

STORIES OF AGENCY: DO GRADUATE STUDENTS PERCEIVE THEMSELVES AS PART OF THE MATHEMATICAL COMMUNITY?

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Graduate student teaching assistants (GTAs) are responsible for the instruction of undergraduate students in critical introductory courses, but are not yet in the position of professors. Given their unique status, we ask if there are differences in how graduate students and professors express their agency when speaking about their responsibilities and how graduate students position themselves as members of the community of mathematicians. We use tools from systemic functional linguistics (Halliday, 1994) to analyze 16 interviews with graduate students and professors from research I universities. We found important differences in how graduate students and professors perceive their agency, and agency varies according to whether it concerns disciplinary or institutional responsibilities. Future research can investigate how to create more opportunities for developing the agency of GTAs in institutional decisions.

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Each year approximately 743,000 undergraduate students enroll in calculus courses and 834,000 enroll in introductory level courses (e.g., pre-calculus) taught in mathematics departments (Blair, Kirkman, & Maxwell, 2013). In some departments GTAs are only responsible for leading recitations and grading, but in other departments they teach over a third of all course offerings (Lewis & Tucker, 2009). Graduate students benefit from the experience because teaching is an aspect of being a mathematician, the community into which they are entering. As Lave and Wenger (1991) stressed, teaching and learning do not only occur in an individual's mind, but rather are mediated by social situations in a community of practice. Teaching positions, as part of the graduate education, assist in the socialization of graduate students into the faculty positions they may eventually take (Austin, 2002). However, GTAs have little to no experience and are given little training. Preparation programs range from a few hours' orientation to weeklong workshops (Ellis, Speer, & Bookman, 2016). How can we support the apprenticeship into teaching for graduate students while fostering quality instruction? This study seeks to understand differences between how professors and GTAs perceive and manage their roles as instructors. We compare their social positioning and *agency*.

Researchers have noted the significance of agency, or "who has control over the way mathematics is done and expressed" (Wagner, 2007, p. 36), for the doing of mathematics in the context of voice in textbooks (Herbel-Eisenmann, 2007; Herbel-Eisenmann & Wagner, 2007; Morgan, 1996) and in classroom discourse (Wagner, 2007). Previous research has addressed teacher and student agency in their interactions with each other and the discipline, but it has not addressed agency in two key areas: comparing agency of different groups of teachers and comparing agency in different aspects of teaching. We will compare graduate students and professors in two aspects provided by our theoretical framework.

Theoretical Framework

Herbst and Chazan (2012) proposed a framework of four *professional obligations* that mathematics teachers must respond to as professionals: towards representing the discipline of mathematics appropriately (disciplinary), treating individual students as persons with unique assets and needs (individual), creating a socially and culturally appropriate environment for students to share space and resources in a class (interpersonal), and respecting institutions such as the school,

department, district, State, or unions in matters including curriculum, assessment, and policy (institutional). We use the institutional and disciplinary obligations as lenses for agency because they are most relevant to how a graduate student socializes into the mathematics community - the departmental community (institution) and the work of a researcher (the discipline). We explore the remaining obligations elsewhere.

Our study of agency uses tools from systemic functional linguistics (Halliday, 1994), which is a theory of language that enables us to explore how meaning is construed by the language people choose. In this study we draw from what Halliday refers to as *processes*, which are aspects of a clause that report about “the event or state that the participants are involved in” and are canonically realized by verbal groups (Thompson, 2013, p. 87). Processes are typically categorized as material, relational, mental, verbal, existential, or behavioral. We wanted to identify processes that revealed happenings with actors or doers, so we focused on *material* processes, which are processes of physical actions (e.g., I taught..., if you are writing..., students have to solve...), and *verbal* processes, processes of saying (e.g., I can talk about..., we have to tell our students that..., I asked them to...) (Thompson, 2013). We contend that analyzing the actors that instructors identify in material and verbal processes will reveal important insights to who feels agentive in different contexts, leading us to ask the following research questions:

1. Are there differences in how graduate students and professors express their agency when speaking on their responsibilities to represent the discipline of mathematics and to their institutions?
2. How do graduate students position themselves as members of the community of mathematicians and/or the departmental community?

Methods

The source of the text analyzed in this study was a set of sixteen hour-long interviews with eight doctoral graduate students and eight tenured or tenure-track faculty members from large midwestern research universities. We focused on responses to questions about the institutional and disciplinary obligations. Participants read and listened to a full definition of each obligation (taken from Chazan, Herbst, & Clark, 2016) and were asked to respond to the question, “Given this description, how does this obligation play a role in your own teaching practice?”

We analyzed the interviews by transcribing them and identifying material and verbal processes with their corresponding actors and sayers. In the following results, we have italicized actors and underlined material and verbal processes. We counted the actors of almost every material and verbal process and decided to count instances of *I*, *we*, *you*, *the institution*, and *students* because they were most frequent. Infrequent actors or processes with ambiguous actors were counted under “other” to create accurate percentages (see Table 1). Certain material and verbal processes were excluded or indicated a lack of agency. Details on the specific ways these were determined are available in a longer report.

Results

The largest distinction between graduate students and professors was in their use of ‘we’ in material (portraying physical action, e.g., “we break [problems] into simple pieces”) and verbal processes (saying, e.g., “we talk about why it’s wrong”) when speaking about how the institutional obligation plays a role in their practice. Professors used the pronoun *we* in 24% of their clauses, compared with 3% from graduate students (see Table 1). The complement to this observation is that graduate students referred to the institution as an actor for 18% of their material processes, compared with 9% by the professors. For instance, student 2 explained, “There are certain due dates that are part of the, that are already designed and built in by the institution.” These observations suggest that

when GTAs enact the institutional obligation, they perceive the institution as an external actor while professors perceive themselves as part of the institution. Professor 7 elaborated,

So in terms of institutional obligation...at least as far as the university is concerned, is to ourselves. *We* decide a policy, and *we* enforce them... And those things are our obligations to policy that *we* set ourselves and the policies are ones we deem reasonable.

Here, the professor has situated himself as a member of the departmental community.

A different story of community emerged in discussions around the obligation to the discipline (see Table 1). We did not find as large of a difference in how graduate students (7%) and professors (13%) used *we* to express agency. The following quote illustrates a graduate student speaking for mathematicians:

Whatever *we* have done, say for centuries before, that subject is built on truth and truth only. At every step we had this choice, zero or one, and every time *we* choose one, and the whole *subject* is built upon it. So that I feel that *I* must impart to students.

He situated himself as one of the mathematicians who knew what was important to represent about the discipline.

Between the two obligations, the largest difference in agency is in the use of ‘I’. Both sets of instructors use ‘I’ to represent the agents of verbal and material processes more often in the disciplinary obligation (36% and 37%) than in the institutional obligation (19% and 15%). This signals that they have much more personal agency when acting on behalf of representing mathematics than when addressing institutional practices.

Discussion

To address our first research question, our findings suggest that there are important differences in how graduate students and professors perceive their agency, and agency varies according to which obligation is at stake. Both professors and graduate students had more individual agency speaking with ‘I’ in responses to the disciplinary obligation. Graduate students use ‘I’ as often as the professors, which may indicate that the students feel as agentic as the professors when representing the mathematical content at stake--this suggests that the issue is not reducible to developmental differences in the sense of agency, or, that agency varies depending on the obligation undergirding what instructors feel responsible to. One valued purpose of course policies is to create a uniform experience covering the same core material at least for the students that pass through a given institution (Rasmussen & Ellis, 2015). But we question whether this is achieved, and why graduate students are disproportionately assigned to these introductory courses that are critical for so many students.

In response to the second research question, we did find evidence that students position themselves as members of the mathematics community by their use of the pronoun *we*. Wagner (2007, p. 42) said that “student[s] who want to show that they are members in this collective of people who do things right have the *we* voice at their disposal.” Both students and professors were able to position themselves as members of the group that holds knowledge of mathematics. However, graduate students were much less able than professors to speak for the community of the department or institution. Professors may feel they can represent their institution due to the stability of their tenure or tenure-track positions and as a byproduct of other work they do to serve their institution. Although the graduate students did not seem oppressed by institutional constraints, they were not affiliating with the choices made by the institutions. Future research should investigate how to create more opportunities for developing the agency of GTAs in institutional decisions.

Table 1: The use of actors or sayers as indicators of agency

Obligation	Actors/Sayers	GTAs		Professors	
		Frequency	%	Frequency	%
Disciplinary	I	27	36	33	37
	Students	19	25	11	12
	We	5	7	12	13
	You	16	21	12	13
	Institution	0	0	0	0
Institutional	I	22	19	12	15
	Students	24	21	9	11
	We	3	3	20	24
	You	6	5	3	4
	Institution	19	17	5	6

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