Summer 8-2023

Positioning Undergraduate Learning Assistants in Instruction: A Case Study of the LA Role in Active Learning Mathematics Classrooms at the University of Nebraska-Lincoln

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POSITIONING UNDERGRADUATE LEARNING ASSISTANTS IN INSTRUCTION: A CASE STUDY OF THE LA ROLE IN ACTIVE LEARNING MATHEMATICS CLASSROOMS AT THE UNIVERSITY OF NEBRASKA-LINCOLN

by

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A DISSERTATION

Presented to the Faculty of

The Graduate College at the University of Nebraska

In Partial Fulfillment of Requirements

For the Degree of Doctor of Philosophy

Major: Mathematics

Under the Supervision of Professors Yvonne Lai & Wendy Smith

Lincoln, Nebraska

August, 2023

POSITIONING UNDERGRADUATE LEARNING ASSISTANTS IN INSTRUCTION: A CASE STUDY OF THE LA ROLE IN ACTIVE LEARNING MATHEMATICS CLASSROOMS AT THE UNIVERSITY OF NEBRASKA LINCOLN

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University of Nebraska, 2023

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Research suggests learning assistant (LA) programs can be a change lever to support the institutionalization of active learning in postsecondary education. Some research suggests LAs offer unique benefits for STEM courses, independent from other change levers, but more research needs to be done to understand how LAs support active learning classrooms, specifically in mathematics. Research on mathematics instruction and the use of reform resources suggests that the successful implementation of reforms is impacted by perceptions individuals hold about that resource, such as the LA role. Yet, there is little research about the LA role in mathematics, particularly where the instructor is a graduate student (GSI).

This dissertation addresses this gap by presenting a qualitative case study of the LA role in active learning precalculus classrooms at the University of Nebraska Lincoln. Participants included 9 LAs, 18 GSIs, 411 students, and one LA Coordinator. This study aimed to understand the LA role by examining how participants perceived LA-instructor and LA-student interactions. Data included interviews, classroom observations, observations of instructor-LA meetings, and open-ended survey responses.

The findings of this study are presented in three chapters: Chapter 4 describes how instructional rights and duties were distributed through five positions that defined LA-instructor interactions. Chapter 5 describes and compares how instructors and LAs perceived LA-student interactions, focusing on two subcases to highlight common themes from the data. Chapter 6 describes how students viewed LA-student interactions. These findings suggest that the LA role manifests through multiple positions, that those involved in instruction may have conflicting perceptions of the LA, and that although LAs are at times thought of as distinct from the instructor, they are often considered to occupy the same role, particularly by students. The conclusions from this research can help inform professional development for learning assistants, as well as extend our field's understanding of factors that influence the manifestation of the LA role.

DEDICATION

To my parents - who from a young age instilled in me a love of learning and stories.

To Taran and Killian - you make our life a story worth telling.

ACKNOWLEDGEMENTS

I am indescribably grateful to all the people who have encouraged me to complete the journey of graduate school. Yet, I find it important to try to put this gratitude into words.

My participants, thank you for sharing your perspectives with me, particularly during a global pandemic.

Yvonne and Wendy, thank you for all your guidance over the years. I've appreciated how you both have pushed me, in different ways, to be a better researcher. I would never have finished this dissertation if it weren't for the support you both have given me. Thank you for your sincere interest in my work, your patience, and your willingness to tell me when it's time to stop (over?) analyzing the data. I feel lucky to be able to call you my advisors, but also my colleagues.

Allan and Josh, thank you for taking the time to read this dissertation and provide feedback as well as insider knowledge about this case. I hope you find it compelling and useful in your work. The mathematics department is lucky to have two faculty members such as yourselves who are so devoted to supporting the experiences of students, learning assistants, and graduate students.

Justin, thank you for being a part of my committee and requesting that I join your *Designing Learning Experiences* course. Your class broadened my view of education and what it means to learn. I'm still thinking about how to apply what I've learned from you to my research. While I can't say that I've avoided the pull of categorizing and theme-

making altogether (to get the “right” representation) I have been more intentional about attending to ways in which things don’t quite fit.

Kelsey, thank you for being my writing partner, my supporter, and my friend. Your passion for research (and your dissertation) helped reinvigorate my interest in my work at a time when I was feeling low - struggling with the demands of being a graduate student, a mother, and a professional. I truly believe that working with you was the push I needed to complete my dissertation. I’m so excited to continue working with you on our research plans.

Molly and Karina, thank you for all your guidance, encouragement, friendship, and gentle reminders that sometimes you just have to complete the thing. I’ve appreciated all of the work we’ve done together and am looking forward to collaborating more in the future.

For all the other mathematics education research-interested folks I’ve collaborated with at UNL - especially Amy, Leilani, Johan, Dakota, and Brittany - thank you for your thoughtful perspectives on research and passion for improving mathematics education.

My family, you are everything. At times I wondered if this was the best thing for us. Thank you for encouraging me to continue, even though I’ve been “so close” for the past two years. Killian, thank you for sharing your mom.

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CHAPTER 1: INTRODUCTION

Opening Vignette

Consider Ciri, an undergraduate mathematics student who is fulfilling the role of a learning assistant (LA) in a precalculus classroom alongside an instructor who is a graduate student in mathematics. Ciri is a mathematics and psychology double major with an interest in going to graduate school for mathematics. Ciri knows they will need to do a lot of teaching in graduate school, so they are eager to put on that "hat" as a LA. Ciri works in an active learning classroom; students spend much of class time working at tables alongside (and with) other students on mathematical tasks. Students in Ciri's class often struggle to start these tasks and ask Ciri for help. Here is how Ciri typically responds:

> If it's a trickier problem, I'd be like, "Oh yeah. That one's like," I'll try to validate where they're at. If it's a problem that I think that they should be able to do, I'll ask "Okay, what about 1B is confusing? Have you thought about trying to do this to that?" Cause it can kind of be a hard line to walk of 'I want to help them all the time, but also they need to be able to do some of this by themselves.' So sometimes I'll be like, "What's the double angle formula for cosine?" Or this or that. And then be like, "Okay, so I'm going to let you try doing that. And I'll check on you in a few minutes." I try to like force them to work on it some. And there would be a good amount of time, so they'd be like, "Oh, okay. Like I get it now. Like we're good." And then when they're just really confused on this problem I'd be like, "Okay. Yeah, that makes sense. This one is, I understand it's a little trickier. Okay. So you see how it's at" and then tell them what rule - kind

> of write up, show them what the beginning of it looks like. And then try to have them keep working on their own. Or I would do the first step and I'd be like, "Okay, so what do I do from here?" And then, someone would be like, "Okay, you know, you divide by two" and I'd be like, "Great, what's next?" And this, kind of, "UNO reverse card." I will now ask you all the questions on how to solve this problem.

In reading Ciri's response, a researcher may have several questions: How does Ciri determine whether a problem is something students "should be able to do"? How do Ciri's actions contribute to the maintenance or decline of students' engagement with mathematics? What mathematical features of the task might Ciri orient students toward to enable problem-solving? Does Ciri mainly identify known procedures or do they probe for understanding? How does Ciri's scaffolding support productive struggle? How do Ciri's actions convey empathy to their students?[1]

In this dissertation, I focus on understanding how LAs like Ciri view their role in relation to students, as this influences what interactions with students look like and, consequently, what opportunities students have to learn and feel a sense of belonging in class. As such, I seek to understand questions like: How does Ciri position themselves as a LA in relation to students through this narrative? What duties does Ciri consider themselves to have when interacting with students? Moreover, Ciri's relationship with the instructor and how they position themselves in relation to the instructor are important facets of their role in instruction. Ciri works with an instructor of record, a graduate

[1] These ideas relate to several areas of research in mathematics education. For examples, see Barlow et al. (2018); Henningsen & Stein (1997); Hiebert (1986); Uhing (2020); Van de Pol et al. (2010).

student, within a highly coordinated course led by an associate convener, also a graduate student, and a convener[2]. As such, I expand this question to: How does Ciri position themselves as a LA in relation to others involved in instruction? How do these individuals position Ciri? I also want to go beyond understanding Ciri's experiences: How do other LAs position themselves? How do individuals involved in instruction position LAs? How do students position LAs? Finally, how do these positionings contribute to an overall understanding of the role of the LA?

The Problem

Students like Ciri have been hired through LA programs nationwide to support student success, particularly in STEM courses. Over the past couple of decades, LA programs have multiplied across the U.S., as have several related initiatives to improve STEM education and address the need for a diverse and evolving STEM workforce.

In the mathematics community, these initiatives have been prompted, in part, by a report by the President's Council of Advisors on Science and Technology (PCAST, 2012), which implicated lower division undergraduate mathematics courses in the dearth of students prepared and interested in pursuing STEM degrees. The Progress through Calculus team reported an average drop-fail-withdrawal rate of 27.36% for students taking precalculus courses and 22.07% for Calculus 1 (Apkarian & Kirin, 2017). Their study included 134 PhD-granting institutions and 89 MA/MS-granting institutions. Given that enrollment in precalculus and calculus courses accounts for over 90% of the roughly 2.5 million students enrolled in collegiate mathematics courses, these results indicate that hundreds of thousands of students are likely failing precalculus and calculus each year,

[2] The term "convener" is synonymous with the more common "coordinator," used in other contexts.

which is problematic considering that students who fail their first mathematics course are more likely to switch away from a STEM major or discontinue their postsecondary education altogether (Laursen, 2019). Further, studies have shown that historically underrepresented minority students and women are less likely to persist in postsecondary education than white men after facing setbacks (Ellis et al., 2016; Moreno & Muller, 1999; PCAST, 2012; Rasmussen et al., 2014; Subramaniam et al., 2008).

Professional societies such as the American Mathematical Society and the Mathematical Association of America have called for mathematicians to address equity issues in STEM, voicing support for the use of active learning instructional methods toward this goal (Friedlander et al., 2019; Mathematical Association of America, n.d.; Saxe & Braddy, 2015). Research has shown that active learning strategies can support increased student success (Hsu et al., 2008; Laursen et al., 2014). In the oft-cited Freeman et al. report (2014), the authors conducted a meta-analysis of 225 research studies and found that students in active learning STEM courses were 55% more likely to pass the course than those in a lecture-based course. Student-centered teaching practices, which include active learning strategies, also have the potential to support increased success for historically underrepresented groups in mathematics, although this is not guaranteed: active learning strategies can introduce adverse outcomes for marginalized groups if issues of participation (particularly, whose voices are heard) are not attended to (Johnson et al., 2020; Laursen et al., 2014; Reinholz et al., 2022).

Instructors who adopt active learning practices need multiple supports to be successful. Such support may include incentives for improvement, curriculum materials, professional development, and LAs (through LA programs). LA programs are intended to

follow a near-peer framework (Barrasso & Spilios, 2021; Hill et al., 2023). Broadly, this means that one intent behind incorporating LAs into classrooms is so that students can interact with a more peer-like teaching figure (i.e., a near-peer) who has subject-specific expertise and provides emotional and social support. Furthermore, LA support can benefit instructors who are otherwise hesitant to use active learning strategies in a larger classroom since LAs act as other facilitators during small group work.

Numerous positive outcomes have been reported about LA programs, including increases in students' conceptual understanding, higher-order cognitive skills, satisfaction, and sense of belonging and decreases in failure rates (Alzen et al., 2018; Clements et al., 2022; Goertzen et al., 2011; Otero et al., 2010; Sellami et al., 2017; Talbot et al., 2015). Furthermore, LAs receive positive benefits, such as the development of a professional identity and sense of belonging in STEM, and, for LAs who go on to become K-12 teachers, improved teaching practices (Close et al., 2016; Gray et al., 2016; Nadelson & Fannigan, 2014). Howeover, the field is still emergent.

Most research about LAs has been in physics, and very little research has delved into the nature of LAs' partnerships with instructors (Barrasso & Spilios, 2021). The research that has been done suggests that these partnerships are fluid, complex, and vary in the degree of agency held by both parties (Davenport et al., 2017; Jardine, 2020; Sabella et al., 2016). However, this research primarily focuses on partnerships between LAs and faculty. Although some research has been done to compare the self-perceptions of graduate teaching assistants, learning assistants, and professors (Becker et al., 2016), there is virtually no peer-reviewed research about LAs working with graduate students acting as instructors of record (GSIs), particularly in mathematics courses. Given the

potentially powerful impacts of introducing LAs into classrooms - for students, instructors, and LAs themselves - it is worthwhile considering how the LA role is conceived of within a context that focuses on a fundamentally different type of LA-instructor partnership (i.e., one in which graduate students take the role of instructor) within mathematics classrooms, and how this conception bears similarities or differences in how the LA role is conceived of in other contexts.

Since several mathematics departments employ graduate student instructors (GSIs) to teach lower-division mathematics courses as instructors of record, it is valuable to the field to explore the role of LAs in mathematics classrooms taught by GSIs. For example, 58% of the 139 precalculus courses offered by Ph.D.-granting institutions who reported information on the Progress through Calculus survey reported frequently hiring graduate students to teach precalculus (Apkarian & Kirin, 2017). The number of mathematics departments employing learning assistants in such courses is low. The Progress through Calculus survey asked departments in what capacity undergraduates are hired to support precalculus/calculus courses, with the options to select: “graders,” “tutors,” “recitation leaders,” “leaders of review sessions,” “leaders of supplemental instruction,” “other,” and “not hired.” Only seven courses were reported as having “other,” which may or may not have included LAs. However, given the quick proliferation of LA programs throughout the country, it is likely that more departments will start incorporating LAs into courses run by graduate students. Furthermore, the existing research on faculty and LA partnerships is mainly in other disciplines and still emerging. As such, it would benefit the mathematics education community to understand

how the LA role may be shaped by a mathematics context, and by having a graduate student instructor (GSI) leading the course.

Purpose Statement and Research Questions

The University of Nebraska—Lincoln (UNL) has hired LAs to support their precalculus courses since the fall 2014 semester. Furthermore, these courses are primarily taught by GSIs. This makes the LA role at UNL a useful case for investigating how the role of the LA manifests in mathematics contexts where the instructor is not a faculty member. The purpose of this qualitative case study was thus to understand how LAs, instructors, students, and others involved in precalculus instruction at UNL interpret or perceive the role of the LA in active learning precalculus classrooms. I collected data from summer 2020 to fall 2021, which included three semesters affected by the COVID-19 pandemic: fall 2020, spring 2021, and fall 2021. For this study, I asked the central question: *How do those involved in UNL's LA-supported precalculus courses perceive the LA role?* I narrowed this question to the following research questions:

RQ1a. How did instructors and LAs in active learning precalculus classrooms position themselves in relation to each other?

RQ1b. How did members of the instructional team describe the expected or actual distribution of instructional rights and duties between LAs and instructors in active learning precalculus classrooms?

RQ2a. How did instructors' and LAs' perceptions of LA-student interactions in active learning precalculus classrooms compare and what influenced those perceptions?

RQ2b. How did LAs position themselves as teachers in LA-student interactions?

RQ3a. How did students in active learning precalculus classrooms describe their interactions with LAs compared to their interactions with the instructor?

RQ3b. Why might students have preferred to interact with either the LA or the instructor?

Understanding the LA role requires an understanding of relationships, and in particular interactions, between LAs, instructors, and students. RQ1a and RQ1b focus primarily on understanding how the instructional team (LAs, instructors, associate conveners, conveners, and the LA Coordinator) perceived the relationship between the LA and the instructor, particularly through the lens of Positioning Theory, which focuses on how rights and duties are distributed in social interactions. RQ2a and RQ2b focus on how instructors and LA perceive LA-student interactions. These research questions are not mutually exclusive, as the distribution of instructional rights and duties necessarily involves perceptions of how students and LAs should interact versus students and instructors. Nevertheless, the focus of RQ2a and RQ2b captures perceptions of how the LA interacts with students that may not necessarily involve the instructor. RQ3a and RQ3b focus on how students view LA-student interactions.

CHAPTER 2: LITERATURE REVIEW AND THEORETICAL FRAMING

Theoretical frameworks can provide useful directions for research by highlighting what concepts and connections between concepts might describe phenomena, as well as provide a common language that researchers can use to connect their ideas. However, theoretical frameworks, especially if rigidly applied, can obscure other ways of understanding that emerge in context (Stewart, 2008). As such, in this section, I present a compilation of the ideas and frames of mind I found useful in shaping my dissertation through planning, collection, analysis, and reporting of findings. However, one of the reasons I chose case study methods was to prioritize the local - using thick descriptions and narratives to allow readers to make sense of the findings themselves rather than narrowly presenting findings from the point of view of one strong theory (Stake, 1995).

In this dissertation, I examined how individuals involved in precalculus at the University of Nebraska—Lincoln (UNL) perceived the role of the learning assistant (LAs) in active learning precalculus classrooms. To connect my inquiry to the literature, I begin with an overview of active learning, change efforts, and the LA Model ("LA Model," n.d.; Otero et al., 2010) as a specific form of near-peer teaching. Collectively, these research areas position LA programs as change levers to support the use of student-centered pedagogies, which influences how the LA role may be perceived by departments more broadly. Following this section, I give a brief overview of research on the partnerships between instructors and LAs. Next, I discuss teacher noticing, which focuses on what teachers notice and attend to in their class. I then discuss perspectives on the instructional triangle and the use of resources that support reform to lay the groundwork for some of the questions one may ask about the LA role and its place in instruction,

particularly connecting this to interactions not only with instructors but also students. Following this section, I introduce Positioning Theory as a framing for understanding how LAs are positioned in such interactions. Throughout this chapter, I discuss the implications of these areas of scholarship for my dissertation study.

Active Learning, Change Efforts, and the LA Model

What is Active Learning?

Active learning is often used as an umbrella term to capture a variety of instructional methods meant to actively engage students in the learning process. Freeman et al. (2014) analyzed over 338 definitions of active learning from audience members at biology department seminars across the United States and Canada to generate the following working definition of active learning:

> Active learning engages students in the process of learning through activities and/or discussion in class, as opposed to passively listening to an expert. It emphasizes higher-order thinking and often involves group work. (pp. 8413-8414)

Although this definition is derived from biology, it includes key components of active learning that often come up in conversations about active learning in other science disciplines, including a focus on discussion, group work, and tasks that emphasize higher-order thinking (Conference Board of the Mathematical Sciences, 2016; Laursen & Rasmussen, 2019; National Research Council, 2015; Prince, 2004).

Mathematics instructors often define active learning in terms of what it is not, i.e., many instructors state that active learning is anything but lecture (Williams et al., 2022). Since active learning is often contrasted with lecture, defining what I mean by the term lecture is necessary. Freeman et al. (2014) adopt Bligh's (2000) definition of lecturing,

which is that lecture is a continuous exposition from the teacher. My conceptualization of lecture builds off of this as well as Otten et al.'s (2015) descriptions of univocal and dialogic discourses. Univocal discourse is characterized by the transmission, or sharing, of knowledge from one person to another. In contrast, dialogic discourse emphasizes the use of multiple voices to co-construct mathematical understanding in the classroom. I define a lecture as discourse during which the instructor and/or the LA primarily transmit information to students. This definition conveys traditional views of lecturing as "teaching by telling," where the purpose of lecturing is to transmit information (univocal discourse) rather than collaboratively construct new meanings (dialogic discourse). Although active learning may include univocal discourse (e.g., when students share information with their peers), lecturing emphasizes the role of instructors and LAs as those who transmit knowledge, while students act as "receptacles of knowledge." (Ryan & Martens, 1989, p. 20)

As the above suggests, there is latitude in interpreting what "active learning" may mean for a particular instructor in a particular context with a particular group of students. One definition of active learning that has been used in professional development for precalculus instructors at UNL is based on Laursen and Rasmussen's (2019) four pillars of inquiry-based mathematics education. These four pillars are derived from two theories: inquiry-based learning and inquiry-oriented instruction. Ernst et al. (2017) define inquiry-based learning as a particular kind of active learning that is facilitated by two "pillars" identified by Laursen et al. (2014):

1. Students engage deeply with coherent and meaningful mathematical tasks.
2. Students collaboratively process mathematical ideas.

Inquiry-based learning emphasizes several skills that mathematicians employ: exploration through mathematical tasks, proposing and testing conjectures, developing multiple solutions, and justifying and communicating ideas to others. Inquiry-based learning draws from a social constructivist stance that individuals develop knowledge and understanding through social interactions with peers (Kogan & Laursen, 2014). Laursen and Rasmussen (2019) build upon Rasmussen and Kwon's (2007) work in inquiry-oriented instruction to identify two more pillars that underscore the role of the instructor in an inquiry classroom:

3. Instructors inquire into student thinking.
4. Instructors foster equity in their design and facilitation choices.

Collectively these four pillars present a useful framework to contextualize the role of the LA within precalculus courses at UNL.

Change Levers to Promote Active Learning

Lecturing is still predominant in postsecondary education despite numerous attempts to transform practices. Much of the current research in active learning is devoted to understanding how departments elicit and sustain major shifts in instructional practice (Kezar, 2014; Henderson & Dancy, 2007). The literature suggests that changes to instructional practice are most successful if they involve multiple "change levers" to overcome situational and cultural barriers that may prevent change (Corbo et al., 2016; Henderson et al., 2011; Kezar, 2014; Laursen, 2019; Reinholz & Apkarian, 2018):

> Why levers? In mechanics, a lever is a simple machine used to move an object at one location by applying a force somewhere else. By working at a distance, a lever acts to magnify the applied force. Metaphorically, then, a lever is a means to

> achieving an end, a method of persuading or causing something to happen. When we try something and see that it is working, we have gained leverage on the problem. (Laursen, 2019, pp. 7-8)

Change levers are resources we use to make change happen: such resources can be people, programs, materials, ideologies, cultures, and structures, amongst other things, that propel change. Given the nature of instructional practice, changes in instruction often necessitate a shift in the department's culture since such changes involve transforming long-standing shared and personal beliefs, values, identities, and attitudes toward teaching and learning (Corbo et al., 2016; Seymour, 2001). Although these shifts are necessary, they may not be sufficient due to burdens from situational factors, such as departmental or institutional expectations and priorities associated with teaching versus research, the costs of implementing reforms, and physical or experiential constraints in terms of a perceived lack of materials or time to spend developing materials that support new instructional practices (Borrego et al., 2010; Henderson & Dancy, 2007; Laursen, 2019). Changes are supported by structural systems that incentivize the adoption of instructional practices and provide opportunities for instructors to develop a shared vision for instruction that supports student learning (Reinholz & Apkarian, 2018; Shadle, 2017; Smith et al., 2021). The LA Model is a type of near-peer instruction model designed to act as a change lever that institutions can use to improve education, particularly in STEM.

Peer Teaching & the LA Model

For several decades, institutions have hired advanced undergraduates to provide academic support for their peers with positive outcomes (Barrasso & Spilios, 2021; Dawson et al., 2014; Whitman & Fife, 1988). Many of these efforts involve "near-peer"

teaching models. Such models are grounded in the view that knowledge is socially constructed and thus prioritize peer-to-peer interactions (Whitman & Fife, 1988, p. 5). There are myriad examples of near-peer teaching models in the literature (Barrasso & Spilios, 2021). Several of these models involve the near-peer supporting students in small groups or individually outside of class. One of the most well-researched models involving outside classroom support is the supplemental instruction model, in which near peers teach, generally small, groups of students in a regular supplemental section of a course (Dawson et al., 2014). The peer-led team learning model developed by Woodward et al. (1993) is another example of a model that usually occurs outside normal lecture time. The peer-led team learning model is designed to support STEM courses by employing undergraduate peer leaders to guide small groups of students in group-based problem-solving tasks. These peer leaders have professional development to support their ability to facilitate small groups and usually have taken the course previously and done well. The model has been shown to positively impact mathematics learning, to varying degrees of success (e.g., Reisel et al., 2014).

The LA Model is perhaps the most prominent near-peer model that specifically integrates the near-peer into regular class time. Furthermore, the LA Model specifically positions undergraduates as change agents to support teaching and learning by requiring that LAs receive extensive pedagogical training, which they use in practice as they use active learning strategies in class. LAs also meet regularly with the instructor, which can support both LA and instructor learning (Hill et al., 2023; McHenry et al., 2010; Schick, 2018).

The University of Colorado Boulder established the LA Model in 2001. Learning assistants (LAs) primarily help facilitate active learning during group work. LAs are often selected to support courses that they have taken (Otero et al., 2006). The University of Colorado Boulder uses its model to address four main goals:

- Course transformation: Learning assistants can support course redesign efforts to establish student-centered learning environments in courses that were originally lecture-based.
- Research: These course transformation efforts utilize educational research on student learning. As such the LA Model introduces faculty to discipline-based education research and encourages discussion about how to use research to inform the design of student experiences in their respective disciplines. Further, institutions of the Learning Assistant Alliance can engage in collaborative research efforts to study the impact of the LA Model on various desired outcomes (e.g., student learning, practices of LAs who become K-12 teachers, etc.)
- Institutional Change: These efforts can lead to cultural change as faculty recognize the value of research-based instructional practices and their impact on students. The model rewards instructional innovation by connecting instructors with a learning assistant who can support their course transformation efforts.
- Recruitment: The LA Model uses an experiential learning program to support learning assistants' development as effective facilitators of student learning. This program allows LAs to gain exposure to teaching and ambitious teaching practices, and so can be used as a method of recruiting future K-12 teachers.

Institutions that implement this LA Model may emphasize each goal differently, and not all institutions follow every aspect of the model. For example, the primary goal of the LA program at UNL is to support existing course transformations, with less emphasis placed on recruitment. To accomplish the aforementioned goals, the Colorado LA Model places significant emphasis on the professional development of LAs through an experiential learning program composed of three components:

1. The Experience: LAs experience teaching firsthand as they facilitate student work in the classroom. They are expected to encourage peer discussion on conceptually engaging problems and to elicit student thinking when making instructional decisions.
2. Pedagogy Course and Reflection: New LAs attend a pedagogy course during which they learn about educational research and its implications for teaching. The course emphasizes ideas that align with the four principles of active learning. During this course, LAs are expected to reflect on their experiences in the classroom to further their understanding of teaching and learning.
3. Content Preparation Meetings and Reflection: LAs meet weekly with their instructional team to prepare for upcoming class sessions. These meetings aim to help LAs deepen their content and pedagogical content knowledge. Often, they are led by the instructor that the LA supports, providing a space for LAs and instructors to co-reflect on how the class is going.

This emphasis on training learning assistants to have the pedagogy skills necessary to support active learning environments distinguishes learning assistants from more traditional undergraduate teaching assistant roles (Otero et al., 2006).

Most research on undergraduate teaching assistants comes from institutions using the LA Model and involved in the Learning Assistant Alliance, a network of roughly 546 institutions representing 124 LA programs (Learning Assistant Alliance, 2023). Much of this research is conducted in physics (Barrasso & Spilios, 2021). Research has shown that the LA Model is associated with an increase in students' conceptual understanding (Goertzen et al., 2011; Otero et al., 2010; Talbot et al., 2015), satisfaction (Talbot et al., 2015), higher-order cognitive skills (Sellami et al., 2017) and a decrease in failure rates (Alzen et al., 2018). Further, recent research suggests that LAs provide social and emotional support in their role (beyond academic support) and support students' sense of belonging (Clements et al., 2022; Kornreich-Leshem et al., 2022).

Although it can be difficult to isolate the impacts of the LA program from the impacts of concurrent change efforts related to implementing active learning (Pollock, 2005), some researchers have isolated the effects of the LA Model from other efforts and found that the LA Model supported increased learning gains (Herrera et al., 2018; Sellami et al., 2017). For example, Sellami et al. (2017) used evidence from student performances on concept tests and common exam questions to describe differences in student learning between LA-supported flipped classrooms and non-LA-supported flipped classrooms. They discovered that although students performed similarly on content assessments, students in the LA-supported course scored better on common exam questions that tested higher-order cognitive skills–skills that LAs were trained to foster. Further, underrepresented minority students seemed to benefit from the LA program (Sellami et al., 2017). This research suggests that LA programs can be a fruitful

contribution to change efforts that may already be well underway within a STEM department.

These findings are encouraging, however, there is considerable variation between LA programs in terms of responsibilities ascribed to LAs, the type of setting LAs support (e.g., lectures, recitations, labs, online courses), and the nature of partnerships LAs have with the instructors they support (Hill et al, 2023). Factors such as setting may influence the efficacy of the LA Model (White et al., 2016). Furthermore, while research suggests positive outcomes for students, only a handful explore students' perceptions of the LA (including their satisfaction with the LA), and there is little research about how students perceive the LA role in mathematics or in contexts in which the instructor is a graduate student. As such, there is a need for more research in various contexts to better understand manifestations of the LA role and the benefits LAs may have for instruction.

Instructor-LA Partnerships & Perceptions of Roles

In my review of the literature, I found two useful frameworks that help to make sense of how instructors and LAs perceive the LA-instructor partnership (Jardine, 2020; Sabella et al., 2016). Sabella et al. (2016) classify these partnerships as mentor-mentee, faculty-driven collaboration, or collaborative. Mentor-mentee partnerships are described as mainly unidirectional, where the instructor assumes a mentor-like role with the learning assistant in which they tell the LA about content but usually do not elicit LA feedback. Faculty-driven (i.e., instructor-driven) collaboration is characterized as one in which the instructor elicits LA input but still makes most of the course decisions. Finally, true collaborative partnerships occur when the instructor and LA share a significant

responsibility in directing the course. The authors argue that such partnerships depend on how LAs and instructors view the role of the LA.

Jardine (2020) used Positioning Theory to characterize interactions between faculty and undergraduate teaching and learning assistants (UTLAs). Although Jardine uses the broader term undergraduate teaching and learning assistants in their work to reflect the many different models of near-peer programs, the program Jardine studied followed the tenets of the LA Model, except that the assistants graded (this is discouraged in the LA Model). Jardine identified five positions LAs adopted: students (faculty as teacher), informants (faculty as information seeker), consultants (faculty as advice seeker), co-instructors (faculty as co-instructor), or co-creators (faculty as co-creators). The student position was assigned to LAs by faculty whenever the faculty member explained content, gave directions, etc., in a way that suggested they were the expert in content or pedagogy. Likewise, LAs could adopt this position by asking the faculty member questions about content or pedagogy. LAs positioned themselves as informants whenever they reported information about students to the faculty member but did not necessarily provide advice related to that information. When LAs provided advice, they positioned themselves as consultants.

Furthermore, LAs sometimes acted as a co-instructor by collaboratively making instructional decisions or grading. When LAs develop instructional materials, they are positioned as co-creators. Importantly, LAs can be positioned in multiple ways simultaneously (e.g., as co-creator and co-instructor). Furthermore, these positions are fluid, changing, and determined in moment-by-moment interactions between faculty and LAs.

These frameworks help illuminate what instructors and LAs think of each other's role in instruction, particularly related to instructor-LA partnerships. However, little research directly investigates how graduate students who work with LAs perceive their role in relation to the LA. In my review of the literature, I found no peer-reviewed research about graduate students as instructors of record (GSIs) working with LAs. Of course, this does not mean that the research does not exist, but it does indicate a gap in the field's understanding of GSI-LA partnerships. I did find one dissertation that focused on the beliefs of a GSI, their LA, and their students within the context of a reformed college algebra course at UNL (Williams, 2016). Williams (2016) found that, initially, the GSI found it stressful to include the LA in their classroom. However, their relationship developed over time. Since the LA and GSI had worked together the prior semester, they had developed some common beliefs about teaching and learning. Furthermore, the LA keenly observed the GSI's teaching and made inferences about the GSI's teaching decisions, although the GSI observed the LA "with less intensity and a different lens" (p. 144).

Additionally, although there is some research into faculty perceptions of LA-student interactions, graduate students' perceptions of LA-student interactions or relationships are virtually unexplored. One exception is a study by Becker et al. (2016). They compared the perceptions of graduate teaching fellows (i.e., teaching assistants), LAs, and professors before and after a physics course in which the graduate student and LA jointly teach discussion sections. They found that graduate students and LAs had differing views on student-teacher interactions. Notably, at the end of the semester, LAs believed that students found them to be the most relatable teaching group (out of graduate

students, LAs, and the professor). In contrast, the graduate students thought they were more relatable than LAs. Strikingly, before the semester started, both LAs and the graduate students predicted that LAs would be viewed as more relatable than the graduate students and the professor.

Teacher Noticing

In mathematics education, particularly in the K-12 literature, teacher noticing has been defined in multiple ways. Sherin et al. (2011) focus on the events upon which teachers attend and how the teachers interpret those events to make sense of what is happening in class. One important component of their conceptualization is that a teacher's interpretation is as important as their noticing of events in class. Santagata et al. (2021) describe four theoretical perspectives on teacher noticing: cognitive-psychological, situated and socially constructed, discipline-specific, and expert-novice paradigm. The latter perspective emphasizes novice teachers' challenges in noticing and interpreting classroom events. Some research in this area suggests that expert teachers are more equipped to notice and interpret important mathematical events, specifically students' understanding (Bastian et al., 2022).

Although these findings cannot be tied directly to how GSIs perceive the LA role, this body of literature suggests that novice instructors may struggle to notice and interpret important events in the classroom. Given that GSIs are often novice instructors, they may struggle to notice and interpret what LAs are doing in class. As such, it is worthwhile to consider how a GSI's experience relates to their perceptions of the LA role and their awareness of what LAs are doing in class.

Instructional Resources and Interactions

Instructional Triangle

Departments often speak about LAs as an instructional resource: this is evident in the language used to describe LAs. For example, the Learning Assistant Model Implementation Guide (Learning Assistant Alliance, 2019) has statements such as "*using* [emphasis added] LAs in the classroom generally helps generate discussion among faculty" (p. 5) or "a transformed course *supported by LAs* [emphasis added] involves active learning and opportunities for groups of students to work toward a learning goal, and for instructors to make instructional decisions based on student ideas" (p. 4). This interpretation of LAs as an instructional resource is also consistent with how many mathematics departments discuss their LA programs: LA programs are structures that can incentivize or support changes in instructional practice (e.g., Webb et al., 2014). Given the language used to describe LAs and LA programs, it is important to consider the research on instructional resources when considering the role of the LA. Cohen et al. (2003) present a theoretical framework for instruction that underscores the importance of the role of resources (e.g., curriculum materials, knowledge for teaching, students' knowledge) in instruction, particularly how they are used. They claim that "instruction consists of interactions among teachers and students around content, in environments." (p. 122). This relationship is often referred to as the instructional triangle in mathematics education due to the triangular figure they used to represent their ideas (teachers, students, and content are vertices of a triangle, and the edges of the triangle represent edges between these vertices).

As Cohen et al. (2003) explain, this conception of instruction is not new. For example, Hawkins's (1974) "I, thou, it" framework focuses on the same elements in learning, arguing that the I and thou (teachers and students), and it (the content) interact with one another to motivate learning. Teachers must respect students "as actual and potential artisans of their own learnings and doings, of their own lives, and as thus uniquely contributing, in turn, to the learnings and doings of others" (Hawkins, 1974, p. 48). Such respect involves developing positive personal relationships with students, and interactions with content should enable these relationships. These ideas harken back to Dewey's (1902) focus on perceiving the curriculum through the perspective of the child. What Cohen et al. (2003) contribute is an examination of this framework through the perspective of resources. Research has shown that access to resources does not necessarily correlate with student learning. Cohen et al. (2003) use this framework to argue that rather than focusing on resource allocation (i.e., what resources instructors and students have access to), we should be asking the more pertinent question of how instructors and students use resources. Cohen et al. (2003) argue that instructors base their use of resources on their knowledge and beliefs about themselves, their students, and the content and the constraints and affordances of external environments (e.g., obligations to parents, departments, etc.). These interactions together account for differences in student learning.

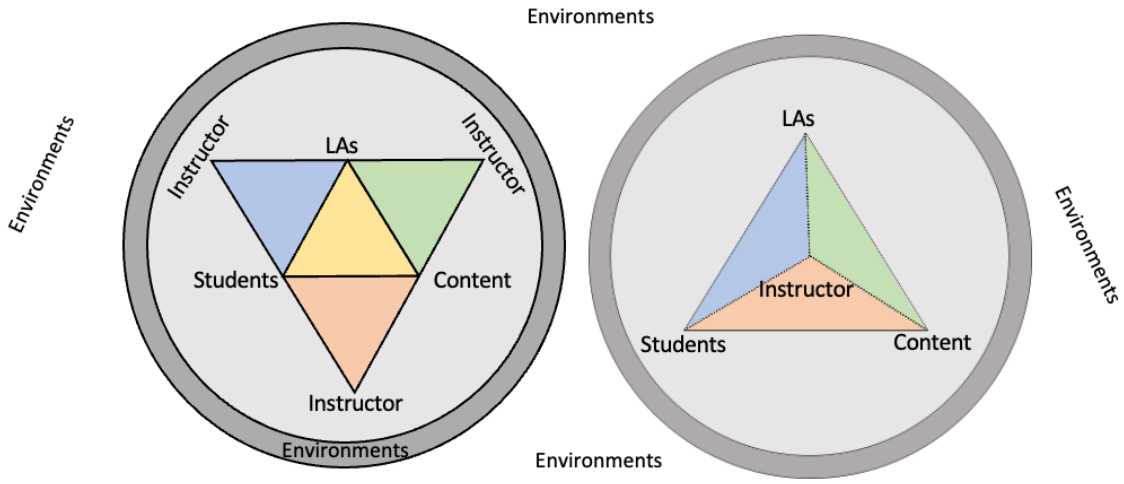
In understanding what role LAs may have in instruction, it is then useful to consider how adding LAs to a classroom may change this triadic relationship between students, teacher, and content. There are several possible ways to think about the influence of LAs on instruction. One way to think about LAs is to consider them part of

the external environment. This mode of thinking separates LA somewhat from the course. Another possibility is that LAs assume the role of teacher when interacting with students about content, suggesting that the LA and the instructor of record are interchangeable. A third possibility is that LAs assume the role of another student in the course, emphasizing the LA's status as a peer.

A final possibility is that LAs should be considered as another vertex and thus as both an actor in the classroom and as a resource (see Figure 1). This representation assumes LAs have differing roles and relationships in the classroom compared to the instructor and the students. Furthermore, this representation highlights that their relationships with the instructor, the students, and the content all contribute to the production of teaching and learning. I present two representations of this resulting triangular pyramid to emphasize the different viewpoints this illustration affords us. The 3D representation emphasizes a holistic consideration of the interactions between all these vertices simultaneously, while the net representation demonstrates that one could choose to focus on a triadic relationship between a subset of these vertices to describe what is going on in a classroom. This emphasizes that LAs may be considered a separate element of the instruction of a course and that the use of LAs by instructors and students is impacted by the perceptions instructors and students have about how LAs fit into this instructional diagram.

Figure 1

Adaption of the Instructional Triangle from Two Perspectives: 3D and Net

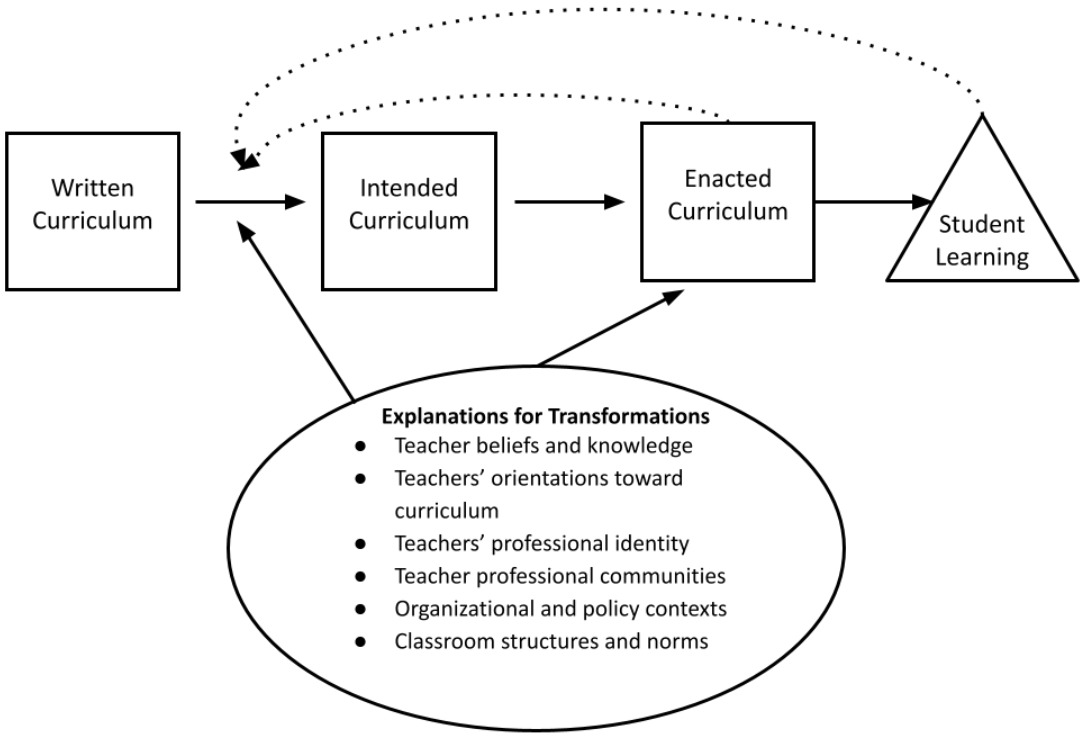


Thus, one way to think about LAs is to identify them as instructional resources, with the goal of supporting change efforts toward institutionalizing active learning. This line of thought suggests that examining the vast literature on curriculum use may be fruitful to identify potentially useful frameworks for understanding how the LA role may be conceived. In particular, Stein et al.'s (2007) framework for curriculum use is a helpful frame for understanding the possible role LAs have in the instructional process.

Curriculum Use vs. LA "Use"

Figure 2

Temporal Uses of Curriculum (Adapted from Stein et al., 2007)



In this section, I briefly describe features of Stein et al.'s (2007) framework for curriculum use, as well as related literature, that help frame my inquiry into how LAs may be perceived and used as an instructional resource in the classroom. This framework decomposes how instructors use curriculum, particularly curriculum associated with reform efforts, into four temporal phases: written (the curriculum as it is described in textbooks or other documents), intended (the instructors' plans for instruction), enacted (the curriculum as it is implemented in the classroom), and the experienced curriculum (how the enacted curriculum impacts students, and in particular, student learning). See Figure 2 for a visual of this framework. Several internal and external factors mediate a

teacher's interpretation and intended use of the written curriculum. This framework also emphasizes that the way teachers interpret and use curriculum evolves based on how the curriculum was enacted and assessments of student learning.

We could deconstruct the use of LAs in active learning mathematics classrooms in a parallel fashion:

1. Written: This represents the frameworks that the LA program draws from, such as the LA Model created by the University of Colorado Boulder.
2. Intended: This comes from the design and vision of the LA program as prescribed by the LA program coordinators and/or developers. This is heavily influenced by the department's overall vision for instructional improvement.
3. Enacted: This refers to how LAs are actually integrated into the classroom. I have chosen to depict this stage as a tetrahedron (as in Figure 3) to reinforce the idea that this integration of the LA possibly depends upon the complex interactions between instructors, LAs, students, and content, and in particular how actors in this relationship position one another.
4. Student Learning: This process ultimately helps to shape students' learning. It was beyond the scope of this dissertation to analyze the impacts of LAs on student learning, although student perceptions of LAs are included, and connect to students' perceptions of their learning and experiences in class.

Figure 3

Use of LAs in a Mathematics Department

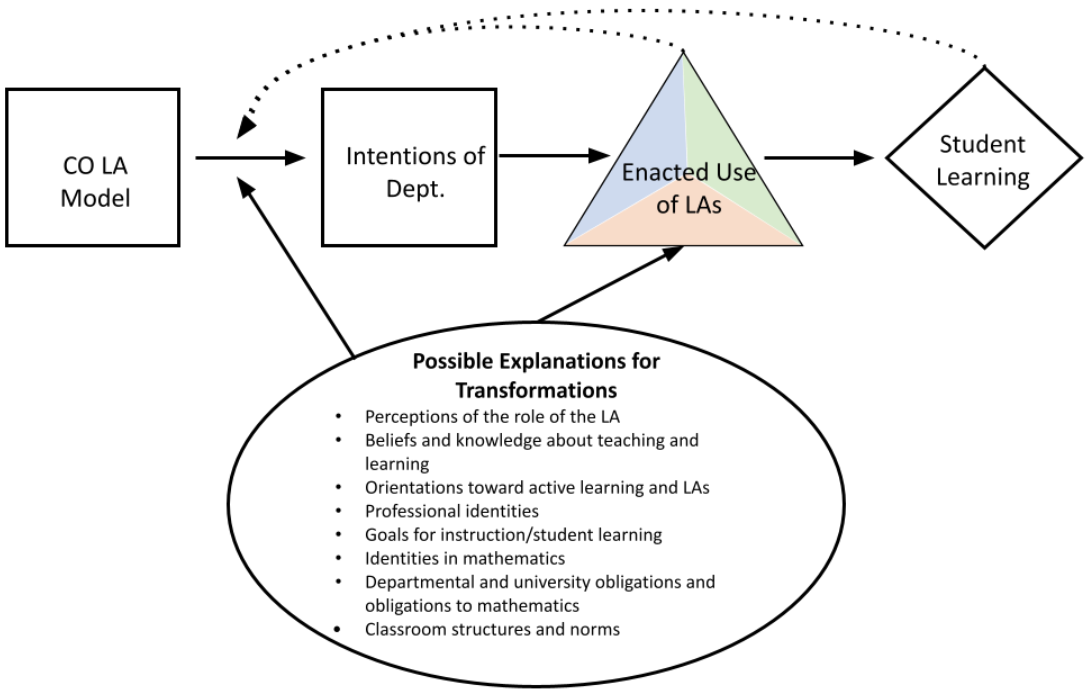


Figure 3

Adapted Framework to Understand the Use of LAs in a Mathematics Department

In the Stein et al. (2007) framework, instructors' beliefs and knowledge about mathematics teaching and learning, their experiences as instructors and students, professional identity, membership in professional communities, and orientations toward curriculum materials all impact how they use a given curriculum and thus how students experience that curriculum. Furthermore, such implementation is influenced by classroom structures and norms as well as policies dictated by larger organizational structures (schools, districts, etc.). Similar factors may influence the use of LAs. In

particular, transformations are likely influenced by stakeholder perceptions of the role of the LA; beliefs and knowledge about teaching and learning; orientations toward active learning and LAs; professional identities; goals for instruction and student learning; identities in mathematics; obligations to the department, university, and discipline; and classroom structures and norms.

Professional identities relate to the conceptions individuals may have about the LA role. Stein et al. (2007) describe professional identity as a social construct that is constructed in relation to others in a professional context. Instructors and LAs build their professional identity based on their experiences in the classroom, both as a person making instructional decisions and as students themselves (Lortie, 1975; Stein et al., 2007). As Lortie (1975) describes, instructors engage in an apprenticeship of observation throughout their schooling experience, which impacts the preconceptions many instructors have when they begin their practice. The way that instructors perceive their relationship with LAs, and the relationship of the LAs to students and content, are all related to how LAs are used as a resource in the classroom. Similarly, students use LAs based on their perceptions of the role of the LA and the instructor and content. For example, they might prefer to interact with LAs more than instructors if they think that the LAs' status as a peer makes them more likely to be able to relay the content in an easy-to-understand way. Conversely, they may prefer to interact with the instructor because they see the instructor as the more knowledgeable teacher.

Although this dissertation focuses on perceptions of the role of the LA as opposed to the use of LAs, since this perception is related to how students and instructors "use" LAs, examining the ways in which LAs are "used" as a resource can lead to justifiable

inferences about the different ways that students and instructors may be thinking about the LA role. For example, in observations of student behavior I saw differences in how students interacted with a LA and with an instructor. Some students acted more informally (e.g., eating food, talking about personal things) with the LA than with the instructor (e.g., that same person hid food when the instructor came to speak with them). These differences in behavior pointed to a difference in how the student used the LA versus the instructor, which I (and the LA) interpreted as the student having a more casual, peer-like view of the LA role.

Positioning Theory

Although the amount of time spent in small group work varies from course to course and instructor to instructor, LAs spend most of their time facilitating small group work. Thus, it is important to explore such interactions with students to understand the LA role. Positioning theory has been used as a lens to understand the nature of faculty and LA interactions, and it can also illuminate the nature of student and LA interactions (Jardine, 2020).

The use of Positioning Theory in mathematics education has expanded over the past two decades (Herbel-Eisenmann et al., 2015). Positioning theory focuses on social interactions, specifically on "the ways in which people use action and speech to arrange social structures" (Wagner & Herbel-Eisenmann, 2009, p. 2). The concept of positions in the social sciences was first introduced by Hollway (1984): "Discourses make available positions for subjects to take up. These positions are in relation to other people. Like the subject and object of a sentence…women and men are placed in relation to each other through the meanings which a particular discourse makes available" (p.236). Thus,

several positions belong to dichotomous categories: powerful/powerless, teacher/student, mother/son, outgoing/reserved, oppressor/oppressed, etc. Davies and Harré (1999) argue that part of developing one's sense of the world and one's position in it requires recognizing various categories that "partition the universe of human beings" into "dichotomous, trichotomous, and other patterns of subgroups" (p. 36).

Positioning Theory focuses on three mutually determining components of positioning: storylines, speech acts - or communication acts as Herbel-Eisenmann et al. (2015) suggest - and positions (Van Langenhove & Harré, 1999). *Storylines* unfold as interactions progress but are also built on the historical, cultural, and personal backgrounds of those involved in the interaction. *Communication acts* are actions that have social significance. *Positions* are a cluster of personal attributes which determine the distribution of rights (what one is owed) and duties (what one owes others) within a certain social milieu, thereby restricting what one is allowed to say and do in an interaction. Positioning theory assumes principles related to social constructionism, namely the assumption that "what people are, to themselves and to others, is a product of a lifetime of interpersonal interactions superimposed over a very general ethological endowment." (Harré & Van Langenhove, 1999a, p. 2).

This is not to say that positions are static. Quite the opposite, Positioning Theory was originally conceived as an improvement to role theory, which assumes relative stability in human interactions. Davies and Harré argue that people who occupy roles interact along storylines that are "already written" and do not "have much choice as to how to play these roles in any particular setting" (1999, p. 41). Further, they learn "how to take up a particular role through observation of others in that role" (p. 41). However,

roles provide a narrative that people can draw upon to position themselves along an unfolding storyline in the classroom. In Positioning Theory, interlocutors - those participating in a conversation - are free to negotiate their positions through various communication acts (including utterances, specific word choices, physical gestures, etc.). Despite being seen as an improvement to the concept of role, Positioning Theory does accommodate the concept of role, or something close to it (Harré, 2012). In their early work Harré and Van Langenhove claimed that "adopting or being assigned a role fixes only a range of positions, positions compatible with that role" (1999b, p. 196). Others have described roles as long-term positions born from a relatively static assignment of rights and duties (Moghaddam et al., 2008). The implication of this for my dissertation was that to understand the LA role, I needed to identify relatively static rights and duties assigned to LAs and the range of positions that may be compatible with the LA role.

Understanding the meaning behind someone's communication requires understanding their position in that interaction and the unfolding storyline in which this position is enacted. By the same token, positions are taken up through communication acts within storylines. Positioned as knowledgeable by students, an instructor's mistake during an explanation can be viewed as a pedagogical strategy, or seen as insignificant, perhaps attributed to the inevitability of human imperfection. However, if positioned as unknowledgeable by students, the same mistake can be viewed as a serious gap in understanding or demonstration of an instructor's lack of competence.

Conversations follow along "jointly produced storylines" (Davies & Harré, 1999, p. 37), which can be significant culturally or be constructed locally. For example, an older teacher may position themselves as a mother or mother figure when conversing

with novice teachers in their school, evoking a culturally significant storyline of mother/son. This storyline involves specific cultural images, symbols, concepts, etc., that the older teacher may draw upon in their conversations. Following this storyline also makes it likely that the older teacher assumes duties commonly assigned to mothers: protecting, nurturing, and teaching whoever they position as the child. In this scenario, the older teacher interactively positions novice teachers as children, who reciprocally have the right to be protected and nurtured, and the duty to learn. In their interactions, these novice teachers may reject or negotiate this positioning. Interlocutors use storylines to understand the progression of a conversation.

Although Positioning Theory often focuses on immanent, moment-by-moment positioning in conversations, others have used Positioning Theory to analyze different settings, such as narratives (Bamberg, 1997; Deppermann, 2013). Wagner and Herbel-Eisenmann (2009) emphasize the immanent while also noting that "storylines are associated with particular discourses, so a student's or teacher's repertoire of storylines to draw upon for conceptualizing their interaction in a particular classroom setting will depend on the discourses with which s/he has had exposure and experience." As such, they "recognize the difficulty in completely avoiding external, discourse-related influences even when attending to immanent experience" (p. 6).

Harré and Van Langenhove (1991) describe three modes of positioning: first, second, and third-order positioning acts. First-order positioning occurs when an individual uses categories or existing storylines to locate (position) themselves and others in conversation. For example, if a LA says to a group of students, "Make sure to turn on your cameras," then they at once position themselves as someone who has the right to

order a student to engage in specific ways, as well as position the student as someone who can be ordered. In this instance, the students can either accept this position (i.e., turn their cameras on) or challenge it by, for example, responding, “The instructor said we don’t have to turn on our cameras.” In the latter case, the students engage in a second order of positioning by questioning the position imposed by the LA. Later, the LA may have a conversation with the instructor about the students not turning on their cameras, in which they position students as resistant. This involves third-order positioning, which occurs outside of the original conversation. “Such third-order positioning can, but does not necessarily have to, involve other persons than the ones performing in the original discussion” (Harré & Van Langenhove, 1991, p. 397). Of course, the LA’s positioning of students is also a first-order positioning in this new conversation, one that the instructor can accept or challenge in a second-order positioning act (e.g., the instructor could argue that students are not being resistant; instead, they are being compliant with the instructor’s rules). In this dissertation, I emphasize the third order, which focuses on positionings that occur in first and second-order positioning practices. In particular, I examine conversations (interviews) with participants and written experiences (open-ended survey responses) in which I prompt participants to position themselves by retelling stories or impressions from their experiences in the classroom.

Harré and Van Langenhove (1991) use moral and personal positioning to describe differences in positioning related to established roles within a “moral order” (p. 397) versus positioning related to individual attributes. They claim that “it is often sufficient to refer to the roles people occupy within a given moral order or to certain institutional aspects of social life to make actions intelligible and to understand the positions that

people take." (p. 397) In contrast, deviations from the expectations associated with a role can be explained by personal positioning. Harré and Van Langenhove explain that positioning is a discursive practice: within a conversation, each participant always positions the other while simultaneously positioning oneself. Positioning allows people to understand their rights and duties in a particular context and negotiate new positions.

People can either claim positions for themselves (reflexive positioning) or be positioned by others through various communication acts (interactive positioning; Davies & Harré 1999). Green et al. (2020) introduce four modes of positioning to delineate further differences in how children positioned themselves (reflexive positioning) and how others influence that positioning in the classroom: positioning by children, positioning with children, positioning of children, and positioning to children. These modes exist along a continuum: positioning by children (which is synonymous with reflexive positioning) occurs when students have more agency in the classroom, whereas positioning to children assumes that children have little agency in the classroom. In their work, they describe how one student, Charlie, was subject to these different modes of positioning. During free reading time, Charlie positioned himself as an engaged, competent reader (positioning by Charlie) by choosing to read sophisticated texts on topics he enjoyed. However, at times Charlie was expected to engage in more structured activities and with groups of other students. During one such activity, students were assigned different roles (e.g., marker pen monitor) and expected to work on tasks related to a particular children's book, although students had some choice in how they completed these tasks. Charlie disputed this positioning (at one point, he tried to assign himself a new role - Lego monitor) and engaged in acts of negotiation with others in his group.

Although Charlie did not have full agency in how he positioned himself, he could interactively negotiate his position with other students (positioning with Charlie). More structured tasks, such as a read-aloud activity, changed how Charlie positioned himself as a reader. During one read-aloud activity, Charlie chose a simpler text to read to his teacher rather than the more sophisticated texts he chose during the free reading portion of the class, perhaps due to the performative nature of the activity. In this case, the positioning of Charlie was authoritatively mediated (by the teacher and the associations he had with the read-aloud activity). Finally, Charlie's school designated him as a remedial reader. Such positioning (positioning to Charlie) was institutionally assigned.

Identifying Positions in Data

Although most studies using Positioning Theory as a theoretical basis focus on immanent - conversations in the moment - others have applied the theory to narrative studies. Interviews with participants are an example of third-order positioning - as participants and interviewers talk about the positioning done in and out of class - which is itself useful to examine as it presents how participants may think of LAs - at least at one moment in time (during the interview) - which influences the storylines they draw upon in further encounters with LAs.

Kayi-Aydar (2021) presents an analytic framework to support the identification of positions in narrated storylines. To identify positions, Kayi-Aydar suggests focusing on four components: a.) attributes and biological dimensions, b.) categorical membership, c.) storyline structure, and d) emotions. Attributes and biological dimensions also include character traits and dispositions (e.g., creative, helpful). Individuals typically use these dimensions to preposition themselves in an interaction (i.e., a type of positioning that

allows individuals to represent themselves in a particular way for particular goals). Categorical memberships refer to an individual's membership in a cultural group, which can lead to particular types of positioning (as members of cultural groups may share particular dispositions or attributes). Storylines can be identified through multiple means. Kayi-Aydar offers several suggestions, including focusing on word choice, sentence structures, abrupt shifts in topic, and the introduction of new people. All support one's understanding of how a person is being positioned, as positions occur along unfolding storylines. Finally, as individuals recollect, they engage in reflection which often involves emotions that can point to ways that individuals have been positioned or positioned others. Examining the use of emotion words or phrases can help to illuminate positions. Emotion words include emotional states (proud) as well as words or sentences that express or imply emotion (e.g., "gross!", "I can do it"). Emotions can also be identified by examining paraverbal aspects of an interview (e.g., intonation, stress, pauses, pitch, etc.). In my dissertation, I used this analytic framework to help identify positions and positioning acts in interviews and free response survey data.

CHAPTER 3: METHODS

This chapter focuses on the methods I used to collect and analyze data for this qualitative case study. I begin the chapter by reintroducing this dissertation study's purpose and research question, followed by a rationale for using qualitative case study methods to address my research questions. Next, I share how I selected the case, explaining the difficulties I experienced in case study site selection and recruitment of participants within these sites. I then describe methods for data collection and data analysis. I also address issues of validity, reliability, and ethics and steps taken to mitigate these issues. I conclude the chapter with a brief overview of the methodology guiding this dissertation.

Purpose and Research Questions

The goal of this dissertation is to understand how learning assistants (LAs), instructors, students, and others involved in precalculus instruction at the University of Nebraska—Lincoln (UNL) interpreted or perceived the role of the LA in active learning precalculus classrooms. The research questions of this study were refined over time, as ongoing data analysis led me to engage in "progressive focusing" so that I could better understand how the LA role is conceived at UNL (Stake, 1995, p. 9). In this study, I report on the final research questions which drove my inquiry. A central question that guided my analysis throughout the study was: *How do those involved in UNL's LA-supported precalculus courses perceive the LA role?* I narrowed this question to the following research questions:

- *RQ1a. How did instructors and LAs in active learning precalculus classrooms position themselves in relation to each other?*

- *RQ1b. How did members of the instructional team describe the expected or actual distribution of instructional rights and duties between LAs and instructors in active learning precalculus classrooms?*
- *RQ2a. How did instructors' and LAs' perceptions of LA-student interactions in active learning precalculus classrooms compare and what influenced those perceptions?*
- *RQ2b. How did LAs position themselves as teachers in LA-student interactions?*
- *RQ3a. How did students in active learning precalculus classrooms describe their interactions with LAs compared to their interactions with the instructor?*
- *RQ3b. Why might students have preferred to interact with either the LA or the instructor?*

Rationale for Qualitative Case Study

Qualitative research supports researchers in "understanding the meaning that people have constructed" (Merriam & Tisdell, 2016, p. 15). Given my focus on how participants make meaning of their interactions with LAs, qualitative methods are appropriate to address my research questions. Qualitative research is also consistent with my theoretical lens and the frameworks I draw upon, as detailed in the prior chapter, which focuses on meaning-making rather than prediction. Further, I chose to use case study research methods as they are useful when the phenomenon to be studied is highly contextually dependent (Miles et al., 2014; Yin, 2018). Given that perceptions of the LA role are dependent upon multiple contextual features of a classroom as well as the people involved in that classroom, I cannot separate the context from my line of inquiry.

The goal of case study research is "particularization," not generalization (Stake, 1995, p. 8). A case study's value is in its rich descriptions of particularities in a case and in trying to describe why those particularities exist. Case studies may not be generalizable to other contexts in a statistical sense; nevertheless, they provide insight into how, where, and possibly why something occurs, thus supporting generalization "from one case to the next on the basis of a match to the underlying theory" (Miles et al., 2014, p. 34). One goal of this dissertation is to provide a richly descriptive account of how UNL's context impacts perceptions of the LA role as a way to contribute to theory building, namely our field's understanding of how and what different contextual factors might influence the LA role, particularly in the context of undergraduate mathematics courses taught by graduate student instructors (GSIs).

Defining the Case

A key issue in a case study is the bounding of the case. Miles et al. (2014) present a case study as a circle enclosing a heart, where the heart represents the focus of the study, and the circle is the boundary that defines what will and will not be studied. As they point out, a case - the heart - may be defined in numerous ways (e.g., by a community, an encounter, an event, or a role). In this study, the case is the LA role at UNL. The questions of interest focus on how this role is conceived of by those involved in LA-supported precalculus active learning classrooms. Thus, a boundary for the case is the set of students, LAs, instructors, associate conveners, conveners, and LA Coordinators involved with LA-supported precalculus classrooms. This case is further bounded by time, as I collected data from the summer of 2020 to the fall of 2021. This study is also an embedded case study. In Chapter 5, I present two subcases of LAs. These

LAs were chosen to illustrate how the LA role may look different based on the instructor, as well as the goals, actions, and beliefs of the LA who assumes this role.

Case Selection

I originally planned to conduct a multiple case study of the LA role at three institutions with mathematics LAs in active learning classrooms. I planned to study each site for one semester. These cases were chosen to highlight various stages of LA program development and implementation of active learning to understand the LA role and its place in institutional change efforts involving active learning. All three cases were involved in a NSF-funded project that I supported as a researcher. I tried to leverage my contacts through that project, emailing faculty members at those sites to see if they would be willing to have me conduct a case study at their institution. For one site, my contact seemed interested and suggested I reach out to the LA Coordinator. Unfortunately, I received no response after multiple emails. The other site made significant changes to their instructional model, making it no longer a viable case study site.

It became apparent early on that, given the unpredictability of COVID-19 and its impact on universities, I needed to be open to changing my data collection plan as well as modifying my focus to ensure that completing my dissertation was feasible. Instead, I refocused efforts on understanding the LA role at UNL across multiple semesters. Upon reflection, this proved to be a positive change, as I was able to investigate the LA role across multiple configurations of instruction, allowing for a richer description of how the LA role may look in different settings that still retain some interesting common properties (e.g., coordination structures, some departmental norms). Furthermore, one important component of UNL's context is that, unlike several other institutions which

employ LAs, most LAs in precalculus work with GSIs. The literature about LAs focuses primarily on contexts in which the instructors that work with LAs are faculty members (if the study shares this participant information at all). Thus, one main contribution of this dissertation is an investigation into the LA role within the context of an instructional environment led primarily by graduate students and how that bears similarities and differences to the LA role reported in the literature at institutions in which faculty were instructors. In the following section, I describe UNL's context.

The Context of the Study

The LA Program During Data Collection

Data collection began in the summer of 2020 and ended in the fall of 2021. This data collection involved three semesters impacted by the COVID-19 pandemic: fall 2020, spring 2021, and fall 2021, as well as four courses (see Table 1): Intermediate Algebra, College Algebra, Trigonometry, and Precalculus. The mathematics department uses the term "precalculus" (with a lower "p") to refer to these four courses, as they are part of a pathway to STEM-track calculus (Calculus 1).

Table 1

LA-Supported Courses: Credit Hours and Average Enrollment of Courses and Sections with LAs

Course	Credit Hours	Average Enrollment of Courses/Sections with LAs		
		Fall 2020	Spring 2021	Fall 2021
Intermediate Algebra	3	26	-	-
College Algebra	3	36	31 (online) 18 (in-person)	38
Trigonometry	2	22	29 (online) 17 (in-person)	-
Precalculus	5	38	53 (online) 22 (in-person)	40

In a typical semester, each section of College Algebra and Precalculus has one LA. However, in fall 2020 the mathematics department converted all precalculus courses to a hybrid model due to the COVID-19 pandemic. At UNL, this hybrid model meant that some students attended class in-person while others attended class synchronously online using the Zoom platform. LAs were hired for all precalculus courses to support students who joined class online[3] for these hybrid courses.

The LAs were hired and supervised by a LA Coordinator, who also leads professional development for LAs. In spring 2020, a team of people (including the current LA Coordinator and myself) applied for and received a $50,000 grant to build our LA professional development program and hire more LAs for fall 2020. In prior

[3] UNL also, in certain semesters, has hired LAs for Applied Calculus. However, the structure of these courses and the experiences of LAs are very different from the experiences in precalculus courses. Furthermore, data collection for these courses was challenging: I only interviewed two LAs who supported Applied Calculus; their data have been removed from the present study.

semesters, LAs met with the LA Coordinator and the instructor of record they supported for two to three hours at the beginning of the semester. During the semester, the instructor of record and LA were expected to meet approximately every week to discuss how the class was going. Beyond this, LAs did not receive direct professional development. With this grant, the LA Coordinator launched a weekly, one-hour LA pedagogy seminar inspired by seminar materials from the CO LA Model. This cross-disciplinary seminar supported LAs in mathematics and computer science as well as undergraduate assistants called "tutors" in the College of Business.

Furthermore, in the fall of 2020 the precalculus LAs were expected to attend a content preparation course every other week. We also developed materials for instructors related to working with LAs, including sample meeting topics to cover when discussing with the LA (e.g., questions to ask about how the class is going, content, etc.). It is important to note that with these changes, UNL's LA program followed the tenets of the CO Learning Assistant Model. Unfortunately, the seminar and content preparation meetings did not continue in spring 2021 and fall 2021; however, the LA Coordinator used the seminar materials in the fall 2021 pre-semester orientation with new LAs, as well as checked in with LAs in the middle of the semester.

In spring 2021, LAs were hired to support all precalculus courses except for Intermediate Algebra. The department moved away from a hybrid model for precalculus courses and instead offered online-only courses and in-person courses that were typically smaller (see Table 1 for information about course enrollments). Online courses with larger enrollments (52-53) had two LAs, whereas the remaining courses had one LA. By

fall 2021, my final semester of data collection, courses were held in person. During that semester, LAs supported College Algebra and Precalculus.

Creating the LA Program

In 2014, the LA program was created to support the department's goal of improving student success in precalculus courses through active learning practices. Incorporating LAs into precalculus allowed the department to build a year-long professional development seminar course for graduate students teaching as instructors of record (GSIs) for the first time. To help GSIs accommodate the course in their schedule, the department decreased GSIs' teaching load during their first year as instructors of record from 2-1 to 1-1. This reduction was balanced, in part, by increasing class sizes from approximately 32 to 40. The department, being aware of the LA Model, decided to hire LAs to support this focus on active learning and the increase in class sizes.

Coordination & Active Learning

At the time of this study, the precalculus courses were highly coordinated to support continuity across courses and across semesters, as well as designed to support instructors' use of active learning methods. Each course was overseen by a course convener, who often was also the LA Coordinator or at least in frequent communication with the LA Coordinator and an associate convener. The course convener was a professor of practice who oversees multiple lower division courses to support continuity between these courses and across semesters. The associate convener, who was also a graduate student, coordinated the majority of intra-semester tasks, including communicating with instructors, leading coordination meetings, and designing exams. In the fall of 2020, they

also led the content preparation meetings every other week with the LAs. These supplemented the weekly LA pedagogy seminar.

Within each course, students were given the same assessments (exams, homework, quizzes, etc.). Furthermore, each course had a workbook with mathematical tasks that students were expected to complete during class time. Typically students worked on these tasks in small groups of three to five. Most classrooms were fitted with tables to facilitate this work, as well as whiteboards on walls around the classroom. However, some instructors taught in classrooms with single desks and only a small whiteboard space. LAs in precalculus courses were expected to support small group work time as students worked through the workbook and host review sessions prior to exams. The instructor largely determined other duties in the classroom. For online or hybrid precalculus courses, LAs supported students working in small online breakout rooms via Zoom.

The mathematics department expected instructors to use active learning methods to teach and follow the workbook; however, instructors had some freedom in how they presented material and organized class time. Each of the precalculus courses used a common, open-source textbook that instructors and students could use as reference material. Moreover, instructors had access to an online Wiki with lesson plans for each unit. Instructors were recommended, but not required, to follow these plans. LAs were not given access to this Wiki page, but they did have access to the Canvas page (as a student) used to organize these courses and the course textbook.

Participants & Recruitment

The participants in this study included the LA Coordinator, nine LAs, and eighteen GSIs (see Table 2 for a summary). To protect the identity of my participants, I will not be reporting demographic information. Moreover, I assigned the GSI focus group participants and the LA Coordinator a code for identification. For the remaining interview participants, I assigned a gender-neutral pseudonym and used gender-neutral pronouns when referring to them.

Table 2

Number of participants by stakeholder role

Stakeholder	n
Learning assistants	9
Graduate student instructors Associate conveners (n=4)	18
Students (College Algebra & Precalculus)	411
LA Coordinator/Course Convener	1

The LAs that took part in this study were undergraduate students with mathematics or mathematics education majors, and often were recruited after working as a counselor in the UNL Mathematics Resource Center (this position is similar to a tutoring position, but counselors are encouraged to have students work together). Furthermore, LAs were expected to have excelled in Calculus, and it was preferred that they had taken at least one 300-level mathematics course. Thus, these LAs had strong mathematics identities. Their experience ranged from zero to two semesters of working as a LA. As detailed earlier, all LAs participated in a pre-semester orientation in August. Further, in the fall of 2020, LAs participated in a pedagogy seminar course. See Table 3

for a list of the 9 LAs included in this study by pseudonyms, the instructor (pseudonym) they worked with, experience, and major.

Table 3

LA Participant Pseudonyms and Experience

Learning Assistant	Instructor	Experience Prior to Semester Interviewed	Majors/Minors
		SUBCASES	
Hailey	Harper	New LA	Math
Holden	Harper	One semester	Math, Other STEM, & Other
Jessie	Jay	Two semesters (includes pre-pandemic)	Math & Other STEM
Wiley	Wade, Wren	New LA	Math & Other
		REMAINING LAS	
Ciri	NA	Two semesters	Math & Other STEM
Elliott	Emery	New LA	Math & Other
Guo	Gene	New LA	Math & Other STEM
Logan	NA	Two semesters	Math
Taylor	NA	Two semesters (includes pre-pandemic)	Math & Other STEM

Note. To protect the identity of the participants, dual majors or minors are reported as "Other STEM" for a different STEM-related discipline, and "Other" for a non-STEM-related discipline. NA means that they were not part of the study during data collection.

The 18 GSIs that took part in this study had a variety of experiences working with LAs, from no prior experience to experience that included working with LAs before the COVID-19 pandemic. As was typical of GSIs at UNL, all GSIs entered their graduate program and started working as graduate teaching assistants for either Calculus 1 or Calculus 2 recitations. Starting in year 2 (or the summer prior), they were assigned to teach a precalculus course as an instructor of record (GSI) while simultaneously taking the professional development seminar course. Beyond the second year, they could express their course preferences, which included precalculus, calculus (both as a GSI and as a GTA for recitations), courses for prospective teachers, and higher-level mathematics courses. Further, they were expected to, as GSIs of precalculus courses, attend a pre-semester orientation in August. This orientation focused on pedagogy, the logistics of teaching a coordinated course, and working with LAs. LAs were also invited to meet the instructor during this orientation. See Table 4 for a list of the 18 GSIs included in this study by pseudonyms and prior experience working with LAs. Four of the GSIs were also associate conveners, or coordinators, of precalculus courses. All but one of the associate conveners had prior experience working with a LA; this information has been omitted to protect their identity. All associate conveners have pseudonyms starting with "A." Further, when both the LA and the instructor(s) they worked with participated in the study, they were assigned a pseudonym that began with the same letter to more easily identify which LAs worked with which instructors.

Table 4

Instructor Participant Pseudonyms and Experience

Type	Instructor	Experience working with LAs Prior to Semester Interviewed?
Instructor-LA Pairs	Emery *(worked with Elliott)*	Yes (includes pre-pandemic)
	*Harper *(worked with Hailey, Holden)*	Yes (includes pre-pandemic)
	*Jay *(worked with Jessie)*	No
	*Wade *(worked with Wiley)*	Yes (includes pre-pandemic); also worked as a LA during undergrad
	*Wren *(worked with Wiley)*	No; but worked as a LA during undergrad
	Gene *(worked with Guo)*	Yes
Associate Conveners	Aiden (also FGA2)	Omitted for confidentiality purposes
	Alexis	Omitted for confidentiality purposes
	Ashley	Omitted for confidentiality purposes
	Avery	Omitted for confidentiality purposes
Remaining Instructors	FGA1, FGA3, FGB1-3	Varied, all at least one pre-pandemic semester
	Blake	No
	Frances	No
	Peyton	No

Note: *Denotes a Subcase

Data Collection

Following the strategies posed by Creswell and Poth (2018), Stake (1995), and Yin (2014), I collected multiple and varied data sources to understand the LA role in UNL's mathematics department: (a) audio recordings of (i) LA interviews; (ii) instructor interviews; (iii) interviews with the LA Coordinator; (iv) classroom observations; (b) field notes from observations of precalculus classrooms and instructor-LA meetings; and (c) open-ended survey responses. The total time of data collection was between the summer of 2020 and the fall of 2021. In the following sections, I describe data collection based on the type of data collected. Before collecting data, I obtained approval from UNL's Institutional Review Board and collected consent from all participants in electronic form either as an email copy of a signed pdf or via an approved Qualtrics consent form.

Interviews & Observations

I conducted 35 individual interviews and three focus group interviews. LAs were compensated either $20 or $50 for their time, depending upon their involvement (e.g., LAs involved in multiple interviews were compensated more).

In the summer of 2020, I conducted two focus groups with GSIs who previously worked with a LA. All GSIs were invited via email to participate in a focus group. GSIs were told that data from the focus group would be included as part of my dissertation and used to inform the development of a new LA pedagogy course for the fall semester and associated professional development materials for mathematics instructors working with LAs. In total, six GSIs participated. Focus groups included questions about participants' understanding of the LAs' role and responsibilities, communication about and with LAs,

departmental and personal expectations of LAs, the purpose and value of the LA program, and the support LAs need to succeed in their role. The goal of these focus groups was to identify emergent themes in how instructors perceived LAs and capture perceptions from individuals who had worked with LAs before the pandemic. Initial data analysis from these interviews informed the interview protocol for interviews held in the fall.

In fall 2020 and spring 2021, the goal of data collection was to identify LAs that could serve as subcases to explore differences and similarities in how instructors and LA perceive the role of the LA as well as to identify what actions LAs took in class. Although LAs were the focus of these cases, they were bounded by the instructors with whom they worked. To identify potential participants, I first obtained the list of LAs from the LA Coordinator, and purposefully selected sets of instructors and LA to maximize variation in terms of the course being taught, the experience of the instructor and LA, and perceived gender. This resulted in ten LAs that I could recruit for the fall of 2020. Their corresponding eleven instructors (some LAs worked with multiple instructors) were invited to participate in the study. If the instructor agreed to participate, I separately emailed their LAs with an invitation. This was done to minimize coercion. Out of the eleven instructors I emailed, seven instructors said they would be willing to participate, two declined to participate, and two either never responded or did not respond to follow-up emails.

Further, of those seven instructors, only three corresponding LAs were interested in participating. Unfortunately, one instructor, while agreeing to participate at the beginning of the semester, did not reply to emails about scheduling interviews and

observations. Thus, in the fall of 2020, I focused on two subcases of LAs (working with three instructors). In spring 2021, I followed a similar process: I attempted to recruit five instructors and their LAs, and based on interest from both the instructors and the LAs, I was able to recruit two subcases of LAs working for the same instructor.

From this process, I recruited four subcases of LAs from two precalculus courses: LA Wiley working with Instructors Wren and Wade, LA Jessie working with Instructor Jay, and LAs Holden and Hailey working with Instructor Harper (all pseudonyms). All participants were interviewed individually for an initial interview held approximately one month into the semester. These interview questions had similarities to the focus group protocol but also included questions about participants' views on mathematics teaching and learning, classroom contexts, and specific interactions in the classroom. Most participants were interviewed two more times, following observations of their classrooms. Jessie, Hailey, and Harper were the exceptions; Jessie could not be interviewed until after my initial observations, and so their initial interview and follow-up interview were combined in a meeting immediately preceding the first round of observations; likewise, Hailey and Harper participated in an interview at the end of the semester, but did not participate in an intermediate post-observation follow up interview. The follow-up interviews had more targeted questions based on preliminary analysis of interviews and observations. I kept detailed notes for each interview, which I reviewed and cleaned up immediately following the interview. I also used these notes to create additional questions in follow-up interviews based on preliminary analysis of themes across subcases and within cases of particular LAs.

For each subcase, I observed the classrooms the LA supported for at least two different time points in the semester, once toward the beginning and once toward the end. For each time point, I attended the classroom twice in a given week, for a total of at least four observations of each of the classrooms the LA supported. Since Wiley supported two classrooms, I observed eight sessions that Wiley supported. Since Hailey and Holden both worked with Harper, I added an additional time point to observe (observing once in February, once at the beginning of April, and once at the end of April) so that I observed a total of six observations of Harper's class, but three observations for each of Hailey and Holden.

For the classroom observations, I kept a running log of LA actions. I made sure to record when there was a shift in classroom activity that resulted in the LA interacting with students (e.g. when the class shifted from lecture to breakout rooms on Zoom). To support my note-taking, I developed abbreviations to describe the level of complexity of questions posed to students by either the instructor or the LA (LL for low level, HL for high level). As much as possible, I tried to record what the LA said verbatim when interacting with students and summarized students' responses. During lectures, I took general notes of the material covered, instructional strategies used by the instructor, and any actions the LA took (which were very few). I also asked instructors and LAs if they consented to having me record their classrooms to support additional analysis. Not everyone consented, so observation notes were used in some cases. Following each observation, I cleaned up the notes. I wrote memos for interactions that stood out to me, explicitly highlighting sources of alignment or misalignment between what the LA was doing and what the instructor was doing. These memos also included details on how

much the LA used active learning strategies. I also observed at least one instructor-LA meeting for each subcase to become more familiar with how LAs and instructors positioned each other in conversations. See Table 5 for a summary of data collected for each subcase.

Table 5

Summary of Data Collection for Subcases

Subcase	Interviews (initial & post-observation)	Observation of Classrooms	Observation of instructor-LA meetings
LA Hailey *(working with GSI Harper)*	LA: 2 GSI: 2	3 (6 total sessions of Harper's class)	1
LA Holden *(working with GSI Harper)*	LA: 3 GSI: 2	3 (6 total sessions of Harper's class)	1
LA Jessie *(working with GSI Jay)*	LA: 2 GSI: 3	4	2
LA Wiley *(working with GSIs Wade and Wren)*	LA: 3 GSIs: 3	8 (4 of Wade's class, 4 of Wren's class)	2 (1 for each)

In the fall of 2020, I also interviewed four GSIs who served as associate conveners for the precalculus courses, each of whom worked with a LA in their classrooms and led biweekly content preparation meetings with all the LAs for the course they oversaw. One of the associate conveners was also part of the summer 2020 focus groups; thus, by the end of the 2020-2021 academic year, I had interviewed four LAs and 13 GSIs.

Through a preliminary analysis of the data in spring 2021, I determined the data collected to date provided insights into the case of the LA role in precalculus at UNL but were insufficiently varied to provide the nuanced answers I hoped to address my research questions. As such, at the end of the spring 2021 semester, I invited all LAs from the prior semester to a focus group (apart from those who had already participated in my study). Three precalculus LAs[4] decided to participate either in an individual or focus group setting (based on their schedules).

In the fall of 2021, I collected my final round of interview data with instructors and LAs. I recruited two instructor-LA pairs (Instructor Emery working with LA Elliott and Instructor Gene working with LA Guo) whom I interviewed and observed at least once. I also interviewed three instructors (Blake, Frances, and Peyton), and observed Blake's and Frances's class at least once. However, their LAs did not respond to an invitation for an interview (Blake's and Frances's LAs did consent to being observed). The purpose of this round of data collection was not to develop subcases; rather it was to allow participants to confirm or disconfirm emergent themes from analysis of data collected in the prior year and to get a sense of how the shift back to in-person instruction may have changed how LAs acted in the classroom. The interview protocol was adapted to support this goal (see the Appendices for all interview protocols). I also interviewed the LA Coordinator, who had multiple additional roles in the department: they led professional development for GSIs and convened multiple lower-division mathematics courses each semester. Before this semester, I had informal conversations with the LA

[4] One of these LAs participated in a focus group with a LA from Applied Calculus, but information from the latter was not included in this study.

Coordinator about the program. I used their interview primarily to provide context to the interviews with other participants and to make connections between departmental expectations and how instructors, LAs, and students thought of the LA role.

Open-ended Survey Responses

I proposed to conduct focus groups with students. I attempted to recruit students that were enrolled in the classes selected for the subcases. I spoke about the focus groups during my final observation, as well as sent an email to the instructor with a request that they forward it to their students. The email included a poll students could fill out to express their interest in participating in a focus group. However, no students filled out the poll. Given the ongoing stresses of the global COVID-19 pandemic and the lack of student responses, I dropped the plan for student focus groups in the fall of 2020. In the spring of 2021, I tried to recruit participants by emailing students from LA-supported classrooms who took the department's end-of-year semester survey and also indicated that they did not mind being contacted for a follow-up interview. Only one student responded. When I emailed them back, I thanked them for their willingness to participate and explained that I would still appreciate the opportunity to speak with them, but that it would need to be an individual interview. Understandably, they declined to participate. I know my experience was not unique; a different project run at UNL that year also struggled to get students to participate in a student focus group. Due to restrictions from COVID-19, the more tried and true strategies of encouraging participation (e.g., offering incentives such as pizza and building rapport by sitting next to students in class) were unavailable to me. However, I was still determined to get students' perspectives, as I

thought they were integral to understanding the LA role. So, I modified my data collection plan.

To ensure that I was considering students' perspectives on the LA role, I used a student survey that was administered by the department in the fall of 2021. In this semester, the Student Postsecondary Instructional Practices Survey for Mathematics (SPIPS-M; Apkarian et al., 2019) survey was administered to coordinated, lower-division mathematics courses, including all LA-supported mathematics courses. I used data analysis of interviews with instructors and LAs to develop additional items for this SPIPS-M survey. These items included open-ended response questions focused on the perceived differences between student-instructor and student-LA interactions. In particular, I proposed a modification to the SPIPS-M survey to include the free response question: *Do you interact differently with [the instructor] than [the LA]? If so, please explain*, which the department accepted. The question was purposefully phrased to encourage students to compare the roles of the LA and the instructor, as one of my main questions in understanding how UNL thought about the LA role was how it might be distinct from the instructor's role.

Not all students progressed far enough into the SPIPS-M survey to see this question and some survey responses were duplicates. In the case of duplicates, all students answered the question the same (i.e., none) or did not answer the question in one of their responses; in the latter case, I kept the most complete response. A total of 490 students enrolled in learning assistant-supported classes responded to the survey and potentially saw the question. The total enrollment at the beginning of the semester was 743 students, representing about two-thirds of all students enrolled in these classes. Of

the 490 students who saw the question, 79 left the question blank, leaving 411 responses to consider for analysis.

Data Analysis

Interviews & Observations

The initial stage of analysis coincided with data collection in the fall of 2020. Following each interview and observation, I organized field notes, all recorded electronically, and added details that I could not record in the moment, as well as my reflections on how the data was helping address my research questions. For each subcase, I had a spreadsheet with a tab for recording notes. I also kept a document to record general patterns I was noticing across participant's responses and areas to follow up on with participants (e.g., 10/15/20 was the first time I noted LA Jessie's focus on aligning themselves with the instructor - this became a key theme in how LAs and instructors thought about the LA role). As such, this early process of reviewing field notes was a useful tool for me to become familiar with the data, as well as supported further rounds of data collection, particularly influencing new interview prompts I hoped to ask in follow-up interviews. In particular, I noted that instructors often discussed the LA role in the context of their own role (i.e., positioning the LA as someone who complimented their instruction, copied their instruction, or gave them useful information about students).

Additionally, when I asked instructors what beliefs, knowledge, and skills LAs needed to do their job effectively, they often mentioned beliefs, knowledge, and skills that one would expect of an instructor. This led me to interrogate how stakeholders envisioned LAs and instructors differently. This also led me to consider my theoretical framing, which initially considered LAs as having a distinct role in instruction (and thus

needing to be included as a separate node in the instructional triangle). In essence, I was narrowing my focus on how LAs and instructors were placed in relation to one another by stakeholders and under what conditions they occupied the same or different spaces in instruction.

In the next stage of analysis, I developed a codebook to code transcribed instructor interviews. I had developed an initial draft of the codebook prior to data collection. This codebook consisted of an initial set of theory-driven codes as well as structural codes based on my research questions (DeCuir-Gunby et al., 2011). Based on my original questions, I tried to broadly code for interpretations of the LA role, orientations or evaluations of the LA program, interactions between the instructors and LAs, and LA actions in the classroom. Furthermore, to provide context to the different ways that people interpreted the LA role, I had codes that captured beliefs about teaching and learning, goals for teaching and learning, and context (COVID, classroom). I had several subcodes for interactions between the instructors and the LAs, modeled after the work of Sabella et al. (2016).

I iteratively refined the codebook through the spring and summer of 2021 after applying the codebook to a small set of interview transcripts for instructors. The purpose of this codebook was to broadly capture excerpts for secondary analysis via a constant comparative coding strategy. As such, the codes overlapped significantly; and I often coded excerpts with a long list of codes. However, I did some consolidation of the codebook at this stage. The most significant changes I made were consolidating the codes for LA actions and interpretation of the LA role and modifying the codes about instructor-LA interactions. The original LA actions and interpretation of the LA role

codes felt distinct until I applied them to my data. In practice, I almost always double-coded them to an excerpt of interview data because it was not always clear if the LA actually did something in the classroom versus being asked to do something by an instructor (which would thus make it a duty and related to the instructor's interpretation of the LA role). For example, when an instructor described asking their LA to take attendance, I double-coded that as an action but also as part of the LA role. Thus, the newly merged "LA Roles" code was used to capture excerpts that included both expectations for LAs as well as realized actions in the classroom. I also had several subcodes for instructor-LA interactions, but most were rarely used and those that were used had substantial overlap with LA Roles. I removed these codes and included a code about communication between instructors and LAs outside of class to capture all excerpts about instructor-LA meetings, conversations between instructors about their LAs, etc. Once I determined my codebook was stable, I coded all instructor interviews collected between summer 2020 and spring 2021 in Dedoose (https://www.dedoose.com), including interviews with associate conveners. See Appendix J for the final codebook.

Given my focus on understanding how stakeholders interpreted the LA role, I then extracted all excerpts labeled "LA Roles" for further coding via an open coding and constant comparative process. I used a spreadsheet to facilitate this, creating a column to open code and another to consolidate codes through a constant-comparative strategy. I read through these responses multiple times, searching for patterns in how instructors described the LA role. This process led to four sub-roles: additional instructor, differentiated instructor, liaison, and representative of the instructional team. After presenting my findings to my advisors, I narrowed these sub-roles to three sub-roles that

seemed to account for many of the ways instructors described the LA role, two primarily focused on attending to students: duplicate instructor and complementary instructor, and one focused on attending to the instructor: liaison instructor.

Before coding the remainder of the interview data, I reread all instructor interviews collected between summer 2020 and spring 2021 and coded for any instances in which these three sub-roles (duplicate instructor, complementary instructor, and liaison instructor) appeared. I realized that in this secondary analysis of instructor interviews, I often double-coded with the three sub-roles, which suggested that instructors ascribed multiple sub-roles to LAs. My intent was then to use the codebook for the remaining transcripts. I tried to apply the instructor codebook (now with a parent code "Instructor-Derived Roles of LAs" and three subcodes "Duplicate," "Liaison," and "Complementary") to LA interview transcripts, but I began to feel hesitant in thinking of these roles as static. I also became concerned that in consolidating the instructor data into these three overarching sub-roles, I had erased details that seemed small in the instructor data, but more prominent in the LA data. For example, although some instructors mentioned not feeling equipped to teach LAs how to teach (as novice instructors themselves), I did not emphasize this as a strong theme associated with the LA role until systematically analyzing the LA data. LAs discussed their roles in ways that seemed more nuanced and fluid than my codebook was capturing and further seemed highly dependent upon the instructor with whom they worked. This led me to investigate Positioning Theory as a possible framework for better understanding and describing the LA role, following the direction of Jardine's (2020) analysis of faculty partnerships with undergraduate teaching and learning assistants.

Because Positioning Theory focuses on how rights and duties are interactively distributed, Positioning Theory seemed promising in capturing the main rights and duties of the LA (e.g., the right to professional development to support their teaching practice). In particular, my understanding of Positioning Theory suggests that to understand the LA role, I also needed to intimately understand what stakeholders thought was the role of the instructor and students. Thus, I was homing in how instructional rights and duties were distributed in the classroom, or expected to be distributed, to understand perceptions of the LA role. Taking the prior example, when some instructors expressed not feeling equipped to teach LAs how to teach, through the lens of Positioning Theory, I could now recognize that the instructors rejected a positioning of themselves as experts of teaching and LAs as apprentices working underneath them. Before using Positioning Theory, it was harder for me to connect how statements such as these (which were more focused on the instructor's perception of their own role) informed the LA role.

Based on this investigation, I adapted my research questions to better focus my analysis, using Positioning Theory to focus my inquiry and help organize my dissertation findings. I changed the "LA Roles" code to "LA Positioning" and redefined the code to ensure I was capturing these nuances. To aid in this process, I redefined the codebook using categories recommended by Kayi-Aydar's (2021) analytic framework for Positioning Theory. This new code helped me identify excerpts in which LAs described adopting particular duties or exercising certain rights. It also helped me identify instances in which LAs were describing why they had access to those rights or duties (e.g., based on the communities they claimed membership to, the things they enjoyed doing) and the

factors that influenced what they thought their rights and duties were (e.g., prior tutoring experience). I defined this new code as

> *LA Positioning*: Refers to the rights and duties assigned to LAs, as well as dispositions (e.g., personality traits), categorical membership of LAs (e.g., mathematics education major, parent, gender, etc.), emotion speech (e.g., "I love math" or "I just get joy out of helping people"), and references to existing storylines that the participant may be drawing upon (e.g., Math Resource Center tutor, Teaching Assistants in Recitation, etc.)

I used this new codebook to code all LA interview transcripts in MAXQDA (https://www.maxqda.com). I also added a "LA Actions" code to capture what LAs actually describe themselves as doing in the classroom - as opposed to generic statements about what they are supposed to do. I used this new codebook to code all LA interview transcripts in MAXQDA.

To identify ways that LAs were being positioned in the classroom, I extracted all excerpts coded with "LA Positioning" and put them in a spreadsheet. I had five columns to support the generation of themes, and directly connected to Positioning Theory: (a) the storyline I felt this excerpt supported, (b) information about what the LA is supposed to say and do (communication acts), (c) a possible position the LA is adopting, (d) evidence of adoption, tensions, or negotiations of this position, and (e) other possible storylines/positions.

Ultimately, I wanted to identify positions (and consequently storylines) that multiple participants were evoking, particularly through the communication acts they described taking, or did take when being interviewed. I focused on positions directly

connected to how LAs interacted with instructors and with students. Thus, I prioritized storylines directly related to a work relationship, or how LAs thought about their work. I grouped storylines and positions as I analyzed the data, as well as looked for differences and similarities between how the LAs positioned themselves and the subroles (which I now identified as possibly being positions) I had identified from the analysis of instructor data. This analysis identified several positions that LAs may adopt in the classroom or be expected to adopt as part of an instructional team. I then reread the previously coded instructor data, coding for evidence of these positions as well as any other evidence I may have missed about how instructional rights and duties were distributed.

I also analyzed the fall 2021 instructor and LA Coordinator interview data, mainly to interrogate these findings, particularly as fall 2021 classrooms were held in person. As such, I reread the transcripts multiple times but only coded for evidence of these positions and statements that counteracted my findings. In Chapter 4, I describe these positions in detail.

Subcase Study Generation

Analysis of excerpts coded with "LA Roles" and "LA Positioning" also led to other themes and positions that the LAs ascribed to themselves, particularly in interactions with students, separate from the instructor. To further explore how LAs positioned themselves, I open-coded LA interview excerpts coded with "LA Actions" and "Instructional Goals" and then used axial coding to identify patterns in what I saw. For LA Actions, I compared these patterns to Thompson et al.'s (2020) Action Taxonomy for Learning Assistants to help name these actions before developing larger categories. To contextualize these findings, I used field note records of class times (I kept a running log

of classroom activity) to calculate, for each instructor I observed, the average time students spent organized into small groups working on mathematical tasks versus other activities (primarily lecture, but also whole class discussion and announcements). Time spent on in-class quizzes was not included in these calculations.

I used subcases to present major findings about how LAs positioned themselves in LA-student interactions, largely separate from the instructor. To support the development of these subcases, I used MAXQDA's summary grid tool for each LA to summarize their beliefs, goals, actions in the classroom, and positions adopted. In this process, I also identified particularly salient quotes to illustrate these themes. Ultimately, this process also helped me narrow the focus of my dissertation, which at this point had started to get unwieldy. Recall that I recruited four subcases of LAs to help address my research questions, which felt manageable at the time of recruitment. However, in consultation with my advisors, I found it sufficient to present two subcases to highlight major themes in how LAs and instructors perceived LAs and themes in the goals and actions LAs took in the classroom. Once I had selected these subcases, I used the summaries created in MAXQDA to organize my findings. Further, I reviewed the observation field notes and recordings (when available) sequentially for these two subcases to identify patterns in the ways that they interacted with students and to connect this to how they positioned themselves in interviews. To aid in identifying patterns, I looked for episodes of sustained interactions between LAs and students (i.e., beyond the LA checking-in with students). I then wrote down a summary of the interaction, using the list of actions I developed from LA interviews to identify themes in actions taken by the LA. These findings are discussed in Chapter 5.

Open-ended Survey Responses

In fall 2021, I analyzed students' responses to the free response survey question: *Do you interact differently with [the instructor] than [the LA]? If so, please explain*. As explained above, 411 responses were initially considered for analysis. I used an Excel spreadsheet to code each of these responses. I coded responses as "Difference," "No Difference" or "N/A" to capture perceived differences between student-instructor and student-LA interactions. In total, 390 (95%) responses were classified either as "Difference" or "No Difference" and included in subsequent analysis. Responses were coded as "Difference" even if students said there was no difference, but provided one. To illustrate this nuance, consider the following student remarks: "No, [LA] has helped me more since he's closer to our table, but we all interact the same" and "I interact the same, but each see problems differently and have different explanations which can be very helpful." Although these students describe the interactions as being the same in some way, they also note a difference in frequency (in the former case) or how instructors and LAs explain content (in the latter case). Thus, if students mentioned any difference, their responses were coded accordingly as "Difference."

I then read through all 390 responses and took notes in a column labeled "Factors" to capture factors influencing differences or similarities in student-instructor and student-LA interactions. Several responses were general (e.g., "we generally ask him [the LA] more questions than [instructor]") or did not specify factors that led to differences or similarities in how students interact with instructors and LAs (e.g., "None"); however, 209 responses provided sufficient detail to be included in a secondary analysis. Criteria for inclusion were broad, including any responses that could illuminate

why students perceived interactions with their instructor to be the same or different from interactions with the LA or that had evidence of particular positioning (e.g., referring to both the LA and the instructor as "teachers" or "instructors") or describing them both as "helpful and nice." For example, the response "No, I respect them both equally as an instructor for this course" was included because, although not overtly specific, this response suggests that the student positions the LA and the instructor in similar ways (positioning both "equally" as instructors) because they respect them as teachers.

In a secondary analysis of these 209 responses that identified factors, I also coded for student preference, as in their expressed preference to interact with the instructor or the LA. In a separate column labeled "Preference," I entered either: Instructor, LA, or Other. After re-reading through the responses coded as "Other," I refined this coding to four subcodes: Incidental, Different, Unclear, or Neither. "Incidental" was used to describe situations when a student did not seem to prefer either the instructor or the LA but may have interacted with one more than the other due to extraneous factors, like proximity (e.g., "No, [LA] has helped me more since he's closer to our table, but we all interact the same.") "Different" was used to describe situations when students remarked on valuing the different perspectives or strengths of the LA or instructor. "Unclear" was used when the preference was not clear ("Yes. i [sic] trust him more."). "Neither" was used to code responses in which the student did not want to interact with either the LA or the instructor.

To further refine and identify how students were positioning LAs and instructors in their interactions with them, I developed categories informed by Kayi-Aydar's (2021) recommended strategies for identifying positioning in texts that, in my reading of the

responses, seemed to be prevalent in the data. These categories were: dispositions, labels/categorical membership, and emotions. I also included teaching quality after identifying that as a main factor influencing how students perceived and compared interactions between their LA and their instructor (see Table 6 for a summary of these codes). I conducted this analysis in a spreadsheet, creating a column for each category so that I could read through the 209 responses and make notes if an individual response could be classified with these categories. Through this process, I identified several themes related to how students interact with their instructor and LA. I structured these themes around storylines to highlight how students positioned LAs in interactions.

Table 6

Codebook for Identifying Storylines in SPIPS-M Data

Code	Definition	Example
Dispositions	Response attributes personality traits and dispositions to a LA or instructor	Yes, because [LA] seems *more personable* and available to help. I also like the way he explains things better than [instructor] does.
Labels/ categorical membership	Response mentions membership in particular cultural groups or communities (categorical membership). This includes designations such as student, peer, woman, etc. Also used to identify titles, metaphors, etc. that are used to describe the LA or instructor.	"Yes, [LA] is *closer to our age* so we talk to him more often."
Emotions	Used to highlight emotions arising from or during interactions with a LA or instructor.	"I'm a college girl and so is [LA], it's just *easier for us* to interact I think. And *I can more easily* say when I don't understand something to her and stop her while she's explaining - *I feel a little rude to do that to Professor* [Instructor]."

Teaching Quality	Response mentions a perceived teaching quality of the LA or the instructor.	[instructor] is better at answering questions.

Validity and Reliability of Findings

Historically notions of validity and reliability are most often associated with quantitative research, although such concepts have close parallels in qualitative work. In quantitative work, more researchers are focusing on validity in terms of the use of said work. Studies must be rigorous enough to support meaningful and valid insights for the field that could potentially be used in designing programs, constructing social policy, or creating legislation. Likewise, in qualitative work, researchers have to consider how their findings may be used and if their findings have a purpose at all. The findings from this study can impact how people in mathematics departments perceive, value, and make changes to their LA programs. As such, it was especially important that I attended to issues of validity and reliability.

There is no consensus on the criteria used to establish validity and reliability in qualitative research, and these criteria depend upon the type of study (e.g., narrative versus case study) as well as one's philosophical lens (Merriam & Tisdell, 2016). Qualitative researchers have suggested various concepts to replace validity and reliability, including trustworthiness, authenticity, and rigor (Lincoln et al., 2011; Merriam & Tisdell, 2016). Yet, there are overlaps in the strategies qualitative researchers recommend employing to support the validity and reliability of one's study, particularly related to methodological rigor (Lincoln et al., 2011; Merriam & Tisdell, 2016). In the remainder of this section, I describe strategies I used, recommended by Merriam and Tisdell (2016), to support the trustworthiness of my findings. I chose to follow Merriam

and Tisdell's (2016) framework because of their constructivist worldview, which aligns well with my views as a researcher.

Internal Validity and Reliability or Consistency

Merriam and Tisdell (2016) refer to internal validity as dealing with the question of "how research findings match reality. How congruent are the findings with reality?" (p. 242). However, they view reality as "holistic, multidimensional, and ever-changing" rather than "single, fixed, objective" (p. 242), thus underscoring that reality is relative and can never be captured objectively by the researcher. They recommend several methods to capture the multiple realities that may occur, including triangulation, member checking, purposefully looking for contradictory or competing constructions of reality, the researcher's position or reflexivity, and peer examination. In addition to these strategies, they recommend using a researcher log to support the reliability or consistency of one's findings. Below I share how and when I used each of these strategies.

Triangulation can include the use of multiple methods, multiple sources of data, multiple investigators, and multiple theories "to confirm merging findings" (Merriam & Tisdell, p. 245). In my study, I collected multiple sources of data: including interviews, observations, field notes, and surveys. These various sources helped illuminate the perspectives of instructors, LAs, department leaders, students, and myself. I also considered my data from the perspective of multiple scholarly fields, as detailed in Chapter 2.

Another recommended strategy for enhancing internal validity is member checking. During interviews, I often clarified or revised what my participants said to check my interpretations. I also used follow-up interviews with instructors and learning

assistants to check my interpretation of their perception of their responsibilities and the responsibilities of the LA, as well as their beliefs and goals about instruction. I also gave the instructors, LAs, and the LA Coordinator a draft of my dissertation chapters so they could read and respond.

It is also important in establishing internal validity to be "purposefully looking for variation in the understanding of the phenomenon." (Merriam & Tisdell, 2016, p. 248) Finding variations in the data, or representing contradictory or competing constructions of reality, helps to ensure that study findings do not privilege one set of participant perspectives over another. I collected data from the summer of 2020 to the fall of 2021 to investigate whether there were variations in the LA role from semester to semester. Periodically during data analysis, I would review the data and ask if anything disconfirmed the themes I found. I also progressively focused my research questions and reanalyzed data as necessary to attend to these variations in support of trying to capture the variety of understandings of the LA role within the department as authentically as possible.

I also engaged in peer examination with multiple members of the department. I regularly met and discussed my dissertation with my advisors. I also shared early analysis at two meetings with my department's educational research group (many of whom worked with LAs).

Finally, the two other major strategies recommended for establishing internal validity and reliability are the researcher's position or reflexivity statement and the researcher's log. I provide a reflection on my position and how it affected the research process in the penultimate section of this chapter. Throughout my study, I kept records of

what data I collected and how I analyzed the data, making note of any changes to what I originally proposed (and the reason for those changes). This chapter of my dissertation reflects those records.

External Validity or Transferability

Statistical generalization is not a goal of qualitative research; however, there is a parallel notion of external validity or transferability of findings in qualitative research. These concepts particularly relate to how the findings of a study are presented. It is the onus of the reader to consider how the findings relate to their particular situation, but in order for them to evaluate the degree of transferability of a study, the researcher needs to provide rich descriptions of the context. Naturally, this leads to two strategies recommended by Merriam and Tisdell (2016): rich, thick descriptions and maximum variation. As a case study, I provide rich contextual details to ground the findings. Further, although this was a single case study of the LA role in one department, I did seek variation within the case through a selection of subcases that varied across courses and based on LA and instructor backgrounds, level of experience in the classroom, and perceived gender. I also collected and analyzed perspectives from multiple groups of people, including instructors, LAs, and students.

Researcher Position

I am a white, cis-gendered woman (she/her) graduate student in the mathematics department at UNL. For most of my graduate career, I have served as a research scientist for the Center for Science, Mathematics, and Computer Education (at the time of writing, I have a full-time position with the center). I also have taught several courses in UNL's mathematics department, including a course supported by a wonderfully helpful LA.

I first became interested in the role of learning assistants in active learning classrooms through my work on Student Engagement in Mathematics through an Institutional Network for Active Learning (SEMINAL). The mathematics departments involved in the SEMINAL project were willing to invest significant resources to support their vision for better instruction; these resources, in turn, require constant justification to support. Some of these departments incorporated undergraduate learning assistants (LAs) as part of their change efforts. During a site visit, I witnessed LAs speaking to students in a mix of English and Spanish. When we spoke with the instructor of record later, we found out that she did not speak Spanish. After this observation, it was clear to me that LAs played a unique role in supporting students' thinking about mathematics in precalculus and calculus courses at this institution, yet I did not hear any participants discussing this benefit of the LA program until after a researcher brought it up. Instead, much of the focus of these conversations was on the benefit of having LAs help with grading group worksheets used in active learning discussion labs.

The ways that participants at this institution speak about LAs changed since the first site visit. I witnessed change leaders mention the benefit of the bilingual skills of LAs multiple times, along with several other advantages of integrating LAs into the precalculus and calculus courses. In a remote site visit conducted in the spring of 2020, it was clear to me that participants valued what LAs brought to their classrooms. Despite this increased understanding of the LA program, the sustainability of their LA program was far from guaranteed. Mathematics departments, especially those that are stretched for resources (an issue that is only intensified by the COVID-19 pandemic), need to be able to justify the resources that they choose to sustain. This sparked my interest in studying

how various stakeholders in mathematics departments perceived and used this resource (LAs).

These research experiences also influenced how I interacted with LAs when I was assigned to a LA-supported class for the first time. I was excited to work with my LA, and based on my, at the time, cursory readings about the benefits of LAs and faculty-LA partnerships I endeavored to make our partnership truly collaborative (Davenport et al., 2017; Sabella et al., 2016). Yet, I also experienced anxiety early in that partnership, not knowing exactly how I could position her to take a meaningful role in the class. I started having conversations with other UNL graduate students about how they had integrated LAs into their instruction. I quickly learned that most people struggled to know how to leverage the unique role of the LA in their classrooms. It was also apparent that some partnerships led to a lot of tension, as some instructors felt that their LA undermined their own instruction. But I also felt that I was missing what LAs thought of this partnership, and their role more broadly - did they feel supported? Did they feel they had a meaningful role in class? What tensions did they feel in their role?

During the semester, I was determined to have a better experience with my LA. We met regularly, and I would often solicit her feedback on students' understanding of the material and suggestions to support particular groups. We also discussed upcoming material and ways to scaffold student learning on particular tasks. However, I quickly discovered that my view of how my LA interacted with students was more like an impressionist painting than a realist one. I vaguely knew that my LA monitored student work, answering students' questions and asking students questions to engage students in conversation. I found myself mostly engaged in conversations with students and largely

unaware of what my LA was doing, working in parallel with the LA rather than collaboratively during class.

I also questioned some of the assumptions that I had gone into the partnership with - for example, I questioned whether my students found her more relatable than me. It seemed I had better relationships with some of the students, particularly those who attended my office hours. I wondered if part of this was because students had more opportunities to interact with me or because I felt empowered to joke with my students during class and talk about personal things, but my LA rarely did (at least, from what I could hear). It made me question if I had been the best instructor to be paired with and if I had given as much support as my LA deserved to feel valued in my classroom. Despite these concerns, overall, I believe my LA and I had a valuable partnership, and I was motivated to figure out ways to improve future partnerships between GSIs and LAs.

My experiences as a researcher and an instructor working with a LA motivated this study. Throughout the implementation of this study, I have both drawn from these experiences to guide and improve my research, but I also have taken measures to ensure that I was centering my participants' experiences rather than over-amplifying my own impressions of the LA role. I talk about some of these measures in the prior section. Furthermore, based on the framing I use it is important to note that my findings are often presented as storylines that I believe participants are evoking to position LAs, and thus contribute to their understanding of the LA role. However, at any point in time in the interview, multiple positions and storylines were evoked by a participant, and of course, what the participants said was filtered through my experiences as a researcher and graduate student. That said, I ground these storylines in the data and, where appropriate,

discuss why certain storylines were highlighted more than alternatives. It would be impossible to capture all possible storylines that participants used to make sense of the LA role, but my goal was to capture some of the most salient ones, particularly ones that seemed to be held in common.

It is also important to acknowledge that, given my interests, I have been involved in the design of professional development materials for LAs. In particular, I was involved with the grant that launched a LA professional development course for LAs in the fall of 2020 and designed some of the materials for that course. The data for this dissertation has both driven my own research and been used to support changes to these materials (e.g., the instructor focus groups were used to inform guidance materials for GSIs working with LAs). The findings of this dissertation will be shared with the department broadly and have been shared with participants. I also believe these findings can support and motivate other departments with similar structures as UNL in trying to understand how individuals in their departments think about the LA role. I hope this is research as praxis–research that can not only further our understanding of the LA role in active learning classrooms but also empower mathematics departments to justify the resources that they commit to sustaining such programs, including professional development efforts.

Summary

In this chapter, I discussed how I used a qualitative case study methodology to understand the LA role within precalculus courses at UNL. I conducted 38 interviews (individual and group) with the LA coordinator, 9 LAs, and 18 GSIs. Some of these interviews were conducted over the course of a semester as I recruited four subcases of LAs, two of whom were developed into embedded subcase studies to represent general

themes about the overall case. In addition, I analyzed student responses to a free-response question included in a survey distributed in the fall of 2021. I used open coding, constant comparative coding methods, and codes derived from my theoretical framework and research questions to generate themes about the data.

I used several strategies to establish the validity and reliability of this dissertation, including (a) triangulation, (b) member checking, (c) purposefully seeking contradictory constructions of reality, (d) detailing my positionality, (e) peer examination, (f) keeping a log of research processes, (g) providing rich, thick descriptions of the case, and (h) seeking variation in sample selection.

CHAPTER 4: INSTRUCTIONAL TEAM'S PERCEPTIONS OF INSTRUCTIONAL RIGHTS AND DUTIES

In this chapter I address the following research questions: *RQ1a: How did instructors and LAs in active learning precalculus classrooms position themselves in relation to each other?* and *RQ1b. How did members of the instructional team describe the expected or actual distribution of instructional rights and duties between LAs and instructors in active learning precalculus classrooms?*

Learning Assistants (LAs) are typically described as being members of an "instructional team" (e.g., "LA Model," n.d.) whose main aim is to support student learning. Central to the effectiveness of this team is the relationship between the instructor and the LA; yet, the role of a LA is less well-defined than that of an instructor (who relies on culturally and socially entrenched storylines about teaching to guide their work). Thus, the LA role is more susceptible to interpretation. How instructors and LAs allocate instructional rights and duties in the classroom is key to understanding their relationship. This allocation varies from conversation to conversation and is based on personal and social attributes. However, this can be illuminated through conversations (interviews) with participants in which they are asked to position themselves and retell stories from their experiences in the classroom.

In this chapter, I synthesize interview data from 18 graduate student instructors (GSIs) and 9 LAs to describe how LAs were positioned in the classroom *in relation to the instructors (GSIs)*. LAs enact their role within the precalculus coordinated system at the University of Nebraska-Lincoln (UNL). Since this system has existing obligations and norms, I found it valuable to augment these responses with data about the department's

understanding or hope for the LA role (through interviews and conversations with the LA Coordinator, documents referencing the LA program or used in LA professional development, etc.). I first describe the main rights and duties of LAs on the "instructional team" at UNL before introducing more specific positions that LAs could and did adopt in different contexts as part of this team. This range of positions provides insight into how the role of the LA is conceived in relation to instructors.

I identified five dominant positions that relate the instructor and LA in a professional capacity: a.) LA as an assistant instructor, b.) LA as an apprentice instructor, c.) LA as a duplicate instructor, d.) LA as a partner instructor, and e.) LA as a complementary instructor. Collectively these positions reflect differences in how instructional duties and rights were expected to be distributed between instructors and LAs in a classroom, as well as the storylines in which these positions were enacted. Although these are certainly not the only positions that emerged in the data, they represent clusters of related duties and rights that I perceived to be taken up by participants through their descriptions of their responsibilities and interactions in the classroom.

Further, I emphasized positions that evoke storylines related to professional relationships (e.g., while a LA may have positioned themself as knowledgeable or caring, I did not identify that type of positioning for this chapter). I specify associated rights and duties, storylines, and communication acts for each position. I also identify conditions that may support the uptake of or appreciation for particular positions and describe any valuation or tensions associated with the position. Finally, I conclude this chapter by

discussing what these positions add to our existing knowledge of instructor-LA dynamics.

Being a part of UNL's Instructional Team

Referencing LAs as part of a team suggests that LAs enact their role along an established storyline (those associated with teams and teamwork). Yet, there is wide variation in how teams distribute rights and duties among their members. Some teams have a highly prescriptive distribution in which members occupy relatively stable long-term positions or roles. Team members on flight crews (e.g., pilot, flight attendant), surgical teams (e.g., anesthesiologists, obstetricians, and doulas), and professional sports teams (coaches, players) all have well-defined responsibilities associated with furthering their team's goals (to transport passengers safely and comfortably to their destination, to support a parent through the labor process, to win a game). Other teams - like intramural sports teams - allow for more flexible positioning.

At UNL, the department explicitly expected LAs to support small group work in class and lead review sessions. Beyond this, the department had very few prescribed expectations for how LAs were integrated into mathematics classrooms, leading to a wide range of positions LAs adopted (or could adopt) in the classroom. Yet, there were also some strong similarities in how instructors, LAs, and department administrators conceived the LA role.

LAs assumed duties that were in part determined by the instructor of record, who in turn worked within the context of an established course coordination system and set of norms related to teaching precalculus courses using active learning. Several participants emphasized the importance of LAs being aligned with the instructor and a broader course

coordination system. Instructor Wren shared how they set this expectation early in the semester with the LA they worked with, Wiley. In their first meeting, Wren told Wiley the importance of "never painting the math department, or the workbook, in a bad light." For the most part, participants positioned the instructor of record as the authority in determining the day-to-day duties of the LA. However, some instructors shared experiences suggesting this could be a point of tension when working with LAs. During their interviews, all the LAs I spoke with positioned themselves as accepting of the authority of instructors in running class. Furthermore, some shared that this was an explicit positioning from the department. For example, Hailey, a new LA, recounted the following conversation with the LA Coordinator:

> Rachel: Okay. Are there any expectations that Harper might have for your role as an LA that are different from the ones that maybe were communicated by [LA Coordinator]?
>
> Hailey: You know, [LA Coordinator] was very upfront about how with everything being different, just because of the COVID stuff, that [they] could give me some very, you know, general ideas of what it was gonna be like. And for the most part, they've all been accurate, but [they] said [they] can't give me a full explanation of exactly what it's going to be because each of the instructors is doing things a little differently. And I'm one of the LAs that works with another LA. So, the stuff [they] said was accurate, but also, because [they] acknowledged, like there's no way to know. It might differ from the first week of the semester to the last week of the semester.

Here, Hailey described how the LA Coordinator positioned instructors as having some authority over what responsibilities LAs take in the classroom. This was corroborated in my conversations with the LA Coordinator, who wanted instructors to have "some flexibility" in how they worked with LAs while also hoping that LAs felt like an "integrated part of the instructional team."

Several other participants described LAs in ways that suggest they appeal to a team storyline when thinking about the duties of LAs in the classroom. For example, Instructor Wade used a weightlifting metaphor to describe the role of the LA: "The LA definitely helps more with balancing the teaching load a little bit. So, like, I mean, I still carry the majority of the weight. But the LA is spotting me." This suggests that Wade perceived LAs as collaborators (they help to balance "the teaching load"), albeit with less responsibility than instructors.

This view of the instructor as the determining authority in classroom decisions was echoed by an experienced LA, Jessie, who consistently discussed the importance of aligning their teaching approach with the instructor in interviews. By fall 2020, Jessie had worked with three different instructors, and said, "Everything always changes a little bit based on the instructor." They appreciated it when the instructor shared their expectations for the class "in regards to both the students and how they want to approach the teaching."

LAs often used specific communication acts to indicate they accepted the authority of instructors. Taylor, a returning LA, described their position, at least in a pre-pandemic world, as "more of a second TA that's *under* the actual teacher." Taylor literally described their role in terms of a physical location (under), thus highlighting

differences in power between the LA and the instructor of record. Later in their interview Taylor said that although they had "done this [been a LA] a lot" they viewed the LA as a support role. They said, "We're here to support rather than take over." Taylor stressed that instructors should trust LAs "to help reinforce your ideas and connect with the students." Furthermore, Taylor suggested that if a LA "tries to make it their course," new instructors tell the LA to "calm down a bit, let me get through this first." In this way, Taylor positioned themselves as an experienced, valuable instructional team member, but stressed that this team is led by the instructor, regardless of the latter's experience level.

LAs also used language which suggests they had some authority in the classroom, particularly to uphold established classroom norms. For example, LA Ciri described how "sometimes the students will want to work on homework during class, and I'll have to be like 'no. Your homework will make more sense after you do the workbook problems.' That does tend to be a good lasso for attention." Thus, Ciri positioned themselves as someone who had the duty and right to redirect students to the tasks they were supposed to complete in class (workbook problems).

Although many participants positioned LAs as additional facilitators of small group work (inherent in the duplicate, partner, and complementary instructor positions discussed later), some instructors were uncomfortable with dividing student interactions between the instructor and the LA. These instructors described the importance of interacting with all their students, often because they were unsure what LA-student interactions looked like. For example, Wren said:

> I want to interact with all of the students, whether I'm supposed to focus on the ones in person or on Zoom. I still want to talk to all of them. But I also don't want

> to cut off Wiley or come in when [they're] waiting for a student to think and start talking. Because when [they're] in person, it's just so much easier because I can really tell what's going on.

Wren wanted to respect LA Wiley's teaching but felt it important that they spoke with every student in their class. This theme of being unsure of LA-instructor interactions is taken up again in Chapter 5. Although Wren desired to speak with all students individually, they also valued that the LA's position in the classroom supported them in having longer connections with students:

> I think I talked to you a little bit before about how, like, I feel like I can spend a lot longer talking to each student or each pair of students. And I think without an LA I wouldn't, that would be like the main difference is I wouldn't be able to talk for too long with any one student or any group of students.

Moreover, although LAs were often described as being part of an instructional team, some felt that since LAs had less authority in the classroom, it was easy for them to be seen as the "good guys" while the instructor was viewed as an adversary. For example, Instructor FGA2 said that "a lot of times, LAs don't realize that they're kind of automatically the good guys over the instructor in the eyes of the student" because LAs are "an assistant" while instructors are the "main instructor." FGA2 said that, due to this dynamic, it is essential for instructors to remind themselves that they are "on the same team" as the LA so that they don't "start undermining each other." Similarly, FGA1 said, "The way I see my LA is that they're the good cop, [I'm the] bad cop. Like that's going to happen." Given the perceived inevitability of this storyline, FGA1 stressed the importance of establishing a good relationship with the LA, letting them know that this

dynamic will occur, and including them in the instructional plan to establish what another instructor, Jay, called “a unified front.”

Some instructors had experiences of LAs challenging their authority, and others (including LAs) shared second-hand accounts of this authority being challenged. This is compounded by the fact that, quite literally, instructors are not the bosses of LAs - they do not hire LAs, nor are they considered their supervisors. During one of the focus groups, one instructor, FGB1, outright rejected the position of boss. FGB1 had vastly different experiences with LAs, from their first LA, whom they described as “probably the best LA there’s ever been,” to a LA who “didn’t listen” to anything they tried to suggest. They described how frustrated they were working with a LA whom they positioned as “unprofessional.” However, toward the end of the focus group, they stated one view of their relationship with LAs: “You’re not like their boss or anything, right? Like you’re not in charge of them, you can’t fire them or whatever” but then goes onto explain that as an instructor “this is your classroom, and if it’s not running up to your standards students are going to suffer.” FGB1 then states that “if it’s something that is going to be productive for students’ sake, it is absolutely something that you should be mentioning to” the LA. Thus, during the focus group, FGB1 rejected the notion that they were a boss to the LAs, offering an alternative positioning of themselves as an authority of the classroom with the duty to ensure that the class runs in a way that supports students. However, they also felt a duty to tell the LA to change how they do things in the classroom if it impacted students’ success. Another instructor, Associate Convener Ashley, explicitly “never wanted [LA] to see me as a boss. I wanted [them] to see me as a partner and I think we achieved that.” Like FGB1, Ashley rejected the position of boss;

however, they instead positioned the LA as a partner in instruction. I describe the partner instructor position in more detail later in the findings.

In the following sections, I introduce the range of positions that provide more nuance to the role LAs take on this instructional team. The positions are assistant, apprentice, duplicate, partner, and complementary instructor. Table 7 provides an overview of how many participants discussed this positioning at least once during their interviews.

Table 7

Positioning by LAs vs. by Instructors Summary

Total	Apprentice	Partner	Complementary	Duplicate	Assistant
Instructor	78%	94%	56%	100%	56%
LA	44%	100%	100%	100%	100%

LA as Assistant Instructor

Instructors and department leaders sometimes positioned LAs as assistants to the instructor of record, and most LAs indicated that they accepted this positioning. I use the term *assistant instructor* to allude to a personal assistant/boss storyline in which the assistant provides support to their boss by taking on less complex duties, including those clerical in nature (e.g., organizing meetings) as well as synthesizing duties (e.g., note-taking). In this storyline, sometimes assistants are intentionally prevented from knowing certain communication or information (especially of a sensitive nature). Connecting to LAs, instructors often asked LAs to take charge of administrative duties such as taking attendance while the instructor lectured (i.e., a task involving little to no instructional complexity, yet integral to classroom management). The program also expected LAs to

lead optional review sessions for students. The program did not, however, involve LAs in grading or creating assessments. Although leading review sessions is arguably more complex than taking attendance, the purpose of these review sessions was to supplement in-class instruction (not replace it). Some participants described this task in ways that suggest LAs were assigned the task to alleviate the instructor's burden, freeing up the instructor's time to focus on other duties such as selecting problems to work through with the whole class. In this way, LAs acted as assistants but were not quite full instructors in the classroom.

Overall, duties associated with this position were less complex than other instructional duties and did not capitalize on or consider differences in LAs' mathematical perspective or ability to engage with students. Furthermore, when LAs took up an assistant instructor position, they assumed little agency in the classroom. Along the positioning continuum, this would be classified as "positioning to," as the duties associated with this position are largely imposed upon LAs by an outside force ("the main thing they wanted me to do…").

While one might infer that instructors gave LAs less complex tasks because they viewed LAs as less knowledgeable or less capable of engaging with students, the exact tasks assigned to LAs varied widely based on the instructor and seemed to be more about furthering the instructor's goals or alleviating the burdens of the instructor than about perceptions of LA competence. For example, in one of the instructor focus groups FGA1 shared that they assign their LAs the task of taking attendance "so that they memorize their names." They also said that "after I have memorized their names, I don't want to spend time taking attendance. I just get them [the LAs] to always take care of it." For

FGA1, having the LA take attendance serves two functions: the LA learns students' names, and by not having to take attendance, FGA1 has more time to devote to other tasks. When LAs adopted an assistant instructor position, instructors had more choice in determining which instructional tasks upon which to focus their energy.

LAs may have been assigned additional responsibilities depending on the semester and course format. For example, in the fall of 2020, the department expected LAs to manage Zoom. Several instructors also asked LAs to monitor student participation and engagement on Zoom. Although this task could be complex (e.g., if LAs were expected to monitor student progress, select student presentations and identify student struggles), some instructors only expected LAs to minimally track engagement in the Zoom rooms to assign participation points. One instructor, Associate Convener Avery, discussed how this positioned LAs in more of a "policeman" role than in prior semesters. Avery asked the LA to monitor participation in a hybrid classroom by identifying students who left the Zoom room early and checking if they turned on their microphones and cameras in breakout rooms. They described how the LA acted as a "second set of eyes on who's participating, who isn't, [and] who often left early."

LAs also position themselves as assistants by taking the initiative in adopting related duties. LA Guo, who supported an in-person course in the fall of 2021, described how, in instructor-LA meetings, they rarely would provide suggestions for the instructor they worked with, Gene. However, they did suggest that Gene separate a group of students who were distracted by their cell phones. I asked if Gene took up this suggestion, and Guo said:

> Yeah, [they] agreed with me that [they] saw that group talking a lot, and then they pay attention on their phone and then they don't pay attention on the material in the class. So [they] separated that group. Half went very near to [Gene], and half very near to me so I can keep an eye on that.

Here, Guo adopted an assistant role by acting as a policeman of student engagement, and Gene accepted this positioning by making it easier for Guo to assume this role (by moving half the students to Guo so they could "keep an eye on that.")

In interviews, some LAs positioned themselves as an assistant by addressing the limits of their role, or stating that they had little say in the direction of the classroom. For example, Taylor, who worked with two instructors in spring 2021, shared:

> Both [masked instructor] and [masked other instructor] like to run the class themselves with little LA interference. The main thing they wanted me to do was them to teach the course and me to go around and help them with problems when they [students] needed help.

Other LAs suggested they had a limited role in determining the pacing of the course or content to be covered. This is unsurprising, given that the instructors of record themselves have limited control over content or pacing, although they did have more control than LAs. Holden, a returning LA, remarked on their desire for more applications in the course:

> If I had a say in it, we would go much more in-depth with exactly how it can be utilized in the real world because I feel like a lot of students don't have a great understanding of how math translates to physical phenomenon, even though it does very well.

Here, Holden positioned themselves as an assistant by suggesting their role is limited compared to others on the instructional team ("If I had a say in it…").

Figure 4

Assistant Instructor Position Summary

Position: Assistant Instructor

Storyline: LAs alleviate the instructor's burden by taking the lead on simpler duties, usually reserved for an instructor, to help the class run more smoothly.

Who positions whom? The instructor and LA Coordinator typically assign instructional (including administrative and class management) duties to the LA. Instructors are given leeway in determining specific duties for LAs. LA may position themselves as an assistant by discussing these duties (and their acceptance of them) or describing their role in ways that suggest they are a subordinate of the instructor. Similarly, other participants may speak of LAs as though they are subordinate to the instructor.

Duties & Rights:

- ✓ LAs conduct review sessions.
- ✓ LAs may manage the Zoom breakout rooms, monitor the Zoom chat, track attendance, or know details about course structures, such as exams or homework.
- ✓ LAs do not control the pacing or content of the course.

Example communication acts indicating a LA adopts, or is assigned, this position:

- ➔ "And by being there for the students, that also means being there for the instructor and helping make the class and the course run smoothly."
- ➔ "Yeah, I interpreted it as they need to be an assistant [emphasis added] to me whenever I need assistance in the classroom."

LA as Apprentice Instructor

Due to the structure of the LA program, LAs were often positioned as apprentices to other members of the instructional team, who in turn were assumed to be more expert

in teaching: the LA Coordinator, associate conveners, and instructors. The LA program positioned LAs as apprentices in three main spaces: in-class small group work, meetings with instructors or the associate convener, and professional development meetings.

In class, the main role of the LA was to facilitate small group work. The LA Coordinator set guidelines for how LAs should facilitate group work during pre-semester orientations, which were reinforced through the pedagogy seminar held in fall 2020 and subsequent semesters in which these materials were utilized. When asked to describe the differences between the LA and instructor roles, the LA Coordinator said:

> But in terms of group work…I think that our instructors, I hope that they are circulating around and they're listening to conversations and occasionally incorporating themselves into conversations. I think at the start of the semester not every LA is maybe doing that. I would hope that they're circulating around, and we talk about this at the orientation before the semester starts - about strategies for incorporating yourself into a group's conversation, or if there's a quiet group helping to promote some of that. But I think that's oftentimes a skill that they have to build by observing the instructor that they're working with.

In this quotation, the LA Coordinator positioned the LA in an apprenticeship relationship with the instructor by suggesting that LAs learn how to facilitate small group work through observation of their teaching practices. The LA Coordinator later expands on this, suggesting that instructors are more expert in facilitating group work due to their more intensive professional development:

> At the very least I would hope that the instructor is setting a very good example during group work with moving around and working with groups and supporting

> their learning. And if the LA isn't completely ready to do that, because they've not seen stuff like that before, then they are observing and at least kind of answering questions as hands come up, and ideally over the course of the semester they're building their confidence and skill set to be able to do that a little more similarly to how the instructor is. Because all of our instructors have gone through or are going through professional development - specifically many week's worth of content is about effectively managing group work.

There was limited evidence that LAs and instructors positioned LAs as apprentices during small group work time. Although in one interview with LA Holden, I asked if their views on effective instruction had changed during the semester. Holden positioned themselves as an apprentice to the instructor Harper, saying, "Through observing Harper, I have kind of learned a little bit more how to, I think, engage the students."

There is also evidence that instructors and LAs viewed lecture as a place for LAs to learn how content should be presented in class. However, rather than focusing on supporting LAs' teaching practices or deepening their content knowledge, participant discourse emphasized the importance of aligning how LAs and instructors present material. As such, LAs were positioned as those who need to align themselves to an instructor to keep the classroom cohesive rather than to learn how to become a better teacher. The focus on alignment suggests different unfolding storylines with different positions. Therefore, such positioning is discussed in the next section about the duplicate instructor position, which unfolds along a storyline of instructional alignment.

LAs and instructors were expected to meet regularly throughout the semester, and in fall 2020, the associate conveners in precalculus led content preparation meetings for

LAs. In the content preparation meetings, associate conveners positioned LAs as apprentices by discussing how students think about class content and how the LA could reinforce student understanding. LA Ciri described how valuable the content preparation meetings were in refreshing their content knowledge. Ciri described interactions in the meetings as similar to "ringing a very, very old bell from far ago." These meetings also helped them explain things "in a clear way to the students." Several LAs described instructor meetings as serving a similar purpose (and indeed, this was the expectation for semesters in which the content preparation meetings did not exist). Some instructors informed LAs of common student misconceptions, difficult workbook problems, or "tricky areas that people tend to slip up on," as well as shared ways that students may think about particular topics and offered suggestions on how the LA could reinforce their understanding. Others described answering LAs' questions about content when they arose. However, one instructor found that they spent too much time answering LAs' questions about content. Instructor FGB2 said, "The only reason we met was [the LA] would ask me how to do the math problems." For the most part, LAs needed only occasional support to understand the workbook problems. Instructor Gene said:

> I expect them to be familiar enough with the problems that they can help students when they have questions, but I don't necessarily feel like it's a good use of time for the LA to go through every problem one by one. Sometimes they will ask a few questions like at the start of class, ones they're not sure on.

Although Gene expected LAs to know how to solve most of the workbook problems, they were willing to answer questions on specific problems if the LA needed help understanding them. Likewise, some LAs described feeling comfortable and willing to

reach out to their instructor if they struggled to understand a particular problem (and no LA said they were uncomfortable doing so).

Even though LAs occasionally positioned themselves as needing support to understand the content or problems, participants felt that LAs had good content knowledge for the most part. Instead, the apprenticeship relationship focused on the knowledge needed for teaching precalculus. One of the instructors, Harper, described how "strong" students probably have enough mathematical knowledge but may struggle to communicate effectively with others that do not have the "same level of knowledge." Associate Convener Avery said something similar: "I think for a lot of them, they're themselves gifted in mathematics. So to realize that students are struggling with something that they haven't covered since they were in high school might be novel." Avery positioned LAs as gifted in mathematics but unable to empathize with students' struggles. In their interview, Avery suggested that this is something LAs need support in, and as such, this is a place where LAs can act as apprentices. Thus, both Harper and Avery positioned LAs as content experts but lacking in pedagogical skills. Instructor Wren sometimes positioned themselves as an expert (and thus their LA as an apprentice) by emailing their LA pedagogical advice:

> While I'm going through the lesson, if I notice something that I think, "Oh, maybe Wiley won't think about this in this way,"…So if there's something like that comes up, then I'll send [Wiley] an email about that.

Wren later clarified that this advice was "not so much about the problems, but about what I think they'll struggle with and how *I* [emphasis added] think [Wiley] could help them." Here Wren asserted their expert understanding of student struggles and used that to

support Wiley's teaching. Wren also described these communications as important for getting on the "same page" with Wiley about particular problems. As such, Wren also positioned Wiley as a duplicate instructor through these emails (the duplicate instructor position is discussed in the next section).

The department used the pre-semester orientations and fall 2020 LA pedagogy seminar to develop LAs' pedagogical knowledge. Some LAs readily accepted this apprenticeship (with the LA Coordinator as expert), as evidenced by their references to what they learned in the pedagogy seminar or evaluations of its use. During their interviews, LA Holden was adamant about the value of the pedagogy seminar. When asked what advice they would give the LA program, Holden said:

> I would say maybe the most important thing is like work on rephrasing all of your questions as open-ended questions. I think that would have been, I mean, I learned that in the pedagogy seminar, so it was fine, but if I could have, have learned one thing before starting last semester, that's kind of what it would be.

Holden viewed open-ended questions as a critical strategy to elicit student thinking. This is underscored by their remark that it would have been valuable to have learned about open-ended questions before their first semester as a LA. Holden positioned themselves as an apprentice by connecting their learning of this strategy to the pedagogy seminar.

Several instructors offered their LAs the opportunity to introduce a topic or example to the class as a way to practice their teaching skills, thus positioning LAs as apprentice instructors. As FGB3 explained, they thought this was an especially good opportunity to offer the LA, who was a mathematics education major. Yet, the LA did not

take FGB3 up on their offer. In fact, of those who mentioned that they offered this opportunity to their LAs, most shared that their LA did not take them up on the offer. For example, in interviews, Instructor Wren shared that it may be helpful to give LAs more instructional responsibilities (e.g., such as leading one part of a class) so that they could learn the content better and feel like they have important instructional responsibilities in class. They did offer Wiley, the LA they worked with, the opportunity to lead a part of the class, saying, "If you want to be a teacher, this would be a great thing for you to do." However, Wiley declined because they did not "want to be a teacher."

In other cases, it was not clear from interviews why LAs rejected this opportunity; however, one can view this as a rejection by LAs of instructors' attempts to position them as apprentices in whole group or lecture settings. For Wiley, Wren recounts how they positioned themselves as someone who was not interested in becoming a teacher and so not interested in this opportunity. However, in my interviews with Wiley, they did position themselves as someone who enjoyed teaching in specific settings (in particular, they described enjoying their role in the Mathematics Resource Center and wanting to have a similar role as a LA). As such, Wiley accepted the position as teacher or apprentice learning to teach in small group or individual settings but not in whole group or lecture settings. Despite most LAs not taking up this opportunity, some LAs accepted or sought out these opportunities. From interviews, it was unclear if they did so because they wanted the practice (i.e., they positioned themselves as an apprentice) or because they felt they had something unique or valuable to share. There was only one instance, described by an instructor, in which the latter happened (detailed in the section about the partner instructor position).

This apprentice/expert relationship, while institutionally assigned, was also sometimes contested by instructors. In some instructor-LA interactions, it was unclear who was the apprentice and who was the expert. Along similar lines, some instructors questioned the assumption that they were more expert in pedagogy. Some of these tensions arose because of experience, as some LAs had more years of experience than instructors within a particular precalculus course. As a result, some instructor-LA pairs negotiated this apprentice/expert relationship by positioning the instructor as an apprentice. This positioning led to both positive and negative experiences for instructors. FGB1 shared how this relationship helped them anticipate student struggles with content and consider different ways of explaining material:

> My LA just like had a lot of like she knew, like I said, what was going to cause students a lot of trouble because I think it was her like six or seventh time to LA for the class. So she knew the material backward and forward. Like, "Oh, you know, completing the square's coming up here's something that you can do two ways." And that's just one of the more prominent examples because it was like a really neat trick and she just like knew what was coming up and it helped me prepare for class a little bit because she knew already where usually students struggle.

Later in the focus group FGB1 suggested that it would be useful for novice GSIs - instructors in their first year - to be with a more experienced LA. However, FGB2 commented that:

> I know for me, one of my biggest issues that first semester with my LA was knowing that she'd already done this before. And so in the back of my head, I was

> like, “Oh, she must already know what she’s supposed to be doing. Who am I as a first-time instructor to be telling her what she should be doing if she’s already been in the classroom like twice before this?”

FGB2 did not act along an apprentice/expert storyline but suggests this is because of their LA’s prior experience. Elsewhere in the focus group, they shared the impact this had on their classroom:

> My LA used to just walk around the room and stare at them. And like, I don’t know if - I guess probably if they raised their hands, she went and helped them. I don’t know. But like I remember my students would tell me we don’t want her to help us because you do a better job. And she just didn’t interact with them…And I don’t know if it actually was a requirement [to facilitate group work] that they just don’t follow necessarily, or don’t know how to follow. Like, I mean it’s not obvious how you’re supposed to do that, you know, and as a first-time teacher I didn’t know how to tell her to do that because I barely know how to do it myself.

FGB2 positioned themselves as someone who, when they had a LA, was still learning how to facilitate small group work effectively (“I barely know how to do it myself”). As a “first-time teacher,” they did not accept the position of expert in relation to the LA. This caused friction in their classroom since they did not feel they had the right to tell the LA to interact with students. However, FGB2 implied they would not accept similar positioning if they were to work with a LA again.

Other instructors made comments suggesting they rejected the position of expert in meetings or conversations with the LA (“I personally never really knew what to do with the meetings that I was supposed to have [with LAs]; FGB3) despite understanding

the importance of it. For example, when asked to describe important skills or knowledge relevant to the LA role, Harper, an experienced instructor, positioned the LA coordinator, rather than themselves, as an expert in pedagogy. Although some instructors did not view themselves as an expert in an apprenticeship, several instructors, such as Wren (discussed above) and the associate conveners who led content preparation meetings, seemed well-equipped to take on this position during meetings.

Figure 5

Apprentice Instructor Position Summary

Position: Apprentice Instructor

Storyline: LAs learn to teach from observing and listening to associate conveners, the LA Coordinator, and instructors, all of whom have more knowledge of mathematical content, ways that students may think about mathematical content, and pedagogy (particularly active learning).

Who positions whom? The structure of the LA program imposes this position on LAs in specific contexts, namely through required professional development and meetings with instructors. However, some LAs did position themselves as apprentices by asking others on the instructional team about content or pedagogy or by accepting opportunities to lead a class session. Furthermore, some instructors positioned LAs as apprentices by teaching them about pedagogy (offering suggestions for how to interact with students) or content, as well as giving them opportunities to lead instruction time. Overall, LAs were able to interactively negotiate this position with the instructor.

Duties & Rights:

- ✓ LAs attend professional development meetings (pedagogy seminar, orientation, etc.).
- ✓ LAs review course content.
- ✓ Some LAs may teach a topic to the class.

Example communication acts (from LAs) indicating a LA adopts, or is assigned, this position:

- ➔ "But it's nice to have that reminder and occasionally they'll mention, 'okay, here's a way to approach [this topic]' that I hadn't thought of before."
- ➔ "There's just like kind of like tricky areas that people tend to slip up on. And [the instructor will] just kind of remind me of these things."
- ➔ "I can always ask the TAs that taught the course like 'okay, just to help me remember this is this right?" or "what is this?'"
- ➔ When given the opportunity to teach the whole class, the LA may reject this position by saying "well, I don't want to be a teacher."

LA as Duplicate Instructor

All participants positioned LAs as duplicate instructors at some point during the interview. LAs positioned as duplicate instructors assumed the duty to uphold classroom norms and structures created by the instructor or instructional team. Although LAs may support these structures as an assistant (e.g., a LA acting as a "policeman" by monitoring student attendance via Zoom), LAs assume this position by engaging in more complex interactions with students, typically during small group and individual work. LAs had significant contact time with students in these settings. The department expected LAs and instructors alike to use active learning methods. Several instructors shared this expectation explicitly during interviews. For example, Instructor FGB3 shared how they expected LAs to support students in completing the main intellectual work of a task:

> I guess the only thing that I expect of them is to uphold the classroom structure. So, being that it's an active learning classroom, like the LA shouldn't be just going to students and explaining to them exactly how to do the problem. They should be asking them the leading questions that we would be expected to ask them instead of just like going up to the board with them and working on a problem where they're taking the lead. Like asking the students to take the lead on these things.

Instructor Jay shared a similar expectation. They considered the primary responsibility of a LA to be supporting their instructional philosophy in class (which they viewed as aligning with an active learning classroom), even if the LA's beliefs differed from their own:

> I think the most important thing for an LA is an understanding and acceptance of instructional philosophy. I know that my LA is not going into rooms and just giving students answers, right? …Because the LA has so much influence and so much direct contact with all of my students I really think that it's super important, for me to be effective, that my LA's approach and philosophy aligns with my own, at least in practice, if not necessarily in belief.

The importance of not just "giving students answers" was echoed by several instructors. For example, Associate Convener Alexis said that the main responsibility of LAs was "to be a resource for students, but also not an answer dispenser." Instructor Gene said:

> I don't want them to just give students the answers. And absolutely, like, at the end of the day, like it's also their best judgment, I will absolutely agree there are times where you kind of do just have to work through the problem for them. I would hope that they use some level of critical thinking to figure out well, they just need a little prod.

Gene also drew from other storylines to suggest ways they expected LAs to interact with students that, in some ways, conflicted with the positioning of LAs as a duplicate instructor:

> I think, at least in my mind, the LAs function in many ways a lot like the counselors in the [Mathematics Resource Center] or tutors [indecipherable]. My LA isn't there to teach my students the material. They're there to help them through the intricacy of a concept they're struggling with, they're there for that.

Others drew from the Mathematics Resource Center storyline differently; Wren and Jay had negative experiences after observing counselors in the Mathematics Resource Center just, as Wren put it, helping students by just writing "out all the steps on a piece of paper" rather than encouraging students to engage with the mathematics. Jay specifically wanted to ensure that their LA had the "correct instructional philosophy," which to them meant that LAs were using active learning to support groups:

> The LA may not know how to interact with students and, you know, seeing some of the people interact with people in the [Mathematics Resource Center], I would not anticipate an LA necessarily having the correct instructional philosophy.

In interviews, LAs shared similar views regarding answering students' questions. LA Elliott said one major responsibility as a LA is answering students' questions "in a way that you're not just giving them the answer." The prevalence of this discourse surrounding LAs being potential "answer dispensers" suggests that this is an important part of how instructional team members view LAs. Beyond the expectation that LAs use active learning strategies, instructors sometimes described specific techniques they expected LAs to use when interacting with students in their class. For example, Instructor FGB1, who mainly had experience working with LAs pre-pandemic, wanted the LAs to physically "sit with the groups that they're talking to, if they can."

Instructors consistently positioned LAs as duplicates of themselves using phrases like "copy of me" or "same person." Instructor Jay said that "If there's significant concerns, they need to bring it up with the instructor privately. But with the class, you and the instructor are the same person in a sense." Similarly, Instructor Peyton described how they and the LA they worked with were "in sync." They said the most important

responsibility of the LA was to facilitate small group discussions and described how they and the LA "equally" distributed help among groups by each taking responsibility for helping half of the groups in a given day. This divide-and-conquer strategy was a common strategy used by instructors. Like Jay and Peyton, Associate Convener Aiden positioned LAs as duplicate instructors through explicit phrasing, saying they should be a "copy" of Aiden:

> I view LAs as kind of being another copy of me during group work. So, there's not enough of me to go around during group work, so there's another copy of me there…also if it was just me, they wouldn't be able to ask as many questions or get as much one-on-one time with an instructor.

Many participants described the value of having an additional instructor in the classroom to ensure that students' questions were answered efficiently. Instructor Blake said that the most important responsibility of their LA was to "answer students' questions efficiently and correctly." The duplicate instructor position assumes that instructional responsibility in an active learning classroom needs to be divided among LAs and instructors to ensure students have sufficient support. Aiden said, "It would be impossible without someone else.'' Like Peyton, they thought the LA shared "equal responsibility when going into the breakout rooms and responding to students." Similarly, Associate Convener Avery said, "It's essential to have a second person in there to be able to go around and answer questions, else you would never get to all the questions." Early in the semester, Avery's students struggled to engage. They theorized that, over Zoom, students could more easily hide in large groups and disengage from class. By having a LA in the classroom with them, Avery was able to make student groups on Zoom smaller in an

attempt to increase interaction. LA Elliott shared similar thoughts “You really do need two people, otherwise, it would be very difficult to ensure that, like, students can get help in an all-efficient manner.” LA Logan said, “So two people going into the classes is better than one, especially when some of the questions can take a while.” Instructor FGB3 described LAs as having “another body in the room,” which they said was “super beneficial as an instructor” when “that body is helpful.” Based on their interview comments, it was clear that Instructor FGB3 positioned LAs as helpful when they facilitated group work using active learning methods. Instructor FGB3 described, in prior semesters, feeling that they “would have drowned in students” if it was not for the support of their LA.

Some instructors monitored their LA to ensure that LAs were upholding the active learning structure of the course. Instructor Jay stated that a couple of times in the semester, especially early on, they would “intentionally drop into the same room as my LA and just sort of see how [they] were working with the students, as well as sort of ask the students how [Jessie] worked with them.” Once they felt comfortable with Jessie’s teaching style, they said

> I don’t feel the need to sort of babysit my LA, you know, I trust [them] and let [them] work. And then whenever we have our meetings, I like to provide feedback of “This is what I really liked over the last period.”

Conversely, most instructors did not feel like they had the time, or the duty, to supervise their LAs. Associate Convener Alexis would occasionally “pop into a room with the LA just to see what was going on” but was more concerned with “making sure everyone got a chance to ask questions” of either them or the LA. This theme is taken up again in

Chapter 5.

LA Jessie sought to align their teaching style with Jay's. They used lectures as an opportunity to learn specific ways that content should be presented to students in class. Jessie said, "I'm mostly just trying to pay attention to what [they are] lecturing them on, so I use the same wording that [they do] in class." Some instructors also viewed lecture as an opportunity for LAs to learn how to discuss content in class. Associate Convener Ashley said:

> And one thing I didn't think about for a long time was the fact that that lecture portion is an opportunity for [the LA] to see the notation that I want them to use, the language I'd like them to use. So it's an opportunity for [them] to sort of see it and align [themselves] with the standards that [masked course] sets for the students. During the breakout room time, I don't actually think our roles were that different. I think it might've been different if we were using that normal model of [them] being on Zoom and me being in the classroom. But because we were both on Zoom together, we were both doing the exact same thing. Our roles really weren't that different once we got to the breakout room part of the class.

I became curious about this theme of alignment during observations of specific LA-instructor pairs and brought it up in subsequent interviews when relevant. In particular, I noticed commonalities in mathematical features that LA Wiley highlighted when working with students and those that Instructor Wade (one of the instructors they supported) highlighted in their instruction. Specifically, Wiley often asked students to consider the units of their problem when evaluating the reasonableness of their solution. This problem solving strategy was also something I noticed Wade mentioning in lectures. When I asked

Wade if they had explicit conversations with Wiley that they thought could account for this pattern, they said:

> I believe this is Wiley's first time [as a] LA, so since [they are] basically listening to what I'm saying, [they've] probably picked up some of those things from me. It could also be possible [they] may have also picked that up from like the other instructor that [they're] working with …. I think Wiley is still new to this and [they're] already starting to see some things and maybe [they're] practicing or experimenting with some things and seeing how things go. I think [they're] also even doing - oh no, wait, no, [they're] not doing the [Mathematics Resource Center] this semester, but [they] might have also, it could also be possible. [They] might have seen something like this from a previous instructor. Like when I was teaching for the first time, a lot of the ways I was explaining things came from instructors that I've had in the past and stuff. 'Cause I feel like, well, this made sense to me, tweak it a little bit. Now I'll use that style in my own teaching.

Wade positioned Wiley as a duplicate instructor by suggesting that Wiley has "probably picked up some of those things from me," yet they also positioned Wiley as a novice, reflective practitioner, saying that he was "maybe practicing or experimenting with some things" and suggested that Wiley is learning from either themselves or the other instructor Wiley works with - thus positioning Wiley as an apprentice. For their part, when I asked Wiley a similar question, they shared that they did try to emphasize content in ways similar to Wade and how it was presented in the course materials.

During meetings with LAs, the instructor or associate convener advised LAs of any particularities in how content should be presented in precalculus courses at UNL.

They also sometimes asked LAs to emphasize a particular mathematical feature of a problem. For example, UNL's precalculus courses heavily emphasized using the words *input/output* of a function rather than using terminology such as the *x* or *y* variable. Associate Convener Avery described the importance of sharing this in content preparation meetings. This was also brought up by LA Wiley, who said,

> That kind of how - that influenced me at the beginning of the course is how they worded it with the text, and everything was not focusing on, like, "Hey, what should *x* be, what should *y* be, what are these *y* values?" but talking about inputs and outputs and how they affect each other.

LA Hailey described how in meetings with Instructor Harper, sometimes Harper provided specific pedagogical direction on how they wanted the LAs to support students' conceptual understanding. Hailey said Harper might say something like: "Hey, on this problem, can you maybe kind of guide them to seeing this thing? This concept that I'm hoping that they'll see, but I don't want you to just outright tell them." LA Hailey shared that a purpose of these interactions is to make sure "we're on the same page," although they also expressed that "most of the time we don't have anything to discuss." This suggests that, when positioned as a duplicate instructor, the purpose of instructor-LA interactions is to align their teaching practice. In their initial interview, Jessie similarly stressed the importance of communicating with the instructor and ensuring that "you're always on the same page, cause you don't want to split the class into two as it were." Similarly, Instructor Wren described that as part of their lesson planning, they would occasionally email LA Wiley to ensure they would be on the "same page" regarding how

they would discuss content with students, for example, making sure that the LA would "scaffold their [students'] problem solving" in a particular way.

Figure 6

Duplicate Instructor Position Summary

Position: Duplicate Instructor

Storyline: LAs alleviate the instructor burden and ensure students receive the support they need by acting as copies of instructors during group work time. LAs align their instruction with the instructional team, using active learning strategies to support small groups in completing mathematical tasks and in addressing students' questions. LAs take on advanced instructional duties when interacting with students (as they are expected to act similarly to the instructor).

Who positions whom? Most participants positioned LAs as duplicate instructors in small group work time. This suggests that the duplicate instructor position is key to how members of the instructional team at UNL think of LAs. This position is institutionally imposed through the department's and instructors' expectations that LAs use active learning strategies to support students during small group work, although some instructors may expect more alignment of teaching practices between themselves and the LA than other instructors. LAs accept this position by trying to align their teaching practices with those of the instructor.

Duties & Rights:

- ✓ LAs uphold classroom norms and structures surrounding active learning.
- ✓ LAs use active learning methods to facilitate small group work time efficiently.
- ✓ LAs may align their explanations and mathematical notation with the instructional team by reviewing the textbook or watching lectures.
- ✓ LAs may have ongoing communication with the instructor to remain on the same page.
- ✓ LAs may support half of the student groups during small group work time.

Example communication acts (from LAs) indicating a LA adopts, or is assigned, this position:

- ➔ "Especially considering how big the class is…you really do need two people, otherwise, it would be very difficult to ensure that students can get help in an all-efficient manner."

- ➔ "I think [they] really like to stick to what is, what is used in the videos to like use the same wordings and stuff. So, a lot of that is what we talk about when we're discussing how we're going to operate in the course or in the next class."

LA as Partner Instructor

At times, how LAs and instructors discussed their relationship suggested that a true partnership had formed between them. LAs positioned as partners collaborated with instructors on instructional decisions or communicated valuable information to instructors based on their experiences in and outside of the classroom. LAs positioned themselves as partners by offering suggestions to instructors or reflections about students' engagement and understanding of content. Instructors often positioned LAs as partners by soliciting information or feedback on student progress, content, or other aspects of the course. In interviews, instructors used terms like "liaison" to position LAs in this role, and LAs positioned themselves as partners by using pronouns like "we" when describing how decisions (like structuring student groups) were made in class. This position manifested through two sub-positions: LA as "a liaison between [the instructor] and the students" (Associate Convener Aiden), which assumes LAs relay information about students to the instructor, and LA as a collaborator, which assumes LAs are involved in instructional decisions. Further, under the liaison sub-position, three distinct positionings determined how LAs relayed information: LA as a channel (providing information about LAs to the instructor), LA as a consultant (LAs providing teaching advice related to this information), and LA as a broker (of knowledge between different communities, such as two different classrooms).

Many instructors valued the liaison position as a way to understand how their students were doing. For example, Instructor Jay described that:

> In Zoom as soon as I leave a group, I have no idea what's going on. So having that extra pair of eyes and ears to hear about what's going on really helped me keep a better picture of how the class was going.

Jessie, the LA Jay worked with, also found it important to supply Jay with this information. They emphasized this position more once Jay quit using Onenote and Jamboard, two platforms that they had planned to use to monitor student progress:

> Interviewer: So how do you feel that your major roles or responsibilities as an LA shifted over the course of this semester? If at all?
>
> Jessie: Well, let's see. At the beginning, this semester, we were a little unsure how things were going to go. So some things that we thought would be a big part of the class dropped pretty quickly. Originally we had planned, like using Onenote or Jamboard or something like that to have the students kind of share their work with each other and with the class. And that didn't last very long. So all of my roles involving that were dropped pretty fast. And I started sort of, to make up for that, more emphasized trying to figure out where the students were struggling and figuring out ways to let the teacher know what kind of questions they were stuck on. And what problems in particular, what kind of topics really needed to be go, go over again.

This was Jay's first semester as an instructor of record. Jay's class of approximately 30 students ran in a hybrid format, with a small group of students attending in person while the rest of the class attended on Zoom. Each day a different group of students attended in

person so that, in theory, each student had in-person interactions with Jay and other students once per week. LA Jessie played a major role in ensuring that Zoom ran smoothly. Class often alternated between lectures and small group work. During small group work, Jay mainly supported students who attended in person, while Jessie supported Zoom breakout rooms. When Jay was able, they would also check in with the Zoom breakout rooms and offer support as needed - but much of this responsibility fell on Jessie, except for days when the class was fully online (and as the semester progressed - Jay subsumed more responsibility in managing Zoom groups). As such, Jessie and Jay emphasized the importance of the channel position in ensuring the class could function. Associate Convener Ashley also shared their belief that the LA's "main role was to be the eyes and ears" in the rooms they could not monitor over Zoom. Ashley said they were "more grateful for just knowing how those other students were doing than I was for [their] actually providing the help, to be very honest."

Sometimes LAs would also share suggestions for the course, thus acting as a consultant. As opposed to Jay's class, Ashley had a small class (less than 15) of students who all attended on Zoom. Both Ashley and Jay used a spreadsheet to help the LA track student progress, yet they used it differently. Jay described the sheet as a bit "one dimensional" - the LA they worked with would add the majority of the comments for Jay's benefit, while Jay's comments focused on logistical considerations (e.g., requests to close Zoom breakout rooms, to tell the LA that students should move onto the next problem). In contrast, Ashley filled out the spreadsheet similarly to their LA - to track student engagement. Ashley said this allowed them to gain a second perspective on how students were doing, although their evaluation of student progress was "probably

harsher" than the LA's. Associate Convener Alexis also used a spreadsheet to track student engagement. Alexis said that the LA they worked with would make broad comments about student progress, like "Hey, a few groups are struggling with this. Can we go over this at the end of class?" Alexis found that to be "really helpful" and would use this feedback to, for example, "choose people to talk at the end of class."

A couple of participants discussed how LAs provided information or suggestions to the instructor based on their experiences in another classroom, thus acting as brokers (Wenger, 1998) between different classroom communities. Ashley worked with a LA who also served in another class. They shared one instance where their students struggled to create equations for application problems. Ashley recounted how their LA said, "Oh, in the section this morning, something that the instructor said was to check the units on both sides of your equations and make sure those match." Ashley recalled that this is a strategy they had shared with students in prior semesters but had forgotten that "that is a helpful strategy" saying that if the LA "hadn't seen it in [their] morning section and then thought to suggest it to me, I probably never would have given that advice to my students." Content preparation meetings were also a setting in which the broker position appeared. In their role as an Associate Convener and leader of the content preparation meetings, Ashley valued the perspective LAs would give on the curriculum and pacing:

> Something I really appreciated was they would give me feedback on the structuring of the content. So the content, the ordering and the pacing is new this semester, we rearranged things. And that's sort of been my child this semester. And I appreciate their feedback on it. I feel like they are giving me more feedback than the instructors have been. Like, Oh, this section, we didn't have enough time.

> Or this section, we had way too much time, or it felt kind of weird that we were doing this before that. So I really appreciated having space in those meetings for them to give feedback on those things too.

Similarly, in content preparation meetings, Associate Convener Aiden would facilitate conversations about different strategies for eliciting student engagement. In one such conversation, Aiden said that "one of the LAs said that their section was doing random breakout rooms and it was working better, which is what prompted me to do random breakout rooms in my class."

There are other ways that LAs brokered knowledge between communities. Namely, some LAs discussed how their prior teaching experiences influenced their decisions in class, thus acting as brokers in ways that do not necessarily involve the instructor.

Some LAs described how important it was to them that the instructor valued and acted upon their suggestions. When asked what advice they would give to an instructor working with a LA for the first time, Ciri said "I always appreciated when my opinion was asked on things. Cause it made me feel more like an active part of leading the class." As such, Ciri felt that sometimes they were positioned as a partner instructor, and further, they readily accepted this positioning. This acceptance was also apparent in the way Ciri described their interactions with the instructor. Ciri often used "we" when describing things that happened in class, suggesting they felt like a collaborator. For example, they said: "And sometimes if *we* noticed enough people were confused by a problem, or like in a previous class, at the beginning of the next class it would get worked through" and "[for] every unit *we* [emphasis added] would try to figure out good groups for the

breakout rooms." When I asked Ciri if they interacted with the instructor during class, they said, "It's more of a divide and conquer during class time," which is discourse characteristic of a duplicate instructor position; however, when I probed further, they said

> *We* would kind of stagger which breakout rooms *we* would start in so that way *we* could kind of try to work our way through them systematically. So no one, *we* [emphasis added] wouldn't both end up at the same place at the same time and then another room has been abandoned.

Thus, Ciri also described this divide-and-conquer strategy in ways that suggest coordinated effort between them and the instructor.

LA Logan also described how much they valued being positioned as a partner. In particular, they felt like the instructor valued their feedback:

> And so [they] would ask me, you know, "How are they? Are they learning this? How do you think they're doing? Do you think that the method I used was appropriate or whatever they got it?" And [they] would take that into account. So I thought that was pretty cool because I got to give feedback and see it translated into things.

On occasion, LAs positioned themselves as partners during lecture by correcting the instructor's mistakes, answering questions in Zoom chat, providing clarification for students to supplement the lecture, or asking to teach a particular topic. For example, LA Taylor described how they would sometimes write clarifying information on a side whiteboard for students. Instructor FGA3 shared how one LA positioned themselves as a partner instructor by asking to teach a topic they felt they knew well, thus acting as a collaborator in figuring out ways to communicate mathematical ideas to students:

> [They were] so excited about completing the square, and really wanted to teach that to everyone. [They were] really excited and like, “I’ve got a good way to do this.” And I mean, I just thought it would be a great way to mix things up. So I said, “Yeah, go for it. You can have a moment to talk about this.”

However, it is important to note that positioning acts related to the partner position was not always well received by instructors. For example, Instructor Frances said the LA they worked with “really wants to be involved at all times,” and would on occasion write additional information on a whiteboard (similar to what LA Taylor described doing). Sometimes this disrupted the mathematical progression of the course, such as during the unit on quadratic functions. Frances described how they were not going to do the "formal process" for finding zeros of a quadratic function yet (e.g., introducing the quadratic formula). However, the LA wrote down this "formal process." It was common in Frances’ class for the LA to write supplementary information on the whiteboard. Frances wondered if it was because the LA did not trust their teaching ability. When I observed Frances’ class in the middle of the semester, I noticed that their LA wrote information on the whiteboard for students - namely formulas related to that day’s content. Although, I rarely saw the LA reference what they had written when interacting with students. In this observation, the LA wrote the following steps for using the distributive property:

- $(a+b)(c+d+e+f)= a(c+d+e+f)+b(c+d+e+f)$
- $(a+b)(c+d) = ac+ad+bc+bd=a(c+d)+b(c+d)$

Although Frances was unsure of the usefulness of this responsibility that the LA had taken upon themselves, they did not discount the hypothetical usefulness of such an act.

Frances described at times feeling frustrated with the LA when the LA continued to talk to a group during lecture or whole group discussion. Some other instructors shared similar frustrations when LAs talked to students during whole group or lecture time. However, Instructor Wren felt differently. They said:

> Something that I always thought, like if social distancing wasn't like [something we needed to do] what I would ideally want my LA to do, would be during the little lecture parts just sit at a table with the students. Because then, it's so nice when a student just doesn't quite understand something - you know how, like when I'm in class if I don't quite understand something the teacher says, if I was in person, I would just like lean over to the person next to me and say like, "is that what they meant?" So it's nice to have the LA right there to just answer those little questions from table to table.

Instructors differed in the extent to which they wanted the LA to be a partner in instruction, and some felt this position should be enacted only in particular spaces. This also is apparent in how different instructors regarded LA feedback. Both Wade and Harper regularly solicited feedback (thus positioning the LAs as consultants), yet Harper mostly considered this feedback useful in affirming their instructional decisions. Harper said, of feedback from LAs,

> I'd say that usually, what they tell me is agreeing with my understanding of the situation. So if, like, they disappear tomorrow or something, I would probably end up making most of the same decisions just with a little bit more worrying that I

> was, you know, misunderstanding something. So it's helpful to, you know, get a second and third opinion on things and hear that they mostly agree with my thinking.

Harper reiterated that conversations with LAs have led to "mostly small improvements" in their own teaching. This suggests that Harper did not position LAs as full collaborators in instructional decision-making. Along similar lines, Wade said that often Wiley would share their assessment of how the class went, leading to some "reassurance" in Wade's instructional decisions. Wade, however, also positioned Wiley as a consultant *and* collaborator by both asking for advice (LA as a consultant) and using that advice to select problems or content to review with the whole class (LA as a collaborator):

> We [Wade and Wiley] always meet near the end of class to discuss a few things for a few minutes just to see what went well, or if [Wiley] saw anything that I should be aware of and stuff. So, I mean, and we usually kind of like to say, "yeah, did you notice that students understood the things" or like, "what did you see?" That way I'll get an idea saying, "all right, maybe this might be something I might want to re-emphasize at the start of class next time." So like…Wiley and I mentioned at that moment I think some of these students didn't quite get through the log problems, so we might want to do maybe an extra problem just to make sure they know what to do. And so I talked with [Wiley] a little more about that on Sunday, and I said, "yeah, let's go ahead and do that one quick problem." And so I just asked, "alright, which problem would you like for me to see here?"

Instructor Gene rarely solicited feedback from LAs. They said that "sometimes I'll get really sucked in to help one group and I'll kind of ask my LA [how students are

progressing]" but in general they had infrequent communication with the. Similarly, LA Guo, whom Gene worked with, rarely provided such feedback unsolicited. However, Guo did describe LAs as important in providing an additional perspective on instruction. When asked if LAs would still be needed in a small section, Guo said, "I think that during a meeting we just ask questions about how this class [is] going so if only one instructor is working in a class, I think the thinking will be like one direction." However, it is of note that this was the only time during Guo's interview that they positioned LAs as possible partners in instruction. Further, it is unclear what thinking Guo refers to or if Guo personalizes this understanding of the LA role - i.e. if they view themselves as a partner instructor in relation to Gene. Guo said it was a "very rare case" that they would provide suggestions to Gene, and the nature of the suggestions was mainly about classroom management which I classified as part of the assistant instructor position.

Interestingly, Gene did posit that instructional feedback would be useful. Early in the interview, they reflected that this was something they could improve upon - asking for a second perspective from LAs, although they hedged this comment by saying, "I'm not saying they should be [providing this feedback]," thereby implying that they do not view the partner position as essential to the LA role. Yet, when I asked what they viewed the LA role to be, they said:

> I think a lot of what the LA is supposed to be is a team with the instructor, I guess, in some sense. A lot of that sort of leads us when discussing the role of the LA, you know, in my mind that would involve a lot more discussions about things and how the students are doing and such beyond just superficial….a lot of discussions about, like, what subjects are, or "what topics do we notice students

> did well in, what topics did student not do so well?" You know, another thing is like, "How well are the groups working together?"...But I do feel like that's the sort of thing where if I was speaking with my LA, you know, I could have maybe gotten a better sense for some of these complaints earlier on in the semester. [They] might have noticed, you know, early on that, "Hey, this table as a whole is not doing so hot."

This quotation further suggests that Gene would have appreciated feedback from the LA they worked with, Guo, if Guo offered it more frequently. In the interview, I clarified this point:

> Rachel: If you had an LA, who was like sharing that information with you, do you think you would have taken it into consideration earlier?
>
> Gene: I think so. I don't think I would be arrogant. I think that, you know, I respect LAs enough that when they have opinions about something I'd listen.

Overall, the extent to which the partner position was taken up varied between classrooms. However, some instructors were very intentional about setting up this relationship. Associate Convener Ashley, in particular, consistently described interactions with their LA in ways that suggested they viewed and valued their LA as a partner. From the onset, Ashley explicitly strived to foster this type of dynamic. Ashley elaborated on this relationship elsewhere in the interview, saying, "We set up a - it was a professional relationship, but it had a lot of friendship elements." One of the reasons Ashley was so focused on developing a good relationship with their LAs was because they had "heard horror stories in the past about instructors not even knowing their LA's name and not

being willing to talk to them and have conversations" and so it was important to Ashley to be intentional in establishing a relationship with the LA. Ashley said,

> "[I knew] a lot about [LA]. I could tell you about [their] cat and [their] class schedule, like a lot of these things, because we took the time to develop a relationship, and that made it really easy to work with [them]."

As a result of this relationship, Ashley believed that their LA was comfortable sharing information (acting as a channel) and suggestions (acting as a consultant), which Ashley used to inform their teaching decisions.

Figure 7

Partner Instructor Position Summary

Position: Partner Instructor

Storyline: LAs collaborate with instructors on instructional decisions or communicate valuable information to instructors based on their experiences in and outside of the classroom.

Who positions whom? Typically, this positioning is either by the LAs themselves or negotiated with the instructor. LAs may position themselves as partners by offering suggestions to instructors or reflections about students' understanding of content. Instructors may position LAs as partners by soliciting feedback on student progress, content, or other aspects of the course.

Duties & Rights:

- ✓ Some LAs may be involved in instructional decisions, like structuring student groups.
- ✓ Some LAs may be involved in lecture (e.g., writing clarifying information on a sideboard, answering student questions, correcting the instructor's mistakes, and teaching a topic).
- ✓ Some LAs act as a liaison between students and the instructor by:
  - Sharing evaluations of individual or group progress.
  - Offering suggestions to the instructor.
  - Brokering experiences from other sections of the course (or their prior experience) to the instructor.

Example communication acts (from LAs) indicating a LA adopts, or is assigned, this position:

- ➔ Use of the word "we" when referring to instructional decisions.
- ➔ Instructors referring to LAs as being their "the eyes and ears."
- ➔ Instructors asking LAs "Do you think that the method I used was appropriate?"

LA as Complementary Instructor

LAs positioned as complementary instructors performed along an unfolding storyline that LAs have insights into student thinking about mathematics content and ways of relating to students that instructors do not have access to. Like the duplicate instructor position, the complementary instructor position also assumes that instructional responsibility in small group interactions is divided among instructors and LAs; however, there is recognition that students may interact differently with LAs versus instructors based on several factors.

Participants shared many factors for why they thought LAs differed from instructors in complementary ways. Some participants described the value of LAs' membership in categorical groups similar to students (e.g., age, undergraduate student) and dispositions that make the LA seem more approachable (e.g., being friendly). Emphasis was also placed on differences between rights and duties assigned to LAs and instructors by the department (e.g., knowledge of student grades), as well as observed differences between how students interacted with LAs and instructors (e.g., students having "'a oops teacher's here' kind of reaction" - Instructor Jay). This position was often, but not always, described in terms of LAs being able to establish a more informal

relationship with students. Several LAs described actions they took in the classroom that established themselves as an informal, peer-like support, including joking with students and engaging in "natural" conversation. Furthermore, some LAs also referred to instructors as the "professor," a title that often imbues more formality in interactions.

Associate Convener Alexis explained the value of the LA perspective in precalculus classes:

> I think they [the LAs] are a resource for your students to have another perspective on a problem. And often the more useful one, because the LAs are much closer to remembering what it's like to learn [course content] than I am.

Thus a graduate student instructor may find it valuable to have the support of a LA who has more recent experience learning the classroom content than themselves. Alexis said that even though the LA they worked with did not find trigonometry difficult (unlike many of their students), the LA still was "closer to a peer" in relation to students than Alexis was. Instructor Gene shared similar sentiments. They said, "it's good for students to see how more than one person presents information."

Gene also thought that students might be more comfortable with the LA because they are closer in age and academic status to students:

> My LAs, you know, are generally younger than me and are undergrads, I think they can be more comfortable sometimes. As you know, by and large, all my students are beginning freshmen and sophomores. You know, I'm a good five years older, there's a lot of ways I can relate to students, and there's also a lot of ways I can't. Generally speaking, LAs just feel more approachable. It's like, you know, who's more approachable: your recitation instructor or, you know, your

> lecturer who has a Ph.D. in math and is potentially scary and intimidating. I think it's similar to that.

Alexis also mentioned the LA's status as an undergraduate student as an important factor that may make students more comfortable with the LA. However, they attributed part of this dynamic to the fact that LAs are not in charge of grades:

> I think it's still the idea that "Oh, well, [the LA is] an undergrad. [They are] taking classes that [the LA] thinks are just as difficult as the classes that I'm taking and [they are] doing similar things to what I'm doing. And then also [the LA] doesn't have to make the rules and isn't looking at my WeBWork and isn't judging me." I guess an instructor kind of has this role where we have to assign grades. And I think students can see that as they're being judged by the instructor.

Alexis believed that, by not being in charge of grades, students might feel less judged by LAs, and thus LAs could establish a relationship with students different from the one they could foster. Associate Convener Ashley felt similarly. They said:

> This is purely speculation, but I would guess that when [the LA] entered their breakout room, it felt a lot more low stakes than when I did simply because of the authority difference. I'm the one on their transcript. I'm the one assigning their grades. And so when I show up in their breakout room, it might be like, Oh, the teacher's here. But when [the LA] enters their breakout room, I would imagine that it's lower stress. Like, "Oh, it's the LA." Like, that's still a big deal, but it's not Ashley. Um, so I would imagine that that is a benefit that [the LA] was having, it was a lower-stakes way to get help than just having me there to offer help.

Ashley's phrasing "this is purely speculation" suggests that although they thought the LA adopted a complementary position to their own, they were uncertain of how students perceived the LA. Other instructors felt similarly. Although they positioned LAs as complementary or identified this position and related storyline as a common discourse about LAs, some instructors described not actually seeing evidence of it in the classroom (e.g., see Wren's perceptions of Wiley in Chapter 5).

Like Alexis, Harper considers assigning grades to be an important duty that distinguishes LAs from instructors:

> I think that really we're trying to fulfill the same role from different angles. And I think that because I am the, like the instructor, I am assigning their grade, I am lecturing them about these things. There's just a different dynamic.

Along a similar vein, Harper shared that their duty as the course lecturer set them apart from the LAs in terms of their relationship with students. They posited that students may be more reluctant to acknowledge that they had not been paying attention during lecture because students may think the instructor would take that more personally than a LA:

> if they say that to me, it's kind of like, I wasn't paying attention to you, but if it was like, if you say it to your LA it's like, "Oh, well, you know, maybe you just got distracted or something." It doesn't sound like - so, so maybe some students are more comfortable saying that to the LAs. And so, I think that having just sort of two people with different roles in a sense means students can develop it, have a second chance to develop a good relationship with some instructor who can give them help.

Here Harper positions LAs as complementary ("different roles"), which they view as beneficial because it gives students more opportunities to develop a relationship with an instructional figure.

Instructor Jay also felt it likely that students viewed themselves as more of an authority figure than Jessie and assumed that students interacted differently with Jessie accordingly:

> I feel like Jessie probably spends more time interacting with any particular set of students than me. Although, because now I have more of my classes that are online it is easier to interact with my students, so I feel like I have a better connection with them now than earlier in the semester…I feel like [the LA] still probably interacts with the students a little bit more than me, probably has a little bit more of a casual teacher-student relationship than I do because I definitely, when I go in there there's definitely "a oops teacher's here kind of reaction."

Jay's class started as a hybrid course, but over time it transitioned to an online course, which they credited as helpful in ensuring that they could connect better with students. However, they still perceived Jessie as having closer connections, or at least more frequent interactions, with students than they had.

Instructor Emery positioned LAs as both duplicate instructors and complementary instructors:

> LAs usually serve as a secondary vers--, like, I obviously can't be everywhere, there's a lot of students and [the LA] helps out. I also think [they] served the purpose of just providing a different perspective and a different personality in

> case someone doesn't get along with me or how I explained things. They can work well with [them].
>
> …Rachel: So from your perspective, like, what's the most important responsibility of LA?
>
> Emery: Being legitimately different than me.

Emery found it valuable to have a LA who was different from them, as it increased the likelihood that a student had an instructional figure in class with whom they could get along. Some LAs positioned themselves similarly. LA Hailey recounted an interaction I observed when I visited their class:

> Well, cause every so often, like I think, I think you witnessed it once…Harper and I will get into the same room. Cause either I'll join a room that [they're] already in without seeing that [they were] in it or sometimes it goes the other way. And so I've had some opportunities to see students asking [them] questions and they're just slightly different than when they ask me questions. But the biggest one was a student was eating food, and as soon as Harper came in she's like [motions that the student hides it]. So I don't think Harper really cared, especially with the setting we're in, but there is a definite difference in the way that they perceive [the instructor]. [The instructor is] definitely much more of an authority figure.

In this narrative, Hailey advances a storyline in which they are more of a casual support to students, while Instructor Harper acts in a moral formal role, as an "authority figure." This storyline is reinforced by the actions of the students who ask questions "slightly" differently when speaking with Hailey than with Harper, and by the actions of the student who viewed eating food to be an informal act, something not appropriate to do in front of

an instructor. Although Harper tried to establish a friendly relationship with students, Harper found it likely that LAs had a different dynamic with students than they did.

Some instructors described giving LAs particular duties that complemented their instruction. Instructor FGA1 leveraged the LA's status as a peer to help establish a classroom community where students felt comfortable asking questions. For the first week or two in the semester, FGA1 would ask LAs to "play a big part in the lecture" by filling in "the role of students if students don't want to ask any questions." FGA1 would direct LAs to ask questions in the middle of a lecture to make "the students feel comfortable doing that [asking similar questions]." Then, once students felt comfortable asking questions in class, the LA no longer needed to fill that role.

The complementary position assumes that LAs do not have the right to knowledge of students' academic performance on assessments. As described earlier, some instructors thought this might help establish a more casual, peer-like relationship between LAs and students than between instructors and students. At the same time, this limited the relationship LAs could have with students. Namely, by having access to students' academic performance instructors could better understand students' backgrounds than the LAs. Associate Convener Ashley stated:

> So, if a student did really poorly on their [assessment] the previous week, I knew that that was a deficit for them, but I was very aware that [the LA] didn't know that that was a deficit for them. [The LA's] only perception of how the students were doing was what [the LA] was seeing in the breakout rooms. [The LA] didn't have as strong of a sense of who's doing well and who needs extra support.

Ashley shared that having a LA made them "more aware of how that [knowledge of grades] was impacting my interactions with students simply because I knew that the LA was not."

Some instructors never positioned their LA as a complementary instructor during the interview. For example, Associate Convener Avery valued the LA role for large class sizes but said there would be no need for a LA if they had a smaller class. In fact, they shared that "it could actually be detrimental because then would the students actually attempt the problems if they had someone there full time? So actually, if you're too small, I don't think so. I think it actually can harm." Another instructor, Blake, said they believed that:

> A good LA would be really, like, chill and make good friends - not good friends, but like have a good relationship with students. So like, it doesn't feel like she's always superior than the students. Like they're, I feel like they should be more like friends than instructors versus students. So there, the students are willing to talk to the LA more.

However, they go on to say that:

> I'm also very chill. So I'm kind of leaning toward that side as well. Yeah, I don't, I never want to be like, feel superior to the students and I also wanna be chill with students. So I guess that's why a lot of them like, raise their hand, because like, I'm pretty chill. I don't wanna be intimidating.

These quotations suggest some instructors had conflicting perceptions about the LA's relationship with students.

Furthermore, this position did lead to some tensions between instructors and LAs or students and the LA. Instructor FGA3 described an experience with the LA that suggests this position subverted the instructor-student relationship:

FGA3: So this is something that I know happened while I was teaching once, and I wasn't actually aware of it until like later on, but I think [the LA] was like helping them with Webwork and homework on like Snapchat or something like, I don't know, like some social media something which was actually a bit of a problem because I wasn't getting Webwork emails and I didn't know what my students are struggling with, but also just, I didn't know [the LA] was doing it. But that's a whole other topic of discussion. But yes, helping students with homework in ways is, I guess, another thing that my LA did.

Rachel: And it wasn't really something, like how did you hear about this?

FGA3: I'm trying to remember because it was a while ago now, but I just I think maybe we had like a meeting and later on [the LA] like, later on in the semester, and [the LA] was telling me [the LA] was doing that and I don't think I quite realized like the problematic aspect of it until like after the fact, as I was like, talking with other people about it and realizing that oh wait, I'm like, missing out on something by the fact that she's doing this. Also, there's potentially subverting any potential relationship building that I could have with students because that semester was rough in particular, I remember, for me. So, I don't, I don't know what happened with that.

While many instructors positioned LAs as more relatable or students as being more comfortable around LAs, some LAs described feeling powerless in this position. Wiley was positioned as a complementary instructor by an instructor they worked with. However, they also said:

> And I think a part of that is just when they see me, they're just like, "Oh, whatever, I'll just tell this guy we don't have any questions" and like, whatever. But when they see [Wade], you know, "well, [Wade's] the one that makes their grade. So they're like, "Oh, Oh crap. We need to, we need to respond. We need to do something.

As such, when LAs are positioned to be complementary rather than full instructors, they may be perceived by students to have less authority in the classroom, which may result in students choosing not to engage.

Figure 8

Complementary Instructor Position Summary

Position: Complementary Instructor

Storyline: LAs have unique insights and ways of thinking about mathematics and relating to students that instructors do not have access to. This typically arises from their proximity in age, status as a student, or their recent experiences learning similar mathematics, thus making a LA seem more like a friend or peer.

Who positions whom? LAs and instructors often positioned LAs as complementary by contrasting LA-student and instructor-student interactions, particularly in trying to explain these interactions. Unlike other positions, students were often viewed as the ones who positioned LAs as complementary, with LAs accepting this positioning.

Duties & Rights:

- ✓ LAs share instructional responsibilities during small group work.
- ✓ LAs do not know student grades.

Example communication acts (from LAs) indicating a LA adopts, or is assigned, this position:

- ➔ LAs referring to the instructor as "professor."
- ➔ LAs referring to their status as an undergraduate student, or to students being more comfortable with them than with the instructor: "Yeah, they did. I would get a lot of emails asking me for help with homework and stuff. I think it's because I'm also an undergrad so it's just less scary than asking the teacher for help."

Discussion

In this chapter I identified five overarching positions that define how instructional rights and duties were distributed or expected to be distributed between LAs and instructors in active learning: a.) LA as an assistant instructor, b.) LA as an apprentice instructor, c.) LA as a duplicate instructor, d.) LA as a partner instructor, and e.) LA as a complementary instructor. Instructors or LAs often attributed multiple positions to LAs

or an individual LA, suggesting that these positions overlapped and could be adopted by LAs based on the needs of the classroom.

By analyzing data involving multiple semesters and three different classroom delivery modes (hybrid, online, and in-person), I identified positions that were salient at UNL across different contexts. Yet, some positions were more prominent in certain contexts than others. For example, the assistant instructor role became more pronounced in hybrid and online spaces, as instructors relied on LAs to help manage Zoom.

Nevertheless, an overwhelming theme across these positions was the importance of alignment between the instructor and the LA, and upholding active learning. Together, this suggests that the LA role at UNL has some adaptability, able to be modified to address changes in the classroom context and the instructor's needs, but overall must support active learning in the classroom. Furthermore, the instructor was assumed to be the leader in decision-making in the classroom. Instructors often rejected or asserted positions based on their goals for the classroom and evaluations of the usefulness of what the LA was doing. For example, some instructors positioned LAs as partners in instruction, or accepted this positioning by LAs, because they found it vital to understand how students were progressing on tasks. However, other instructors rejected this positioning when it undermined their instruction or the mathematical goal and progression of a lesson.

It is tempting to place these positions along a continuum from less desirable to more desirable based on criteria such as how much power or agency LAs have in instructional decision-making. But this would be misplaced; each of these positions had benefits for instructors or students, as well as associated tensions. The duplicate instructor

position assumes that LAs are facilitating small group work in similar ways as the instructor, and so this limits the agency LAs have when working with students, but in practice, this usually meant that LAs were expected to use active learning strategies, which can benefit students. Furthermore, although some positions clearly imply less instructional agency (e.g., the assistant instructor), other positions do not clearly delineate how much agency is afforded to LAs. For example, the complementary instructor assumes that LAs have unique insights that guide their instruction, arguably meaning they hold more power to connect with students and more agency than the instructor. However, being positioned as a friend or a peer also meant that some students may reject a LA's attempts to uphold the norms associated with an active learning classroom, like engaging with each other and with the content. Furthermore, although many instructors and LAs thought the complementary position was a benefit for students, this could lead to negative consequences for the instructor's ability to relate to students, reinforcing a scenario in which the LA was seen as a "good guy" and the instructor as an adversary.

Ties to Literature about instructor-LA Relationships

The five positions (assistant, apprentice, duplicate, partner, and complementary) I identified relate to the existing literature on partnerships between instructors and LAs. These positions had strong parallels to the positions Jardine (2020) introduced (student, informant, consultant, co-instructor, co-creator); yet there were notable variations, likely due to contextual differences resulting from different classroom structures and characteristics of instructors. The positions with the clearest analogs in Jardine's work were apprentice instructor (related to student) and partner instructor (related to informant and consultant).

The apprentice instructor position relates strongly to Jardine's student position, which occurs along a storyline that "faculty instructors are more expert in both content and pedagogy than UTLAs" (p. 59). Here, UTLA refers to undergraduate teaching and learning assistants. Associated communication acts include LAs raising their hands in meetings to ask questions and faculty explaining course content or pedagogy. In the UNL data, the apprentice instructor position was similar: associate conveners, the LA Coordinator, and instructors were all assumed to have more knowledge of content and pedagogy in this storyline. However, this apprenticeship position also assumes that LAs learn to teach from observations of the instructors. I labeled this position as "apprentice" to allude to Lortie's (1975) apprenticeship of observation. This position also connects to what Williams (2016) found about the relationship between a GSI and LA. In that study, also situated at UNL, the GSI supported the growth of the LA's teaching practice during meetings outside of class about teaching and learning, and furthermore, they described how the LA learned by observing the teaching of the GSI. It is possible that Jardine's focus on identifying positions through discourse between instructors and LAs meant that they would be less likely to identify LAs observing and learning from instructors (as this would likely be an internalized positioning by the LA, only illuminated in this study during interviews where this positioning or expected positioning was made explicit).

The partner instructor position ties most closely to the informant and consultant positions in Jardine's work. Indeed, the partner instructor position often emerged as a liaison position, encompassing both the informant and consultant-like actions and related storylines. However, informant, as a label, may evoke a storyline of a police/informant, suggesting that LAs share privileged information with the instructor without students'

consent or knowledge. I do not believe that Jardine uses this label in this way; however, it was one of the reasons why I rejected this label to categorize my data even though a similar position arose, instead choosing to call this position a channel (a communication channel). Additionally, at UNL, this partner instructor position included brokering. Several LAs were returning LAs or worked in multiple classrooms; thus it may be that they were more likely to broker knowledge between classrooms than in the setting of Jardine's study. The partner instructor position also has some similarities to the co-instructor position in Jardine's study; namely, it is distinguished by communication acts such as the use of "we" to refer to both instructors and LAs. At times, UNL LAs were positioned as partners in instructional decision-making (as collaborators), which Jardine would likely identify as positioning as a co-instructor. However, the co-instructor position implies much more. In particular, LAs at UNL did not support grading.

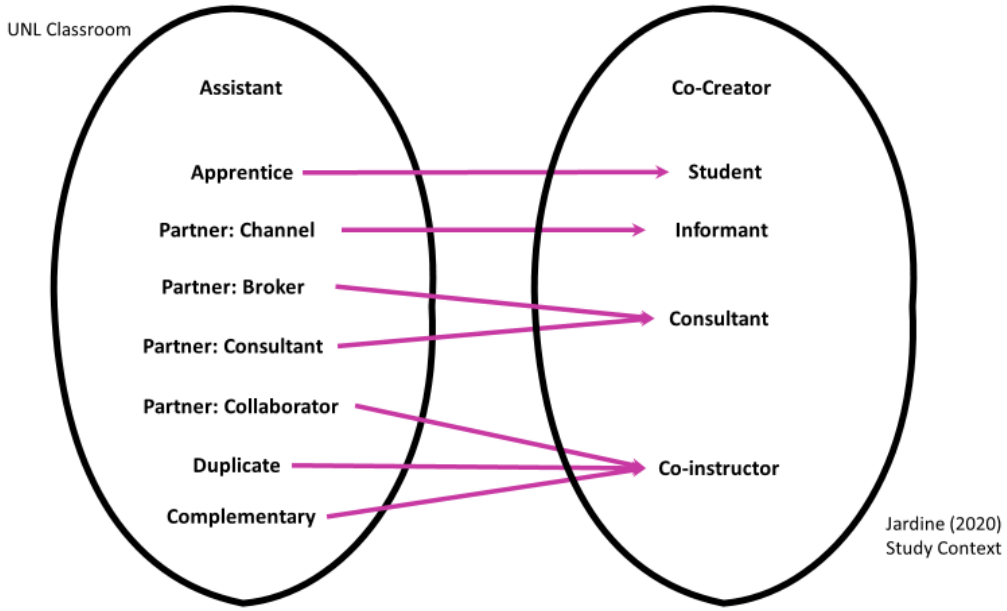
Jardine (2020) did not identify a position like the assistant instructor, nor did I identify a position similar to co-creator. Moreover, at a surface level, the duplicate and complementary positions are most closely related to the co-instructor position, but there are pronounced differences in the storylines that unfold related to these positions. Jardine (2020) uses the co-instructor position to describe instances in which LAs were given autonomy and flexibility in instructional decisions in the classroom. Even though the duplicate position assumes some autonomy (LAs are also teachers), the defining feature of this position is that LAs are meant to copy what the instructor is doing. Similarly, the complementary position assumes that LAs act as another teacher in the classroom, albeit one with a different, complementary perspective than the one provided by the GSI. In this storyline, LAs are also positioned as having a different perspective arising from their

status as peers, students, etc. which is similar to storylines associated with the informant and consultant positions from Jardine's work. Figure 9 provides an approximate mapping of my findings onto Jardine's (2020) positions. As a mapping, I related positions from the UNL data to their most closely related position in Jardine's data. However, this mapping is an imperfect representation. Projecting my findings onto Jardine's identified positions results in some loss of nuance (e.g., brokering is lost, as well as the various ways LAs acted as a teacher). Likewise, a mapping from Jardine's findings to my own would also result in a loss (e.g., of the co-creator position). This suggests that, although similarities existed between the LA roles within these different contexts, contextual features shape what the LA role looks like in considerable ways.

In their work, Jardine resists categorizing instructor-LA partnerships using Sabella et al.'s (2016) framework: mentor-mentee, faculty-driven collaboration, and collaborative, as they argue that such labeling might "limit our understanding of the complexity of those partnerships and lead us to fail to notice variation" (p. 60). That said, they do connect the interactional norms of their participants to Sabella's framework, identifying such partnerships as faculty-driven or fully collaborative. Notably, they do not describe either partnership as mentor-mentee despite the student position appearing in data, supporting their claim that positioning allows for more nuanced understandings of the ways in which LAs interact with instructors. Like Jardine (2020), I found that these positions allowed for a more nuanced view of what the LA role could be at UNL.

Figure 9

Cloud Mapping Diagram Comparing Jardine (2020) to Chapter 4 Findings



Limitations

These data primarily draw from interviews between me and the participant. As I describe in the literature review, this is a type of third-order positioning. Although participants did not use the language of Positioning Theory, in interviews they described the ways in which LAs were positioned in and outside of the classroom, primarily through narratives of their experiences. However, it is important to note that Positioning Theory is more often used to describe first-order positionings. For example, Jardine (2020) used Positioning Theory as a lens to describe conversations between instructors and LAs. As such, it is likely that I missed important positionings that would have occurred in these conversations; however, this third-order positioning was appropriate for my study, which focused on perceptions of the LA role. In these interviews, individuals not only positioned LAs in particular ways but often did so by sharing their

interpretations or reflections related to those positionings. As such, I was able to investigate their interpretations of the LA role, at least at one moment in time.

CHAPTER 5: LA AND INSTRUCTOR PERCEPTIONS OF LA-STUDENT INTERACTIONS

In this chapter I address the following research questions: *RQ2a: How did instructors' and LAs' perceptions of LA-student interactions in active learning precalculus classrooms compare and what influenced those perceptions?* and *RQ2b: How did LAs position themselves as teachers in LA-student interactions?*

All the classes I observed in fall 2020, spring 2021, and fall 2021 devoted some percentage of classroom time to allow students to work on workbook problems in small groups. During this time, LAs typically worked unsupervised with students. To gain a sense of how much time LAs had with students, consider Table 8 and the accompanying Figure 10.

Table 8

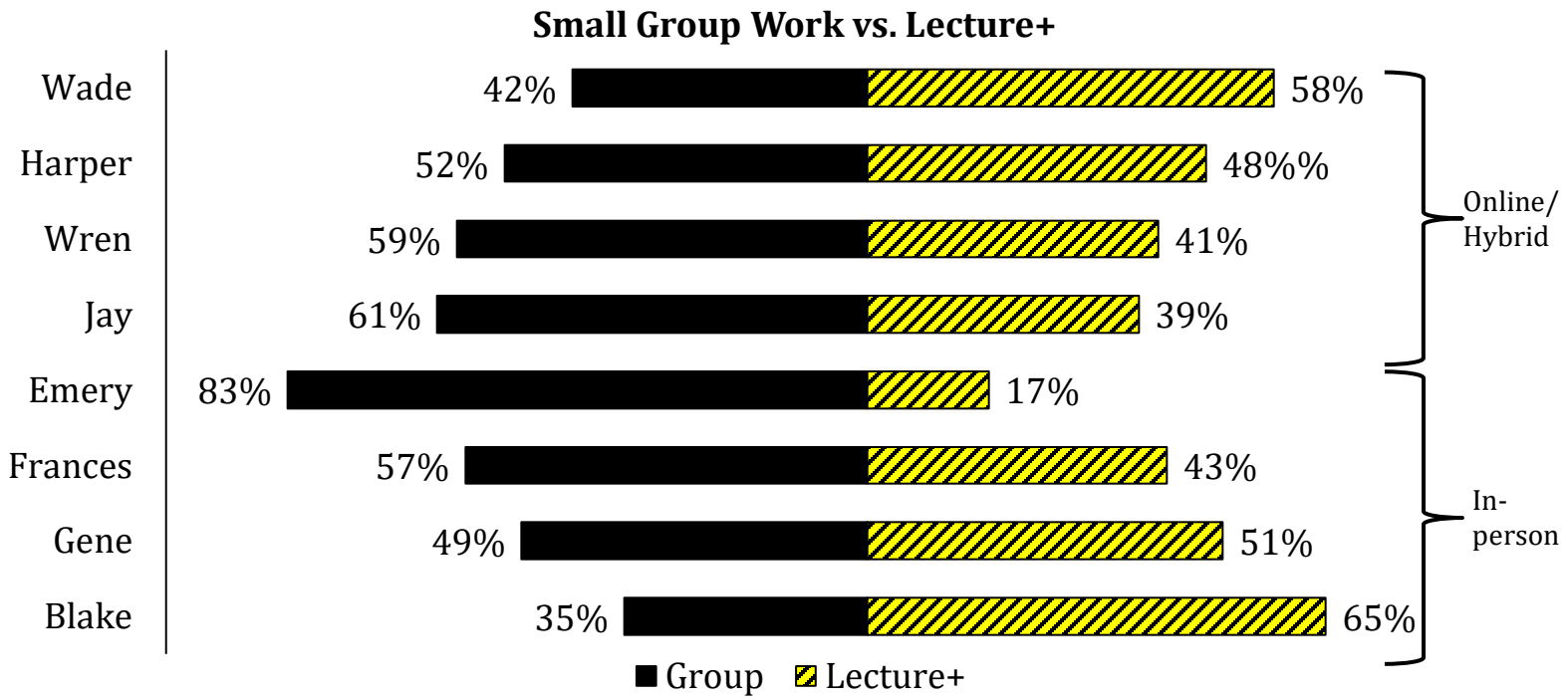
Percentage of Observed Class Time: Small Group Work vs. Lecture+

Format	Wade	Harper	Wren	Jay	Emery	Frances	Gene	Blake
Group	42%	52%	59%	61%	83%	57%	49%	35%
Lecture+	58%	48%	41%	39%	17%	43%	51%	65%

Note. "Group" refers to the proportion of class time that is devoted to small group work, while "Lecture+" refers to all activity that involved the whole group and was guided by the instructor, including lecture, whole class discussion, and announcements. Time spent on in-class quizzes was not counted.

Figure 10

Classroom Observations - Percentage of Small Group Work vs. Lecture+ Time



Note. I omitted two observations because the instructors indicated they were atypical: one of Blake's classes (which was cut short by over 20 minutes), and one of Gene's classes (which was a project day in which students worked in groups for almost the entire class time; these project days were infrequent).

Most instructors devoted at least half of class time to group work regardless of the mode of the course (online, hybrid, or in-person), with some instructors devoting significantly more time to group work (e.g., Emery). I used the term "Lecture+" to capture all classroom time led by the instructor of record, which overwhelmingly was direct instruction with little input from students (beyond low-level forms of engagement, such as asking students to recall factual information). Despite notable exceptions (e.g., Wren's "Lecture+" time often involved student presentations and whole-class discussions), this indicates that group work time provided students the most opportunities to do mathematics. As such, it is important to know what small group work time looked like, particularly how LAs interacted with students during this time and what influenced those interactions. Furthermore, instructor and LA perceptions of these interactions influence how LAs are integrated into the classroom and the value that instructors ascribe to LAs. Therefore, it is also important to understand how instructors and LAs perceive LA-student interactions and how these perceptions are formed.

This chapter adds to an understanding of the LA role by providing clarity on what LAs do and think about their work when interacting with students, as well as by showcasing how instructors perceive these interactions and what influences these perceptions. I draw on an analysis of interviews with LAs and instructors, and observations of classroom activity to address these questions. The structure of this chapter is as follows: first, I share evidence of an emergent phenomenon of instructor unawareness of LA-student interactions in the classroom to motivate why one would want to compare instructor and LA perceptions of LA-student interactions. I then present cases of two LAs (Wiley and Jessie) to illustrate variations in the degree to which

instructor and LA's perceptions of LA-student interactions align, as well as share differences in how LAs positioned themselves as teachers in interactions with students.

Instructor Focus on Student Not LA: Assume They're Off Doing Good Work

Most instructors described being largely unaware of what LAs did during group work time due to an intense focus on interacting with students. Consider, for example, this exchange in an instructor focus group:

> FGA2: …And I always had a really hard time knowing whether my LA was doing a good job because I was just like, very focused on teaching and trying to go to all of the groups and get a sense of how class is doing so I just completely ignored my LA basically all the time until we reconvened at the end of class.

This lack of awareness of actions by LAs could perhaps be ascribed to instructor experiences. Research on K-12 teachers suggests that novice and experienced instructors notice classroom experiences in different ways (Bastian et al., 2022; Sherin et al., 2011). It is possible novice GSIs felt more of a need to focus on their own instruction, which prevented them from monitoring their LA's actions in the classroom. FGA3 seemed to think this was a cause:

> FGA3: I just think there's a cognitive overload in the second year. You're not used to paying attention to a room filled with people like you do the first time you're teaching. So like later, now, I feel like I could maybe manage like paying attention to what my LA is doing. But like - oh no, I'm just trying to make sure I do a good job, me personally, a little bit more when I was having an LA. So paying attention to what my LA was doing was a lower priority. If that makes sense.

Yet, comments from other GSIs suggest that this phenomenon occurred for experienced instructors as well. FGA1, an experienced instructor who had "taught precalc like five times" and worked with four LAs, said:

> I still don't pay attention to what my LAs are doing when they are interacting with students. Because I'm still busy dealing with me, personally, knowing the students. So I don't know if instructors can effectively monitor what LAs are doing during group work because the LAs are there to support us in monitoring the work. So, it's not like we can just constantly be watching them.

This suggests that there are conflicts between being an effective instructor of record and being someone who supervises LAs. For some instructors, LAs were there to support instructors in monitoring student activity, and so observing the LA would defeat the purpose of having a LA.

Focus Group A came to a consensus that monitoring LAs would interfere with their ability to teach effectively. Other instructors shared similar sentiments, although some said that they had a general awareness of how LAs interacted with students. By the time I interviewed Instructor Peyton in the fall of 2021, I had identified this as a prevalent theme emerging from interview data. I shared this theme with Peyton, and Peyton shared that although they did not have a "microscopic view" of what their LA was doing, they broadly knew which groups the LA had helped so they knew which groups had not yet received direct instructional support.

Despite largely being unaware of what LAs did in class, one instructor knew LAs were supporting students because their absence caused significant disruptions in classroom activity. In a conversation about the benefits of having a LA, and strategies

they employed for checking in with groups, Instructor Blake shared that they often were unaware of what the LA was doing given their intense focus on students they were helping in class. I then started a conversation about this theme:

> Rachel: A lot of people I've talked to have like, almost like a sense that their LA is almost invisible because they're so focused on helping students that it's like, "oh, I don't know what my LA's doing at all!" So, a little bit, you like resonate with that a little bit? [Blake nods] Okay.
>
> Blake: Yeah, I definitely felt like that at the beginning of semester. Where I just feel like my LA's invisible to me. Like, I don't know where they are, what they're doing. But that, it's all from that one time where [they were] sick in this class, I was like, holy - I can't handle this. So like, [they] must have been doing a lot of things.

Earlier, Blake had shared how overwhelmed they felt when their LA missed a class due to being sick. They viewed the LA as integral to making sure students received individual help, although they were largely unaware of how the LA interacted with students.

Some instructors, like FGA1, believed that it was within their right not to monitor LA behavior, thus rejecting the positioning of instructors as monitors or supervisors of LAs during small group work time. Similarly, when asked what advice they would give to instructors working with LAs for the first time, Instructor Harper said:

> I guess just sort of the general advice, or attitude I inherited from the department (which I assume they'd also have inherited), they're [LAs] there to help you, they're there to help students. I don't know if this is advice or just a statement about how my classroom works, but like don't focus on the LA. Assume that

> they're off doing good work on the other side of the classroom and instead just work with the students.

Thus, this was a prevalently held belief about the role of the LA, one that was reinforced (or believed to be reinforced) by the department. Although this is at odds with some of the ways instructors were positioned in relation to LAs (e.g., as an "expert" to an "apprentice").

Not all instructors were unaware of how their LAs interacted with students, and directly supervised students so that they could trust what their LA was doing. As discussed in the prior section, most instructors discussed their hopes or expectations for how LAs interacted with students (e.g., as a duplicate of themselves), and some took this a step further by monitoring a sample of interactions between students and their LA to evaluate this alignment. However, LAs were far more articulate in how they positioned themselves during their interactions with students, and not surprisingly were able to comment on the storylines they drew from to influence those interactions. For example, Holden described how they came to understand the expectations of the LA role by drawing from a tutor/tutee storyline:

> I guess it was internally communicated to myself. I guess when I knew I was going to take on the role of LA, I was just like, "Okay, what makes a good tutor? And how can I help students in the best way possible?" And I was just like, thinking through the ways I could do that and then doing some of my own research. So I guess it's like, it was probably like 75/25 on [LA Coordinator] and myself.

Another LA, Ciri, drew from their experiences in calculus recitations (in particular, the teaching assistant) to guide their understanding of the LA role and how they should interact with students. The remainder of this section is devoted to two subcases of LAs to understand how perceptions of these interactions between LAs and students compare between LAs and instructors, as well as the various themes that came up about how LAs positioned themselves as teachers working relatively autonomously with students.

Subcase of Wiley

Wiley as a subcase was chosen to showcase three main things: (a) different instructors may have different perceptions of the same LA, and further these perceptions may differ from how the LA perceives themselves, (b) LAs positioned themselves in LA-student interactions based on their perception of how the instructor positioned themselves with students and (c) that several LAs had content-specific goals for students.

At the time of data collection, Wiley was a senior double major in mathematics and a non-STEM major and intended to pursue graduate school in mathematics. Wiley was also a first-time LA but had prior experience in the Mathematics Resource Center, which they enjoyed. In fall 2020, they worked with two different instructors teaching the same course: Wade and Wren. Class periods varied from 60 to 75 minutes (depending on the day). I observed four 75-minute classes for both Wade's class and Wren's class[5].

Both Wade and Wren were graduate students with prior experience as instructors of record. Furthermore, both were undergraduate mathematics learning assistants at the undergraduate institutions they attended. Thus, they were familiar with the learning

[5] Note, throughout this chapter I sometimes refer to a classroom as being owned by an instructor, e.g. "Wade's classroom" rather than Wade's and Wiley's classroom. In this way, I am positioning the instructor as having more authority, or ownership of the classroom, than the LA. This is partially for readability, but also aligns with how the department, and many participants, positioned instructors.

assistant position, as well as the department's expectations for precalculus courses. Despite similar backgrounds, there were striking differences in how Wade and Wren perceived Wiley's interactions with students. I argue that differing classroom contexts and norms account for some of these differences. To support this argument, I begin this section with a rich description of Wade and Wren's classrooms. Later, I detail how Wade, Wren, and Wiley perceived Wiley-student interactions, augmented with observation data to illustrate parallels between these perceptions and what I saw during observations. Finally, I describe key features of Wiley's instruction to showcase how LAs might be thinking about their role and position themselves in the classroom.

One of the main differences between Wade and Wren's classes was the number of students, modality (in-person, hybrid, online), and resources at their disposal. Wade had about 40 students enrolled in the course; given restrictions related to the pandemic, about two-thirds of the students attended online, and one-third attended in person. The class rotated which group of students attended on a given day in the week (i.e., one-third attended on day 1 of the week, a different one-third of the class attended on day 2, etc.). Wiley always attended online and, at least initially, was the main support for students during small group work. Wiley was also in charge of Zoom, including splitting students into breakout rooms. In contrast, Wren taught a much smaller class of around ten students, all enrolled in a university learning community, and consequently, Wren's class primarily met in person. On occasion, Wren would hold the whole class online, or host one Zoom group of about 3-4 students (as COVID-positive students were discouraged from attending class). Toward the end of the semester, there was consistently at least one group attending online supported by Wiley. Wiley did not have any technical

responsibilities in Wren's class, as the logistics of holding a Zoom session were much less complicated for the few students who attended online. In addition to small class sizes, every student in Wren's class had access to a trackpad, provided for the students' learning community.

Beyond differences in class size, modality, and resources available to students, Wade and Wren structured their class time very differently. For Wade, the class structure was borne out of struggles with engaging students and uncertainty in the hybrid model. Wade often described their efforts to maintain active learning with a resigned tone; in their final interview, they went as far as to say, "We got rid of the active learning" (Instructor, Interview, Fa20_3[6]). When I asked Wade to elaborate, Wade commented on their struggles to organize student presentations at the start of the semester. Early in the semester, Wade asked student groups to record and present their work on Jamboard slides, but once it came time to present, there would "be nothing there." Wade was frustrated with this outcome but concluded that presentations only work in an in-person setting or if "the class size is small enough" (Instructor, Interview, Fa20_3). In response, Wade changed the structure of the class. For the remainder of the semester, Wade typically started class by lecturing before allowing "20 or 30 minutes" for small group work time during which Wade and Wiley would "round robin" (Instructor, Interview, Fa20_1) from group to group. Wade saw small group work time as the main active learning component of their class, as it allowed students to "get into their groups and work together and talk together (Instructor, Interview, Fa20_3). However, from Wade's

[6] In this chapter the following notation is used to describe quotations for the subcases: (Title, Type of Data, Semester_DataNumber). For example, (Instructor, Interview, Fa20_3) means that this participant is an instructor, the quotation referenced is from an interview with this participant conducted in Fall 2020, and it was the third interview with this participant.

descriptions it was evident that student groups had different norms about communicating with each other:

> Sometimes I have groups that are quiet and sometimes I have groups that are actually talking...I say “Hey what questions do you have?” Or “how are things going?” And depending on the group they will say “We’re fine” or they will say they’re “not sure what to do.” I think some of the groups that have been online, if they don’t like to talk to each other, usually try to work on things on their own. And there’s nothing wrong with that, but I am at least trying to get that active learning component going, which has been really hard. Cause it’s really hard to enforce…I might just see who’s in that group and I’ll ask “hey are you ok? Did you catch that?” (Instructor, Interview, Fa20_1)

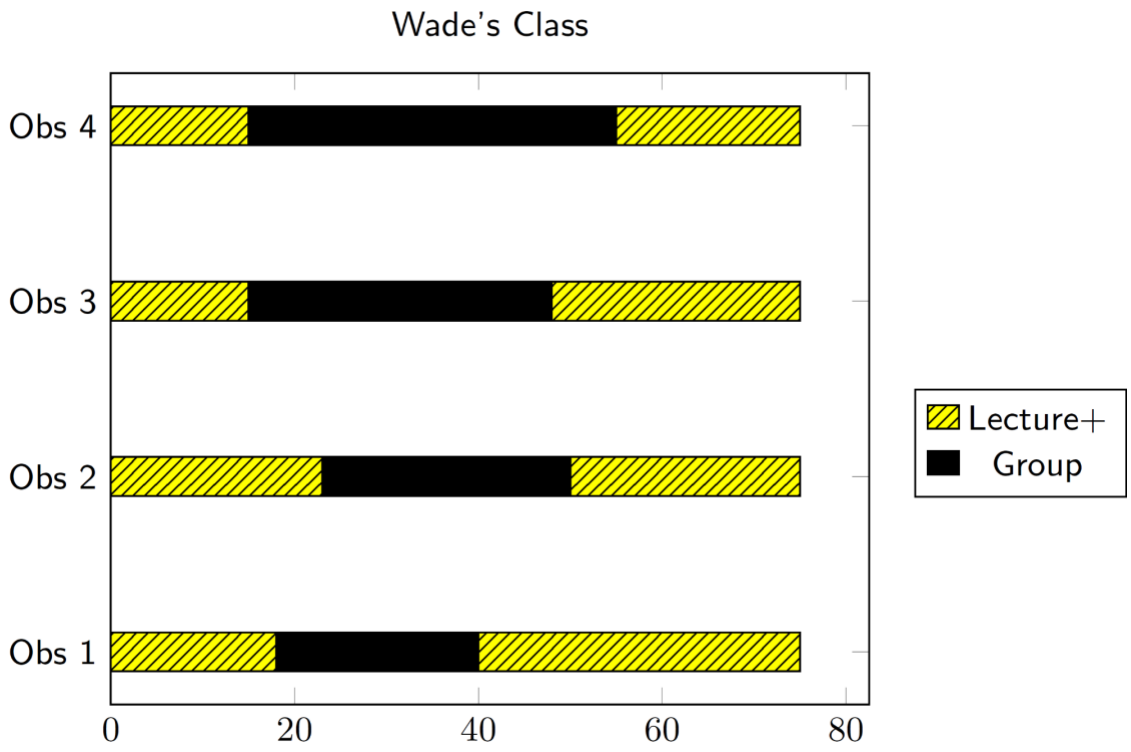
Although Wade said “there’s nothing wrong with” students working individually, they did consider it important to give students opportunities to communicate about mathematics. In my second interview with Wade, they described being more intentional about encouraging peer-to-peer interactions. Wade said that as a result, students had become “a little bit better [at] discussing amongst each other” (Instructor, Interview, Fa20_2). Overall, Wade considered it their responsibility to monitor individual student understanding and for Wiley to reinforce concepts.

To wrap up class Wade would work through solutions for workbook problems as they “explain[ed] key steps along the way.” Wade frequently attempted to engage students by soliciting quick feedback (e.g., through the thumbs-up feature on Zoom or chat), or by asking low-level questions (e.g., “Okay, we have a polynomial at the top and the bottom. Tell me, what is the degree of this? What is the degree of the bottom?”).

Wiley rarely had duties during this wrap-up time, although on occasion Wiley would comment on something Wade said (e.g., pointing out typos). In their first interview, Wade stated that this "template" for the course (i.e., lecture, small group work, wrap-up/demonstration of solutions) would not change regardless of if their class went entirely online (Instructor, Interview, Fa20_1). Wade's rationale for this was that "once you have the template set for the first two weeks, that's usually how students are going to adjust. They will not want to change to a new thing." See Figure 11 for a breakdown of class times from observations of Wade's class.

Figure 11

Class Times for Instructor Wade (working with LA Wiley)

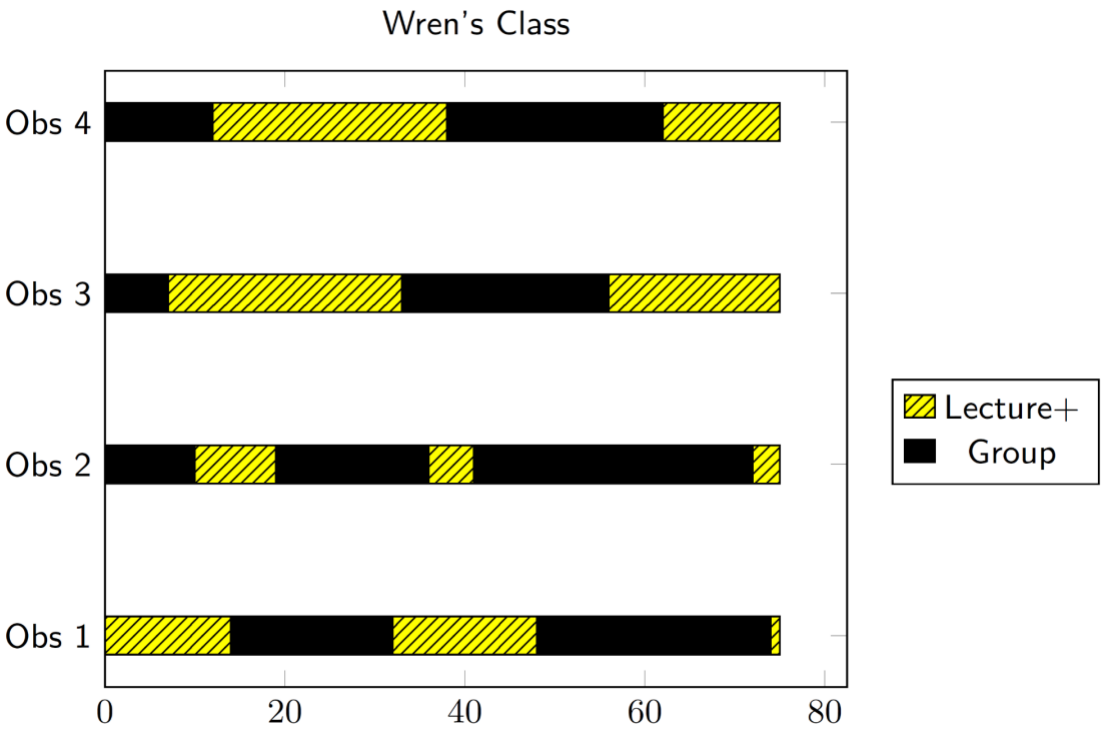


Note. In Observation 1 of Wade's class, there was a 10 minute quiz at the end of class (included in "Lecture+").

In contrast, students in Wren's class were typically engaged throughout class. See Figure 12 for a breakdown of class times from observations of Wren's class.

Figure 12

Class Times for Instructor Wren (working with LA Wiley)



Early in the semester Wren established a norm of students using Google Jamboard (https://jamboard.google.com/) to share their work and take class notes. This was likely supported by students' access to a trackpad. Wren also focused on making experiences cohesive between the online and in-person components of their course by having all students use the Jamboard, including those in class. Typically, Wren started class with a warm-up problem written on one of the Google Jamboard slides and projected on a screen in the classroom or shared on Zoom. After a set amount of time, Wren would lead a class discussion about the warm-up, often having students write their solutions on the

Jamboard anonymously. Wren then would share a "knowledge bank slide" to review the content (e.g., definitions, procedures, formulas) presented in the videos that students were expected to watch before class. At this point, Wren would either share an example, have a student solve a problem, or jump into pairs to work on workbook problems. Periodically Wren stopped class to have a student present or to discuss a particular problem, again using Jamboard as a shared writing space. On some occasions, Wren held class entirely online, but the structure of the course remained essentially the same.

Wade's Perceptions of Wiley

This section is split into two subsections to highlight the duality in LA-student interactions. The first section focuses on Wade's perceptions of Wiley's actions when interacting with students, as well as Wiley's broader approach to teaching. The second section focuses on Wade's perceptions of students' responses to Wiley.

Perceptions of Wiley's Actions and Teaching

Early on in the semester, Wade found Wiley's ability to navigate Zoom to be "quite impressive" and highly valuable, going so far as to describe it as Wiley's most important responsibility, saying: "[their most important responsibility is] being able to manage the Zoom call…if anything the LA is more of a tech support/assistant in this case, but they do at least help with the learning part of it" (Instructor, Interview, Fa20_1). As someone who worked with LAs in the past, Wade said this differed from prior semesters in which LAs were "focused on the learning objective type of duties." (Instructor, Interview, Fa20_1). Although Wade de-emphasized Wiley's instructional role initially, Wade positioned Wiley as an instructor more frequently as the semester progressed.

In their second interview, they posited that Wiley was learning from either themselves or Wren and said that Wiley was likely "practicing or experimenting with some things" instructionally (Instructor, Interview, Fa20_2). Thus, Wade positioned Wiley as an apprentice instructor and reflective practitioner. Furthermore, in their final interview, Wade described how over the semester Wiley had "stepped up to [their] role as a LA", taking it "pretty seriously" (Instructor, Interview, Fa20_3). Wade said, "Sometimes I would just hop into [their] room, you know, just to see how things were going, and I could see that [they were] making sure, trying to create engagement with students" (Instructor, Interview, Fa20_3). During this same interview, I explicitly asked Wade to compare their role to Wiley's role in the classroom. They said that "I guess in terms of being similar, I see that Wiley and I have - [acted] more as facilitators in a sense that we kind of conveyed knowledge." Thus, Wade positioned Wiley and themselves similarly as distributors of knowledge to students. Wade continued:

> I deliver most of the core concepts, and then Wiley's role is to help reinforce those concepts when students are working on their problems…So I think what the difference is that I guess I do the fair share of the lecturing here. Quote unquote. Whereas then what is similar between us is that we go ahead and talk to students about these things. And then we kind of just ask the typical questions. Like, "What do you think, what have you tried, you know, or could you explain this a little bit further?" (Instructor, Interview, Fa20_3).

In this manner, Wade at times positioned Wiley as a duplicate instructor when students worked on problems.

Although Wade perceived similarities in how they interacted with students, Wade did also comment on differences. One perceived difference Wade shared was their belief that Wiley was more likely to demonstrate problems to students:

> One thing I would say maybe that Wiley does a little differently than me is like maybe when a student asks about a particular problem, say, "I don't know what to do here" And if it's like a problem that has a part or something, then Wiley kind of fully works out that part for them and then kind of explains some of the steps that go along the way. Me, I would say sometimes I do that depending on whether I can see whether the student really is struggling or whether it's just the student needs help to get started. (Instructor, Interview, Fa20_3).

As such, Wade perceived Wiley as being more likely to provide direct instruction to students during small group work time than themselves. Wade did not suggest this difference in instruction was problematic or make comments suggesting that this was misaligned with their own instructional goals.

Awareness of Wiley's Actions

In my initial analysis I noted that Wade's descriptions of what Wiley did in class often were accompanied by words such as "maybe" or "probably," perhaps suggesting some degree of uncertainty or speculation in their comments about Wiley's actions. For example, Wade described an instructional strategy that they used to engage with students and said they were "pretty sure" Wiley used it as well:

> So, this is a strategy that I use - and I'm pretty sure my LA uses - is like when the students are working and they say "I'm not quite sure how to do this." Then I turn on my camera at that moment and just say, "Hey, how are things going?" Because

> they usually don't ignore that I'm in there. And then that's usually where I probe them at that question right there…that's a learning opportunity for them, at that moment. So we try to spot those scenarios as often as we can. That's the reason why we tried to get people to interact more because when those questions come out, right, that usually is a sign that you quite haven't fully mastered the topic at hand or that at least that piece of the topic. (Instructor, Interview, Fa20_1)

Elsewhere in the interview, Wade discussed how during instructor meetings they rarely discussed pedagogy and that it was very difficult to reflect with Wiley because "we really don't know what's going on. Like you think about it - we're all in one breakout room at a specific moment, right? We're never in the same breakout room. And usually, there are like six total breakout rooms" (Instructor, Interview, Fa20_1). Relatedly, Wade said that they had not "talked much about what [the LA has] done with the groups who don't interact much" (Instructor, Interview, Fa20_1). Thus, in my initial interview with Wade, it was unclear to me if Wade's perceptions of Wiley's actions in class were a result of direct observation, something else, or multiple factors. There is evidence that Wade's awareness increased over the semester, perhaps due to more conversations about how to engage students or more intentional observations of Wiley in breakout rooms. For example, later in the semester, Wade and Wiley jointly increased their efforts to encourage peer-to-peer interaction. Overall, Wade trusted Wiley to support their classroom.

Perceptions of Students' Responses to Wiley

Wade thought students might interact differently with Wiley because of their status as an undergraduate student. For example, when asked what benefits Wiley brought to Wade's instruction, Wade said:

> I think another benefit is really, you know, like, I mean, not that I'm saying I'm not an approachable instructor, but maybe there was a student, maybe some students would say "okay, maybe I'm a little afraid to ask Wade's things. So I'll go ahead and ask the undergrad this question because maybe the undergrad would probably be more reasonable and stuff." (Instructor, Interview, Fa20_3)

Wade, in part, attributed this perception to their experience talking with other colleagues: "Based on what I've heard from other colleagues, sometimes students are just afraid to approach them" (Instructor, Interview, Fa20_3). Wade also shared this view early on in the semester, saying that students "probably "view[ed]" Wiley "as a role model…like the undergrad who is just really good at math" (Instructor, Interview, Fa20_1). Further, although in their final interview, Wade said they observed Wiley on occasion, I asked Wade if they felt Wiley had a different relationship or rapport with students. Wade responded:

> You know, honestly, that's really hard to tell. I don't know if I can really give an exact answer to that given the structure that we've had this semester. in previous semesters, I've usually noticed that like when we were back in an in-person scenario and the LA either gets along quite well with the students, you know, and maybe the students feel more comfortable asking the LA, and then there may be some students who are comfortable with just asking the instructor because maybe

> they just don't quite exactly know. Maybe they didn't find the LA assistant as helpful. So in this scenario, I don't think I really have much of an answer to provide…I had to make sure I go in and hit all the breakout rooms and sometimes, you know, like, I mean, it would be very nice if I could just sit in and listen to what my LA is saying to the students and all that, but then I don't know how long that's gonna take… So that's the one thing I feel like that I'm not too happy with Zoom, that you can't really overhear multiple stuff going on at the same time. (Instructor, Interview, Fa20_3)

Although Wade sometimes joined the same breakout room as Wiley (see the prior section), Wade still felt unable to comment on how students responded to Wiley. Thus, it is perhaps the case that such infrequent observations increased Wade's understanding of the types of instructional strategies Wiley used in interactions with students but were not enough for Wade to gain a more nuanced understanding of how Wiley and students interacted. Notably, Wade thought that in an in-person setting would alleviate some of these issues.

Wren's Perceptions of Wiley

This section is split into two subsections to highlight the duality in LA-student interactions. The first section focuses on Wren's perceptions of Wiley's teaching when interacting with students. The second section narrows in to focus on Wren's perceptions of students' responses to Wiley.

Perceptions of Wiley's Actions and Disposition

In their first interview, Wren shared that they had a "rose-colored view [of the LA pedagogy course] because Wiley is such a good LA" and they had not "talked to anyone

else about their LAs." (Instructor, Interview Fa20_1). Wren thought that, in general, Wiley did "a good job of doing [their] best to let the students struggle," and "leading the students to answer their own questions" which Wren considered to be important for student learning (Instructor, Interview, Fa20_1). However, like Wade, they did notice that Wiley at times would demonstrate problems to students rather than support that struggle. Wren was empathetic about this, saying that "it sometimes feels like, "wow, [this is] the only way to explain this" but stressed that the most important responsibility Wiley had was to "ask questions instead of doing that" (Instructor, Interview, Fa20_1). In my second interview with Wren, they again highlighted the importance of "asking questions instead of giving answers," but added that a LA should "be listening to what the students have to say" and supporting students in making progress "on the track that they're already going along - keep them on there, but just straighten them out a little bit." They also acknowledged that this was "hard on Wiley, because sometimes [the students are] not saying anything" and that this was particularly "hard on Zoom" where you must "squeeze the information out of them" (Instructor, Interview, Fa20_2).

Wren perceived Wiley to be knowledgeable and enthusiastic about mathematics when interacting with students, which supported their goal of realizing that math is about more than "plugging in numbers and chugging along:"

> [Wiley] has a really deep understanding of math. So [they're] a fifth-year senior, and [they] took modern algebra last year. So [they've] taken a lot of really good classes. So I know, and [they're] excited about math, which so like for that second goal of helping students, like perceive mathematics as more than just calculations,

> it's nice to have an LA who is excited about math the way that Wiley is. (Instructor, Interview, Fa20_1)

At another point of the interview, Wren brought up the importance of content knowledge, connecting it to their own experiences as an undergraduate assistant and elementary school student. Wren said that from their experience as an undergraduate assistant, they believed it was helpful to have knowledge of calculus to support students in learning precalculus concepts, as it gave them the "tools" to better address students' questions (Instructor, Interview, Fa20_1). Further, as an elementary student, Wren described not liking math because their teachers "didn't know how to answer their questions" (Instructor, Interview, Fa20_1). Thus, Wren perhaps valued Wiley's advanced content knowledge because they perceived it to be helpful in supporting Wiley's ability to address student questions.

Awareness of Wiley's Actions

Overall, Wren felt highly aware of what Wiley did in the classroom. However, as Wiley attended more Zoom sessions, their awareness decreased, which Wren presented as a challenge to interacting with students:

> I want to interact with all of the students, whether I'm supposed to focus on the ones in person or on Zoom like I still want to talk to all of them. But I also don't want to cut off Wiley or come in when [they're] waiting for a student to think and start talking. So I think it might be beneficial for us to talk about - because when [they're] in person, it's just so much easier because I can really tell what's going on in person over here while I'm on Zoom with the students. (Instructor, Interview, Fa20_2)

This challenge with Zoom was also brought up by Wade. Perhaps unsurprisingly, Zoom obscured the instructor's awareness of what Wiley did in class. While it is tempting to state this is an artifact unique to the Zoom environment, several instructors who worked with LAs in person felt a similar lack of awareness of what their LA did (see prior sections of this chapter). It is likely that Wren's smaller class size supported their awareness of Wiley. It is also possible that Wren felt more perceptive of Wiley's actions because they asked targeted questions about how Wiley interacted with students during instructor meetings ("When you come into a breakout room, what's it like?"; Instructor, Interview, Fa20_1).

It is also worth foregrounding Wren's respect for Wiley as an instructor and desire to support Wiley's interactions with students, as this impacts how they perceive Wiley. This respect for Wiley was echoed in other remarks made by Wren. For example, in Wren's first interview, they said that one of the main benefits of having Wiley in their classroom was that they didn't have to "feel bad about spending a little extra time with one group," and thus were able to better personalize their instruction (Instructor, Interview, Fa20_1). Importantly, they felt this was reciprocal, in the sense that Wiley was also able to personalize their instruction and spend "a little extra time with a group that needs it." Wren, therefore, positioned Wiley as an instructor whose relationship with students mattered, even though at times this conflicted with their own ability to interact with students in class. (Instructor, Interview, Fa20_1)

Perceptions of Students' Responses to Wiley

Unlike Wade, Wren questioned whether students saw Wiley as a peer. They said: "I don't know if they see [Wiley] as a fellow student just because [they're in their late twenties]

and [they] really [seem] more like another instructor, like a co-teacher than [as] another student." (Instructor, Interview, Fa20_1). Further, in my final interview with Wren, they shared their perception that Wiley did not have as close of connections to students as them:

> I think maybe I have just slightly better rapport with the students. I think it's probably just because they know me more because I talk more. But I also like - I also try to talk to them about things other than math a little bit more than - I don't think Wiley does that at all. So I think I have a little bit better rapport with the students. Partially because they know that I'm the instructor, but I think partially because I talk to them before class and after class a little bit more than [Wiley] does. So I think that kind of affects the way the students interact with us. (Instructor, Interview, Fa20_3)

Thus, Wren felt their efforts to discuss topics beyond mathematics with students, as well as the frequency of their conversations, resulted in them having a better rapport with students. I asked Wren if they thought Zoom had an influence on Wiley's ability to have these types of conversations with students, and Wren said that they thought it was related to their exposure to students: Wren spoke with each student every single day, no matter if they attended in person or online, whereas Wiley only saw "one of those groups from day to day" (Instructor, Interview, Fa20_3).

Wiley as Teacher

In the following sections I share how Wiley positioned themselves as a teacher in interactions with students, comparing this positioning with the perceptions Wade and Wren had of Wiley's instruction. I begin by describing Wiley's mindset as they came into

their LA role and their impressions of their relationship with students. I also detail the broader goal Wiley had for these interactions: supporting students' abilities to understand and make connections across content, and their efforts to adapt their instruction to account for the role of the instructor and perceived level of student engagement. Where appropriate, I make direct comparisons to how Wade and Wren perceived Wiley.

Wiley's Perceived Relationship with Students

Wade posited that Wiley seemed more approachable to some students based on Wiley's status as an undergraduate student. In contrast, Wiley never described themselves as a peer. They said students in both classes asked them questions like "So you're a grad student? You know all this stuff" or referred to them as "Mx. Wiley." Wiley interpreted this positively, as they said: "That showed me enough that like, at least they think that I know what I'm talking about and that it doesn't seem like I don't know how to help them at all." (LA, Interview, Fa20_3) Their perceptions of how students saw them were similar to how Wren thought students may perceive Wiley; Wren questioned whether students would view Wiley as a peer, given their age and extensive mathematical background. Thus, Wade positioned Wiley as a complementary instructor due to their status as an undergraduate, yet Wiley (and Wren) would likely reject the assumed storyline of this particular positioning.

Despite not positioning themselves as a peer, Wiley did position themselves as complementary at times due to their ability to provide an alternative perspective on content. In a retelling of one memorable interaction with a student in Wren's class, Wiley described how they provided an alternative way of thinking about inverse functions to support a student who was struggling to apply Wren's solution strategy to solve a

problem. Namely, the problem asked students to determine if a function had an inverse, and if so, find the inverse. Wren suggested to the student that they try to tackle the problem by trying to find an inverse for the function (i.e., algebraically). Wiley had approached these problems differently, and so when the student could not make progress Wiley suggested that the student consider "how this thing [the function] looked" (i.e., to graph the function) and use the graph to reason through whether the function was invertible or not. (LA, Interview, Fa20_1). Thus, Wiley acted as a complementary instructor in this interaction.

Although Wiley said some students saw them more like a graduate student, this also depended upon the students. Wiley described facing challenges when working with students who perceived them to be less of an authority figure. Wiley felt it likely that some group of students responded more to Wade than themselves. Wiley said, "When I go in, it's just sometimes like, 'Hey guys, anybody there?' like screaming into the void. And they're like, "Oh, we don't care about that [person]."' Despite this, Wiley felt that both Wade and themselves behaved similarly in breakout rooms. (LA, Interview, Fa20_3)

The classroom structure had a significant impact on how Wiley perceived their relationship with students. In particular, early in the semester, Wiley described being able to "see and communicate with the students a lot more" and "get a lot more time with each student" in Wren's class than in Wade's (LA, Interview, Fa20_1). Perhaps unsurprisingly, small group work was also easier to manage. In Wade's class, Wiley described needing to be "methodical" about visiting groups due to the large number of students, "Whereas with Wren's class", Wiley said, "I don't have to worry about that. I can bounce back from group to group, you know, a hundred times." In their final

interview, Wiley described feeling proud of the relationships they were able to develop with some students, saying that there were "several students that I think that I've connected with - that it seemed like they actually kind of not just understand what they're doing, but kind of enjoy it, you know asking deeper questions" (LA, Interview, Fa20_3). Wiley particularly felt strong connections with a student in Wren's class and remarked how their relationship was facilitated by the structure of the class as well as the students' personal drive. That is not to say that Wiley did not develop relationships with students in Wade's class. There were also students in Wade's class that Wiley felt they had "good discussions" with (LA, Interview, Fa20_1). In their first interview, Wiley discussed how they tended to have better discussions with student groups that interacted with one another and had their cameras on:

> So when I come in, they've got cameras on, they're talking about the problems - or sometimes not. Sometimes they're talking about Hydro Flasks and stuff, which is fine, but you know, they're interacting. So when I come in there, I can join in on their conversation and maybe redirect it back to math, or like answer some of their questions. And, whereas some of the groups where it's no cameras, or there might be one student that wants to interact and nobody else to interact with, everybody else is kind of just like a brick wall. Even with those students, it's kind of hard [to interact]. (LA, Interview, Fa20_1)

One thing I want to highlight about this quotation is that Wiley described redirecting student conversation to mathematics. This did not come up as a prominent theme when analyzing Wiley's actions in the class, but it is worth mentioning because in my observations I rarely observed Wiley engaging in non-mathematical talk with students,

and this is something that Wren perceived to be a barrier to Wiley's developing rapport with students.

Wiley's interactions with students were also heavily influenced by their disappointing experiences interacting with a LA when they were a student. In their first interview Wiley discussed how they perceived their interactions with students in Wren's class to be much different than how this LA interacted with students:

> She [Wiley's former LA] just kind of, you know, every once in a while would come up and say, "how are you guys doing?" And then we'd be like, "okay." And she'd walk away. And so in, like, I'm not saying she didn't help us, sometimes she did, but there was no, there wasn't a whole lot of learning there…It's definitely not how I perceive how I interact with the students. I guess I would say, I feel like I, especially in Wren's class, I have a very front position - I don't know how to describe that - with the students where I'm constantly interacting with them and like, and they knew who I am. (LA, Interview, Fa20_1)

In the final interview, Wiley brought up this LA again to account for how Wiley approaches their work:

> One thing that was beneficial to me is at the beginning of the semester, I just kind of put myself in like an instructor's role mentally. So I know way back when I took algebra and we had a learning assistant, that was just somebody that kind of stopped by our table every once in a while and answered any questions we had and didn't really engage with us any more than that. Just like a checker, I guess like, "Oh, you did this wrong, you did this right." And I didn't feel that was that helpful. I felt like we would always just be actually wanting the instructor to come

> over because he'd come over and explain everything and have a conversation with, sort of like push us. (LA, Interview, Fa20_3)

Wiley thus positioned themselves as an instructor in their own internal dialogue when interacting with students: "If I were to put myself in the position as if Wren or Wade weren't there and I was the only source of information for the students, that's how I would try to answer their questions." Wiley said that although this approach does not always work, this has helped them in their ability to communicate with students and helped students have a positive view of their relationship:

> Of course that doesn't always work out sometimes and sometimes I fail to do that, but I think doing that kind of opened me up to being more conversive [sp] with them, and explaining things better and in a different way, rather than just like, "Oh yeah, that's right. That's wrong. Yeah, you just want to do this" and simple answers. And I can tell that for some students that kind of - that helped or that it - whatever relationship was created by that they definitely had a different outlook on like my teaching or like my instructing than they would have if I would've just shown up and been like, "I'm a student, and I'm just here to check your questions [sic]." (LA, Interview, Fa20_3)

Focus on Understanding and "Connecting those Dots"

From the beginning, Wiley considered their most important responsibility to be "helping the students, asking questions, getting them to think and talk about things." They found reassurance in students' positioning of themselves as knowledgeable and used that knowledge to try to enhance students' understanding and appreciation of mathematics. Further, they said, "I see all of the administrative things as just kind of like

housekeeping that needs to be done. But I really feel that my main priority is getting them to understand and interact with the material" (LA, Interview, Fa20_1). This is in contrast with Wade's (at least initial impressions), who in their first interview positioned Wiley primarily as an assistant supporting Zoom.

As part of Wiley's emphasis on understanding, one of Wiley's main goals was to help students "compile information, [so] they can think back to what they learned previously." They thought that the course structure supported this goal, but also explicitly would help students "connect those dots" by asking "a lot of questions" and varying the amount of information they provide students, providing them "less information" as they progressed through the content to "try to get them to connect those dots on their own." (LA, Interview, Fa20_1). Wiley said that to support students to make connections across content they would "instead of just pointing to what the next step is, talk about what's going on, what information we're given and like why, what they think and stuff like that" (LA, Interview, Fa20_1).

I often observed Wiley guiding students through a mathematical task by helping them to identify given information, check the reasonableness of their answers, and on occasion make connections to prior content. In many instances, Wiley did so in response to incorrect answers from students. As an example, in my first round of observations of Wade's and Wren's classes, students worked on exponential functions and applications of logarithm problems. To support students' understanding, Wiley frequently asked students to identify units of quantities in the problem (e.g., "What did you get for units on those [solutions]?"; LA, Wade's Class Observation Recording, Fa20_1). They also would ask students to reflect on the reasonableness of their final answers. In one particular

interaction, a student found a growth rate of 114.9% for Problem 6 (Figure 13) which was too high. Wiley responded by asking them:

> So let's think about how valid this answer is, right?...[that means] every year we are essentially doubling and a little bit more, right? So we know from the problem that the population doubles in size every five years. So does it make sense that it doubles in a little under a year? (LA, Wren's Class Observation Recording, Fa20_1)

Thus, Wiley asked students to think about their solutions in the context of the problem, as a way to reason through why their initial answer was incorrect.

Figure 13

An Applied Exponential Function Task

Problem 6. Suppose a population doubles in size every 5 years.

(a) Find the percent annual growth rate of the population.

(b) Find the continuous growth rate of the population.

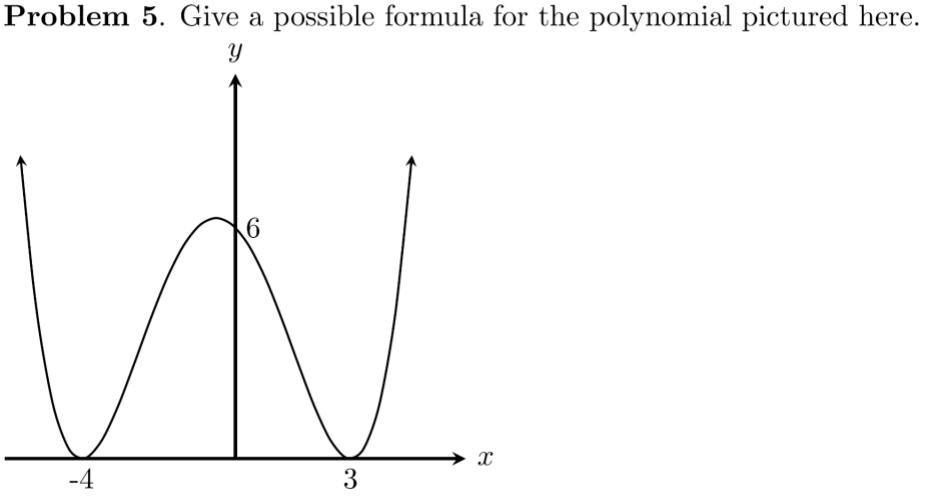
(c) Is your answer to part (a) or part (b) larger? Why does this make sense?

Throughout the semester, students would often tell Wiley they did not know how to start a problem. Although in my observations I rarely saw Wiley respond by doing an entire problem or example for students, as Wade thought Wiley was more likely to do, I did notice (like Wren) that sometimes Wiley provided significant direct instruction or explanations to students. I also noticed that Wiley would frequently prompt students to engage by asking low-level questions, especially to get them started on problems.

As an example, in my third observation of Wade's class students were focused on identifying the short-term behavior of polynomial functions. The first four workbook problems required students to either identify a set of features of a polynomial function (leading term, degree, zeros with multiplicities, "bounces", "crosses", long-run behavior) or graph a polynomial function based on its algebraic representation. However, Problem 5 (see Figure 14) introduced a new level of complexity by providing students with a graphical representation of a polynomial function and asking students to come up with a possible formula for it. Wiley helped multiple students get started on this problem. Next, I detail an interaction that typifies what that support looked like.

Figure 14

Graph of a Polynomial Function Task



The interaction began when Wiley entered breakout room 6. When Wiley entered the breakout room, there was no talking (as was typical of most groups in Wade's class). Wade waited (as was typical) for about a minute before asking students if they had "any questions yet?" One student replied by saying they were working on Problem 5 but just

didn't know "where to start." Wiley responded by suggesting that it was important to identify the "little pieces of information" that could be pulled "out of this graph." Thus, Wiley pointed the student to a productive first step: identifying the given information of a task. The student correctly identified that the graph "bounces'' off the zeros at x=3 and x=-4, but struggled to connect that information to the algebraic representation of this function. Wiley asked multiple questions to encourage the student to make the connection. They first asked a low-level question requiring knowledge of definitions presented in class (namely, multiplicity):

> Wiley: So, when we're talking about like if something bounces off of the x-axis or if it goes through, what's that word that we need to look at to determine if something goes through or not?

and then after a brief pause from the student, becoming more explicit in their line of questioning to connect the graphical and algebraic representations of polynomials:

> Wiley: Or like maybe not even the word, but just like what part of a function? Like if I were to give you in problem four, (x+1) to just the first power and then (x+3) squared, like would (x+1) go through the line, or would it bounce off?

By pointing the student to an explicit factor (from problem 4), Wiley supported the student in recalling what the class had learned about multiplicities, although the student's correct response ("through?") was uncertain in tone, perhaps suggesting that they wanted Wiley's affirmation that their response was correct. After a small exchange, Wiley was satisfied that the student knew that the multiplicities of the factors (x-3) and (x+4) were even, and they told the student there was "one more piece of information" they could pull from the graph. The student guessed that the 6 labeled on the y-axis was important, but

they did not know why. However, once Wiley pointed out that x=0 at that point (i.e., when y=6), the student was correctly able to identify that point as the y-intercept. At this point, Wiley affirmed that what the student said was correct, and concluded the interaction by saying "Yeah, exactly. So, all of those pieces of information, the multiplicity of the zeros, where the zeros are, and the y-intercept will help you create a formula" and moving to a different breakout room. The entire interaction was about four minutes long.

Although this interaction involved several low-level questions, Wiley used these questions to emphasize the importance of the vocabulary covered in the lesson. To successfully complete the task, the student would then need to figure out how each of these features of a polynomial function would be useful for creating a possible formula for the given graph. From my own experience, students find this task to be cognitively demanding, often struggling to understand how the y-intercept influences their solution and how to parse the directions, which implies that there are multiple possible solutions (in fact, infinitely many).

Leaning Back in Wren's Class, Leaning Forward in Wade's Class

Wiley's approach to teaching changed as the semester progressed and in response to student engagement. In Wren's class, Wiley started taking "more of a backseat role" where they would wait and let students "figure things out and talk…let them struggle." Wiley did say that they would jump in if they heard something wrong to "redirect" students, but that they were not as "hands-on" as they used to be (LA, Interview, Fa20_3). In Wade's class, Wiley felt that they took the opposite approach, asking students several questions to get them engaged. Wiley explained that they adopted this

position because students in Wade's class would often say they did not have any questions, and then expect Wiley to leave. Later in the interview, Wiley elaborated on these differences. They said:

> One thing that's stuck out to me in Wren's class is…I guess it's that [they play] more of the authoritative role where [they're] going in, like, "Hey, make sure you guys are discussing this" and stuff like that. Where I'll just look at what they're doing and look at their work and just let, I guess in a way I let them get away with being quiet a little bit more. And so, and not that that's a good thing. I think that I could definitely take that role of pushing them more. But I think my role has, I've kind of fell [sic] back more into just helping them with the math and with what the content of the discussions, where [Wren] kind of carries that role of making sure that the discussions are happening, period. And then in Wade's class, I think as far as like when we're both in breakout rooms, I think we both take that same role…. (LA, Interview, Fa20_3)

Thus Wiley perceived themselves to be more lenient with Wren's students in terms of encouraging students to discuss with one another. Wiley later explained that because Wren was constantly asking students to talk with one another, they felt that it would be "too much" also to be "pressing them" (LA, Interview, Fa20_3). In contrast, in a "class like Wade's," Wiley felt it was necessary for both Wade and themselves to "be constantly reminding" students to discuss with one another (LA, Interview, Fa20_3).

Subcase Summary

In Wiley's case, differences in class sizes, classroom norms, and the modality of the course all contributed to variations in how Wade and Wren viewed Wiley, and to

what extent these perceptions aligned with Wiley's perception of themselves. This is evidenced by the struggles Wren faced when more students started attending class online. In general, Wren seemed to be more confident than Wade in their awareness of how Wiley interacted with students, but Wren also had the benefit of seeing Wiley interact in person for the first part of the semester. When that dynamic changed, as Wiley increasingly supported students on Zoom, Wren struggled to balance their desire to interact with all students at every session, and their respect for Wiley's interactions with students. In short, Wren struggled to know how those online conversations progressed and when it was appropriate for them to enter the conversation.

Wren, Wade, and Wiley also had different perceptions of how students responded to Wiley. Wade expected that some students would gravitate toward Wiley rather than the instructor because of Wiley's status as an undergraduate student. Further, they described this as something unique and beneficial that Wiley was able to bring to the classroom, expecting that some students would be more comfortable around Wiley. But Wiley felt differently and retold conversations with students to support their belief that some students saw them as a graduate student more than a peer. Wren also doubted how much students viewed Wiley as a peer. They brought up attributes about Wiley to support their perception - describing how Wiley was an older student who had taken several advanced mathematics courses. However, although Wiley did not position themselves as a peer support, they did believe that at least some of the students in Wade's class perceived Wade to be more of an authority figure and thus were less likely to interact with Wiley when prompted by Wiley to engage. Thus, Wiley describes their lack of authority as a hindrance to their instruction rather than a benefit, as Wade described it.

Wren also perceived Wiley to have less of a rapport with students than themselves due to their belief that Wiley only discussed math with students. This may also be a consequence of Wiley's decision to take a more backseat role in Wren's class toward the end of the semester. Wiley saw Wren's constant efforts to encourage student-to-student discussion as being sufficient and therefore did not feel as strong of a need to fulfill that responsibility as they did in Wade's class, in which student engagement was concerningly low. Wren's perception of Wiley also reflects the goals and priorities that Wiley shared in their interviews: Wiley had goals for students' understanding and appreciation of mathematics but did not have goals related to personally developing a relationship with students.

Subcase of Jessie

Jessie, as a subcase, was chosen to showcase three main things: (a) some LAs are well aligned with their instructor, including in their perceptions of the LA role (b) although several LAs had content-specific goals, some LAs had goals about students affective experiences and building connections with students and (c) LAs often struggled to know when to provide support and when to let students figure things out on their own.

Like Wiley, Jessie was a senior mathematics student with a double major: a major in mathematics and computer science. Jessie became a LA in fall 2019 and so had a year of experience as a LA in the same course they supported in fall 2020. Jay was a second-year GSI and first-year instructor of record. Thus this was their first time working with a LA. Their case is notable for the high degree of trust in their partnership due to Jay's early efforts to monitor Jessie, as well as Jessie's prior LA experience and approach to teaching. Similar to the prior section, I start by providing a rich description of Jay's

classroom before elaborating on how Jay perceived Jessie's teaching, in particular their interactions with students. I then introduce how Jessie viewed their interactions with students and highlight key characteristics of their teaching that exemplify some of the themes found in data about LA goals and actions.

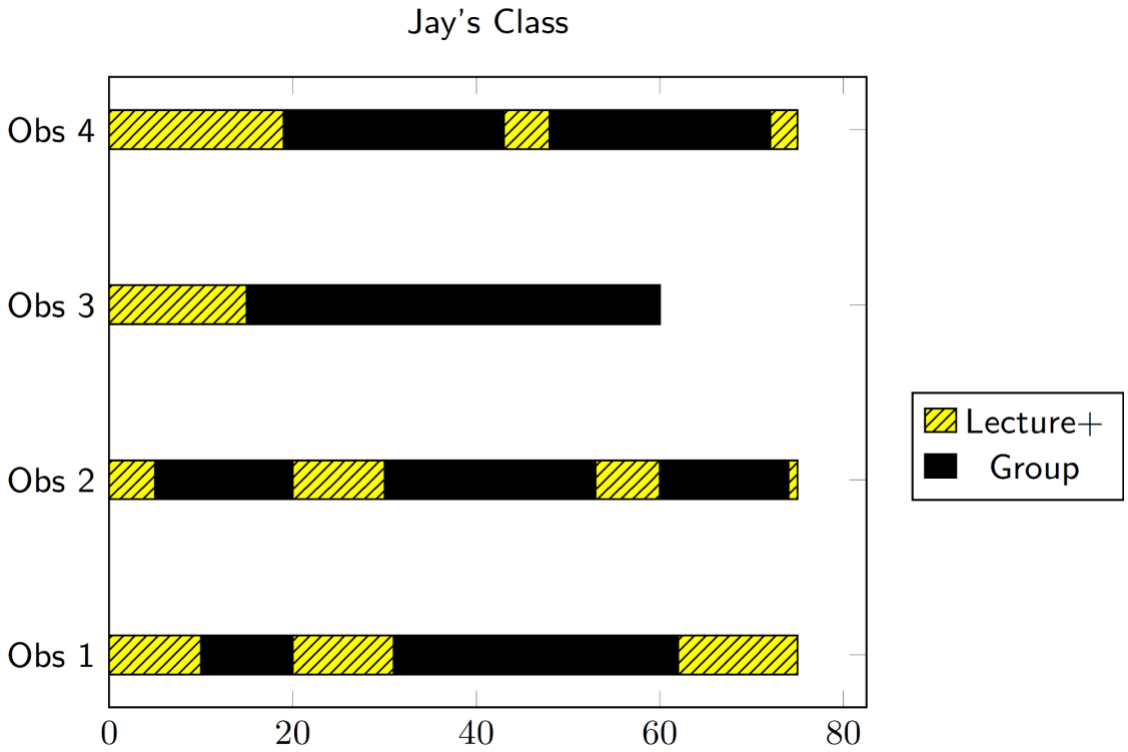
There were typically between 25 and 30 students on Zoom during my observations of Jay's class. Class periods varied from 60 to 75 minutes (depending on the day). I observed three 75-minute classes and one 60-minute class. Due to expectations set by Jay later in the semester, a comparatively large number of students kept their cameras on during class - at the beginning of the semester it was, as Jessie described it, about "half and half" but by my final observation most students had their cameras on during the breakout rooms. The classroom alternated between lecture and breakout room time (see Figure 15). During breakout rooms, Jay assigned a subset of the workbook problems for students to work on. In my initial observations, Jay was in class with a subset (expected to be one-third of a ~40-person class, in reality about 3-5) of the students, while the remaining students were expected to attend on Zoom, which Jessie monitored. Frequently, as the semester progressed, Jay would have all students attend via Zoom. I asked Jay and Jessie how typical these observations were, and they found the observations to be fairly typical. As such it can be inferred that students spent quite a bit of time in breakout rooms during Jay and Jessie's class.

Jessie was typically in charge of Zoom management and had significant responsibilities to support students on Zoom (which was the majority of the class). Although Jay also checked in on Zoom breakout rooms as they could, this left Jessie, like Wiley in Wade's class, with the overwhelming duty of managing several student groups.

Jessie would communicate about student progress to Jay via a spreadsheet, and they also had regular meetings in which they would discuss student progress. During these meetings, Jay often gave Jessie positive feedback on the actions they took in class, including their communication through the spreadsheet. Jay specifically asked Jessie to provide commentary on how students interacted with one another (e.g. if they were working individually vs. together, comparing answers vs. having a thoughtful discussion).

Figure 15

Class Times for Instructor Jay (working with LA Jessie)



Jay's Perceptions of Jessie

Jay constantly positioned Jessie as an instructor. For instance, Jay said it was typical for Jessie and Jay not to "cross paths" during class, which Jay found ideal in ensuring that the "instructional attention" was not being "devoted to one spot"

(Instructor, Interview, Fa20_2). The use of the phrase "instructional attention" by Jay positions Jessie as someone who was providing instruction of some kind. More explicitly, Jay described Jessie as a "second instructor, in the sense of managing groups" (Instructor, Interview, Fa20_3) and, in their initial interview, said, "My LA has a really good teaching instinct" (Instructor, Interview, Fa20_1).

Jay trusted Jessie and believed that they adhered to the instructional philosophy of the class:

> I know that my LA is not going into rooms and just giving students answers, right? That my LA is not undermining the structure [of the course]…Because the LA has so much influence and so much direct contact with all of my students, I really think that it's super important for me to be effective, that my LA's approach and philosophy aligns with my own, at least in practice, if not necessarily in belief. (Instructor, Interview, Fa20_1)

This was important to Jay, who hoped to treat Jessie as a "colleague" (Instructor, Interview, Fa20_1) and a "peer" (Instructor, Interview, Fa20_3) outside of class while maintaining a "unified front" during class (Instructor, Interview, Fa20_1). The quotation above also demonstrates Jay's recognition of just how much contact Jessie had with students. Although Jay said, "It's my responsibility to make sure that groups aren't being left behind," Jay depended upon Jessie to know which groups were falling behind. As such, the main responsibility Jay expected of Jessie was "to make sure that the groups that are online are progressing through the material and are not lost" (Instructor, Interview, Fa20_1). Given how many students were online, this meant that Jessie had a significant load of the instructional responsibility. Although, over time this lessened as

Jay moved more class sessions fully online and consequently was able to monitor online groups more easily.

Despite holding more sessions online, in the final interview, Jay still thought that their students interacted more with Jessie than themselves. They said:

> I feel like [Jessie] still probably interacts with the students a little bit more than me - has a little bit more of a casual teacher-student relationship than I do because when I go in there's definitely a "oops, teacher's here" kind of reaction. (Instructor, Interview, Fa20_3)

Thus, Jay felt that students interacted more formally with them than with Jessie.

Jay's Awareness of Jessie's Actions and Teaching

Jay's awareness of Jessie's actions in class was atypical for an instructor. Unlike other instructors (several of whom were mentioned at the beginning of this chapter), Jay intentionally observed Jessie working with students in breakout rooms "a couple of times" as well as asked "the students how [Jessie] worked with them." After these appraisals, Jay felt "fairly comfortable with [Jessie's] style," stating that they no longer felt "the need to babysit my LA, I trust [them] and let [them] work" (Instructor, Interview, Fa20_1). This was consistently reinforced by the communication between Jessie and Jay, as Jessie often acted as a liaison to provide Jay with needed information about student progress. Throughout the semester, Jay continued to speak positively about their relationship: "I had such a great experience with my LA because [they were] someone who didn't need a lot of oversight and management." (Instructor, Interview, Fa20_3).

Jessie as Teacher

In the following sections I share how Jessie positioned themselves as a teacher in interactions with students by describing how Jessie facilitated student progress on workbook problems and adapted their instruction to support students' progress. I also describe the broader goals Jessie had for these interactions: supporting students' abilities to make connections across content and independently problem solve, as well as supporting students in having positive experiences at the university in general (and mathematics in particular).

Jessie as Facilitator

Jessie used a variety of teaching actions to facilitate students' progression on workbook problems, including inviting student contributions (e.g., probing for the next step in a problem, waiting for a student response), providing direct instruction (e.g., walking through an example or part of a problem, providing information), and giving feedback (e.g., evaluating students' answers).

When asked to describe a typical interaction with a group, Jessie said that they would either immediately answer questions students have or check-in (e.g., by asking questions like "Hey, how's it going?"; LA, Observation Notes, Fa20_4) and give students time to respond about their progress on the problems or discuss their confusion. Jessie typically waited "for a couple of students to tell" them about the group's progress, which would then sometimes prompt "students into saying 'well, I'm not sure about this. Can we talk about it?' (LA, Interview, Fa20_2). Jessie would frequently prompt further conversation by asking students for their answer or approach to solving a problem.

Sometimes Jessie seemed to be working one-on-one with a student, yet I often observed Jessie end an interaction with a student group by asking questions like “Does everyone understand how we did that?” and waiting to give other students in the group time to ask clarifying questions (LA, Observation Notes, Fa20_2). Further, when checking in with groups, Jessie used plural pronouns (e.g., “How does everyone feel about logarithms?”; “Where are we at?”), which helped to establish an expectation that students should be progressing as a group (LA, Observation Notes, Fa20_2). In one instance, a student asked Jessie a question and Jessie replied by asking another student in their group to explain their answer (LA, Observation Notes, Fa20_2).

I observed several instances in which students would ask Jessie to walk them through a problem or part of a problem. Jessie did go through problems with students during my observations, although they also prompted students’ contributions by asking students for the next step in a solution process (“Anyone else [have] the next step?; LA, Observation Notes, Fa20_3). I also witnessed Jessie choosing to go through problems that were not assigned by Jay rather than helping students through the particular problem they requested. For example, when students in one group found the task in Figure 16 to be challenging and asked Jessie to walk through how to solve one of the parts of the task, Jessie specifically stated that they chose to discuss parts b and f because those were not assigned, thus reinforcing that students should be solving the assigned parts on their own (rather than receiving answers from Jessie).

Figure 16

A Logarithm Problem with Multiple Parts

Problem 1. Evaluate the following.

(a) $\log_3(1) =$ _____

(b) $\log_2(4) =$ _____

(c) $\log_3(81) =$ _____

(d) $\log_{10}(100) =$ _____

(e) $\log_{10}\left(\frac{1}{100}\right) =$ _____

(f) $\log_7(7^{3.2}) =$ _____

Students often checked their answers with Jessie who would verbally affirm their correctness ("Yep, sounds like what I got") if the students got it right or gently guide students if they got it wrong ("You're close," "You're on the right track," "You're half right"). On occasion, Jessie would ask students to explain their reasoning, even if their answer appeared to be correct. From my perspective, it appeared that Jessie was more likely to probe for students' reasoning when their rationale for their answer was not clear or if the problem was what Jessie called a "tricky problem." As an example, in one breakout room, Jessie listened to three students discussing a matching activity (see Figure 17). They were mostly checking their answers with one another. Jessie eventually chimed in, saying that while Jessie thought they "have it," Jessie wanted to discuss some of the parts because they were kind of "tricky." One of the students pushed back, asking Jessie if they got the problem right, to which Jessie responded that yes, they did, but Jessie wanted to "go through the reasoning." Given that this was a matching activity, it is likely that Jessie wanted to make sure that students were not just eliminating answers but rather that they understood why two expressions were equivalent using properties of logarithms.

Figure 17

A Matching Logarithm Task

Problem 1. Match each expression on the left with its equivalent expression on the right for $A, B > 0$.

$\ln(AB)$	$\log(A^{3t})$
$\log\left(\frac{A}{B}\right)$	$\ln(A) + \ln(B)$
$\log(A^2) - \log(B)$	1
$t\log(A^3)$	$\frac{\ln(A)}{2}$
$\log(1)$	$2\log\left(\frac{A}{\sqrt{B}}\right)$
$\ln(e)$	0
$\ln(\sqrt{A})$	$\log(A) - \log(B)$

Jessie also often acted as a scribe for groups by writing on their tablet and sharing it with the group virtually. They found it useful to use the tablet to clear up explanations they provided, as well as clarify what students were doing: "We could go one step at a time and they could tell me so I could write it down and we could all see it" (LA, Interview, Fa20_3). This was especially helpful given the mode of the course: "Being online, it's really difficult to share work. I can't see what they're working on and it's kind of difficult to explain math in words sometimes" (LA, Interview, Fa20_3).

All these actions supported students in progressing through the workbook problems that Jay assigned during breakout room time. These types of interactions are common actions for LAs who facilitate group work: several of these actions appear in the Action Taxonomy for Learning Assistants (ATLAS; Thompson et al., 2020).

"Keeping an Eye on Things" and Seeing Content through "Multiple Angles"

Jessie felt a sense of responsibility to support Jay by "keeping an eye on" progress in the breakout rooms and making "sure that students know what they're doing when

they're in Zoom two-thirds of the time" (LA, Interview, Fa20_1). Thus, at multiple times during our interviews, Jessie positioned themselves as a partner instructor, and in particular a liaison between Jay and the students. As mentioned in Chapter 4, Jessie also positioned themselves as a duplicate instructor by focusing on aligning their instruction with Jay. During lectures, Jessie would pay attention to how Jay taught to use similar wording and approaches when discussing content with students. Jessie said:

> There'll be times where we'll break out into rooms right away and I'll kind of explain something one way, and then when we come back together, [Jay] explains it in a different way. So I try and keep an eye on that, just so I don't keep explaining it the wrong way twice. (LA, Interview, Fa20_1)

Yet, Jessie also described the importance of being adaptable to students' needs by approaching a problem from "multiple angles:"

> Sometimes we get to the problem and we'll start explaining it one way and they just are really confused, and sometimes, "okay, this isn't working, let's try something completely different." (LA, Interview, Fa20_1)

In one observation of an interaction between Jessie and a student, Jessie explicitly told a confused student that they would show them an alternative way to solve a problem (in particular, to identify the long-run behavior of a function). The student indicated that they understood how to solve the problem after Jessie shared their alternative approach, and Jessie reiterated that either of the two solution methods (Jay's or Jessie's) would work (LA, Observation Notes, Fa20_4). Thus, Jessie may have prioritized aligning their instruction with Jay's, but when students struggled, they were willing to offer students new ways of looking at content to support their thinking. It is of note that Jessie had prior

experience supporting this course as a LA, so perhaps they were better positioned to offer multiple ways of thinking about content.

Jessie's Focus on Making Connections

During my first interview with Jessie, they shared an explicit goal for students: that students would "understand the overall concepts…just how to approach each problem" (LA, Interview, Fa20_1). Jessie later elaborated that they wanted to support students in understanding one of the main themes of the course: functions. Jessie hoped students would be able to, given any type of function from the course, notice features about that function (e.g., slope, intercepts, long run behavior). To this end, Jessie helped students retain old content by focusing on identifying "pieces of old problems to make sure that we're continuously bringing back the old stuff" (LA, Interview, Fa20_1).

I observed Jessie making connections to prior content or prior problems multiple times. In one instance, during my fourth observation, Jessie was helping students understand the definition of a rational function to solve a multi-part problem (see Figure 18). Students were struggling to correctly identify the function in part (a) as a rational function. Jessie asked students for the definition of a rational function, to which a student replied that it involved two polynomials. Jessie, as was typical of their response to students, affirmed the student's contribution, but then provided a bit more precision ("a polynomial divided by a polynomial"). However, this did not seem to help students solve part (a). Jessie reminded them of the definition of a polynomial, which did not move the conversation forward, so Jessie pivoted by introducing a concept students were more familiar with: rational numbers. Jessie asked, "Can we write 2 as a fraction?" A student responded with "2/1" which led Jessie to say "Let's do the same thing with 2x^3+7. Now

is (2x^3+7)/1 a rational function?" Students still said no, because they did not recognize 1 as a polynomial. Jessie again affirmed students' thinking ("That's a good thought") and asked for input from other students "Anyone else have any thoughts?" When no one responded Jessie said, "It's a little tricky, what if I rewrite it as 1x^0?" At this point, students understood that 1 is indeed a polynomial, and so part (a) satisfied their definition of a rational function.

Figure 18

Rational Functions Task

Problem 2. Determine whether the following functions are rational functions. If so, write them in the form $p(x)/q(x)$, where p and q are polynomials.

a) $f(x) = 2x^3 + 7$

c) $f(x) = \dfrac{x^2}{2-x} - \dfrac{1}{x-2}$

b) $g(x) = \dfrac{2^x + 1}{2^x - 2}$

d) $g(x) = \dfrac{\sqrt{x} + 3}{\sqrt{x}}$

"Jumping in" vs. Letting Students "Figure it Out Among Themselves"

By discussing moments in which they felt proud of their interactions with students, Jessie shared a goal of having students participate. Jessie said:

> So, it's always really cool when you finally get a group of students to, like, really open up and to participate with you. And like, during the first few weeks, everyone's a little closed off. Cause you don't know anyone and they don't know you. And it is just a weird situation. But I've had a good semester so far; every once in a while, I'll have a group that's like just suddenly, okay. "Yeah, now we get it. And we're going to participate now." (LA, Interview, Fa20_1)

Jessie supported this goal by encouraging participation when it happened. Jessie would answer questions as soon as they could, saying that it was important that students did not think Jessie was ignoring them, and gave students constant positive reinforcement (LA, Interview, Fa20_1). However, this also was a point of tension in Jessie's work. It was clear from interviews that Jessie wanted students to learn to be independent problem solvers. Jessie described feeling "always worried" about "jumping in a little too quickly" when students were working (LA, Interview, Fa20_2). They said that they did not want to "answer everything" for students but that it was challenging to figure out students' progress online and give appropriate support. Jessie combated this challenge by waiting and listening to students' conversations before offering support:

> So when I would join a breakout room I usually try and listen to the discussion and see, "Are they talking, are they really confused? Are they just working?" And if it sounded like there was an issue where they were confused, I'd try and give them a few minutes to see if they could figure it out among themselves. Because sometimes other students will jump in and be like, "Oh, well actually I think this is how it works." And I don't want to interrupt that. If there's just a lot of confusion or if it's just…a question is met with just complete silence, that's usually when I would try and jump in. And then I start by trying to ask a question, I guess, to try and get things moving. And if that didn't work, then I'd pull up the whiteboard and try and get a few more students involved and help them see where things are going. (LA, Interview, Fa20_2)

This quotation demonstrates that Jessie valued student-to-student interaction (not wanting to interrupt it), but was ready to support as needed, typically in the form of acting as a scribe and facilitator for the group.

Following the Students' "Track"

Jessie believed that the more students were able to ask questions in class, the more successful they would be. Although Jessie prioritized answering student questions, Jessie scaffolded their support:

> Usually, what I try and do, if they have a question on the problem, I try and get them, especially if they've gotten stuck somewhere, try and get them to go back a couple of steps and usually they're on the right track. And so, I tell them that they have the approach right. "Here's a tricky step - let's talk about it. There you go." In a lot of cases, the students seem to kind of know what they're doing, but they aren't sure that they know what they're doing.

In this quotation, Jessie described supporting students in finding their own mistakes and correcting their solution path. Jessie also demonstrated a belief in students' capabilities, despite their own lack of confidence in their knowledge. Thus, Jessie positioned themselves as someone who supports students by reassuring them when they are "on the right track."

Jessie also positioned themselves as adaptable, willing to tailor their teaching strategy for the group. Although Jessie supported students to problem solve independently, at times they would offer more direct instruction to support groups that were facing major difficulties progressing on a problem:

Jessie: I've seen some groups that are really good at working individually and they just want like, "here's how you take step one" and then they can just run with it. And I've seen other groups that really want to see a bunch of examples worked out before.

Rachel: And so how does your approach vary based on that? So in the situation where you have groups that are working well individually, in the situation where you have groups that want to see a bunch of examples, does your approach to working with those groups change?

Jessie: To some degree, if they seem to be working really well individually and are just stuck on, "Okay, how do I go from this step to this step?" I usually try and just give them a little hint, just so they kind of get to that next step. And then usually after that, they just sort of keep going and I'll monitor it for a little while just to make sure. But if they seem to have it all, I'll just sort of let them go with it. If it's - sometimes I'll get groups where the students are just like, "Yeah, I just don't know how to do this." And then I'll try and either work through a workbook problem with them or find an example that's similar and just try and go over the approach and major concepts with them a couple of times.

Thus, Jessie tried to scaffold their support of student groups and be adaptable to their perception of what students needed.

Being "Someone in their Corner"

Jessie also hoped students would become "more comfortable" with university courses (mathematics in particular), and for students to see Jessie as a resource on which they could rely. Jessie said:

> I know it - being a really weird year, I just hope that they would walk away from the class without it negatively affecting their view of math or university classes in general since online classes can be difficult. And so I was hoping that they'd at least have a good experience with it, and they'd have their questions answered and they would have someone who was in their corner helping them out. And they would know that. (LA, Interview, Fa20_2)

It is possible that Jessie's goals evolved over the course of the semester due to seeing the impact of COVID on students or perhaps by experiencing their own difficulties with online courses.

Jessie positioned themselves as a resource in multiple ways during the classes I observed. Jessie frequently made positive remarks on how students were doing, for example, by providing enthusiastic feedback when students got an answer correct or provided an accurate explanation of their answer "Yes, well done!" (LA, Observation Notes, Fa20_4).

Although in this chapter I focus on interactions during class, it is of note that Jessie said that there were "not a whole lot" of interactions between them and students outside of class because "they're supposed to reach out to Jay if they have questions on homework." Despite this, in my first observation, I overheard an exchange with students that suggested students sometimes reached out to Jessie with concerns about the class. In

that instance, one student was discussing a lack of communication with the instructor Jay about a particular assessment, to which another student replied that they should email Jessie so that Jessie could communicate with Jay. In this instance, the students very specifically positioned Jessie as a liaison between them and the instructor. This episode demonstrates that some students in the class did view Jessie as a reliable resource, as Jessie had hoped.

Jessie as Not a Teacher

There were also times when Jessie specifically positioned themselves as not a teacher. At times, Jessie would clarify a task for a student by using language like "Ok, *they* [emphasis added] want us to say the long-run behavior of top, bottom, and the whole thing" (LA, Observation Notes, Fa20_4). Similarly, Jessie would sometimes provide commentary on how the workbook problems were connected: "I think this is why *they* [emphasis added] gave you problem…*they* [emphasis added] want you to combine them" (LA, Observation Notes, Fa20_4). By referring to the workbook authors as "they," Jessie positioned themselves more in a peer-like role with the student. Jessie, alongside the student, was trying to interpret the intentions of the workbook authors. This arguably positions Jessie as not a teacher, because in a typical teacher/student storyline the teacher is aware of the intentions of a problem or task and would be expected to use first-person language when clarifying an activity.

Subcase Summary

Jessie and Jay had a high level of trust and respect for one another. Jessie strived to align their approach with Jay's teaching, although they also perhaps drew from their prior experience as a LA for the course to offer multiple perspectives on content when

students struggled to understand methods presented by Jay. Jay's trust in Jessie was predicated on their perception that Jessie taught using active learning methods. Indeed, Jessie cared about student understanding, peer to peer interactions and tried hard to encourage student participation - consistently being vocal and encouraging as students worked on problems. Yet, Jessie often struggled to know how to scaffold their support, particularly in knowing when it was appropriate to jump in and when to let student groups progress on their own. Jessie also positioned themselves as someone who was in the students' corner, who cared about students' sense of comfort and belonging at the university.

Discussion

Despite the appreciable time that LAs spent with students, a prevalent theme in speaking with instructors was a general unawareness of what the LA was doing during these interactions. This is potentially a barrier in supporting meaningful partnerships between LAs and instructors, as it obscures how LAs are interacting with students, the challenges LAs may be facing in these interactions, as well as the benefits LAs bring to an active learning classroom.

In this chapter, I presented two subcases of learning assistants to illustrate how and perhaps why awareness perceptions of LA-student interactions may differ between instructors and LAs. These subcase analyses also reveal ways in which LAs may think of themselves as instructors by foregrounding their goals for and actions during interactions with students, which have strong parallels to the goals and actions you might expect from an instructor in an active learning setting. Wiley's case demonstrates how different

instructors working with the same LA may have markedly different perceptions of that LA and further that these perceptions may differ from the LA's own perceptions.

Some of the reasons for differences in perceptions include classroom structures and the instructor's own experience and goals for students. Furthermore, there is evidence that LAs adapted their instructional approaches based on roles they thought the instructor was fulfilling. Wiley thought that Wren's efforts to ensure students were talking with one another were good enough for their class, and so did not themselves take on the duty of encouraging peer-to-peer interaction. Yet, in Wade's class, they felt they did need to encourage such interactions. Wiley is also interesting as a subcase because they demonstrate that despite being an undergraduate student, some LAs may be perceived more as a graduate student than as a peer-like, complementary instructor. Furthermore, Wren viewed Wiley as less personable with students than themselves, suggesting that LAs are not necessarily the more relatable instructional figure in the classroom. Wiley's case was also chosen to highlight one of the main themes when analyzing the larger corpus of data for LA goals: namely, the focus on students' understanding of content. This is also reflected in Jessie's priorities. Jessie's case highlights another central theme: LAs' desire to be someone that students had in their corner. Jessie often encouraged students by affirming their ideas and seemed to be viewed by some students as a valuable, friendly resource. Jessie's subcase also represents an instructor-LA relationship built on substantial trust. Jay felt very aware of their LA's interactions with students, and so felt comfortable letting Jessie take a leading role in interacting with students.

CHAPTER 6: STUDENT PERCEPTIONS OF INTERACTIONS WITH LAS AND INSTRUCTORS

In this chapter, I address the following research questions *RQ3a: How did students in active learning precalculus classrooms describe their interactions with LAs compared to their interactions with the instructor?* and *RQ3b: Why might students have preferred to interact with either the LA or the instructor?*

In fall 2021, all students in mathematics classes supported by learning assistants (LA) were invited to take a modified version of the SPIPS-M survey. In this survey, students were asked to directly position LAs in relation to instructors by answering the question: *Do you interact differently with [the instructor] than [the LA]? If so, please explain.* For this chapter, all student responses to this question were collected and analyzed. Their responses provide insight into how students understand the LA role and its relationship with the instructor's role. Students were intentionally asked to comment on interactions with the instructor and the LA, as people are positioned in interactions with others, and thus my hope was that this would encourage students to share how they position LAs in instruction and thus give insight into how they understand the LA role. By asking students to directly compare interactions with the LA and with the instructor, I also hoped to interrogate how the LA's role differed (or not) from the instructor's role in the classroom. As described in prior sections, the instructors were all graduate students (GSIs).

In the first section, I describe an explorative analysis of the data, mainly using code frequencies, to demonstrate that a large number of students (n=196) felt they interacted with LAs and instructors similarly and thus positioned them in similar ways. In

this section, I also use code frequencies to provide evidence that students' perceptions may vary dramatically based on the classroom in which they are enrolled. However, the use of code frequencies does not account for why variations in perceptions existed across different sections or classes of a course, nor why an equally large number of students (n=194) positioned instructors and LAs differently.

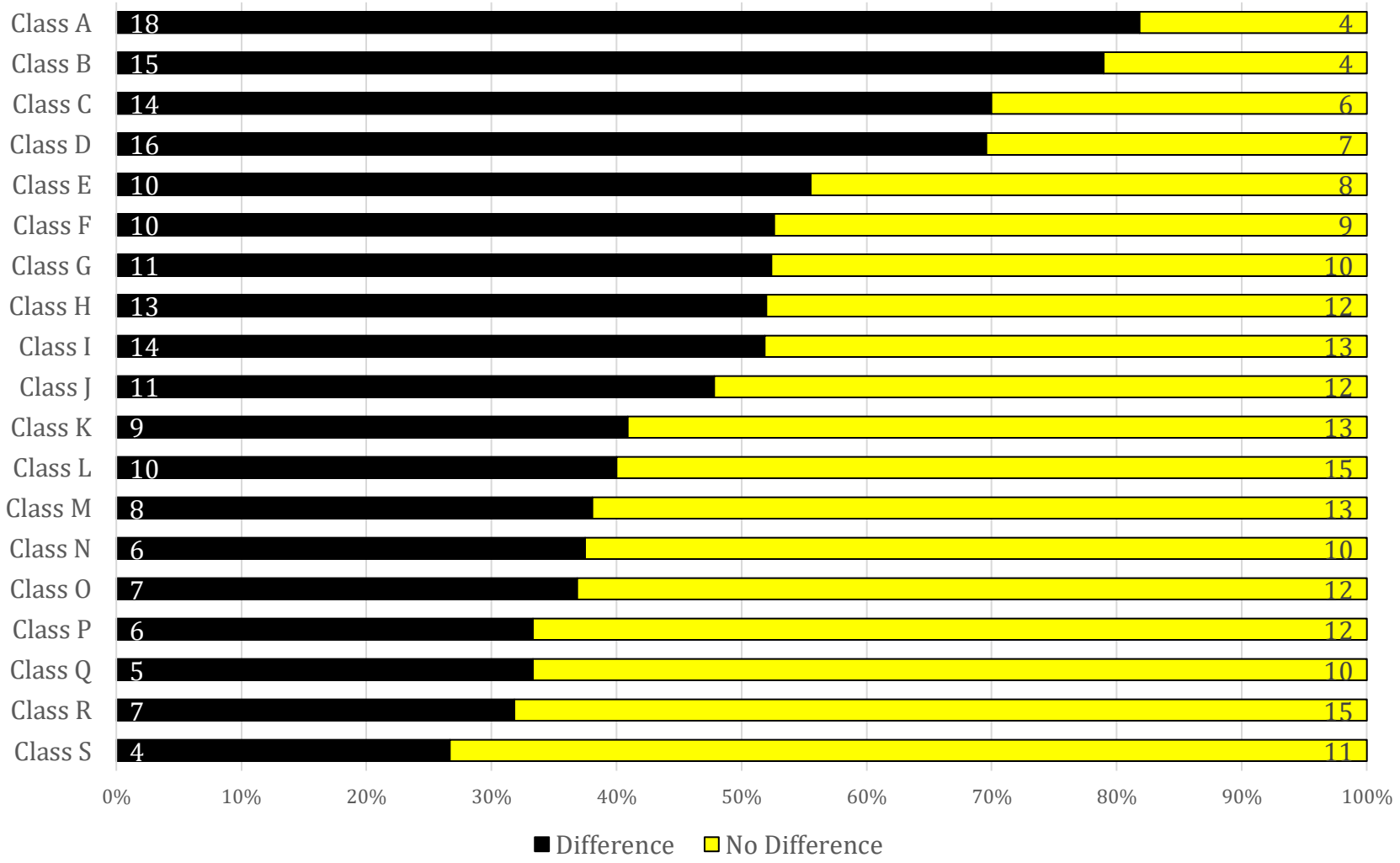
In the second section of this chapter, I address this, using Positioning Theory as a lens to understand how students locate LAs in instruction. Through these analyses, I argue that students positioned LAs along three storylines: (a) *LAs and instructors only differ superficially, and thus have the same duties in interactions with students,* (b) *LAs and instructors have the shared duty to make interactions comfortable for students by having an inviting disposition, and teaching content well,* and (c) *LAs and instructors have different duties in instruction*.

Exploration of the Data

In total 390 responses to the question "*Do you interact differently with [the instructor] than [the LA]? If so, please explain.*" were classified either as "Difference" or "No Difference" and included in subsequent analysis (see Chapter 3 for more details). Responses were split close to equally between "Difference" (n=194) and "No Difference" (n=196). Comparison within the courses (College Algebra and Precalculus) resulted in similar results: "Difference" responses accounted for 49% and 51% of responses, respectively. However, there was a wide variation when comparing by instructors, from a low of 27% of responses coded as "Difference" to a high of 82% (see Figure 19). Out of the 19 classrooms included in this analysis, nine had 27-41% of "difference" responses coded, while ten had 48-82% of responses coded with "difference."

Figure 19

Differences vs. No Differences in Student-Instructor and Student-LA Interactions: By Classroom



The descriptive analysis of data represented in Figure 19 suggests that the course in which students were enrolled influenced how they answered this question, and thus how they perceived differences in interactions with the LA versus the instructor. To explore this further, I started by reading through responses from students that indicated there was a difference in how they interacted with the instructor versus the LA (classes with "Difference" responses in the range of 48-82%). In this analysis, I realized that students often shared a preference for working either with the LA or the instructor. For each of the "Difference" responses, I then recorded whether the student expressed a preference to interact with the LA or instructor, marking responses that were unclear or that identified some other factor as "other" (see more details about methods in Chapter 3). The results from this analysis are represented in Figure 20.

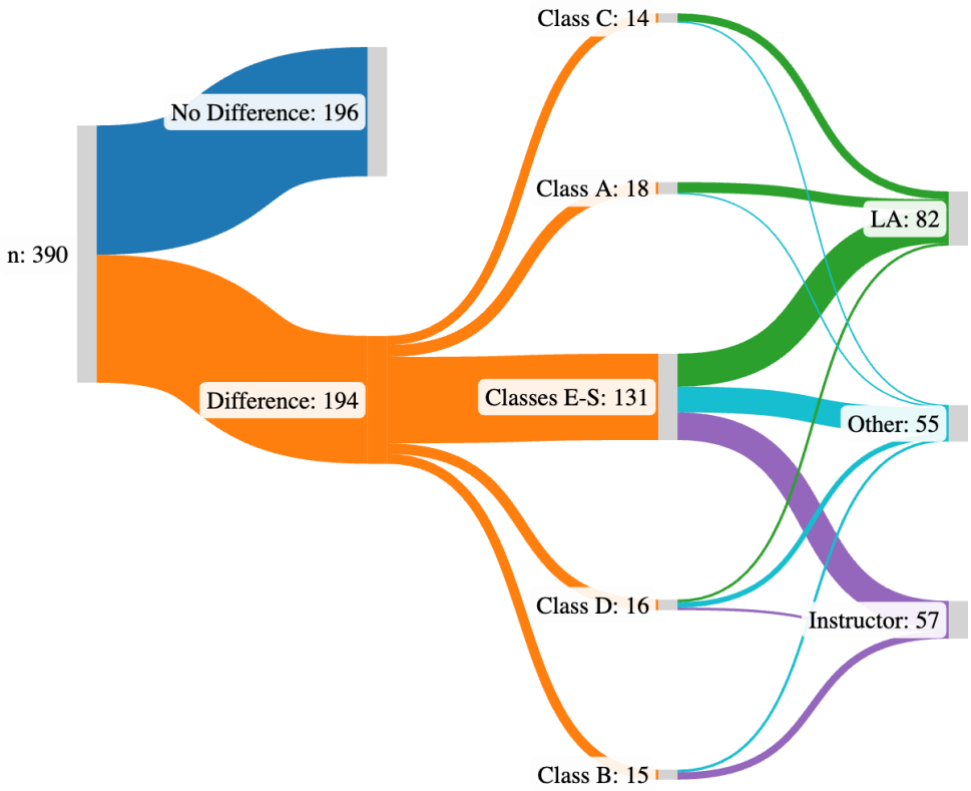
I chose to highlight Classes A-D, as they represented the highest percentage of students who perceived a difference in LA-student and instructor-student interactions (70% to 82%), and further, there was a noticeable percentage gap between Class E and Class D. I use noticeable in a semi-quantitative sense, in that the gap was 14%, which was the largest gap in percentages across courses. Classes A-D demonstrate different patterns of preference that can occur, which I describe next.

Although several students in Class D identified a difference in interactions between LA-student and LA-instructor interactions, further analysis suggests that students did not have a collective preference for interacting with either the LA or the instructor. In fact, four students preferred to interact with the LA and four students preferred to interact with the instructor. Eight students identified a difference in interactions but did not express a preference. Some of these "Other" responses included

being physically closer to either the LA or the instructor or being approached by the LA or instructor more frequently. In contrast, for Class C, 12 out of 14 students who identified a “Difference” preferred the LA, and for Class A, 16 out of 18 students who identified a “Difference” preferred the LA. Thus, Classes C and A both demonstrated a strong preference for the LA. Class B demonstrated a strong preference for the instructor (11 out of 15 students who identified a “Difference” preferred the instructor).

Figure 20

Sankey Diagram of Code Counts



Collectively, these analyses demonstrate that one cannot assume that students will prefer interacting with a LA versus an instructor, or vice versa. Given that one of the

rationales for including LAs in the classroom is that they provide a different, unique role in the classroom, it is useful to explore this further. In the next section, I use Positioning Theory to share how students in active learning classrooms described their interactions with LAs compared to interactions with the instructor. In particular, I present three major storylines students used to describe their interactions with LAs and instructors.

Before presenting these storylines, I do note that some of the differences students perceived seemed to come out of implicit bias toward instructor gender identity or instructor appearance. For this chapter, I focused on responses about instruction.

Identified Storylines, Positions, and Duties

Storyline 1: LA ≅[7] Instructor

In this section I present evidence of one of three prevalent storylines in the student data: *LAs and instructors only differ superficially, and thus have the same duties in interactions with students*. Some students indicated that the only difference between their interactions with the LA versus the instructor was due to incidental factors (17 out of 194 "Difference" responses). For example, one student said that "I interact with them [the LA and instructor] the same, I just seem to talk to [instructor] more." This student did not share a reason for why they talked to the instructor more, nevertheless, they thought their interactions with the LA and the instructor were the same. However, others said that factors such as proximity to their table influenced this frequency: "usually [LA] helps answer our questions first." One student said that they did interact differently, "just because [LA] sits closer to our table. [instructor] helps people on his side." Although this student did perceive there to be a difference in how they interacted with the instructor

[7] This is a symbol used in mathematics for "approximately equal."

versus the LA, their reason for this difference was tied explicitly to a somewhat random factor - their location in the classroom. Similarly, another student felt they did not interact differently because “they both seem like instructors so I ask either one questions if I have them, based off of who is closest.”

Like this student, some students from the “No Difference” responses specifically labeled the instructor and LA similarly, which in effect positioned the instructor and LA as occupying the same position (e.g., "No, I see them as both of my teachers who teach me the course material in and out of class,"No, I treat them both as my professor..."). Teacher, instructor, and professor were the most common labels in this group, but one student also referred to their instructor and LA as “guides” through “the journey of math class," and another student labeled them as “mentors” to help them learn.

This storyline calls attention to a group of students that did not perceive there to be any meaningful differences between the LA or instructor. However, these students did not provide enough information in their responses to glean the perceived, shared, duties of the LA and the instructor. The following storyline elaborates on these duties.

Storyline 2: LA ≅ Instructor: Emotions, Dispositions, and Teaching Quality Matter to Students

The second storyline I present is an elaboration of the first: *LAs and instructors have the shared duty to make interactions comfortable for students by having an inviting disposition, and teaching content well*. This storyline is a synthesis of three themes that I synthesized from the data: (a) the importance of emotions in students’ perceptions of their interactions, particularly feelings of comfort (b) the importance of students’ perception of LA and instructor dispositions and (c) the importance of perceived teaching

quality. By analyzing students' preferences (to interact with the instructor, LA, both, or neither) I connected these themes to the assumed duties and rights of the students, LAs, and instructors during interactions. This resulted in an overarching storyline: that LAs and instructors have shared duties, and these duties are to make students feel comfortable and to teach content well. In the following sections, I share student data supporting these themes.

Importance of Emotions

One of the main themes from an analysis of student responses was the importance of emotions in students' perceptions of their interactions. There were a total of 40 student responses related to this theme. Typically, students described how interactions with their LA or instructor felt, and in turn how that influenced with whom they preferred to interact. For example, one student said

> [instructor] *makes me feel more comfortable*[8] because she is engaging and friendly. She explains the answer and why the problem works the way it does. *She is encouraging and makes me feel like I can actually do the problem.* [LA] walks around and occasionally gives the answer. However she is not very clear, and does not explain her thought process. She is reserved and *does not make me feel confident in my answer.*

This student positioned their instructor as someone who is encouraging, engaging and friendly. As a result, this student felt more comfortable in interactions with their instructor than with their LA, who they positioned as reserved and not very clear in their explanations. Notably, the instructor made the student feel capable of solving

[8] Students could not format their responses, as such all italics represent emphasis added by me.

mathematics problems. In contrast, the student does not feel confident when working with the LA. Other students had similar sentiments but about their LA. One student shared how they felt "more *sure of my answers* and *more confident to ask questions* when speaking to [LA]." Another student shared the following sentiment:

> I *feel more comfortable* asking [LA] questions than [instructor] because he makes sure I understand the problem and how to solve it. [instructor] does make sure I understand it but the process she shows is usually longer or a bit more *confusing* than how [LA] teaches it.

This student felt more comfortable asking their LA questions because they perceived the LA to be focused on their mathematical understanding and in contrast found interactions with the instructor to be a bit more confusing and time-consuming.

This student was not alone; many students shared preferences for the LA or the instructor based on their perceived ability to support student understanding or instructional competence. For example, one student shared:

> I do interact differently, I feel that [instructor] gets confused when me or other tables ask her questions when we don't understand because *she expects us to know it* whereas [LA] fully explains everything and *feels easier to ask her*.

In this quotation, the student described interactions with the LA as "easier" than interactions with the instructor because the LA "fully explains everything" whereas the instructor "expects us to know it." Another student shared that

> [instructor] explains how a problem is done, while also *encouraging us to think about it more engagingly*. She is very encouraging and gives a *feeling of comfort because she does things just so well in general.* [LA] is a little less engaging, it is

> helpful that she comes to answer questions, however sometimes it is unclear as to how an answer is to be done.

In this case, the student felt comfortable working with their instructor because they perceived their instructor to be skilled. Similarly, one student said they were "more willing to talk to [instructor] about things" because they felt he was "more relatable and better at explaining what we are doing." Overall, these data suggest that students view it as their right to be comfortable in interactions with LAs and instructors.

Importance of Dispositions

Fifty-two students identified dispositions that an instructor or LA may have to account for differences or similarities in how they interacted with LAs and instructors. For example, one student said "No. They are both super friendly and motivating" to explain why there was no difference in how they interacted with LAs and instructors. The majority of these students described dispositions that promoted interactions. These were often connected to the agreeableness and extroversion of an instructor or LA (e.g., nice, personable, trustworthy, relatable, talkative, friendly, approachable) which directly impacts communication and one's ability to relate to students. For example, one student described their instructor as "more personable so it is easier to have a conversation with him."

However, students also shared dispositions that inhibited their interactions with either the LA or the instructor. These included dispositions likely to result in less communication with students (e.g., quiet, reserved) as well as traits that were likely to result in negative interactions (e.g., rude, complainer). Often students used antithetical dispositions to highlight differences between the instructor and LA:

> If I have a question about a problem that I really do not understand, I will ask [LA]. He takes the time to explain things and is *super helpful and patient.* [instructor] always seems like *they are in a rush* to get to the next table or does not understand/ listen to what you are trying to ask. In general, I interact with them the same way.[9]

This student preferred to interact with their LA because they viewed them as patient while describing the instructor as "rushed." Out of the 52 students who described dispositions of their instructor or LA, 41 also expressed a preference for interacting with either the LA or the instructor. Table 8 provides a complete list of the dispositions used to describe LAs and instructors when students also expressed a preference for interacting with either the LA or the instructor (note the count of this list will be higher than 41 because some students commented on multiple dispositions in their responses).

The dispositions students ascribed to LAs and instructors, and the connection of these dispositions to their preference for whom they interact, suggest that students view it as the duty of the LA and the instructor to be inviting as a way to create a comfortable atmosphere in these interactions.

[9] Note the last sentence of this quotation seems to contradict what is said earlier. I interpret this as the student perceiving a difference between how the instructor and LA interact with them, but not in how the student chooses to approach the instructor or LA. I discuss students' interpretations of this question more thoroughly at the end of this chapter.

Table 9

Dispositions Students Attribute to LAs and Instructors

Preference	LA Disposition	Instructor Disposition
LA	approachable (2) calm communicator easy-going engaging friendly (3) helpful (5)* kind patient less intimidating chill outgoing passionate personable relatable (3)	difficult to approach quiet rude rushed straightforward kind* helpful* passionate*
Instructor	complainer down to business less engaging reserved nice*	encouraging (4) engaging (3) friendly helpful nice easy-going helpful nice not personal but knowledgeable personable (4) talkative relatable trustworthy understanding (2)

Note. Each disposition was mentioned by one student response unless otherwise noted (n)

*Three students described both their LA and their instructor using similar dispositions (kind and helpful; passionate; and nice) while still expressing a preference for the other teacher figure. Preference was dictated by other factors, including the ability to understand explanations, one teacher figure's step-by-step approach to facilitation, and one teacher figure's more personable approach to teaching.

Importance of Perceived Teaching Quality

It was common for students to evaluate the teaching ability of their instructors and LAs when comparing how they interact with these teaching figures[10]. In sum, 101 students described the teaching quality of their instructor or LA. Students focused primarily on how the LA or instructor explained content and answered questions. Students also discussed the opportunities given to students to figure things out on their own and receive feedback, as well as differences in the knowledge of the LA and instructor.

Out of the 101 students who mentioned teaching quality, 61 responses focused on the ability of the instructor or LA to explain content or answer questions to support their understanding. Some students expressed a preference for interacting with their LA because they perceived their instructor's explanations to be non-direct or confusing. As an example, one student shared that their instructor's approach to student questions (answering questions by asking questions) was ineffective. In contrast, they perceived their LA to be more adaptable to their learning needs:

> Yes, I believe that both are good instructors however, *my interactions with [LA] are different because he takes my learning disability into account and bases his methods of teaching or explaining off of it.* No offense to [instructor], I think he is a good teacher and works very hard but I cannot learn efficiently or effectively with his style of teaching. *Every question that I have, he answers with a question*

[10] These evaluations reflect student perceptions of their interactions with instructors and LAs; however, I purposefully am not making any claims about the quality of the teaching by LAs or instructors involved in this study.

> *that I don't know how to answer*. I am sure that this works well for other students but it does not for me.

Another student stated that their instructor's focus on definitions and proofs made it difficult for them to learn, and as such they turned to their LA who they knew would "be able to explain it in a way I understand."

Many students commented on the depth of explanations. For example, one student shared that

> I have learned that [LA] gives more in-depth explanations to questions I have where [instructor] gives me short answers. When I raise my hand I hope that [LA] comes because I know he will help me more.

Similarly, another student said that their instructor "is a little rude and does not help explain stuff in-depth as [LA] does." Often students positioned LAs as someone who provided more thorough explanations, which they valued. Relatedly, some students remarked on the value of LAs going step-by-step through a problem:

> They are both very passionate about what they do the only difference is their approach to teaching. [LA] goes through everything step by step which sometimes early in the morning is helpful.

However, some students shared a preference for their instructor's explanations, often for similar reasons as those cited by students who preferred interacting with their LA. For example, one student remarked that they feel comfortable asking their instructor questions because of their thorough explanations:

> Yes, I feel comfortable asking [instructor] just because she has the answers, and not that [LA] doesn't I just like it when [instructor] explains it throughly [sic]

> rather than not explaining the problem and giving the answer by explaining quickly.

Another student described a preference for interacting with their instructor because of their focus on understanding “why the answer is the answer it is," in-depth explanations, and scaffolding:

> I feel a little closer to [instructor] and that he explains deeper and better…*he has a great way of explaining problems and makes sure we know why the answer is the answer it is. He will give us problems and will go through one slowly with you then will have you try one on your own which helps a lot.* I usually get help from [instructor] more than [LA]. [LA] is not a bad assistant but I just prefer [instructor]’s way of teaching more.

This student valued how the instructor scaffolded their support, starting by modeling a problem before having students try it on their own. A few students also seemed to value when their instructor or LA gave them space to extend or push their thinking:

> Yes, I have had little interactions with [LA]. However, I’ve had many great interactions with [instructor]. I get along well with [instructor], and [instructor] pushes my thinking and helps me with the material.

Another student said, “[Instructor] makes me think about the problem we are solving before she helps me and makes more sense [when] she’s explaining the problem in-depth.” However, this was not a prevalent theme. Several students seemed to prefer more explicit instruction. One student shared that they preferred having every step explained to them, and viewed their instructor’s attempts to provide them thinking space as unhelpful, perhaps due to the absence of follow-up by the instructor:

> Yes. I feel that [LA] has helped me understand it by explaining every step to me. whereas [instructor] makes me guess until she doesn't help me and she says "Think about it." and then she walks away and never comes back to ask.

Two students described appreciating the feedback on their work. One student said: "I am more comfortable asking [LA] questions than I am asking [instructor]. She gives me helpful feedback and helps me work out the problem." Another student felt similarly, but about their instructor: "he knows more of what I need to practice and work on and he gives back more crucial feedback in order to help me succeed."

Nine students also described how differences in the knowledge of the LA or the instructor impacted their perceptions of interactions with them. One student expressed a preference for interacting with the instructor because "[instructor] knows all of the course material so he can answer any questions while [LA] does not always know all of the material." In another class, a student said something similar: "[instructor] knows what he is talking about usually and can help with homework and [LA] cannot." However, interestingly, a different student in the class said "[LA] is usually more helpful with homework or workbook questions, so I ask him rather than [instructor]." Although these students had different preferences for who they interacted with, both valued the teacher figure's ability to answer questions specific to the course (e.g., homework, workbook problems). Another student perceived their instructor to have more knowledge about how students "learn certain concepts," which perhaps means that students also noticed differences in the content knowledge for teaching of LAs and instructors.

Students' perceptions of teaching quality had a significant impact on how they evaluated their interactions with LAs and instructors. From this analysis, it is clear that

students believe both LAs and instructors need to teach well, and further students hold LAs and instructors to the same set of standards when describing what teaching well means.

Overlap of themes

These three themes: the importance of emotions in interactions, LA and instructor dispositions, and perceived teaching quality often overlapped. For example, consider one of the quotations shared earlier:

> [instructor] explains how a problem is done, while also encouraging us to think about it more engagingly. She is very encouraging and gives a feeling of comfort because she does things just so well in general. [LA] is a little less engaging, it is helpful that she comes to answer questions, however sometimes it is unclear as to how an answer is to be done.

This student positioned their instructor as a very encouraging and engaging person (disposition) who did their job well (teaching quality), thus the student felt confident (emotion) after interactions with her. This is contrasted with the LA, whom the student positioned as helpful, although less so than the instructor because they were seen as less engaging (disposition) and competent than the instructor.

Taken together, these themes provide insight into how students are thinking about interactions with LAs and with the instructor. In particular, by examining what students value in these interactions and the choices they make (to interact with the LA or the instructor, both or neither) I can identify duties that students implicitly ascribe to LAs and instructors. These were often shared duties, and include: making students feel

comfortable in interactions, having a disposition that invites students to engage (e.g., being approachable, personable, encouraging, and patient), and teaching in such a way that supports that level of comfort (and for some students, that pushes them) by helping students feel like they understand content.

Storyline 3: LA ≇ Instructor

LAs and instructors have different duties in instruction.

The prior two storylines focused on shared duties between LAs and instructors. However, several students described interactions with the LA and instructor that suggest they perceive their roles to be different, and at times, complementary. This is distinguished from the storyline above, in which students often expressed a preference for working with either the LA or the instructor based on a set of common criteria. I capture this idea as the storyline: *LAs and instructors have different duties in instruction*. For the remainder of this section, I describe how this storyline was composed, focusing on the communities that students categorized LAs and instructors into, and their valuation of having different instructional perspectives. Responses from 17 students form the basis of this storyline.

Sometimes, but not always, students felt that interactions were more comfortable, easier, or less intimidating with LAs than with instructors. Further, some of these students attributed this to belonging to the same community as the LA. For example, one student shared:

> I would say I don't act differently between [instructor] or [LA] but I feel slightly more comfortable with [LA] just because *he's closer to my age*. I feel that I can

> crack jokes and make silly mistakes when [LA] helps me and I'm not afraid to not know an answer.

This student described feeling slightly more comfortable with the LA because he's closer to the student's age, positioning the LA as someone the student can joke with, as well as someone that allows them to be mathematically vulnerable. Another student said it was "easier to ask for help" from their LA "almost as if he was my *peer*." Similarly, another student thought it was "slightly easier" to talk to the LA because they were a "student," whereas they viewed the instructor as a "professor." Thus, some students preferred to interact with the instructor because of the LA's status as a peer, student, or age. For some students, gender played a role in how they perceived interactions with their instructor versus their LA. As an example, one student said:

> I'm a *college girl* and so is [LA], it's just easier for us to interact I think. And I can more easily say when I don't understand something to her and stop her while she's explaining - I feel a little rude to do that to *Professor* [instructor].

Another student said they interact "better with women than men, and with students vs. teachers" and that she felt she had "more in common" with the LA than the instructor. Both of these students preferred to interact with their LA because they shared commonalities in gender, but also academic status as a student (rather than a teacher or professor).

Some students acknowledged similarities between themselves and the LA but did not connect this to a preference for interacting with the LA versus the instructor. As an example, one student said "I think I treat [LA] more as a peer because we are closer in age" but did not say that they preferred one over the other. Another student said had they

very similar perceptions, but added that they thought of both the LA and instructor as an "instructor:"

> Sort of. I think of them both as my instructor. [LA] is *close to my age* to [sic] I tend to take to her more like my *peer*. But with [instructor] I talk to her as my teacher.

This student perhaps is conveying that they, like another student said, "respect them [the LA and instructor] both equally as an instructor for this course." Nevertheless, they felt their relationship with the LA was different due to the LA's age. All these responses indicate that some students interacted differently with their LA versus their instructor due to their categorical membership.

Further, some students described intentionally interacting with instructors and LAs for different purposes. One student explained

> Yes, I interact with them differently because [instructor] is my professor so I come to her with more important or difficult questions. I also act more professional with her. With [LA], I'm much more relaxed and I ask him much more mundane questions.

Other students discussed approaching the LA for help on particular components of the course (e.g., homework) while approaching the instructor for different help (e.g., clarification on the notes). Relatedly, some students valued the different perspectives that LAs and instructors brought. One student said "I wouldn't say I interact differently, I just understand that they have different ways in explaining problems. Therefore I can ask them different questions and one might be able to help me more than the other."

Several students perceived LAs and instructors as different. Most of these students described similarities between the LA and themselves (i.e., categorical membership in the same communities) as accounting for this difference. Some students cited this as their reason for preferring to engage with the LA. Other students valued the different perspectives and expertise brought by the instructor and LA and used these differences to guide who they interacted with and for what purposes. This indicates that one prominent storyline is: *LAs and instructors have different duties in instruction*. One early draft of this storyline was: *LAs and instructors have complementary positions in instruction*. I argue that this storyline is viable as a storyline that some students adopted when positioning LAs, however, it was unclear if all students would position the LA and instructor as complementary. In particular, for the group of students who preferred to interact with their LA due to a shared membership in some community, this storyline did not seem to fit as it was usually unclear how they positioned the instructor. I ultimately settled on the storyline *LAs and instructors have different duties in instruction* to foreground that these student responses point to a larger conception of the LA and instructor role: namely, that they should be thought of as having different roles in the classroom. This contrasts with the prior two storylines, which cast LAs and instructors into similar positions.

Discussion

In this chapter I analyzed students' responses to a free response question: *Do you interact differently with [the instructor] than [the LA]? If so, please explain.* in order to understand students' perceptions of their interactions with their LAs, and how those interactions may compare to their interactions with their instructor. These responses

provide an additional layer of understanding about how the LA role is perceived within UNL's lower-division mathematics courses. Through analysis of these responses, it was evident that students tell common storylines to position LAs in the classroom. I identified three prominent storylines: (a) *LAs and instructors only differ superficially, and thus have the same duties in interactions with students*, (b) *LAs and instructors have the shared duty to make interactions comfortable for students by having an inviting disposition, and teaching content well*, (c) *LAs and instructors have different duties in instruction*. These storylines can be grouped into two categories: storylines that position the LA and instructor as the same, and storylines that position the LA and instructor as different. Further, when LAs and instructors were positioned as the same, it was clear that some students had explicit ideas about the duties of the LAs and the instructors, while other students mostly just accepted help from whoever reached out to them.

Out of all of these storylines, *LAs and instructors have the shared duty to make interactions comfortable for students by having an inviting disposition, and teaching content well* had the most related student responses. Given the nature of how these data were collected, I hesitate to say that this means students did not position their instructor along other storylines. Rather, there were likely multiple storylines students drew from to make meaning of their interactions with the LAs and the instructor. However, what these data may suggest is that the majority of students viewed, at one point or another, the LA as having the same position as the instructor in the classroom, and further judged the value of the LA according to their perceptions of what good teaching is and how they felt in those interactions. Furthermore, although only a relatively small number of students did position LAs as providing a unique perspective or difference in instruction, for those

students the impact of having someone they could relate to was impactful to their experience.

I also want to highlight the similarity of these storylines to those that emerged from the instructional team. In particular, it appears that several students may be positioning LAs as either a partner or duplicate instructor in the classroom, with a handful of students positioning the LA as complementary to the instructor. This is interesting, as one persistent storyline in the literature about LAs is that the LA is a near-peer to students, and thus more relatable. Yet, several students seemed to position LAs in ways that run counter to the storylines evoked by such categorical membership. In the conclusion of this dissertation, I describe ways in which storylines about the LA role evoked by instructors, LAs, and students are converging (or not) within the mathematics department, as well as connect these storylines to broader storylines told in the literature about the LA Model.

Limitations and Considerations

One limitation of these findings is that students interpreted the question differently. For example, one student said:

> I tend to reach out to [instructor] first because he gets straight to the problem while [LA] tries to explain using terms I don't understand. I interact with them the same though.

I interpret this student's response as saying that they, as a student, do not interact differently once an interaction has begun; however, they do perceive a difference in how the instructor interacts with students versus the LA (the instructor "gets straight to the problem" while the LA is difficult to understand). In situations like this, I coded the

response as “Difference” because there was still a perceived difference in those interactions. However, I was only able to make that decision because the student explained their thinking. It is possible that some students who said there was no difference but did not provide a reason for their answer did perceive a difference (as I would define it). Thus, I could be underreporting how many students perceive there to be a difference in student-instructor and student-LA interactions.

Furthermore, there are, of course, other storylines that exist for students and that they draw from in defining the LA role. For example, several of these students positioned LAs along a storyline such as this: *LAs are similar to students and thus more likely to have an informal relationship with students than the instructor*. However, this storyline was drawn from a comparatively small number of responses (see the prior section), and so I categorized it under a larger storyline of LAs and instructors having different duties in instruction. Although the three storylines reported here are broadly representative of student responses across the data corpus, myriad other storylines and sub-themes were also present across student responses. With the overall focus on the case of LA roles at UNL, I ultimately chose the three storylines in this chapter due to their prevalence in the student data.

CHAPTER 7: CONCLUSION

A Return to the Beginning

I return to the opening vignette. Recall that Ciri, a learning assistant (LA), is responding to a hypothetical but common scenario posed by me during an interview. The scenario involves a commonly observed moment in these classes: one of a student struggling to start a mathematics problem. I asked Ciri to describe how they would interact with this hypothetical student:

> Ciri: [If it's a trickier problem, I'd be like, "Oh yeah. That one's like," I'll try to validate where they're at. If it's a problem that I think that they should be able to do, I'll ask "Okay, what about 1B is confusing? Have you thought about trying to do this to that?" Cause it can kind of be a hard line to walk of 'I want to help them all the time, but also they need to be able to do some of this by themselves.' So sometimes I'll be like, "What's the double angle formula for cosine?" Or this or that. And then be like, "Okay, so I'm going to let you try doing that. And I'll check on you in a few minutes." I try to like force them to work on it some. And there would be a good amount of time, so they'd be like, "Oh, okay. Like I get it now. Like we're good." And then when they're just really confused on this problem I'd be like, "Okay. Yeah, that makes sense. This one is, I understand it's a little trickier. Okay. So you see how it's at" and then tell them what rule - kind of write up, show them what the beginning of it looks like. And then try to have them keep working on their own. Or I would do the first step and I'd be like, "Okay, so what do I do from here?" And then, someone would be like, "Okay, you know, you divide by two" and I'd be like, "Great, what's next?" And this,

kind of, "UNO reverse card." I will now ask you all the questions on how to solve this problem.

Throughout their response, Ciri positioned themselves in various ways: as someone who has the duty to validate student struggles (“this one [problem] is, I understand, it’s a little trickier), help students solve problems, and become independent problem solvers. Ciri also positions themselves as someone who can evaluate the difficulty level of mathematical problems for students (“they [students] should be able to do”) and adjust their interactions with students accordingly. Reciprocally, in this process, Ciri interactively positions students in multiple ways: as students with the right to receive support and validation and duty to learn to work independently. Yet, the language Ciri uses also suggests that students may resist or reject their duty to be independent problem solvers, as they need to “force” students to work without assistance and “try to have them keep working on their own.” This is a point of tension for Ciri, a “hard line” they walk. Ciri straddles that line by trying to “force” students to work independently after receiving guidance from Ciri through scaffolding their instruction. Ciri refers to this instructional strategy as using the “UNO reverse card,” which, in the context of UNO, is a surprise move that forces another’s hand.

In the context of my dissertation’s findings, I argue that Ciri positioned themselves as a duplicate instructor by using strategies associated with active learning, which the instructional team valued and expected of them. For example, Ciri described inquiring into students’ thinking (“What about 1B is confusing?”) to facilitate progression on a task. Their response also demonstrates that LAs discussed their teaching in ways that are more nuanced than the findings from Chapter 4. Although not included

as a subcase in Chapter 5, Ciri is yet another example of how LAs can position themselves as teachers in LA-student interactions: although a hypothetical scenario, Ciri described taking action to validate students (thus it is likely they cared about students' emotions and sense of comfort in class) and supporting task progression, just like Jessie. Furthermore, like Jessie, Ciri found it challenging to scaffold their support of students. Ciri's account represents a common point of tension in the LA role.

Overview of Study

The central question of my dissertation was *How do those involved in the University of Nebraska—Lincoln (UNL)'s LA-supported precalculus courses perceive the LA role?* By answering this question in a largely unexamined context, namely postsecondary mathematics classrooms taught by graduate students, I cast light on how different contextual features and characteristics of instructors and LAs can influence the ways in which individuals make sense of the LA role. Since the LA role primarily involves interactions with members of the instructional team and students, as well as those involved with the professional development of LAs (who were also a part of the instructional team), I prioritized the perceptions of the LA role from these perspectives. I used theories about instructional resources and positioning in interactions to narrow my central question to the following research questions:

> *RQ1a. How did instructors and LAs in active learning precalculus classrooms position themselves in relation to each other?*
>
> *RQ1b. How did members of the instructional team describe the expected or actual distribution of instructional rights and duties between LAs and instructors in active learning precalculus classrooms?*

RQ2a. How did instructors' and LAs' perceptions of LA-student interactions in active learning precalculus classrooms compare and what influenced those perceptions?

RQ2b. How did LAs position themselves as teachers in LA-student interactions?

RQ3a. How did students in active learning precalculus classrooms describe their interactions with LAs compared to their interactions with the instructor?

RQ3b. Why might students have preferred to interact with either the LA or the instructor?

To address these questions, I conducted a qualitative case study involving interviews with 18 graduate student instructors (GSIs), LAs, 411 students, and the LA Coordinator. I also observed numerous classrooms across three semesters affected by the COVID-19 pandemic, including hybrid courses (courses taught with a mixture of online and in-person sessions), courses taught entirely online, and courses taught in person.

In what remains of this chapter, I summarize my findings. Next, I provide implications and suggestions based on these findings. These implications and suggestions are presented in the form of two letters (one for a LA program coordinator and one for an instructor/LA pair) and a section with future directions for researchers interested in extending these efforts. Because this is a case study, the findings and implications are for the particular LA role at UNL, however, the findings, as well as my presentation of the findings, are richly detailed so that others can consider how and if these findings may apply to their own or similar contexts.

Summary of Findings

In my theoretical framework I describe how I conceptualized the LA role as a resource for instruction, in line with how LAs are discussed in literature about LA programs. This led to a consideration of how to place LAs in the normally triadic relationship between the instructor of record, students, and content. I posited that LAs could be considered either part of the external environment, interchangeable with the instructor, or another vertex of the instructional triangle, thus creating an instructional tetrahedron. These possibilities suggest different ways that LAs may interact or develop relationships with students, instructors, and content and thus different conceptions of the LA role. Therefore, given my interest in conceptions of the LA role, I focused on describing how individuals perceived the interactions or relationships LAs were having with students and the instructor (and to a certain extent although certainly less emphasized, the mathematics at the center of these relationships).

In Chapter 4, I used Positioning Theory to highlight LA-instructor relationships, including how members of the instructional team described interactions between them, as well as the expected and actual distribution of instructional rights and duties between the LA and the instructor. Overall, LAs were positioned as members of an instructional team. On this team, instructors were viewed as having more authority in the classroom, and LAs were expected to modify their approach based on their instructor's direction. However, there were some tensions associated with the LA's position on this team. In particular, some participants felt that including a LA in the classroom would inevitably result in a good cop/bad cop storyline. Others felt this could be mitigated by ensuring alignment between the instructor, the LA, and the overall instructional team. This focus

on alignment was critical to how participants discussed the LA role. LAs were expected to adhere to the active learning philosophy of the course, in particular ensuring that they were not just acting as "answer dispensers."

To further describe what being a member of the instructional team meant for a LA, I identified and described five overarching patterns of distribution of instructional duties, or positions, that further describe how LAs acted or could act as a member of the instructional team: a.) LA as an assistant instructor, b.) LA as an apprentice instructor, c.) LA as a duplicate instructor, d.) LA as a partner instructor, and e.) LA as a complementary instructor. Some of these positions became more likely to be taken up as well as valued in certain contexts, such as the assistant instructor position in hybrid and online settings, and the duplicate instructor position in larger classroom sizes. Often, participants positioned LAs in a variety of overlapping and sometimes contradictory ways. This is perhaps related to the high degree of freedom instructors were given to imagine how LAs could be integrated into their classrooms. Overall, the duplicate instruction position seemed most central to the understanding of the LA role, although the partner instructor position also was prevalent in the data. In particular, LAs often acted as liaisons (channels, consultants, or brokers) to share knowledge and advice about students and their interactions with content with instructors, including sharing knowledge across classrooms. All of these positions had tensions - but the apprentice instructor position was notable for its relatively low prevalence in the LA data, as well as for its contentious nature in the instructor data. Some instructors rejected the notion of being able to adequately support a LA positioned as an apprentice.

The complementary position, too, was contentious. Although prominent in the LA data, as most LAs positioned themselves as complementary, only a little more than half of the instructors described this position. Of these instructors, some were uncertain about whether students positioned LAs as complementary instructors or not. This relates to findings from Chapters 5 and 6 that focus on perceptions of LA-student interactions. I conclude this chapter with a discussion about how these positions relate to the positions identified by Jardine (2020), suggesting that differences between the positions identified by Jardine and myself likely arise from differences in context, instructor characteristics (i.e., GSI versus faculty), and methodological choice (i.e., Jardine examined mostly first and second order positionings through observation of instructor-LA discourse, while I mostly examined third order positionings through interviews).

In Chapter 5, I use subcases to illustrate major themes in how instructors and LAs perceived LA-student interactions. There was a strong theme among instructor data that instructors did not have a good sense of what these interactions looked like. However, LAs positioned themselves as instructors in multiple ways. Wiley as a subcase represents how LAs may adapt their role to fit the perceived needs of the classroom they are supporting, by taking on different positions. In one classroom context, Wiley felt that they did not need to reinforce peer-to-peer collaboration because the class was small and the instructor consistently reminded students to work together. However, in a larger classroom setting, in which students struggled to engage, Wiley felt more of a duty to encourage peer-to-peer collaboration. Wiley also is an example of how the position of LA as a complementary instructor may be contestable. One instructor Wiley worked with thought Wiley may be viewed as more relatable by some students because Wiley was an

undergraduate student, however, both Wiley and the other instructor they worked with thought (at least some) students viewed Wiley more like a graduate student due to their mathematical experience and age. Yet, Wiley also felt that some students disregarded them because they were not the teacher, and so did not feel like they needed to engage.

Both Wiley and Jessie positioned themselves as instructors by caring about students' conceptual understanding and ability to connect mathematical concepts. Several other LAs cared about this as well. Moreover, Jessie consistently positioned themselves as a teacher who cared about being in the students' corner, helping students become comfortable with mathematics and the university setting. Yet, they also distanced themselves from being a teacher in the ways that they referenced course materials, and used third-person language when clarifying tasks for students. Jessie's subcase also emphasizes how LAs wanted to align their teaching with the instructor, and the challenges they faced in supporting active learning - particularly in scaffolding support for students. Overall, through more illustrative subcases of LAs, Chapter 5 supports the notion that the LA role was adaptable and differed based on how individuals who enacted the role perceived the needs of their instructor and the classroom as a whole. Yet, Chapter 5 also showcases an interesting phenomenon - that the LA role may also be difficult for instructors to understand fully, particularly because there are challenges in noticing LA-student interactions during class beyond having a more macroscopic view of what these interactions look like.

In Chapter 6 I foreground the students' perspective on the LA role. In this chapter, I analyzed open-ended survey responses to examine how students viewed their interactions with LAs versus instructors. About half of the students felt they interacted

the same, while half felt they interacted differently. By analyzing the responses of students who shared why they felt that way, I identified three possible storylines students drew from to make sense of the LA role: (a) *LAs and instructors only differ superficially, and thus have the same duties in interactions with students*, (b) *LAs and instructors have the shared duty to make interactions comfortable for students by having an inviting disposition, and teaching content well,* and (c) *LAs and instructors have different duties in instruction*.

The majority of students seemed to perceive the LA role and the instructor role as being equivalent. I draw this conclusion based on my analysis that half of the students did not perceive differences in their interactions with the LA and the instructor (thus they perceived their specific LA and instructor to be similar), as well as analysis of why students preferred to interact with the LA or the instructor. Namely, out of all of these storylines, *LAs and instructors have the shared duty to make interactions comfortable for students by having an inviting disposition, and teaching content well* had the most related student responses, suggesting that students had similar criteria for evaluating their LA and their instructor. This suggests that these students thought of the LA and the instructor as having similar roles during times when LAs and instructors were providing synchronous support (e.g., during small group work time). Nevertheless, there were some students that strongly preferred to engage with the LA, often positioning them as a complementary instructor due to similarities in age, academic status, gender, or other factors.

Implications and Suggestions

Dear [LA Program Coordinator or Department Leaders],

I hope this letter finds you well. Thank you for your interest in reading my dissertation [see attached]. To support your digestion of the ideas contained herein, I want to share four key implications of my findings and suggestions for the hiring and professional development of LAs.

Implication 1. Program Goals

It is important to consider the varying goals you have for the program. At UNL, a main goal was to support larger class sizes, and thus alleviate some of the instructional burden on the instructor. In other departments, a goal may be to train LAs to become teachers in K-12 or the postsecondary level. This would hopefully align with different ways in which the LAs are or could be positioned in the classroom, and the professional development given to LAs. For example, if you are interested in supporting LAs as future K-12 teachers, GSIs, or faculty, you may want to intentionally support the partner position, and provide professional development on, for example, how to sequence student presentations of content. If you care more about LAs being a near-peer support, you may want to include more guidance on how LAs and instructors can leverage their role without undermining the instructor's role.

Implication 2. Hiring

One of the main narratives told about LAs in the literature is that they "are more accessible and provide the connective tissue between institution and student." (LA Program, n.d.). At UNL, some students certainly found the LA to be more relatable due to the LA's complementary position to the instructor. However, a far more prevalent

storyline was that LAs and instructors have similar roles when interacting with students. Members of the instructional team also often positioned LAs as duplicates, or copies of instructors when interacting with students. It is possible that, because the instructors in this study were GSIs, the difference between LAs and GSIs was less pronounced than in other settings. Moreover, LAs all had strong mathematics identities, and many wanted to go to graduate school, making them similar as a whole to the group of GSIs. As such, as a LA Coordinator, it is worthwhile considering: What are some of the benefits and drawbacks to having GSIs and LAs fulfilling similar roles in the classroom? Do you want LAs to adopt a more peer-like or complimentary position? If so, how would this influence your hiring practices? How would you want to explicitly position LAs to support their ability in taking up this positioning?

Implication 3. Professional Development

A large proportion of class time in precalculus courses involved LAs supporting students during small group work, being positioned as duplicate instructors expected to use active learning strategies. But research has shown that instructors need support to use active learning effectively, and based on these findings this was a major tension point for LAs as well. Thus, professional development for LAs is imperative.

Since LAs may be positioned in a variety of ways, professional development will need to be varied to support these different positionings (particularly, the positionings you would want to foster). For example, LAs being positioned to share complex instructional responsibilities (e.g., duplicate, partner, or complementary) require different support than LAs positioned as assistants. Since that is likely influenced by the desires

and goals of each instructor and LA pair, it may be helpful to have professional development they attend together.

It is not clear to what extent other LAs were observing instructors during small group work to guide their own interactions with students during this time. Only one LA described learning how to interact with students by observing their instructor. Given how challenging it was for instructors to notice LAs in class, it is also possible that LAs also struggled to notice anything beyond their own interactions with students. Thus, it may not be sustainable to assume that LAs are learning how to effectively facilitate group work by observing their instructor. However, observation can be a powerful way to learn about teaching practices. One strategy to consider, advanced by a GSI, is to have LAs observe other precalculus classrooms.

Instructors varied in their awareness of what the LA was doing when interacting with students, however, interactions between LAs and students were largely independent from and invisible to the instructor. This suggests that many instructors are rejecting or unable to accept a positioning of themselves as a supervisor for LAs, and also means that instructors may be missing an important understanding of their students' experiences in class. Although the department did not position instructors as supervisors, it is important to ask - should such a position exist? I argue that having someone institutionally (deliberately) positioned as a supervisor of LAs, who supports their professional development and use of active learning, would be a valuable addition to a LA program[11].

[11] In fact, UNL did hire a graduate student to support the supervision of LAs in the fall 2022/spring 2023 academic year.

Associate Conveners often positioned LAs as apprentices learning to teach, and reflexively positioned themselves as experts whom LAs could learn from (or were positioned by the department as such). Associate Conveners saw the value of this apprentice/expert positioning for LAs, as well as for themselves (e.g., in these meetings LAs often acted as partners, channeling information about how students were engaging with new course developments, or by brokering information from one section to another). LAs, too, valued the content preparation meetings, as well as the pedagogy seminar. It would be valuable to continue positioning specific, experienced GSIs as experts in knowledge about content for teaching, and to set up regular meetings so that LAs could support brokering between classroom sections.

Implication 4. Prior LA Experiences

LAs drew from various experiences and storylines to shape the positions they adopted in the classroom, including experiences in the Mathematics Resource Center, prior experiences being in a class with LAs, and experiences observing and working with teaching assistants in Calculus recitations. How could these storylines be leveraged to help LAs make sense of their role in the classroom? What are some pitfalls in using these storylines to describe the LA role, and how could these be made explicit to LAs?

I hope that you find these implications and suggestions helpful in thinking about your LA program.

Cheers,

Rachel

Dear [Instructor/LA pair],

I hope this letter finds you well. Thank you for your interest in reading my dissertation [see attached]. I want to summarize some key suggestions based on these findings, in case you find yourself wanting a quick answer to the question "So what?" and in particular "So what does this mean for us?"

Suggestion 1

Overall, LAs supporting precalculus active learning courses at UNL are perceived to be members of an instructional team. This team involves a LA Coordinator, conveners, associate conveners, GSIs, and LAs. GSIs and LAs are expected to use active learning to support students, based on numerous studies suggesting its efficacy in supporting student learning. However, GSIs also have some leeway in how they want to integrate LAs into their classrooms. Yet, several GSIs have chosen to position LAs as partners in instruction and found it valuable. In class, I suggest keeping a unified front. This helps to curb something that others have found naturally occurs - namely, the positioning of LAs and instructors along a good cop/bad cop storyline. Actively work to stop this positioning through your words and actions with one another and students. Outside of class time, you can discuss differences in opinion, but inside the classroom maintain a unified front.

Suggestion 2

The LA role is somewhat malleable, but once positioned in a particular way there are implications for how LAs can interact with students. Some students may gravitate towards a LA because they perceive the LA to be more like them - this is especially more likely if the LA is closer in age to them, in a class with them, the same gender, and approachable. The department makes this a bit more possible by not having LAs in

charge of assigning grades. However, this positioning of the LA as a complementary instructor may lead to students not respecting the LA when the LA tries to encourage student engagement or may undermine relationships the instructor can make with students. In the former case, there may need to be some intentional positioning on the part of the instructor to make it clear that LAs do have that authority even if this diminishes the LA's ability to adopt a complementary position. In the latter case, depending upon the situation LAs may need to establish more formal boundaries with students. They could also act as a liaison, channeling necessary information about the students with whom they have connected to the instructor so that the students are adequately supported. Ultimately, the needs of your classroom, and your strengths, should determine how you position each other.

Suggestion 3

LAs can support GSIs by acting as a channel of information, making suggestions, and brokering knowledge from one classroom community to another. But this does not need to be a one-way transmission, instructors can likewise share information with LAs so that LAs can have better context in supporting students. Instructors often have more contact with students (e.g., through office hours), so can provide insights about students that LAs may need to be better teachers.

Suggestion 4

LAs have significant responsibilities during small group work time. It may be challenging to observe one another during this time, but I would encourage you to talk about what those interactions look like with one another. These discussions should include reflection on any successes and challenges you have had with particular groups.

Suggestion 5

LAs' responsibilities during lecture time are less clear: LAs, you may use this time to observe how the instructor describes content, in particular, what notation is used, or problem-solving strategies they emphasize. Instructors, you may ask your LA to take the lead on some part of lecture or whole group discussions, such as identifying groups to present problems or walking through an example. You may also want the LA to act as a student, particularly at the beginning of class, and ask several questions to model for other students that it is ok to ask questions in class.

Suggestion 6

Some students may gravitate toward you as the instructor, or you as the LA, based on things outside of your control. That is ok and to be expected. However, you have a role in shaping what those interactions look like. Students seemed to care about how they felt in interactions (e.g., did they feel confident and capable of doing mathematics?) and perceived teaching quality.

Suggestion 7

It is beyond the scope of this study to study in depth how students evaluated teaching quality, although I did identify that explanations mattered. Overall, it is worthwhile talking with one another about how to scaffold student understanding to minimize unnecessary frustrations that occur during active learning, while also maintaining expectations that students are the doers of mathematics. In line with having a united front, it may be worthwhile making these intentions explicit with students.

I hope that you find these suggestions helpful in thinking about your partnership.

Cheers,

Rachel

Implications and Future Directions

These findings advance the field's understanding of the LA role by examining it within a particular, as of yet under-researched setting: mathematics courses taught by GSIs. At UNL, storylines about the LA role that frequently appear in the literature - such as LAs as a more relatable and accessible resource for students than instructors - are less pervasive. However, UNL also hires LAs who typically have advanced content knowledge and an interest in mathematics. It would be valuable to study other, similar contexts to see how the mathematics identity of LAs impacts students' perceptions of the role of the LA.

At UNL, the LA role fixed several types of positions that LAs could adopt, negotiate, and reject, which had similarities to positions existing in other contexts (e.g., Jardine, 2020). This suggests that there may be core components of a LA role that transcend different contexts. Of course, one limitation of these findings is that the pedagogy seminar and content preparation meetings only occurred during one semester; as such, one should question to what extent these findings are informative for contexts following the LA model more faithfully. Furthermore, Jardine's (2020) study involved LAs that were part of a program that had extensive pedagogical training but included LAs in grading (they were referred to as UTLAs in Jardine's study). Nevertheless, it would be a mistake for the field to discount these results. There are several programs across the country that are establishing or trying to establish LA programs. These findings can be

useful in helping such programs consider how particular program components or contexts influence what positions LAs have available to them. In general, such programs would benefit from clear connections between program design and these positions.

This leads to one future research direction. The findings in this study did describe some of the ways in which the LA role was enacted, but the focus was on general perceptions of the LA role. Further research would use adaptations of Stein et al. 's (2007) framework to study how the structure of different LA programs influenced changes between the CO LA Model, the intended use of LAs (from the LA program's perspective), the enactment of LAs in the classroom (including the positions LAs adopted or were assigned), and the resulting effect on students.

Another study would focus on the apprentice position and the implications of having different individuals in a department positioned as experts of teaching in relation to the LA. In the CO LA Model, the pedagogy course instructor and those that lead content preparation meetings are likely positioned as experts in interactions with LAs. But it is not set in stone who takes on this duty. What are the implications and possibilities of having these experts be the instructor? A coordinator/convener? Perhaps another LA?

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APPENDICES

Appendix A: GSI Focus Group Protocol Summer 2020

I want to thank you for taking time out of your busy lives to participate in this focus group interview. The focus group will take us about 45 to 60 minutes. Your participation in this focus group is totally voluntary. I will do my best to keep information from this focus group confidential. When I analyze data collected from this focus group I will not use names or other identifying information so that the only people who will know who participated in this focus group are those sitting in this room. That being said, given the nature of focus groups, I can not guarantee confidentiality. As such, please respect the privacy of your fellow graduate students, and not repeat what is said in the focus group to others.

If you have not sent me your consent form yet, please do so as soon as possible. As noted in the consent form, I plan to record this focus group so that I can be sure to capture your responses verbatim, rather than relying on handwritten notes. Is that ok? [Start recording]

Before we begin, do you have any questions about your participation, the department's plans for a new LA professional development program, or anything else?

For this focus group, I'm hoping to hear from everyone, but due to limited time this may not be possible for every question. Therefore, for some questions I might explicitly say this is a question where I would like to hear everyone's response, but for other questions please just speak up and contribute whenever you are inclined to do so.

The interview will have four sections. First, I want to start by getting everyone's impression of what the LA program is at UNL. Remember, there are not right or wrong answers to these questions.

Instructor Understanding of LA role and responsibilities

1. What are the major roles and responsibilities for the LA in your class, as set by the department?
2. Does anyone have any additional expectations for your LA, beyond those set by the department? How do you communicate those expectations?
    a. Has your LA done anything beyond the traditional expectations of the position to support you as an instructor or your students?
3. Does the department have any expectations for how we use or interact with LAs?

I want to dig a little deeper into how LAs are being used in classrooms, and how we as instructors are interacting with LAs. To begin,

LAs as a Student Resource

4. Describe to me what a typical class period looks like in the Math XXX classroom you support.

5. How does your LA typically interact with students in class? How does this differ from your interactions with students?
6. What are the skills and knowledge that LAs need to effectively support our courses? [probe for specific examples from their classes]
7. How does including LAs in the classroom benefit, or not, your students? Can you give an example?

LAs as an Instructional Resource & Active Learning

8. I know we all interact and communicate with our LAs in different ways and to varying degrees--some of us may have a dedicated weekly meeting time with our LAs where we lesson planning together etc., while others of us have found that a quick chat before or after class, when needed, is sufficient. If you think of these interactions on a spectrum: from "I don't really interact with my LA much" to "I interact with my LA a lot", where do you think you fall? Are you satisfied with the amount of interaction you have with your LA?
    a. To what extent do you and your LA plan together for class? (probe for frequency, duration, purpose)
    b. To what extent do you and your LA communicate during class? (probe for frequency, duration, purpose)
    c. To what extent do you and your LA reflect after class? (probe for frequency, duration, purpose)
    d. To what extent do these discussions during class and joint reflections afterwards help you make instructional decisions for future lessons?
9. If you've had an LA before this semester, was there anything you did differently when interacting with your LA this semester? What was the reason for that change?
10. What other expectations or guidelines could we make formal for LAs to better support you as an instructor? Some LAs work in the MRC for an hour per week, but could that time be spent in a different way to support you or your students more directly
11. In what ways does having an LA support your use of active learning in the classes you teach?
    a. Imagine next semester, for whatever reason, you don't have an LA in your classroom. How would that change your teaching, if at all? [probe for impact on teaching and students]
12. If you've had an LA before this semester, was there anything you did differently when interacting with your LA this semester? What was the reason for that change?

As I said in the email, we are working on developing a LA PD program. So I'd like to close out the interview by having a conversation about what we think should be included in that professional development, as well as what professional development we, as instructors, would like to have to support our use of LAs.

Professional Development

13. What information do you think would be best to include in a LA PD program?

14. What professional development do you personally wish you had in order to effectively work with your LA? (e.g., guidelines for leading weekly meetings with your LA)

Closing Questions

1. What advice would you give to a fellow instructor/GTA who will have an LA for the first time next semester?
2. Would you be willing to participate in a follow-up, 30 minute interview via Zoom about your experiences as a P2C2 instructor working with LAs?

Appendix B: Instructor Interview Protocol Fall 2020/Spring 2021

Thank you for taking the time to meet with me today. This interview is meant to capture your thoughts about the LA program and its role in instruction here at [institution]. This interview should take about 45-60 minutes. Anything you say in this interview will be kept confidential, and no names will be used in any of my research reports. Your participation in this interview is voluntary, so you can choose to answer all of the questions, some of the questions, or none of the questions, without any negative impacts for you.

I have sent you an official consent form, which describes my study and your participation. As noted in the consent form, I plan to record this interview so that we can be sure to capture your responses verbatim, rather than relying on handwritten notes. Is that ok? [Turn recorder on.] Before we begin, do you have any questions about my study, your participation, or anything else?

Background Information

1. What course(s) are you teaching this semester?
    a. Which of these courses have LA support?
    b. How many LAs are you working with in these courses?
2. Have you worked with LAs in the past? If so, for which courses?
3. Describe to me what a typical week looks like in these courses with LA support. What do you do as the instructor? What are the students expected to do? What do the LAs do?
    a. [Probe: Are there any elements of the course that are synchronous? What elements of the course are asynchronous? Which elements do the LA(s) support?]
4. What are you most proud of in terms of your relationship with the LA(s) who are supporting the course you're teaching?

Instructor Understanding of LA Role and Responsibilities

1. What are the major roles and responsibilities for LAs that support your class?
    a. How do these roles and responsibilities differ from yours?
    b. [if they have worked with LAs in the past] How have these responsibilities evolved since the transition to [format] instruction?
2. How were these roles and responsibilities established? (probe: Did you communicate these to your LAs? Were these communicated by the dept/LA Coordinator?)
3. What are the most important responsibilities of the LA? [probe for specific examples from their classes]
4. What are the most important knowledge, beliefs, and skills that a LA needs to support your course? [probe for specific examples from their classes, as well as skills necessary to support the remote/hybrid/etc. course format]
    a. How might those be different from your role as an instructor?

LAs as a Student Resource

1. How does including LAs in the classroom benefit, or not, your students? Can you give an example?

Active Learning

Instructors' beliefs on teaching and learning

1. What does effective mathematics instruction look like?
    a. [Probe: Do you use active learning strategies in your classroom, if so what strategies do you use and why?]
2. How does an LA(s) support your ability to instruct effectively?
    a. How do LAs influence or support your use of active learning strategies in the classes you teach?
    b. Imagine next semester, for whatever reason, you don't have an LA in your classroom. How would that change your teaching, if at all? [Probe for impact on teaching and students]
3. What types of interactions do you have with your LA (probe for instructor meetings, interactions in class, frequency, etc.)?
    a. What do you talk about?
    b. What is the purpose of those interactions? What do you get out of them? What do you think the LA gets out of them?
    c. To what extent do you and your LAs plan or reflect together? [Probe for frequency, duration, purpose]
        i. To what extent do conversations with your LA(s) help you make instructional decisions for future lessons?

Final Questions

1. Suppose your class was entirely online and we didn't have to worry about social distancing. How do you think your relationship with the LA might change, or the ways that they support your class?
2. What advice would you give to a current student considering applying to be an LA next semester?
3. What advice would you give to an instructor who will have an LA for the first time next semester?
4. What advice would you give to the math dept to improve the LA program?
5. Is there anything we should know about this course that hasn't been discussed yet?

Appendix C: Instructor Interview Protocol - Follow Up Fall 2020/Spring 2021

Thank you again for letting me observe your class and planning meeting with the LA this week, as well as taking the time to meet with me today. I want to remind you that there are no wrong answers to any of the questions I ask, and that I am just interested in hearing your thoughts and experiences with working with LAs to support the course that you're teaching. I expect that this reflection will take around 20 minutes.

1. Reflection
    a. Thinking about teaching: what worked well this week? What would you have changed, or would you want to do differently in the future? How are things going in terms of engaging students?
    b. Thinking about your interactions with the LA, or their interactions with students: what worked well this week? What would you have changed, or would you want to do differently in the future?
2. First I want to talk about your interactions with your LA outside of class time.
    a. How typical is the meeting I observed today between you and your LA? [Probe: content, frequency, duration]
    b. How helpful was this meeting today for you as an instructor? How helpful do you think it was for your LA?
        i. To what extent do you believe this meeting with your LA will help you make instructional decisions for future classes?
3. Now I'd like to reflect on class this week. Are there any specific interactions between the LA and your students, or you and the LA, that you found significant?
    a. What made this interaction significant?
    b. What did your LA do this week to support students and student learning? Is this typical?
    c. What did your LA do this week to support you as an instructor? Is this typical?
4. *[Include case-specific questions based on observations]*
5. Last time I interviewed you said that _____ were the most responsibilities for LAs in your course. Is there anything else you would want to add, or possibly change? [probe for specific interactions/experiences that may have caused this to change]
6. Similarly, last time I interviewed you said that _____ were the most important knowledge, beliefs, and skills that LAs need to support this course. Is there anything else you would want to add, or possibly change? [probe for specific interactions/experiences that may have caused this to change]
7. Are there any other interactions between students, LAs, and yourself that you want to bring up from this week? [probe for specific interactions/experiences that may have caused this to change]
8. Is there any additional support you wish you had from the department to support you in working with your LA?

Thank you for your participation!

Appendix D: LA Interview Protocol - Fall 2020/Spring 2021

Thank you for taking the time to meet with me today. This interview is meant to capture your thoughts about the LA program and its role in instruction here at [institution]. This interview should take about 45-60 minutes. Anything you say in this interview will be kept confidential, and no names will be used in any of my research reports. Your participation in this interview is voluntary, so you can choose to answer all of the questions, some of the questions, or none of the questions, without any negative impacts for you.

I have sent you an official consent form, which describes my study and your participation. As noted in the consent form, I plan to record this interview so that we can be sure to capture your responses verbatim, rather than relying on handwritten notes. Is that ok? [Turn recorder on.] Before we begin, do you have any questions about my study, your participation, or anything else?

[For group interviews] So while I have several questions, these questions are meant to serve as springboards for relevant comments and more detailed discussion of your experiences. So I am hoping these questions will stimulate discussion and that everyone gets a chance to contribute and to talk with each other. This meeting is intended to be as conversational as possible; I will assist by facilitating the session by keeping track of time and making sure that all of the issues in which we are interested are discussed.

Background Information

1. Let's start by saying which course(s) you are currently involved with this semester, and what your major and year in school are.
2. How long have you been a LA?
3. Why did you decide to become an LA? What did you think it would be like? How does that compare to your current experience?
4. Describe to me what a typical week looks like in the course(s) you support. What do you do as the LA? What are the students expected to do? What does the instructor do?
    a. [Probe: Are there any elements of the course that are synchronous? What elements of the course are asynchronous? Which elements are you involved with?]
5. What are you most proud of in terms of your interactions with students so far this semester, as well as your relationship with the instructor, other LAs, etc.?

Roles and Expectations

1. What are your major roles/responsibilities as an LA? (probe for both in general/in their class)
    a. Does the department/lead instructor/coordinator have other expectations for what you do? What are these expectations?
    b. What about teaching-related responsibilities out of class? (e.g., office hours, time working in the Resource Center, weekly course meeting)

2. How were these roles and responsibilities communicated? (probe: Was this talked about when you were hired, in some sort of training, while communicating with the instructor, etc.)
3. Is your role as a LA clear to you, the instructor, and the students? Why or why not?
4. From your point of view, what is your most important responsibility as an LA?
5. [if they have served as an LA in person] How have your responsibilities and experiences as a LA changed this semester, as a result of the different course format?

LAs as an Instructional Resource

1. I'd now like to talk about how you communicate with your instructor. What types of interactions do you have with your instructor [Probe for instructor meetings, interactions in class, frequency, etc.]?
    a. What do you talk about?
    b. What do you think is the purpose of those interactions? What do you get out of them? What do you think the instructor gets out of them?

Active Learning

LAs' beliefs on teaching and learning

1. What does effective mathematics instruction look like?
2. At UNL our courses follow an active learning model. While active learning can be defined in many ways, for my work I define active learning as teaching methods and classroom norms that promote:
    a. students' deep engagement in mathematical thinking,
    b. peer-to-peer interaction,
    c. instructors' interest in and use of student thinking, and
    d. instructors' attention to equitable and inclusive practices.
    In what ways, if any, do you think as an LA you are able to contribute to these pillars?
3. What skills, knowledge, attitudes, or beliefs do you need to be effective in your role as an LA? Where do you learn these skills, knowledge, attitudes, or beliefs?
4. Has being an LA changed your thinking of what effective instruction looks like? (If yes) How?
    a. Probe: Have meetings with the LA Coordinator, other LAs, or the LA seminar [if applicable] impacted what you think mathematics instruction should look like? If so, how?

LAs as a Student Resource

1. What are some of your goals for your students? How do you help students accomplish those goals?
2. What do you hope students will learn from the class you support? How do you help students reach this point?
3. What does it take for students to be successful in the class you support? To what extent do you believe students are doing these things?

   a. Do you believe that all students can succeed in this course? Why or why not?

Preparation and Support

1. I'd now like to discuss the types of preparation and support the department has provided for you as a LA. Please talk about some of the ways the department has helped you prepare to teach **before** the semester.
   a. Did you feel adequately prepared for the start of your duties? Why or why not?
2. Talk about some of the ways the department supports you as a LA **during** the semester.
   a. Do you feel like you have enough support during the term?
   b. What other supports would you like to have?
3. To whom do you typically go to discuss issues related to teaching?
4. To what extent do you get a chance to give feedback about your preparation program?
   a. What impact has any feedback had?

Final Questions

1. Does it seem like your role is valued in the classroom? Why or why not?
2. How would Math XXX classrooms look different without LAs?
   a. Thinking about what you just said, to what extent does this apply to the class you're supporting?
3. Do you plan to work as a LA next semester? Why or why not?
4. What advice would you give to a current student considering applying to be an LA next semester?
5. What advice would you give to an instructor who will have an LA for the first time next semester?
6. What advice would you give to the math dept to improve the LA program?
7. [if they seem to have a broad perspective of the LA program] Overall, do you think the LA program is worth sustaining?
8. Is there anything we should know about this course that hasn't been discussed yet?

Thank you so much for your participation!

Appendix E: LA Interview Protocol - Follow Up Fall 2020/Spring 2021

Thank you again for letting me observe your class and planning meeting with the instructor you support this week, as well as taking the time to meet with me today. I want to remind you that there are no wrong answers to any of the questions I ask, and that I am just interested in hearing your thoughts and experiences as an LA. I expect that this reflection will take around 20 minutes.

1. First I want to talk about your interactions with the instructor outside of class time.
    a. How typical is the meeting I observed today between you and the instructor? [Probe: content, frequency, duration]
    b. How helpful was this meeting today for you as an LA? How helpful do you think it was for your instructor?
2. Now I'd like to reflect on class this week. Are there any specific interactions between you and the students, or you and the instructor, that you found significant?
    a. What made this interaction significant?
    b. What did you do this week to support students and student learning? Is this typical?
    c. What did you do this week to support the instructor? Is this typical?
3. *[Include case-specific questions based on observations]*
4. Last time I interviewed you said that _____ were the most important responsibilities you had as an LA. Is there anything else you would want to add, or possibly change? [probe for specific interactions/experiences that may have caused this to change]
5. Similarly, last time I interviewed you said that _____ were the most important knowledge, beliefs, and skills that you need to support this course. Is there anything else you would want to add, or possibly change? If so, why? [probe for specific interactions/experiences that may have caused this to change]
6. Are there any other interactions between students, the instructor, and yourself that you want to bring up from this week?
7. Is there any additional support you wish you had from the instructor or the department to support your work as a LA?

Thank you for your participation!

Appendix F: LA Content Prep Associate Convener Interview Protocol Fall 2020

Thank you for taking the time to meet with me today. This interview is meant to capture your thoughts about the LA program and its role in instruction here at [institution]. This interview should take about 45-60 minutes. Anything you say in this interview will be kept confidential, and no names will be used in any of my research reports. Your participation in this interview is voluntary, so you can choose to answer all of the questions, some of the questions, or none of the questions, without any negative impacts for you.

I have sent you an official consent form, which describes my study and your participation. As noted in the consent form, I plan to record this interview so that we can be sure to capture your responses verbatim, rather than relying on handwritten notes. Is that ok? [Turn recorder on.] Before we begin, do you have any questions about my study, your participation, or anything else?

Background Information

1. What course(s) are you teaching this semester?
2. Which of these courses have LA support?
    a. How many LAs are you working with in these courses?
3. Have you worked with LAs in the past? If so, for which courses?
4. Describe to me what a typical week looks like in these courses with LA support. What do you do as the instructor? What are the students expected to do? What do the LAs do?
    a. [Probe: Are there any elements of the course that are synchronous? What elements of the course are asynchronous? Which elements do the LA(s) support? How does this differ from last Fall?]

Instructor Understanding of LA role and responsibilities

1. What are the major roles and responsibilities for LAs that support your class?
    a. How do these roles and responsibilities differ from yours?
    b. [if they have worked with LAs in the past] How have these responsibilities evolved since the transition to [format] instruction?
2. How were these roles and responsibilities established? (probe: Did you communicate these to your LAs? Were these communicated by the dept/LA Coordinator?)
3. What are the most important responsibilities of the LA? [probe for specific examples from their classes]
4. What are the most important knowledge, beliefs, and skills that a LA needs to support your course? [probe for specific examples from their classes, as well as skills necessary to support the remote/hybrid/etc. course format]
    a. How might those be different from your role as an instructor?

LAs as a resource

1. How does including LAs in the classroom benefit, or not, your students? Can you give an example?

Active Learning

Instructors' beliefs on teaching and learning

1. What does effective mathematics instruction look like?
    a. [Probe: Do you use active learning strategies in your classroom, if so what strategies do you use and why?]
2. How does an LA(s) support your ability to instruct effectively?
    a. How do LAs influence or support your use of active learning strategies in the classes you teach?
    b. Imagine next semester, for whatever reason, you don't have an LA in your classroom. How would that change your teaching, if at all? [Probe for impact on teaching and students]
3. What types of interactions do you have with your LA (probe for instructor meetings, interactions in class, frequency, etc.)?
    a. What do you talk about?
    b. What is the purpose of those interactions? What do you get out of them? What do you think the LA gets out of them?
    c. To what extent do you and your LAs plan or reflect together? [Probe for frequency, duration, purpose]
        i. To what extent do conversations with your LA(s) help you make instructional decisions for future lessons?

LA Content Prep Questions

1. What responsibilities are entailed in serving as the LA content prep leader?
    a. What kind of communication do you have with the math department about LAs (i.e., with P2C2 instructors)?
    b. Are you involved in the hiring process? If so, please describe the hiring and selection process for LAs. [probe for what skills, knowledge, etc. they look for when hiring LAs]
2. Please tell us about the Learning Assistant program and how learning assistants are used on this campus during a "normal" semester. [Probe for which classes get LAs, how many LAs there are, who can be an LA, how an instructor gets an LA, who hires/chooses LAs]
    a. What changes have occurred as a result of the transition to [format] instruction?
        i. [Probe: How do you think this has changed from the perspective of LAs?]
3. What are you most proud of in terms of the LA program or your role as an LA Coordinator?

Final Questions

1. What advice would you give to a current student considering applying to be an LA next semester?
2. What advice would you give to an instructor who will have an LA for the first time next semester?
3. What advice would you give to an instructor who will be leading these content prep meetings for the first time next year?

4. What advice would you give to the math dept to improve the LA program?
5. Is there anything we should know about this course that hasn't been discussed yet?

Appendix G: LA Coordinator Interview Protocol Fall 2021

Thank you for taking the time to meet with me today. This interview is meant to capture your thoughts about the LA program and its role in instruction here at [institution]. This interview should take about 45-60 minutes. Anything you say in this interview will be kept confidential, and no names will be used in any of my research reports. Your participation in this interview is voluntary, so you can choose to answer all of the questions, some of the questions, or none of the questions, without any negative impacts for you.

I have sent you an official consent form, which describes my study and your participation. As noted in the consent form, I plan to record this interview so that we can be sure to capture your responses verbatim, rather than relying on handwritten notes. Is that ok? [Turn recorder on.] Before we begin, do you have any questions about my study, your participation, or anything else?

Background Information

1. Please talk briefly about your history here at [institution]--what is your current role?

LA Enactment

2. How long have you been the LA Coordinator?
    a. What kind of information or training did you receive going into this position?
    b. [If applicable] To what extent do you talk with the previous LA Coordinator?
3. What responsibilities are entailed in serving as the LA Coordinator?
    a. What kind of communication do you have with the math department about LAs (i.e., with P2C2 instructors)?
    b. Are you involved in the hiring process? If so, please describe the hiring and selection process for LAs. [probe for what skills, knowledge, etc. they look for when hiring LAs]
4. Please tell us about the Learning Assistant program and how learning assistants are used on this campus during a "normal" semester. [Probe for which classes get LAs, how many LAs there are, who can be an LA, how an instructor gets an LA, who hires/chooses LAs]
    a. What changes have occurred as a result of the transition to [format] instruction?
        i. [Probe: How do you think this has changed from the perspective of LAs?]
5. What are you most proud of in terms of the LA program or your role as an LA Coordinator?
6. What are the major goals for the LA program?
    a. We know the math department uses active learning in [MATH XXX]. What role do LAs have in supporting the use of active learning in these classes?
        i. I know that the term active learning can mean different things to different people, what is your definition of active learning?

[provide their definition of active learning, if on record from SEMINAL and ask them if that definition has changed]

   b. How has this changed, if at all, as a result of the transition to [format] instruction?
      i. [Probe: How do you think this has changed from the perspective of LAs?]

7. What are the major roles and responsibilities of LAs during a "normal" semester? [Probe for in and outside of class, such as facilitating discussion labs, grading, leading review sessions, etc.]
   a. How are these roles and responsibilities communicated to LAs?
   b. How has this changed, if at all, as a result of the transition to [format] instruction?
      i. [Probe: How do you think this has changed from the perspective of LAs?]
8. What are the most important knowledge, beliefs, and skills that a LA needs to support P2C2 courses? [probe for specific examples]
9. What professional development do LAs receive? [Probe for who trains LAs]
   a. What are the major goals for this development?
   b. How much and what kind of development do LAs get **before** the semester?
   c. How much and what kind of development or support do LAs get **during** the semester?
   d. Besides this development, what are other ways that LAs receive support?
   e. Has any of this changed as a result of the transition to [format] instruction?
10. What professional development do instructors receive prior to working with an LA [probe for who offers this development]?
   a. To what extent does the training prepare people for working in an active learning classroom environment?
11. What are the expectations for instructors and LAs as they work together? (Probe for: meet weekly before class, etc.)
   a. Has any of this changed as a result of the transition to [format] instruction?
12. What successes and positive outcomes are you experiencing through the use of Learning Assistants? [Probe for what might account for these successes, and successes in a remote environment]
13. How long do you expect to be in the role of LA Coordinator?
   a. What information will you pass on to the next coordinator in terms of what they need to know to be successful with these responsibilities?
14. If you were going to redesign any aspect of the LA program, what would you change and why?
   a. [Probe if "stuck": What advice would you give to someone who is starting a new LA program]

Final Question

15. Is there anything we should know about the LA program that we haven't talked about?

Appendix H: Instructors Interview Protocol Fall 2021

Thank you for taking the time to meet with me today. This interview is meant to capture your thoughts about the LA program and its role in instruction here at [institution]. This interview should take about 45-60 minutes. Anything you say in this interview will be kept confidential, and no names will be used in any of my research reports. Your participation in this interview is voluntary, so you can choose to answer all of the questions, some of the questions, or none of the questions, without any negative impacts for you.

I have sent you an official consent form, which describes my study and your participation. As noted in the consent form, I plan to record this interview so that we can be sure to capture your responses verbatim, rather than relying on handwritten notes. Is that ok? [Turn recorder on.] Before we begin, do you have any questions about my study, your participation, or anything else?

Background Information

1. What course(s) are you teaching this semester?
2. Which of these courses have LA support?
    a. How many LAs are you working with in these courses?
3. Have you worked with LAs in the past? If so, for which courses?
4. Describe to me what a typical week looks like in these courses with LA support. What do you do as the instructor? What are the students expected to do? What do the LAs do?
    a. [Probe: Are there any elements of the course that are synchronous? What elements of the course are asynchronous? Which elements do the LA(s) support?]
5. What are you most proud of in terms of your relationship with the LA(s) who are supporting the course you're teaching?

Instructor Understanding of LA role and responsibilities

1. What are the major roles and responsibilities for LAs that support your class?
    a. How do these roles and responsibilities differ from yours?
    b. [if they have worked with LAs in the past] How have these responsibilities evolved since the transition to [format] instruction?
2. How were these roles and responsibilities established? (probe: Did you communicate these to your LAs? Were these communicated by the dept/LA Coordinator?)
3. What are the most important responsibilities of the LA? [probe for specific examples from their classes]
4. Do you believe that the role of the LA is clear to you, the students, and your LA? Why or why not?
    a. Probe for awareness of LA actions in the classroom
5. What are the most important knowledge, beliefs, and skills that a LA needs to support your course? [probe for specific examples from their classes, as well as skills necessary to support the remote/hybrid/etc. course format]
    a. How might those be different from your role as an instructor?

LAs as a resource

1. How does including LAs in the classroom benefit, or not, your students? Can you give an example?

Active Learning

Instructors' beliefs on teaching and learning

1. [*Make sure to have this question displayed somewhere for the participant to read easily.*] At UNL our courses follow an active learning model. While active learning can be defined in many ways, for my work I define active learning as teaching methods and classroom norms that promote:
    a. students' deep engagement in mathematical thinking,
    b. peer-to-peer interaction,
    c. instructors' interest in and use of student thinking, and
    d. instructors' attention to equitable and inclusive practices.
    Does your LA help make these things more possible in your classroom or serve as barriers to accomplishing these things in your classroom?
2. Are there other ways in which the LA(s) support your ability to instruct effectively? Why or why not?
    a. Imagine next semester, for whatever reason, you don't have an LA in your classroom. How would that change your teaching, if at all? [Probe for impact on teaching and students]
3. What types of interactions do you have with your LA (probe for instructor meetings, interactions in class, frequency, etc.)?
    a. What do you talk about?
    b. What is the purpose of those interactions? What do you get out of them? What do you think the LA gets out of them?
    c. To what extent do you and your LAs plan or reflect together? [Probe for frequency, duration, purpose]
        i. To what extent do conversations with your LA(s) help you make instructional decisions for future lessons?

Final Questions

1. What advice would you give to a current student considering applying to be an LA next semester?
2. What advice would you give to an instructor who will have an LA for the first time next semester?
3. What advice would you give to the math dept to improve the LA program?
4. Overall, do you think the LA program is worth sustaining? Why or why not?
5. Is there anything we should know about this course that hasn't been discussed yet?

Appendix I: Observation Field Note Template

Observation Date - Instructor NAME & LA NAME

Instructor(s) and LAs:	
Class Observed:	
Content:	
Start and end time:	

Description of Setup (breakout rooms, feedback bar, whiteboard tool, etc.):

Shorthand	Question Type	Description
Tell	Rhetorical; Telling	LA asks a question that they answer themselves, engages in a mini-lecture, or provides a direct response to a student question
LL	Low-level: Purpose is to gather information, check for a method, or lead students through a method	LA seeks a direct answer, usually right or wrong; students rehearse known facts or procedures
HL	High-level: engages students in deep mathematical thought	LA seems to be engaging one or more students in what appears to be a high-level interaction about mathematics, such as probing for understanding
PP	Prompt peer participation	LA directly engages other students in the discussion by asking them a (LL or higher-level) question
M	Monitor	LA gives students time to work on problems individually or in groups, but is still monitoring student progress
♡	Empathy	LA demonstrates empathy for students
✓	Checking in on a group	"How are things going?"
S1, S2, …	NA	Use to distinguish between students in a breakout group

Running Log

Document:

- Transitions between lecture/whole class activity and small group activity (in which the LA interacts with students)
- AL used by the instructor

- Particularities in how the instructor discusses content

Reflection Notes

Appendix J: Final Codebook

Codes used in summer 2020-spring 2021 instructor interviews and all LA interviews	
Code	Definition
Background	Refers to the background of the participant, including their major, years in their role, etc.
Beliefs about teaching and learning	Refers to the instructor's or LA's beliefs about teaching and learning mathematics. This includes beliefs about what effective math instruction looks like, beliefs about active learning, etc. This does not include beliefs about LA vs. instructor roles, but it can include generic descriptions of the role of an instructor.
Challenges	Refers to the challenges faced by instructors or LAs in or outside of the classroom. This can include challenges related to the power distribution between LAs, instructors, and students.
Classroom and course context	Refers to responses to the question "Describe a typical day in your class" and should be double-coded with the appropriate course.
Communication about and with LAs	Refers to communication that members of the department have with or about LAs outside of class. This includes communication during instructor-LA meetings, conversations between instructors about LAs, etc.
COVID	Refers to statements about COVID, or online teaching.
Evaluation of LAs/LA program	References to a person's evaluation of the LA program, including how much they value the LA program
Instructional Goals	Refers to the instructor's or LA's learning goals for students in the targeted course (e.g., Precalculus or Calculus course)
Professional Development and Supports	Refers to both formal and informal, as well as internal and external, professional development

	and support for LAs and instructors
Instructor Roles	Refers to the expectations that members of the department have of instructors as well as instructor's use of active learning. This code is more specific than the LA Roles code because it is expected that the classroom context code will capture many instructor actions.
[only for instructor interviews] LA Roles	Refers to the real or expected roles and responsibilities that members of the department attribute to LAs. This also includes descriptions of the real actions LAs take in the classroom.
Codes added for LA interviews	
LA Positioning	Refers to the rights and duties assigned to LAs, as well as dispositions (e.g., personality traits), categorical membership of LAs (e.g., mathematics education major, parent, gender, etc.), emotion speech (e.g., "I love math" or "I just get joy out of helping people"), and references to existing storylines that the participant may be drawing upon (e.g., Math Resource Center tutor, Teaching Assistants in Recitation, etc.)
LA Actions	Refers to descriptions of the real actions LAs take in the classroom.
Instructor-Derived Roles of LAs	Refers to excerpts that have specific connections to the roles present from instructors' positioning of LAs, namely "Liaison," "Duplicate Instructor" and "Complementary Instructor"

Appendix K: Recruitment and Scheduling Email Samples

Sample Recruitment Email to Instructor

Hi [Instructor],

As part of my dissertation I am interested in how learning assistants (LAs) support instruction at UNL, especially in the tumultuous environment brought about by the COVID-19 pandemic. In particular, my research will focus on instructors and their partnerships with LAs, and the actions LAs take in the classroom to support active learning.

As an instructor of Math XXX this semester, and a prior associate convener, I am reaching out to you to see if you would be interested in participating in this research project. For this study, I plan to collect data from instructor-LA pairs multiple times during the semester to get the best sense of how LAs interact in your class, overtime: (**boldface** indicates your involvement)

- Initial interview
    - Target date: Early September (before Sept. 14th)
    - **Zoom interview (45 min.) with you**
    - Zoom interview (45 min.) with your LA
- Observations and follow-up interviews
    - Target dates:
        - Weeks of Sept. 14th & Sept. 21th
        - Weeks of Oct. 12th & Oct. 19th
        - Weeks of Nov. 2nd & Nov. 9th
    - 6 Zoom observations and/or recordings of your class (2 during each of the two-week time frames listed above)
    - **Zoom observations of any planning meetings between you and the LA**
    - **Post-observation Zoom interview (15-20 min.) with you**
    - Post-observation Zoom interview (15-20 min.) with your LA

Your main involvement would include an initial Zoom interview (45 minutes), three post-observation Zoom interviews (15-20 minutes), and providing me access to join in on at least a portion of the Zoom meeting(s) between you and your LA within a given two week time frame (as listed above). I will be recording our interviews. Additionally, I am planning on observing your class, and if possible, recording/having access to a recording of the classes I observe to identify LA actions taken in the classroom. These recordings will not be publicly shared. Any data I collect will be anonymized (so I'll remove names and other identifying information).

Also these time-frames are flexible! As part of the LA professional development program we are planning to observe classes, so my observations would coincide with that work. I would also plan on communicating with you to determine when would be the best time to conduct class observations (e.g., if you would rather have my observations occur on the same day as the associate convener's observations, then I will do my best to make that happen).

If you are interested in participating in this study or if you have any questions, please let me know. I would love to have the opportunity to learn from you!

Thanks!

Rachel

Sample Recruitment Email Reminder to Instructor

Hi [Name],
A couple of weeks ago I sent an invitation to participate in my dissertation study about how learning assistants support instruction at UNL, in math courses. Would you mind replying to this email and letting me know if you would be willing to participate? I am more than happy to answer any questions you may have before deciding or concerns you might have about what it takes to participate. For example, if you would like to participate, but do not wish to be recorded, then please let me know and I would be more than happy to just observe and take field notes.

Thanks so much!
Rachel

Sample Recruitment Email to LA

Hi [Name],

As part of my dissertation I am interested in how learning assistants (LAs) support instruction at UNL, especially given the effects of the COVID-19 pandemic on the structure of our mathematics courses. My research will focus on mathematics instructors and their partnerships with LAs, and the actions LAs take in the classroom to support active learning.

As an LA in Math XXX working with [instructor] this semester, I am reaching out to you to see if you would be interested in participating in this research project. For this study, I plan to collect data from instructor-LA pairs multiple times during the semester to get the best sense of how you interact in your class, overtime: (**boldface** indicates your involvement)

- Initial interview
    - Target date: Late September
    - **Zoom interview (45 min.) with you**
    - Zoom interview (45 min.) with [instructor]
- Observations and follow-up interviews
    - Target dates:
        - Weeks of Sept. 28th & Oct. 5th
        - Weeks of Oct. 19th & Oct. 26th
        - Week of Nov. 9th
    - Three Zoom observations and/or recordings of your MWF 11:30-12:20 class
    - Zoom observations of any planning meetings between you and [instructor]
    - **Post-observation Zoom interview (15-20 min.) with you**
    - Post-observation Zoom interview (15-20 min.) with[instructor]

Your main involvement would include an initial Zoom interview (45 minutes) and three post-observation Zoom interviews (15-20 minutes). I will be recording our interviews. Additionally, I am planning on observing your class, and if possible, recording/having access to a recording of the classes I observe. These observations will NOT be evaluative in nature - I am just interested in describing what actions LAs take in the classroom (e.g., managing Zoom, asking students probing questions, etc.). I will coordinate with you and [instructor] to manage any recordings.

These recordings will not be publicly shared. Any data I collect will be anonymized (so I'll remove names and other identifying information).

Also these time-frames are flexible and will be coordinated between you, myself, and [instructor]! As I mentioned in the LA seminar last night, you will be asked to record one of your classes, so my observations would coincide with that to try to minimize any extra work on the part of you or [instructor].

If you are interested in participating in this study or if you have any questions, please let me know. I would love to have the opportunity to learn from you!

Thanks!
Rachel

Sample Recruitment Email for Site

Hello [name],

I hope you are doing well in these stressful times. I wanted to reach out to see if you had the chance to investigate whether [case study site] would be willing to defer to UNL's IRB for my dissertation. Last I communicated with [masked], he said he believed that [case study site] would defer to a UNL IRB, but suggested I check in with you first.

My timeline for data collection has shifted, so I am hoping to be able to collect data late next Spring (March or April).

Please let me know if you have questions for me, and thank you in advance for your help,
Rachel

Sample Recruitment Email for Students of a Particular Class

Hi [NAME],
Thank you again for being willing to participate in my research study, and thanks for sending those email exchanges between you and [LA]! As we discussed, I'd like the opportunity to speak with some of the students in your class in order to get their perspective of how LAs may support their learning. If you could email the message below (or some variation of it) to your students today or early next week, I would really appreciate it. Thanks!

--
Hello,

Rachel Funk, the graduate student who has been observing our class this semester, is inviting you to participate in an up to 45-minute focus group centering on your experiences taking a LA-supported course this semester. The insights learned from these interviews will help the math department understand how LAs may support students' learning and sense of belonging in math classrooms, and subsequently will inform the professional development of both graduate student instructors and LAs.

If you are willing to participate in this focus group, please complete the Google form below with your availability **by Monday, November 30th**. The focus group will be held during the 3-week session.

[Link]

If you have any questions about this research, please contact Rachel Funk (rachel.funk@huskers.unl.edu).

Sample Recruitment Email to LAs (Focus Group)

Hello [Name],
My name is Rachel Funk, and I am a graduate student in the math department. My research focuses on understanding how learning assistants (LAs) support math instruction, as well as how LAs are supported in their roles. I would like the opportunity to hear about your experiences as a math LA this semester. The math department and LA program are also interested in understanding these experiences so that they can make improvements to the LA program for next year.

Since you served as a LA this semester, you are invited to participate in one 45-60 minute interview this summer. The math department can pay you $20 for your time. This payment would be direct deposited to the same account that is used to pay your learning assistant salary, once you have completed the interview. Note: you must be 19 years or older to participate. If you are willing to participate, please reply with:

- At least three time slots that you are available for a 45-60 minute interview sometime in the weeks of May 17th and May 31st.
- An indication of if you are willing to take part in a focus group interview with 1-2 other LAs, or if you'd prefer an individual interview.

Attached you will find a copy of the consent form and payment form. If you agree to participate, please sign these forms and return them to me. Alternatively, you may indicate your consent here: [link]

If you have any questions, please feel free to contact myself or [LA Coordinator].

Thank you, I look forward to the opportunity to learn about your experiences!
Rachel Funk

Sample Recruitment Email to Instructors (Focus Group)

Hello fellow Math GTAs,

The UNL Math Department (PI: [LA Coordinator]), in conjunction with the College of Business and Computer Science Department, has received a grant to develop a professional development program for learning assistants (LAs) which will begin in the Fall. To support the planning and implementation of this program, I will be researching how graduate students have interacted with LAs in the past, and to what extent these interactions have been useful in supporting student learning and instruction. In particular, I am interested in identifying what preparation, from the perspective of GTAs, is most useful for LAs to have in order to best support instructors and

students. I am also interested in hearing about different ways that GTAs have interacted with their LAs in the past, the extent to which these interactions have been useful, and what additional preparation or tools GTAs wish they had in order to develop a good working relationship with LAs.

If you have worked with an LA in the past I invite you to participate in a (45-60 min.) Zoom focus group that centers on these issues. If you are interested, please fill out the link below with times you are available:

[link]
Also if you have any questions please don't hesitate to reach out to me, or [LA Coordinator]. We would love the opportunity to hear from you! Your feedback will be incredibly useful for us in developing a robust LA professional development program.

All the best,
Rachel Funk