Characterizing College Instructors' Attention During Peer Observations

Emily Jones
UT San Antonio

Stephen Lee
UT San Antonio

Jessica Gehrtz
UT San Antonio

Priya V. Prasad
UT San Antonio

Research has highlighted that actively involving students during instruction can lead to positive outcomes for students. However, college mathematics instructors may need support to develop the knowledge and skills necessary to effectively implement this type of instruction. This study looks at how college algebra instructors in a grant-supported professional learning community (PLC) focus on different aspects of their own and others' teaching. We leverage the instructional triangle as an analytical framework to characterize the foci of participants' observations. We analyzed PLC meetings where participants reported on specific aspects of each other's observed classes. Our analysis revealed that instructors each had a primary focus that drove their observations. We anticipate these different foci will inform future PLC meetings and lead to new questions about instructor thinking, and to continued development of the instructional triangle.

Keywords: Instructional Triangle, Peer Observations, Professional Learning Community

Research has repeatedly emphasized that teaching that actively engages students can lead to improved learning outcomes and conceptual understanding for students (e.g., Eddy & Hogan, 2014; Freeman et al., 2014; Kogan & Laursen, 2014; Laursen et al., 2014; Theobald et al., 2020). However, lecture remains a common form of instruction in many college mathematics classes (Apkarian et al., 2021; Stains et al., 2018). As such, it is important to support college mathematics faculty in developing the knowledge and skills necessary for teaching in a way that centers students and their thinking and moves beyond lecture.

This study is part of a larger ongoing funded project of collaborative instructional improvement at the university level, aiming to support the implementation of evidence-based instructional practices that actively engage students with the course content (funding information blinded for proposal). The project is a professional development experience for the instructors of all sections of a university-level college algebra course at a single institution. As part of this project, instructors work as a group to implement Continuous Improvement cycles (Berk & Hiebert, 2009) to develop and facilitate lessons on particular course topics. This process closely mirrors Lesson Study in that instructors work together to develop lessons, observe each other's lesson facilitation by watching video recordings, and then reflect on and revise the lessons (Dick et al., 2022). Instructors chose to create and use Desmos Classroom activities as a way to incorporate active learning in their teaching. Although instructors differed in how they used these activities (with some soliciting and leveraging student thinking more than others), they all gave students time to work individually or in small groups before discussing the activities in class. Notably, no instructors felt that they needed to lead students through the activities themselves.

This study centers on the discussions surrounding participants' observations of their peers' teaching. These observations were conducted in the style of a video club (e.g., Sherin & van Es, 2005), with each instructor watching the recording of another instructor's class and choosing clips to highlight for the whole group. Our research aims to answer the following question: What do college mathematics instructors notice when observing each other's teaching?

Theoretical and Analytic Frameworks

Teacher noticing informed the conception, data collection and analysis of this study. Noticing occurs when a teacher identifies important instances in a teaching situation, and then works to make sense of them (Jacobs et al., 2010; Sherin & van Es, 2005). Research on teacher noticing has highlighted that expert teachers tend to focus on noteworthy events, provide interpretive comments, and make connections between student thinking and pedagogical moves. In contrast, teachers with less developed noticing skills focus on general impressions and provide descriptive or evaluative comments about what was observed (van Es, 2011).

For this study, we used the "instructional triangle" as our analytic framework to capture what instructors were attending to as they observed one another's classes. Cohen and Ball (2001) argued that instruction consists of "interactions among teachers and students around content, in environments" (p. 122). These three components (teacher, students, content) are often represented as the vertices of the Instructional Triangle, with the edges of the triangle representing the relationships between each of these elements.

Recent research examining instruction at the college level has leveraged the Instructional Triangle to analyze instructors' reflections and discussions during an online working group centered on the teaching of Abstract Algebra using inquiry-oriented instruction (Kelley & Johnson, 2022). Specifically, Kelley and Johnson (2022) categorized instructors' comments as focused on the instructor, students, or mathematical content, and then connected this to instructors' roles during discussion in the working group. They found that over the course of the working group that individual instructor's foci shifted in different ways, but both instructors demonstrated a shift from a focus on content to a focus on the relationship between content and students. Our research aims to characterize instructors' foci when observing another instructor teaching a target lesson that was collaboratively developed, and then to use what we learn to inform how to support shifts in participant discussion for future observations.

Methods

The participants were four college algebra instructors at a large university who met weekly in a professional learning community (PLC) to share and discuss video clips of classroom observations and revise course curriculum for future semesters. For this study, we first recorded each instructor teaching an online lesson on algebraic properties. The PLC facilitators (who are the project's principal investigators) then asked participants to watch the video-recording of another participant teaching this lesson and select clips that caught their attention before the next meeting. Participants were paired, each watching their partner's recorded lecture in order to highlight specific aspects of each other's teaching. Participants were asked to consider things that would help improve the lessons for future classes and to identify any other interesting aspects of the teaching. At the next PLC meeting, participants showcased what they noticed from recordings of each other teaching this lesson, following a video club format. We then repeated this process for the lesson on fractions and the lesson on factoring. We recorded and transcribed the PLC meetings for analysis.

We utilized the Instructional Triangle (Cohen & Ball, 2001) to generate and assign codes to both the selected video clips and the participants' observations immediately following each video clip. Our aim was to gain insight into which aspects of a clip the participant was focusing on. We coded segments for the participants' focus on mathematical Content (C), Teachers (T), Students (S), and the interactions between the three: Teacher-Content interactions (CT), Student-Content

interactions (CS), and Teacher-Student interactions (TS). We also differentiated between participant focus on teacher-student interactions about specific content, such as an instructor answering a content-related question (Teacher-Student Content interactions; TSC), and teacher-student interactions that were not explicitly related to content, such as discussions about classroom procedure or the instructor validating a student's contribution to the class discussion (Teacher-Student Non-Content interactions; TSN). Another addition we made to our codebook was creating the Content-Teacher-Student (CTS) code, which captured the participant tying all three corners of the instructional triangle together at once. This code differs from TSC by emphasizing the ways in which all three vertices interact at once, with each vertex engaging with the other two equally, while TSC highlights interactions between students and teachers where they are focusing on each other rather than engaging with the content individually.

The first and second author independently coded the transcripts, and then met to discuss all coding decisions. After reconciling all coding decisions, we calculated the frequency of codes that arose from each participant's comments about the video clips. By analyzing these frequencies and trends, we were able to identify focus profiles for each of the instructors.

Results: Participant Focus Profiles

Our data analysis allowed us to identify three distinct focus profiles demonstrated by the four participants, including a profile focused on Non-Content Teacher-Student interactions, a profile on Content-Teacher interactions, and a profile focused on Content interactions. In this paper, we provide a brief summary of each of the three profiles based on the participants' discussion from the algebraic properties lesson. Table 1 shows the frequency of specific codes assigned to each participants' discussion during the PLC meeting, highlighting what they noticed while observing the algebraic properties lesson.

Table 1. Frequency of Codes for Each Participant's Discussion on the Algebraic Properties Lesson

Participant		C	CS	CT	CTS	S	T	TSC	TSN	Total
Alex	*n*	0	2	0	2	1	3	0	15	23
	%	0.0	8.7	0.0	8.7	4.4	13.0	0.0	65.2	100.0
Nicholas	*n*	0	0	1	0	0	4	0	11	16
	%	0.0	0.0	6.3	0.0	0.0	25.0	0.0	68.7	100.0
Ivy	*n*	3	1	4	2	1	0	1	5	17
	%	17.7	5.9	23.5	11.8	5.9	0.0	5.9	29.4	100.0
Shay	*n*	0	0	10	1	1	1	0	4	17
	%	0.0	0.0	58.8	5.9	5.9	5.9	0.0	23.5	100.0

Focus on Non-Content Teacher-Student Interactions

Two participants, Nicholas and Alex (pseudonyms), tended to focus on Non-Content Teacher-Student interactions (TSN) as more than 65% of their discussion about the video clips

were coded as such. Interestingly, both Nicholas and Alex appeared to have a secondary focus on the Teacher category, with 25% of Nicholas' and 13% of Alex's contributions receiving Teacher codes (T). Because of this, we characterized Nicholas and Alex as primarily concerned with the ways in which teachers conduct themselves in the classroom, and the interactions they have with students that are not related to specific pieces of content.

We find it interesting that these participants were so similar in their foci, because the other participants had very different foci in their discussions about the observations. We hypothesize that similar priorities and strategies between Alex and Nicholas' teaching may have contributed to the similarity of their foci during the video club meetings. For example, Alex spoke a lot about Nicholas' (and other participants') approach to gathering buy-in from students, saying, "He said, 'You know, no matter how we feel about the group work, there's a reason we're doing it.' He's… providing that… explanation of why we should do the group work [for students]." Alex also responded to Shay's comments about a clip of Ivy's teaching, saying, "I kind of just agree with everything that was said. I like, a lot the way that [Ivy] is kind of candid with her students. I think that helps encourage the buy-in. She just tells it like it is."

Similarly, Nicholas spoke about Alex's (and others') efforts to motivate students and the response from students those efforts garnered. Responding to a clip of Alex's teaching, Nicholas commented, "I liked that he actually gets his students to talk and discuss." Nicholas also responded to a clip of Ivy's teaching that Shay presented by saying:

> I think in general, even if we feel like we were on rinse and repeat, the more we say, 'This is why we're doing this this way. This is what we're trying to accomplish.' I think… it's enough throughout the semester to get the buy-in from the students … I think [Ivy] handled that perfectly - I always get the pushback of, 'Well, you're not teaching, you're not explaining something.' Well, we are. We're interacting and we're doing it together.

This focus on the interactions between teachers and students, and how those interactions can encourage students to participate fully in class, was a major component of Alex and Nicholas' contributions to the discussion.

Although Nicholas and Alex tended to focus a similar amount on Non-Content Teacher-Student interactions, we did identify some differences between Nicholas and Alex based on what else they focused on during the discussion of video clips. Nicholas' focus on Non-Content Teacher-Student interactions and Teacher comments accounted for 93.75% of his contributions, while Alex's focus on the same two categories accounted for only 78.26% of his. The remaining contributions from Nicholas fell under Teacher-Content Interactions (CT), while Alex's were spread between CS, CTS, and S. Note all of these codes involve interactions with students, which highlights that Alex was also concerned with the students' experience. This difference between Nicholas and Alex may be influenced by their standing within their instructional team. Nicholas is a course coordinator, so his primary focus on instructors may follow from that. Alex is a younger instructor, with preparation in secondary mathematics teaching and a graduate background in mathematics education research. We hypothesize that this may contribute to his focus on the experience of the students.

Focus on Content-Teacher Interactions

The second profile we identified is demonstrated by Shay (pseudonym), who was primarily focused on Content-Teacher interactions, with 59% of her observations focusing on the relationship between the instructor and the content they presented. Shay was secondarily focused on Non-Content Teacher-Student Interactions, with 24% of her contributions receiving that code.

A large portion of Shay's focus on Content-Teacher interactions was directed inward, reflecting on her own teaching. For example, after observing Ivy teach the algebraic properties lesson, Shay said:

> That's something that I never thought of … I'm like, when was the last time I actually did … teach the properties? And I'm like, it's been a really long time. So being able to see how … [Ivy] talked about these two [properties] was really nice.

We characterized Shay as Content-Teacher Focused because of this emphasis on her own and other instructors' relationship or interaction with the content they teach.

Focus on Content Interactions

Our third profile that we identified was characterized by Ivy's (pseudonym) primary focus on content and the ways in which individuals in the classroom interacted with said content. In particular, over 65% of Ivy's contributions were anchored to content, with the Content code consisting of 18% of her comments, Content-Teacher-Student interactions as 12% of her comments, and the codes Teacher-Student Content interactions and Student-Content interactions codes accounting for 6% each of her comments. Ivy's focus can be illustrated by this quote:

> Students got answers of 16, 8, 10, and 1, and [Shay] was asking for input … 'Would you mind sharing how you got your answer?' And that was after they had already established that 16 was the correct answer. So students actually did start answering and saying that this is what they did.

Because Ivy's focus is on the content in relation to both the instructor's words - "Would you mind sharing how you got your answer?" - and on the students' engagement with the content - "Students actually did start answering and saying this is what they did" - we characterize Ivy's contributions as being Content-Focused. We distinguish this from the Content-Teacher Interactions profile described above because Shay was focused on content and instructors, whereas Ivy was focused on both instructors' and students' relationship with the content.

Discussion

The diversity of participant foci in our results offers the opportunity to look into and pose questions about why certain instructors had the focus they did. We saw Alex and Nicholas both had a focus on Non-Content Teacher-Student interactions in their observations. This makes us wonder if they may have taken this observation opportunity to look for ways to further develop their pedagogical skills, specifically in relation to their interactions with students. This begs the following questions for further study: 1) Does this focus come from a perceived lack of those skills or from a perceived strength in those skills?, and 2) How does this impact the instructors' approach to soliciting and leveraging student thinking in class?

Further, during our coding and analysis of the transcripts we noticed a consistent focus of pedagogical observations relating to the use of technology, such as Desmos and Zoom. The prevalence of these observations leads us to consider the potential of adding technology as a fourth vertex to the instructional triangle in our analytic framework, especially for classes conducted online. Further investigation on the interactions between the three elements of the instructional triangle and technology could highlight how the mechanics within Desmos can be used to elicit student thinking in different ways. Finally, we intend to explore further the ways that instructors differ in their pedagogical and content priorities and their interactions in order to better shape professional development opportunities within the project and better support PLC interactions and discussions in the future.

Acknowledgements

Support for this work was provided by the National Science Foundation (#2116187). Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

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