Introduction

Many researchers have explored the impact of graphing technologies in mathematics classrooms (see Heid & Blume, 2008). The implementation of such instruments often raises questions related to new complexities concerning the teacher’s role in supporting rich student learning (Guin, Ruthven, & Trouche, 2005). In recent work, researchers have examined ways that teachers use whole-class discussions to guide and shape students’ mathematical activity with these types of instruments (e.g., Drijvers, 2011). This present study builds on and extends related research by specifically targeting teacher actions used to support students’ graphing calculator use in small group settings.

Research Question

What types of instrumental orchestrations does a teacher implement with students who are working within small groups?

Emergent Questions: As the Analysis Progressed

- What does the teacher do during the interactions?
- Who operates the graphing calculator during the interactions?
- Who initiates the interactions?
- Who does the thinking during the interactions?
- Who does the talking during the interaction?
- Who assumes the mathematical authority?

Method

Following a case study design adapting Drivers’ (2011) instrumental orchestrations as an analytical framework, I observed and video-recorded a single high school teacher’s instruction focusing on quadratic functions over the course of four days. Coding of the video data revealed patterns in the ways that the teacher supported student activity with graphing calculators. Postlesson interviews were used to triangulate the observed orchestrations.

Initial Results

The teacher heavily favored the use of two types of orchestrations, the Work-and-Walk-by and the Technical-Demo (Drijvers, 2011). While implementing the Work-and-Walk-by orchestration type, the teacher primarily verified that students were on task and making progress towards solving the assigned problems (Figure 6). The Technical-Demo orchestration, however, was implemented in multiple ways, which led to the delineation of three subtypes of orchestrations: one where the teacher computes without showing students the keystrokes used on the graphing calculator (Figure 7); one where the teacher shows the keystrokes used (Figure 8); and one where the teacher performs some of the graphing calculator operations and pauses to prompt for student input and thinking (Figure 9).

Response to the Research Question

The teacher primarily implemented teacher-centered orchestrations, influenced by student unfamiliarity with some aspects of the graphing calculators.

Day 4 Interview (19:09 to 19:49)

“While the students didn’t have a good understanding of how the tools work – basically, it seems like the taking it out of their hands (pause), doing as a demonstration, is more demonstration than trying to get them to think about it – and get a feel for it by themselves. Um, it’s a lot of the students get real anxious – and I can tell that – I don’t completely understand that anxiety, um, what were – and I can even think it’s my fault, given as example of using Microsoft Word and personal troubleshooting efforts.”

References


Implications for Future Work

- Collect data over a longer time span to observe variations and changes in orchestrations.
- Investigate how teachers transition from teacher-centered orchestrations to more student-centered orchestrations.
- Examine patterns that transcend teachers’ whole class and small group orchestrations.

Classroom Observation: Day 4 (39:54 to 40:07)

T: Yeah?
S: Okay, we got the answer.
T: [verifies the student’s output on the calculator] Awesome!
S: Do we have to do the quadratic… [quadratic regression]
T: Yes.
S: Okay.

Classroom Observation: Day 3 (14:39 to 15:02)

T: Yeah.
S: I just got it here [referring to a data list], indicating progress with the graphing calculator.
T: Yeah, so we’re looking for the average dimension of the frame -- so, we’ve got two dimensions. Just average them together.
S: Alright.
T: And then the cost goes in the other one [referring to a data list].
S: Alright.
T: So the L2 is going to be the cost list right down there, and then the L1 is just average the two numbers together each and put the averages in there.
S: Okay.

Classroom Observation: Day 4 (44:02 to 44:26)

S: How do I get those zeros off there [pointing at extra data values entered into a list]. “cause it’s messing up what the thing is.
T: [while pressing the ‘delete’ button so that the student can see the screen change] Delete, delete, delete, delete, delete, delete. [pause] Delete. You wanna push the last delete?
S: Yeah, sure.