learning? If not, a teacher might be able to accomplish other tasks while students work. Could there possibly be unintended consequences of circulation, or such a thing as "too much" circulation? Teachers employed both proactive and reactive initiations with students, but in what circumstances might proactive initiation be more appropriate, or are there any cases in which a teacher may not react to a students' raised hand? What do students themselves perceive of these forms of circulation and initiation? Many other empirical questions may build upon patterns identified in this paper.

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